BIOLOGY

Unit 1 Acellular Life

Topic 1.1 Viruses

Past MDCAT Questions

MCQ 1.1.1 What does the term bacteriophage refer to? (MDCAT 2022)

A	a virus that infects bacteria	B	a bacterium that infects a virus
C	a virus which behaves as a bacterium	D	a combination of a bacterium and a virion

Solution: (a) The name means bacteria-eater, and that is what these viruses do.

MCQ 1.1.2 Which of the following viruses contains single stranded DNA? (MDCAT 2022)

A	adenovirus	B	herpes virus
C	parvovirus	D	poxvirus

Solution: (c) The parvoviruses carry a single strand of DNA.

MCQ 1.1.3 How many tail fibrils are attached to the end plate of a bacteriophage? (MDCAT 2022)

A	2	B	4
C	6	D	8

Solution: (c) Six fibrils spread from the end plate and hold the phage to the bacterial wall.

MCQ 1.1.4 Which of the following viruses contains single stranded DNA? (MDCAT 2023)

A	adenovirus	B	herpes virus
C	parvovirus	D	poxvirus

Solution: (c) The parvoviruses are the single stranded DNA viruses; the other three carry double stranded DNA.

MCQ 1.1.5 An example of a virus having a polyhedral capsid with 252 capsomeres is: (MDCAT 2024)

A	adenovirus	B	tobacco mosaic virus
C	influenza virus	D	bacteriophage

Solution: (a) The adenovirus capsid is an icosahedron built of 252 capsomeres.

MCQ 1.1.6 The causative organism of measles is: (MDCAT 2024)

A	poxvirus	B	papovavirus
C	picornavirus	D	paramyxovirus

Solution: (d) Measles is caused by the measles virus, a paramyxovirus.

MCQ 1.1.7 In the life cycle of a bacteriophage, lysozyme is required in which step of the infection process? (MDCAT 2024)

A	release of the new phages	B	penetration
C	replication	D	adsorption

Solution: (b) The enzyme digests a hole in the bacterial wall so the phage DNA can be injected.

MCQ 1.1.8 Why are retroviruses placed in a separate class of RNA viruses? (UHS MDCAT 2025)

A	They always infect animal cells only	B	Their RNA acts directly as mRNA
C	They lack protein coats	D	They use reverse transcriptase to make DNA from RNA

Solution: (d) A retrovirus carries reverse transcriptase, which copies its RNA into DNA for the host to integrate.

MCQ 1.1.9 Which disease is caused by enveloped virus? (KMU MDCAT 2025)

A	Leaf curl disease of cotton	B	Flu
C	Polio	D	Hepatitis A

Solution: (b) The influenza virus takes a lipid envelope from the host membrane as it leaves.

MCQ 1.1.10 On the basis of morphological classification, influenza virus is an example of: (KMU MDCAT 2025)

A	Helical capsid virus	B	Polyhedral capsid virus
C	Enveloped capsid virus	D	Non-enveloped capsid virus

Solution: (c) Influenza is a helical virus wrapped in an envelope, so it is classed with the enveloped viruses.

MCQ 1.1.11 Which of the following virus is having double stranded RNA in its core? (NUMS MDCAT 2025)

A	Small pox	B	Mild rash virus
C	Diarrhea virus	D	Rubella virus

Solution: (c) The rotavirus of infantile diarrhoea carries double stranded RNA.

MCQ 1.1.12 Pore size of porcelain filter ranges between: (NUMS MDCAT 2025)

A	10 - 100 nm	B	100 - 1000 nm
C	10 - 10 μm	D	100 - 1000 μm

Solution: (b) A porcelain filter has pores of about 100 to 1000 nanometres, small enough to hold bacteria and let viruses through.

MCQ 1.1.13 Reverse transcriptase converts: (NUMS MDCAT 2025)

A	ds RNA to ss RNA	B	ss RNA to ds RNA
C	ss RNA to ds DNA	D	ss DNA to ds DNA

Solution: (c) Reverse transcriptase copies the single stranded RNA of a retrovirus into double stranded DNA.

MCQ 1.1.14 Which group of viruses can cause diseases like influenza, measles and rabies? (SIBA MDCAT 2025)

A	Plant viruses	B	Animal viruses
C	Fungal viruses	D	Bacteriophages

Solution: (b) Influenza, measles and rabies viruses all multiply in animal cells.

MCQ 1.1.15 Envelope in a virus is derived from (SZABMU MDCAT 2025)

A	Host cell ribosomes	B	Host cell membrane
C	Viral capsid proteins	D	Viral genome replication

Solution: (b) An enveloped virus wraps itself in a piece of the host membrane as it buds out.

MCQ 1.1.16 **The shape of Adenovirus is: (SZABMU MDCAT 2025)**

A	Helical shape	**B**	Tadpole shape
C	Polyhedron shape	**D**	Circular shape

Solution: (c) The adenovirus capsid is an icosahedron, that is a polyhedron.

MCQ 1.1.17 **Example of viruses having a polyhedral capsid that is with 252 capsomeres is: (UHS MDCAT 2024)**

A	Adenovirus	**B**	Tobacco Mosaic Virus
C	Influenza virus	**D**	Bacteriophage

Solution: (a) The adenovirus capsid is an icosahedron built of 252 capsomeres.

MCQ 1.1.18 **In the life cycle of a bacteriophage, the lysozymes are required in which of the following steps of infection process? (UHS MDCAT 2024)**

A	Genome injection	**B**	Penetration
C	Replication	**D**	Adsorption

Solution: (b) The tail lysozyme digests a hole in the bacterial wall so the genome can be driven in.

MCQ 1.1.19 **The genetic code of _____ is bound by a lipid membrane? (KMU MDCAT 2024)**

A	Enterovirus	**B**	Flu virus
C	Hepatitis A virus	**D**	Polio virus

Solution: (b) The influenza virus takes a lipid envelope from the host membrane; the picornaviruses are naked.

MCQ 1.1.20 **Viruses Can NOT _____. (KMU MDCAT 2024)**

A	Crystalize	**B**	Excrete
C	Infect bacteria	**D**	Mutate

Solution: (b) A virus has no metabolism of its own, so it neither feeds nor excretes.

MCQ 1.1.21 **Which of the following is NOT true about viruses? (KMU MDCAT 2024)**

A	Contain DNA	**B**	Can replicate on their own
C	Can infect bacteria	**D**	They have a sub-cellular structure

Solution: (b) A virus can only be copied inside a host cell, using the machinery of that cell.

MCQ 1.1.22 **Which of the following virus has a double stranded DNA genome? (NUMS MDCAT 2024)**

A	Rubella	**B**	Influenza
C	HIV	**D**	Small pox

Solution: (d) The smallpox virus carries double stranded DNA; the other three are RNA viruses.

MCQ 1.1.23 **What of the following virus contains single stranded DNA? (UHS MDCAT 2023)**

A	Adeno virus	**B**	Herpes virus
C	Parvo virus	**D**	Pox virus

Solution: (c) The parvoviruses are the smallest DNA viruses and their genome is a single strand.

MCQ 1.1.24 **How may tail fibrils are attached to the end plate of a bacteriophage? (UHS MDCAT 2023)**

A	2	**B**	4
C	6	**D**	8

Solution: (c) Six tail fibres spread from the end plate and hold the phage to the bacterial wall.

MCQ 1.1.25 **All viruses are: (SZABMU MDCAT 2023)**

A	Autotrophs	**B**	Heterotrophs
C	Parasites	**D**	Predators

Solution: (c) A virus can multiply only inside a living cell, so every virus is an obligate parasite.

MCQ 1.1.26 **The complete, mature and infectious virus particle is known as: (NUMS MDCAT 2023)**

A	Venome	**B**	Genome
C	Virion	**D**	Capsid

Solution: (c) A complete infectious virus particle is a virion.

MCQ 1.1.27 **Virus is what type of agent? (UHS MDCAT 2023)**

A	Cellular agent	**B**	Infectious agent
C	Non-infectious agent	**D**	Non-protein agent

Solution: (b) A virus can do nothing but infect a living cell and multiply in it.

MCQ 1.1.28 **Viruses usually are limited to specific hosts because: (PMC MDCAT 2022)**

A	They contain either DNA or RNA	**B**	They contain protein
C	They are specific to cell receptors	**D**	They are capable to divide with in the host body

Solution: (c) A virus can enter only a cell whose surface carries the receptor its coat proteins fit.

MCQ 1.1.29 **A virologist who studies viruses in great detail which of the following would he use? (PMC MDCAT 2022)**

A	Compound microscope	**B**	Porcelain filters
C	Electron microscope	**D**	CT scan machine

Solution: (c) A virus is far below the resolving power of a light microscope.

MCQ 1.1.30 **Which of the following was the first virus to be isolated and studied under the electron microscope: (PMC MDCAT 2022)**

A	HIV	**B**	Rabies Virus
C	Pox Viruses	**D**	TMV

Solution: (d) Tobacco mosaic virus was the first virus isolated and the first seen under the electron microscope.

MCQ 1.1.31 **Which of the following is incorrect about virus? (PMC MDCAT 2022)**

A	Viruses are intracellular parasites	**B**	Viruses cannot attack upon prokaryotes
C	Viruses contain genetic information and have a capsid protein coat	**D**	Viruses cannot survive without a host

Solution: (b) Bacteriophages attack bacteria, which are prokaryotes.

MCQ 1.1.32 **The viruses who can attack the bacteria are known as: (PMC MDCAT 2022)**

A	Retrovirus	**B**	Pox virus
C	Bacteriophage	**D**	Oncovirus

Solution: (c) A virus that infects a bacterium is a bacteriophage.

MCQ 1.1.33 **Which of the following virus has complex capsid that consists of polyhedral head and helical tall? (PMC MDCAT 2022)**

A	Influenza virus	**B**	Herpes virus
C	Bacteriophage	**D**	Human Immuno Deficiency virus

Solution: (c) A T-even bacteriophage has a polyhedral head and a helical tail.

MCQ 1.1.34 **Poxviruses are: (PMC MDCAT 2022)**

A	Double stranded DNA virus	**B**	Single stranded RNA virus
C	Single stranded DNA virus	**D**	Protein virus

Solution: (a) The poxviruses carry a large double stranded DNA genome.

MCQ 1.1.35 **A virus has its genome which is enclosed by a protein coat, called: (PMC MDCAT 2022)**

A	Spore	B	Capsid
C	Envelope	D	Shell

Solution: (b) The protein coat round the viral genome is the capsid.

MCQ 1.1.36 **Viruses are able to recognize the host surface by means of their: (PMC MDCAT 2022)**

A	Capsid	B	Spikes
C	DNA	D	RNA

Solution: (b) The spikes of the envelope fit the receptors of the host cell.

MCQ 1.1.37 **Which one can be considered as living characteristic of a virus: (NUMS MDCAT 2022)**

A	Can be crystallized	B	No cellular respiration
C	Mutate their genetic	D	Lack biosynthetic machinery

Solution: (c) Mutation of its genetic material is the one thing a virus does that living things do.

MCQ 1.1.38 **What is the function of the lysozyme enzyme released by bacteriophages? (PMC Practice 2021)**

A	Injecting DNA	B	Replication
C	Dissolve bacterial cell wall	D	All of these

Solution: (c) The tail lysozyme digests a hole in the bacterial wall so the genome can be driven in.

MCQ 1.1.39 **What is the viral envelope composed of? (PMC Practice 2021)**

A	Proteins	B	Glycoproteins
C	Lipids and proteins	D	All of the above

Solution: (d) The envelope is a piece of the host membrane, lipid and protein, with viral glycoprotein spikes in it.

MCQ 1.1.40 **Icosahedral Viruses have how many faces? (PMC Practice 2021)**

A	20	B	30
C	10	D	40

Solution: (a) An icosahedron has twenty triangular faces.

MCQ 1.1.41 **_____ refers to the breakdown or removal of the capsid. (PMC Practice 2021)**

A	Assembly	B	Uncoating
C	Integration	D	Maturation

Solution: (b) Uncoating is the stripping of the capsid that frees the viral genome inside the host cell.

MCQ 1.1.42 **Which of the following is not related to the enveloped virus? (PMC MDCAT 2020)**

A	They survive for a long time	B	Their envelope is not sensitive to sunlight
C	They are tolerant to antibodies	D	Envelope is derived from host

Solution: (b) The lipid envelope is easily damaged by sunlight, drying and detergents.

MCQ 1.1.43 **The complete, mature and infection virus particle is known as: (PMC MDCAT 2020)**

A	Venome	B	Genome
C	Virion	D	Capsid

Solution: (c) A complete infectious virus particle is a virion.

MCQ 1.1.44 **The protein coat of virus is called: (UHS MDCAT 2019)**

A	Capsid	B	Cosmid
C	Capsomere	D	Chromophore

Solution: (a) The protein coat of a virus is its capsid.

MCQ 1.1.45 **In viruses, a combined structure formed by core (Nucleic Acid) and capsid is: (UHS MDCAT 2018)**

A	Nucleocapsid	B	Prion
C	Envelope	D	Capsomeres

Solution: (a) The genome with its capsid together are the nucleocapsid.

MCQ 1.1.46 **Phages which show lysogenic cycle are known as: (UHS MDCAT 2018)**

A	Enveloped Phage	B	Virulent Phage
C	Temperate phages	D	Bacteriophage

Solution: (c) A temperate phage integrates its genome and lies dormant instead of bursting the cell at once.

MCQ 1.1.47 **Size of virus ranges in: (UHS MDCAT 2017)**

A	20 to 250 nm	B	25 to 250 nm
C	25 to 300 nm	D	20 to 300 nm

Solution: (a) Viruses run from about 20 to $250\,\text{nm}$ across.

MCQ 1.1.48 **All viruses can reproduce within living organisms only, so they are known as: (UHS MDCAT 2016)**

A	Ectoparasites	B	Endoparasites
C	Obligative Intracellular Parasites	D	Facultative Intracellular Parasites

Solution: (c) A virus can multiply only inside a living cell, so it is an obligate intracellular parasite.

Topic 1.2 AIDS and HIV Infection

Past MDCAT Questions

MCQ 1.2.1 **The enzymes integrase, protease and reverse transcriptase are found in which virus? (MDCAT 2022)**

A	HIV	B	hepatitis A virus
C	influenza virus	D	poxvirus

Solution: (a) HIV is a retrovirus, and these three enzymes are what let it copy its RNA into DNA and splice it into the host genome.

MCQ 1.2.2 **Which one is transmitted through infected blood and hypodermic syringes? (MDCAT 2024)**

A	HIV	B	influenza virus
C	morbillivirus (measles)	D	Vibrio cholerae (cholera)

Solution: (a) HIV travels in blood and body fluids, so shared needles pass it on.

MCQ 1.2.3 **All of the following are the modes of transmission of AIDS, EXCEPT: (KMU MDCAT 2025)**

A	Transfusion of infected blood	B	Sharing infected needles
C	Shaking hands with infected person	D	Sexual contact with infected person

Solution: (c) HIV needs blood, semen or milk to pass; ordinary contact carries no risk.

MCQ 1.2.4 **Which symptoms disappear after few months in an asymptomatic carrier of HIV? (NUMS MDCAT 2025)**

A	Loss of memory	B	Swollen lymph gland
C	Weight loss	D	Night sweats

Solution: (b) The swelling of the lymph nodes of the first weeks subsides, and the carrier then seems well for years.

MCQ 1.2.5 **Which of the following is a route of HIV transmission? (SIBA MDCAT 2025)**

A	Unhygienic living conditions	B	Blood transfusion with contaminated blood
C	Hand shaking	D	Living together in the same room

Solution: (b) HIV passes in infected blood, so a contaminated transfusion carries it.

MCQ 1.2.6 **The best way to avoid AIDS is: (SIBA MDCAT 2025)**

A	Preventive measures	**B**	Vaccination
C	Medication	**D**	Shots

Solution: (a) There is neither vaccine nor cure, so avoiding infection is the only real defence.

MCQ 1.2.7 **_____ is transmitted through infected blood and hypodermic syringes. (UHS MDCAT 2024)**

A	HIV	**B**	Influenza Virus
C	Morbilli Virus (Measles)	**D**	Vibrio Cholerae (Cholera)

Solution: (a) HIV travels in blood, so transfusions and shared needles carry it.

MCQ 1.2.8 **Where are the enzymes required for the replication of HIV virus located? (KMU MDCAT 2024)**

A	In the protein spikes	**B**	Surrounding the viral core
C	Inside the capsid	**D**	Outside the capsid

Solution: (c) Reverse transcriptase and integrase are packed inside the capsid with the RNA.

MCQ 1.2.9 **Which of the following is transmitted through infected blood and hypothermal syringes? (SZABMU MDCAT 2023)**

A	HIV	**B**	Influenza Virus
C	Morbilli Virus (Measles)	**D**	Vibrio Virus (Cholera)

Solution: (a) HIV travels in blood, so transfusions and shared needles carry it.

MCQ 1.2.10 **The provirus of HIV is structurally and chemically made up of? (UHS MDCAT 2023)**

A	ssRN	**B**	ssDNA
C	dsRNA	**D**	dsDNA

Solution: (d) Reverse transcriptase copies the viral RNA into double stranded DNA, which is then integrated.

MCQ 1.2.11 **HIV use the RNA polymerase to make the mRNA in host body. The RNA polymerase is of: (PMC MDCAT 2022)**

A	Virus that is synthesized in the same host	**B**	Host that is synthesized in the its previous generator
C	Host that is synthesized in its current generator	**D**	Virus that is synthesized in the previous host

Solution: (c) A virus carries no polymerase of its own for this, so it uses the enzyme the host cell has made.

MCQ 1.2.12 **When HIV attacks upon its host target cell: (PMC MDCAT 2022)**

A	Its RNA genome is broken down immediately	**B**	Its RNA genome is replicated first and then broken down
C	Its RNA genome is converted into viral DNA first and then broken down	**D**	Its RNA genome immediately causes breakdown

Solution: (c) Reverse transcriptase copies the RNA into DNA, and the RNA is then destroyed.

MCQ 1.2.13 **Another problem for those studying viral origins and evolution is their high rate of mutation, particularly the case in RNA retroviruses like: (PMC MDCAT 2022)**

A	HIV	**B**	Bacteriophages
C	Pox viruses	**D**	HAV

Solution: (a) HIV copies its RNA with an enzyme that does not proof-read, so it mutates constantly.

MCQ 1.2.14 **The HIV genetic information flows from viral _____, and used to form viral _____. (PMC MDCAT 2022)**

A	RNA to DNA: RNA and protein	**B**	DNA to RNA: DNA and protein
C	DNA to RNA : RNA and protein	**D**	RNA to protein : RNA and protein

Solution: (a) Reverse transcriptase copies the viral RNA into DNA, and that DNA is then read back into RNA and protein.

MCQ 1.2.15 **Reverse transcription, carried out by retroviruses, is the process by which? (PMC MDCAT 2022)**

A	RNA is duplicated	**B**	DNA is duplicated
C	RNA information is copied into DNA	**D**	DNA information is copied into RNA

Solution: (c) Reverse transcription copies the information of RNA back into DNA.

MCQ 1.2.16 **Reverse transcriptase of HIV is used in: (PMC MDCAT 2022)**

A	Conversion of viral RNA into viral DNA	**B**	Conversion of viral RNA Into host DNA
C	Conversion of viral DNA into viral RNA	**D**	Conversion of host DNA Into viral DNA

Solution: (a) Reverse transcriptase copies the viral RNA into viral DNA.

MCQ 1.2.17 **Human Immunodeficiency virus is: (PMC MDCAT 2022)**

A	An enveloped, RNA virus	**B**	An enveloped, DNA virus
C	A non-enveloped, RNA virus	**D**	A non-enveloped, DNA virus

Solution: (a) HIV carries RNA in a capsid wrapped in an envelope taken from the host membrane.

MCQ 1.2.18 **It uses the single strand RNA as a template for making double stranded DNA: (PMC Practice 2021)**

A	DNA polymerase	**B**	DNA ligase
C	Reverse transcriptase	**D**	All of these

Solution: (c) Reverse transcriptase copies single stranded RNA into double stranded DNA.

MCQ 1.2.19 **There is no vaccine against HIV. What is the possible reason? (PMC Practice 2021)**

A	The virus is highly mutated	**B**	The vaccine is too expensive
C	The virus can be controlled through change in hygiene	**D**	None of these options is correct

Solution: (a) HIV mutates so fast that its surface proteins change faster than any vaccine can match.

MCQ 1.2.20 **Numerous opportunist diseases might attack people suffering from the following diseases? (PMC MDCAT 2020)**

A	Measles	**B**	Influenza
C	Hepatitis A	**D**	AIDS

Solution: (d) With the helper T cells destroyed, organisms that a healthy body ignores become deadly.

MCQ 1.2.21 **Which of the following is NOT TRUE about Human Immunodeficiency virus (HIV)? (PMC MDCAT 2020)**

A	It is a retrovirus	**B**	It is surrounded by an envelope
C	It does not cause AIDS	**D**	It causes deficiency of the human immune system

Solution: (c) HIV is the cause of AIDS; the other three statements are true of it.

MCQ 1.2.22 **Among followings, _____ enzyme is naturally found in human immunodeficiency virus (HIV). (UHS MDCAT 2019)**

A	Ligase	B	Reverse Transcriptase
C	RNA Polymerase	D	DNA Polymerase

Solution: (b) Reverse transcriptase is carried in the virion and copies its RNA into DNA.

MCQ 1.2.23 **Reverse transcriptase is the function of: (UHS MDCAT 2017)**

A	Pox virus	B	HIV
C	Paramyxovirus	D	Tobacco mosaic virus

Solution: (b) HIV is a retrovirus and carries reverse transcriptase in its core.

MCQ 1.2.24 **AIDS is caused by: (UHS MDCAT 2016)**

A	Bacteria	B	Virus
C	Fungi	D	Algae

Solution: (b) AIDS is caused by the human immunodeficiency virus.

Unit 2 Bioenergetics

Topic 2.1 Respiration

Past MDCAT Questions

MCQ 2.1.1 **What is the end product of glucose breakdown by yeast in anaerobic respiration? (MDCAT 2022)**

A	ethanol and oxygen	B	ethanol and water
C	ethanol and CO_2	D	lactic acid and CO_2

Solution: (c) Yeast ferments sugar to ethanol and carbon dioxide.

MCQ 2.1.2 **Each carrier in the electron transport chain is first _____ and then _____. (MDCAT 2022)**

A	broken down, regenerated	B	generated, broken down
C	oxidized, reduced	D	reduced, oxidized

Solution: (d) A carrier takes electrons from the one before it, which reduces it, and passes them on, which oxidizes it again.

MCQ 2.1.3 **The electron transport chain explains: (MDCAT 2022)**

A	photophosphorylation	B	the Z-scheme
C	photolysis	D	the mechanism of ATP synthesis

Solution: (d) The energy released as electrons fall down the chain is what pumps protons and drives ATP synthase.

MCQ 2.1.4 **Which of the following is NOT a consequence of anaerobic respiration in human muscle cells? (MDCAT 2022)**

A	cramps	B	high consumption of energy
C	pain	D	tiredness

Solution: (b) Anaerobic respiration yields far less energy per glucose, not more; the lactic acid it leaves behind causes the rest.

MCQ 2.1.5 **The most primitive respiratory process occurring in a living cell is; (UHS MDCAT 2025)**

A	Lactic acid fermentation	B	Alcoholic fermentation
C	Glycolysis	D	Krebs's cycle

Solution: (c) Glycolysis needs no oxygen and no organelle, and every kind of cell still uses it.

MCQ 2.1.6 **Living cells Do NOT directly acquire energy released from the breakdown of food molecules because: (KMU MDCAT 2025)**

A	Glucose cannot be broken down inside the cells	B	Energy released is too small to be used by the cells
C	Glucose molecules do not store any energy	D	The energy released is too large, leading to heating and wastage

Solution: (d) Oxidizing the whole molecule at once would waste the energy as heat, so it is released in small steps into ATP.

MCQ 2.1.7 **In glycolysis glucose is: (NUMS MDCAT 2025)**

A	Oxidized into pyruvic acid	B	Reduced into pyruvate
C	Broken down to G3P	D	Reduced to NADPH

Solution: (a) Glycolysis oxidizes glucose to two molecules of pyruvic acid and gives up hydrogen to NAD.

MCQ 2.1.8 **In the following process the cells release energy from oxidation of food molecules? (SIBA MDCAT 2025)**

A	Cellular respiration	B	Photosynthesis
C	DNA replication	D	Protein synthesis

Solution: (a) Cellular respiration is the controlled oxidation of food to release energy as ATP.

MCQ 2.1.9 **How many NADH are produced, when one Acetyl co-A is oxidized during Krebs's cycle? (SIBA MDCAT 2025)**

A	1	B	2
C	3	D	6

Solution: (c) One turn of the cycle yields three NADH, one FADH2 and one GTP.

MCQ 2.1.10 **How many ATPs are produced during oxidative phase of glycolysis? (SZABMU MDCAT 2025)**

A	2	B	4
C	34	D	36

Solution: (b) The payoff phase makes four ATP, of which two repay the investment of the first phase.

MCQ 2.1.11 **The process of ATP synthesis through a combination of electrochemical and osmotic events is known as: (KMU MDCAT 2024)**

A	Fermentation	B	Glycolysis
C	Oxidative phosphorylation	D	Oxidation of pyruvate to acetyl CoA

Solution: (c) Electrons passed down the chain pump protons, and their return through ATP synthase makes the ATP.

MCQ 2.1.12 **During glycolysis, isomerization takes place in the formation of: (NUMS MDCAT 2024)**

A	Dihydroxyacetone phosphate and 2-phosphoglycerate	B	G3P and fructose 6-phosphate
C	PEP and pyruvate	D	Fructose 6-phosphate and 3-phosphoglycerate

Solution: (b) Glucose 6-phosphate is isomerized to fructose 6-phosphate, and dihydroxyacetone phosphate to G3P.

MCQ 2.1.13 **Fats and proteins are metabolized via – which of the following serves as common duct for both metabolisms? (NUMS MDCAT 2024)**

A	Acetyl-CoA	B	Pyruvate
C	G3P	D	Lactate

Solution: (a) Fatty acids and most amino acids are cut down to acetyl coenzyme A before entering the Krebs cycle.

MCQ 2.1.14 **What is the end product of glucose by yeast in anaerobic respiration? (UHS MDCAT 2023)**

A	Ethanol and oxygen	B	Ethanol and water
C	Ethanol and CO2	D	Lactic acid and CO2

Solution: (c) Yeast ferments glucose to ethanol and carbon dioxide.

MCQ 2.1.15 **Each carrier in Electron Transport Chain is first _____ and then _____. (UHS MDCAT 2023)**

A	Broken-down, Regenerate	**B**	Generated, Broken-down
C	Oxidized, Reduced	**D**	Reduced, Oxidized

Solution: (d) Each carrier takes the electrons from the one before, so it is reduced, then passes them on and is oxidized again.

MCQ 2.1.16 **Electron transport chain explains: (UHS MDCAT 2023)**

A	Photophosphorylation	**B**	Z-Scheme
C	Photolysis	**D**	Mechanism of ATP synthesis

Solution: (d) The chain pumps protons whose return through ATP synthase makes the ATP.

MCQ 2.1.17 **Which of the following is NOT a consequence of anaerobic respiration in humans muscles cells? (UHS MDCAT 2023)**

A	Cramps	**B**	High consumption of energy
C	Pain	**D**	Tiredness

Solution: (b) Anaerobic respiration yields far less energy, not more; the cramps and pain come from the lactic acid.

MCQ 2.1.18 **Which of the following is used in baking? (UHS MDCAT 2023)**

A	Aerobic respiration	**B**	Anaerobic respiration
C	External respiration	**D**	Internal respiration

Solution: (b) The yeast in dough ferments anaerobically, and the carbon dioxide raises the bread.

MCQ 2.1.19 **Which is the major event in electron transport chain? (UHS MDCAT 2023)**

A	ATP synthesis	**B**	Substitution
C	Decarboxylation	**D**	Isomerisation

Solution: (a) The chain pumps protons whose return through ATP synthase makes most of the cell's ATP.

MCQ 2.1.20 **Metabolism is about _____. (PMC MDCAT 2022)**

A	All chemical reactions taking place in a cell	**B**	All chemical reactions in prokaryotic bodies
C	All chemical reactions In eukaryotic bodies	**D**	All chemical reactions in an industry

Solution: (a) Metabolism is the whole of the chemical change going on in a cell.

MCQ 2.1.21 **The end products of aerobic respiration are: (PMC MDCAT 2022)**

A	Sugar and oxygen	**B**	Water and energy
C	Carbon dioxide, water, and energy	**D**	Carbon dioxide and energy

Solution: (c) Aerobic respiration ends in carbon dioxide, water and ATP.

MCQ 2.1.22 **The prime function of ATP is to: (PMC MDCAT 2022)**

A	Act as a catalyst	**B**	describe the function of a cell
C	Act as a template for protein synthesis	**D**	Act as an energy currency

Solution: (d) ATP is the molecule in which energy is carried from where it is released to where it is spent.

MCQ 2.1.23 **The quantitative study of energy relationships in a biological system is called? (PMC MDCAT 2022)**

A	Bioenergetics	**B**	Biochemistry
C	Biotechnology	**D**	Biophysics

Solution: (a) The study of energy changes in living systems is bioenergetics.

MCQ 2.1.24 **Oxidative phosphorylation during the respiratory electron transport chain requires: (PMC MDCAT 2022)**

A	NAD+ as oxidising agent	**B**	NADP+ as oxidising agent
C	Molecular oxygen	**D**	Light energy

Solution: (c) Oxygen is the last acceptor of the electrons, and without it the chain stops.

MCQ 2.1.25 **How many phosphate groups are present in nicotinamide adenine dinucleotide phosphate? (PMC MDCAT 2022)**

A	1	**B**	2
C	3	**D**	4

Solution: (c) NADP carries the two phosphates of the dinucleotide and one more on the ribose, three in all.

MCQ 2.1.26 **In glycolysis, the conversion of Glucose-6-phosphate to fructose-6-phosphate involves: (PMC MDCAT 2022)**

A	Phosphorylation	**B**	Oxidation
C	Isomerization	**D**	Reduction

Solution: (c) An aldose is rearranged into a ketose with no atoms gained or lost, which is isomerization.

MCQ 2.1.27 **Which of the following chemical activity is involved in the conversion of pyruvate into acetaldehyde during anaerobic respiration? (PMC MDCAT 2022)**

A	Reduction	**B**	Decarboxylation
C	Oxidation	**D**	Phosphorylation

Solution: (b) Pyruvate loses a molecule of carbon dioxide to give acetaldehyde.

MCQ 2.1.28 **Which of the following releases 7.3 kCal energy when terminal phosphate is lost? (PMC MDCAT 2022)**

A	NADP	**B**	ADP
C	ATP	**D**	FAD

Solution: (c) Hydrolysing the terminal phosphate of ATP releases about $7.3\,\text{kcal}$ a mole.

MCQ 2.1.29 **To reduce one molecule of O2, _ _ _ electron(s) must be passed through the electron transport chain and _ _ _ molecule(s) of NADH ls(are) oxidized (PMC MDCAT 2022)**

A	1:1	**B**	4:4
C	1:2	**D**	4:2

Solution: (d) Oxygen takes four electrons and four protons to give two molecules of water, and each NADH gives two electrons.

MCQ 2.1.30 **Which of the following is the correct path of alcoholic fermentation? (PMC MDCAT 2022)**

A	Glycolysis -> Reduction	**B**	Glycolysis -> Reduction -> Decarboxylation
C	Glycolysis -> Decarboxylation -> Reduction	**D**	Glycolysis -> Link reaction -> Kreb cycle -> ETC

Solution: (c) Glucose is broken to pyruvate, the pyruvate loses carbon dioxide, and the acetaldehyde is reduced to ethanol.

MCQ 2.1.31 **The initial process of breaking down glucose is called (PMC MDCAT 2022)**

A	Reduction	**B**	Glycolysis
C	Chemiosmosis	**D**	Oxidation

Solution: (b) Glycolysis is the first stage, in which glucose is split to pyruvate.

MCQ 2.1.32 **What is the net gain of ATP In glycolyslis, if it occurs during anaerobic respiration? (PMC MDCAT 2022)**

A	2 ATP/glucose molecule	**B**	4 ATP/glucose molecule
C	6 ATP/glucose molecule	**D**	8 ATP/glucose molecule

Solution: (a) Four ATP are made and two spent, so the net gain is two.

MCQ 2.1.33 **Which respiration is directly involved in the production of energy, necessary for all living activities? (PMC MDCAT 2022)**

A	Organismic	**B**	Cellular
C	Breathing	**D**	External respiration

Solution: (b) Cellular respiration is where the energy of food is actually released into ATP.

MCQ 2.1.34 **One ATP molecule contains 1% of total energy of glucose. In anaerobic reactions how much energy of glucose is released as ATP: (PMC MDCAT 2022)**

A	1%	**B**	2%
C	36%	**D**	38%

Solution: (b) Anaerobic respiration nets two ATP from a glucose molecule, that is about two per cent of its energy.

MCQ 2.1.35 **In aerobic respiration, chemiosmosis occurs during : (PMC MDCAT 2022)**

A	Electron transport chain	**B**	Photophosphorylation
C	Glycolysis	**D**	Kreb's cycle

Solution: (a) Protons pumped by the electron transport chain return through ATP synthase, and that is chemiosmosis.

MCQ 2.1.36 **Which of the following is the final electron acceptor in the respiratory electron transport chain? (PMC MDCAT 2022)**

A	NADP+	**B**	Molecular oxygen
C	PS-I	**D**	PS-II

Solution: (b) Oxygen takes the electrons at the end of the chain and is reduced to water.

MCQ 2.1.37 **oxygen is available, the complete breakdown of glucose produces ----- ATP molecules in prokaryotes: (NUMS MDCAT 2022)**

A	20	**B**	36
C	38	**D**	40

Solution: (c) A prokaryote has no mitochondrial membrane to cross, so it nets the full thirty-eight.

MCQ 2.1.38 **It is the most energy rich compound. (PMC Practice 2021)**

A	FADH2	**B**	ATP
C	NADH	**D**	GTP

Solution: (c) Each NADH yields about three ATP, more than any of the others here.

MCQ 2.1.39 **Carbohydrate catabolism is concerned with the fate of: (PMC Practice 2021)**

A	ATP	**B**	Glucose
C	Aminoacid	**D**	All of these

Solution: (b) Carbohydrate catabolism is the breaking down of glucose.

MCQ 2.1.40 **What is the final product of the Krebs cycle? (PMC Practice 2021)**

A	Malate	**B**	Succinate
C	Oxaloacetate	**D**	Fumarate

Solution: (c) Oxaloacetate is regenerated at the end of each turn, ready to take the next acetyl group.

MCQ 2.1.41 **What are the end products of the electron transport chain in animals? (PMC Practice 2021)**

A	ATP	**B**	Carbon dioxide
C	Water	**D**	Both Options A and C are correct

Solution: (d) The chain makes ATP and leaves water where the electrons and protons meet the oxygen.

MCQ 2.1.42 **The end product in anaerobic respiration is: (PMC MDCAT 2020)**

A	Ethanol and Carbon dioxide	**B**	Lactate
C	Pyruvate	**D**	Both A and B

Solution: (d) Yeast ferments to ethanol and carbon dioxide, muscle to lactate.

MCQ 2.1.43 **The end product of glycolysis in acrobic respiration is (PMC MDCAT 2020)**

A	Ethanol and carbon dioxide	**B**	Lactate
C	Pyruvate	**D**	Acetyl CoA

Solution: (c) With oxygen present, glycolysis ends at pyruvate, which then enters the mitochondrion.

MCQ 2.1.44 **How many molecules of ATP would be utilized for phosphorylation of one glucose molecule during glycolysis? (UHS MDCAT 2019)**

A	Three	**B**	Two
C	Four	**D**	One

Solution: (b) Two ATP are spent in phosphorylating the glucose before any is made.

MCQ 2.1.45 **Glycolysis takes place in the _____ of cells. (UHS MDCAT 2019)**

A	Nucleus	**B**	Mitochondria
C	Golgi complex	**D**	Cytoplasm

Solution: (d) Glycolysis needs no organelle and goes on in the cytoplasm.

MCQ 2.1.46 **The enzymes required for the Kreb cycle are found in _____. (UHS MDCAT 2018)**

A	F1 particles	**B**	Lysosomes
C	Cytoplasm	**D**	Matrix

Solution: (d) The Krebs cycle enzymes are dissolved in the mitochondrial matrix.

MCQ 2.1.47 **In aerobic respiration (UHS MDCAT 2018)**

A	Pyruvate is completely oxidized to form carbon dioxide and water	**B**	Pyruvate is completely oxidized to form oxygen and water
C	Pyruvate carboxylated to produce citrate	**D**	Pyruvate is converted to ethanol and carbon dioxide

Solution: (a) With oxygen present the pyruvate is oxidized right through to carbon dioxide and water.

MCQ 2.1.48 **At the last step of Glycolysis, which of the following compound is formed: (UHS MDCAT 2018)**

A	Pyruvic acid/ Pyruvate	**B**	Lactic acid
C	Ethyl Alcohol	**D**	Fructose Phosphate

Solution: (a) Glycolysis ends at pyruvate.

MCQ 2.1.49 **The enzymes required in Glycolysis are present in: (UHS MDCAT 2018)**

A	Golgi Apparatus	**B**	Cell cytoplasm
C	Inner Mitochondrial Membrane	**D**	Matrix of Mitochondria

Solution: (b) Glycolysis needs no organelle and goes on in the cytoplasm.

MCQ 2.1.50 **In Citric Acid Cycle Acetyl CoA combines with: (UHS MDCAT 2017)**

A	Glucose	B	CO2
C	Rubisco	D	Oxaloacetate

Solution: (d) Acetyl coenzyme A joins oxaloacetate to give citrate and start the cycle.

MCQ 2.1.51 **The term glycolysis refers to the conversion of: (UHS MDCAT 2017)**

A	Pyruvate to Glucose	B	Glucose to Pyruvate
C	Citric acid to CO2	D	Both Pyruvate to Glucose and Glucose to Pyruvate

Solution: (b) Glycolysis is the splitting of glucose to two molecules of pyruvate.

MCQ 2.1.52 **Malate is oxidized by (UHS MDCAT 2015)**

A	ATP	B	NADP to oxaloacetate in Krebs's Cycle.
C	NAD	D	FAD

Solution: (c) Malate dehydrogenase passes the hydrogen to NAD.

MCQ 2.1.53 **In electron transport chain, the electrons from NADH and FADH2 are passed to; (UHS MDCAT 2015)**

A	Cytochrome a	B	Cytochrome a3
C	Co-enzyme c	D	Co-enzyme Q

Solution: (d) Both feed their electrons into coenzyme Q, which passes them along the chain.

MCQ 2.1.54 **Carriers of the respiratory chain are located on: (UHS MDCAT 2015)**

A	Matrix of mitochondria	B	Outer membrane of mitochondria
C	Inner membrane of mitochondria	D	Cytoplasmic matrix

Solution: (c) The carriers sit in the inner mitochondrial membrane.

Unit 3 Biological Molecules

Topic 3.1 Biological Molecules

Past MDCAT Questions

MCQ 3.1.1 **Hydrolysis is the reverse of which process? (MDCAT 2022)**

A	condensation	B	oxidation
C	reduction	D	hydrogenation

Solution: (a) Condensation joins two molecules and removes water; hydrolysis adds water back and splits them.

MCQ 3.1.2 **Name the biomolecule essential for information storage and transmission within cells. (SIBA MDCAT 2025)**

A	Carbohydrates	B	Lipids
C	Nucleic acids.	D	Proteins

Solution: (c) DNA holds the information and RNA carries it, so the nucleic acids are the information molecules.

MCQ 3.1.3 **Hydrolysis process is a reverse of ---------- -------- process. (UHS MDCAT 2023)**

A	Photolysis	B	Condensation
C	Deduction	D	Convection

Solution: (b) Condensation joins two units with the loss of water; hydrolysis splits them by adding it back.

MCQ 3.1.4 **Which bond is the potential source of chemical energy for cellular activities? (SZABMU MDCAT 2023)**

A	C=O	B	C-H
C	C-R	D	C-N

Solution: (b) The carbon hydrogen bond is where the energy of a food molecule is stored.

MCQ 3.1.5 **Most abundant organic compound in mammalian cells are: (NUMS MDCAT 2023)**

A	Water	B	Lipids
C	Carbohydrates	D	Proteins

Solution: (d) Proteins are the most abundant organic molecules of an animal cell; water is not organic.

MCQ 3.1.6 **Energy is by the breakdown of complex molecules into simpler ones, such reactions are called catabolic reactions (UHS MDCAT 2023)**

A	Released	B	Consumed
C	Produced	D	Destroyed

Solution: (a) Catabolism breaks large molecules down and releases the energy held in their bonds.

MCQ 3.1.7 **Which of the following is the most abundant organic molecule in the human body? (PMC MDCAT 2022)**

A	Enzymes	B	Lipids
C	Water	D	Proteins

Solution: (d) Proteins are the most abundant organic molecules of the body; water is not organic.

MCQ 3.1.8 **All organic biomolecules contain: (PMC MDCAT 2022)**

A	Iron and oxygen	B	Carbon and hydrogen
C	Carbon and nitrogen	D	Carbon and Sulphur

Solution: (b) Every organic molecule is built on a skeleton of carbon carrying hydrogen.

MCQ 3.1.9 **Hydrolysis is the breakdown of polymer into its monomers by the addition of: (NUMS MDCAT 2022)**

A	Hydroxyl group	B	Hydrogen
C	Water	D	Nitrogen

Solution: (c) Hydrolysis is the splitting of a polymer by the addition of water.

MCQ 3.1.10 **What type of atom is the carbon atom? (PMC Practice 2021)**

A	Divalent	B	Monovalent
C	Trivalent	D	Tetravalent

Solution: (d) Carbon has four outer electrons and makes four bonds.

Topic 3.2 Biological Importance of Water

Past MDCAT Questions

MCQ 3.2.1 **Human bone cells contain what percentage of water? (MDCAT 2022)**

A	20	B	40
C	85	D	90

Solution: (a) Bone is the driest tissue of the body, at about 20% water.

MCQ 3.2.2 **What is the percentage of water in bone cells? (MDCAT 2024)**

A	70%	B	20%
C	98%	D	60%

Solution: (b) Bone is the least watery of the tissues, with about a fifth of its weight as water.

MCQ 3.2.3 **Which property of water helps in moderating Earth's climate and maintaining stable temperature in aquatic environment? (UHS MDCAT 2025)**

A	Low viscosity	B	High specific heat capacity
C	High surface tension	D	High polarity

Solution: (b) Water takes in a great deal of heat for a small rise in temperature, so it steadies the climate.

MCQ 3.2.4 **The high specific heat capacity of water is due to: (KMU MDCAT 2025)**

A	Ionic bonding	B	Hydrogen bonding
C	Covalent bonding	D	Hydrophilic bonding

Solution: (b) Much of the heat given to water goes into breaking hydrogen bonds rather than into motion.

MCQ 3.2.5 **Which properties of water enable it to circulate in living bodies and act as transport medium? (KMU MDCAT 2025)**

A	Ionization and low density	B	Cohesion and ionization
C	Ionization and adhesion	D	Adhesion and cohesion

Solution: (d) Cohesion holds the column of water together and adhesion holds it to the walls of the vessel.

MCQ 3.2.6 **Water can circulate in living organisms due to: (SIBA MDCAT 2025)**

A	Surface tension and polarity	B	Cohesion and adhesion .
C	Solubility in cells	D	Stable liquid range

Solution: (b) Cohesion holds the water column together and adhesion holds it to the vessel wall.

MCQ 3.2.7 **Which property of water allows it to stick to polar surface like wood? (SIBA MDCAT 2025)**

A	Density	B	Adhesion
C	Cohesion	D	Non-polar attraction

Solution: (b) Adhesion is the attraction of water to a different polar surface.

MCQ 3.2.8 **The temperature of underground water remains constant due to: (SZABMU MDCAT 2025)**

A	Heat capacity	B	Polarity of water
C	Heat of vaporization	D	Specific heat of vaporization

Solution: (a) Water takes in a great deal of heat for a small rise in temperature, so a body of it changes temperature slowly.

MCQ 3.2.9 **All of the following properties of water are associated with its capillary action. EXCEPT: (SZABMU MDCAT 2025)**

A	Adhesion	B	Density
C	Cohesion	D	Surface tension

Solution: (b) Capillary rise depends on adhesion, cohesion and surface tension; the density only sets how high the column can be held.

MCQ 3.2.10 **Water commonly known as a universal solvent because: (SZABMU MDCAT 2025)**

A	It dissolves polar and ionic substances effectively	B	It supports chemical reactions without reacting itself
C	It has a high specific heat capacity	D	It dissolves many substances due to its small molecule size

Solution: (a) Its molecules are polar, so they pull ions and polar molecules apart and surround them.

MCQ 3.2.11 **Which of the following structural change in water molecule leads to the low density of ice? (SZABMU MDCAT 2025)**

A	Formation of ionic bonds	B	Expansion due to hydrogen bonding
C	Increased kinetic energy	D	Loss of polarity in molecules

Solution: (b) On freezing, the hydrogen bonds hold the molecules in an open lattice that takes up more room than the liquid.

MCQ 3.2.12 **Which property of water enables it to act as temperature stabilizer in living organisms? (SZABMU MDCAT 2023)**

A	High polarity	B	Being non polar
C	High specific heat capacity	D	High heat of vaporization

Solution: (c) Water takes in a great deal of heat for a small rise in temperature, so it steadies the body.

MCQ 3.2.13 **Thermal stability of organisms in the environment is because of which characteristic of water? (NUMS MDCAT 2023)**

A	Solvent property	B	Heat capacity
C	Ionization	D	Protection

Solution: (b) Water takes in a great deal of heat for a small rise in temperature, so it steadies the body.

MCQ 3.2.14 **Which type of bond must be broken for water to vaporize? (UHS MDCAT 2023)**

A	Nonpolar covalent bonds	B	Polar covalent bonds
C	Hydrogen bonds	D	Covalent bonds

Solution: (c) Vaporizing water means pulling its molecules apart, which breaks the hydrogen bonds between them.

MCQ 3.2.15 **_____ forms almost three-fourth of the body by weight (UHS MDCAT 2023)**

A	Water	B	Protein
C	Carbohydrates	D	Lipids

Solution: (a) About three quarters of the mass of the body is water.

MCQ 3.2.16 **Due to its high heat of vaporization water plays important role in living organism as: (NUMS MDCAT 2022)**

A	Being an excellent solvent	B	Cooling agent
C	Membrane stabilizer	D	Thermal shock resistor

Solution: (b) Evaporating a little sweat carries off a great deal of heat, which is how the body is cooled.

MCQ 3.2.17 **The attraction between water molecules and the cell wall of xylem is termed as: (PMC Practice 2021)**

A	Cohesion	B	Tension
C	Adhesion	D	Imbibition

Solution: (c) Water clinging to a different surface is adhesion; water clinging to itself is cohesion.

MCQ 3.2.18 **Water acts as a universal solvent because of: (PMC MDCAT 2020)**

A	Heat of vaporization	B	Hydrogen bonding
C	High polarity	D	Cohesion and adhesion

Solution: (c) The water molecule is strongly polar, so it pulls ions apart and surrounds them.

MCQ 3.2.19 **If water has a high latent heat of vaporization, how could this property of water be helpful to plants and animals? (UHS MDCAT 2019)**

A	With the release of large amount of water, a small amount of heat loss can take place.	B	With the release of small amount of water vapours, a great amount of heat loss can take place.
C	It will keep their temperature very high.	D	No cooling effect, with the release of even a large amount of water vapours.

Solution: (b) A little sweat carries off a great deal of heat, which is what makes evaporation such an efficient coolant.

Topic 3.3 Carbohydrates

Past MDCAT Questions

MCQ 3.3.1 **Monosaccharides have a general formula represented by: (MDCAT 2024)**

A	$C_n(H_2O)_n$	**B**	$C(H_2O)_n$
C	$C_6(H_2O)_n$	**D**	$C_n(H_2O)$

Solution: (a) A monosaccharide carries one water for every carbon, which is what "carbohydrate" means.

MCQ 3.3.2 **Polysaccharides in plants are synthesized by the process of: (MDCAT 2024)**

A	hydrolysis	**B**	oxidation
C	condensation	**D**	glycolysis

Solution: (c) Each glycosidic bond is made by removing a molecule of water between two sugars.

MCQ 3.3.3 **An oligosaccharide is made up of at least: (UHS MDCAT 2025)**

A	two saccharide units	**B**	ten saccharide units
C	three to ten saccharide units	**D**	more than ten saccharide units

Solution: (c) An oligosaccharide is three to ten monosaccharide units joined by glycosidic bonds.

MCQ 3.3.4 **Which one of the following biomolecules is a polymer/polysaccharide? (UHS MDCAT 2025)**

A	Sucrose	**B**	Pentose
C	Lactose	**D**	Glycogen

Solution: (d) Glycogen is a branched polymer of glucose; the other three are single or double sugars.

MCQ 3.3.5 **Which of the following is a branched polysaccharide found in animals: (KMU MDCAT 2025)**

A	Cellulose	**B**	Glycogen
C	Amylose	**D**	Chitin

Solution: (b) Glycogen is the branched storage polysaccharide of liver and muscle.

MCQ 3.3.6 **A diabetic patient is advised to avoid both sucrose and lactose, because they both: (KMU MDCAT 2025)**

A	Are structural carbohydrates	**B**	Increase blood glucose after hydrolysis
C	Cannot be digested in human	**D**	Act as non-caloric sweeteners

Solution: (b) Both are disaccharides that hydrolyse to sugars the blood absorbs, so both raise blood glucose.

MCQ 3.3.7 **Identify the CORRECT option that matches the sugar with its carbon number and functional group: (KMU MDCAT 2025)**

A	Glyceraldehyde - Triose, Ketone group	**B**	Ribose - Pentose, Aldehyde group
C	Ribulose - Pentose, Aldehyde Group	**D**	Galactose - Hexose, Ketone Group

Solution: (b) Ribose is a five carbon sugar with an aldehyde group.

MCQ 3.3.8 **At least how many saccharide units must be present in polysaccharide? (SIBA MDCAT 2025)**

A	1	**B**	2
C	10	**D**	11

Solution: (d) An oligosaccharide runs to ten units, so a polysaccharide begins at eleven.

MCQ 3.3.9 **Homopolysaccharide that is found in the cell wall of fungi and in the exoskeleton of arthropods is: (SIBA MDCAT 2025)**

A	Cellulose	**B**	Glycogen
C	Starch	**D**	Chitin

Solution: (d) Chitin is a polymer of a single sugar derivative, so it is a homopolysaccharide.

MCQ 3.3.10 **Polysaccharides such as starch and glycogen are mainly used for: (SZABMU MDCAT 2025)**

A	Structural framework only	**B**	Short-term and long-term energy storage
C	Enzyme catalysis	**D**	Ready source of energy

Solution: (b) Starch and glycogen are the storage polysaccharides of plants and animals.

MCQ 3.3.11 **Which of the following characteristics is common among sucrose, lactose and maltose? (SZABMU MDCAT 2025)**

A	molecular formula	**B**	occurrence in living beings
C	chemical nature of their monosaccharide units	**D**	to act as reducing sugar

Solution: (a) All three are disaccharides of formula $C_{12}H_{22}O_{11}$.

MCQ 3.3.12 **Which monosaccharide will from a gluco pyranose ring in solution? (UHS MDCAT 2024)**

A	Fructose	**B**	Glucose
C	Ribose	**D**	Deoxyribose

Solution: (b) Glucose closes into a six membered ring, the glucopyranose form.

MCQ 3.3.13 **Sugarcane contains _____. (KMU MDCAT 2024)**

A	Fructose	**B**	Glucose
C	Ribose	**D**	Sucrose

Solution: (d) Cane sugar is sucrose, a disaccharide of glucose and fructose.

MCQ 3.3.14 **Loss of reactivity of sucrose is due to its: (NUMS MDCAT 2024)**

A	High solubility in water	**B**	Polar nature
C	Unavailability of functional group	**D**	Alpha 1-2 Glycosidic linkage

Solution: (d) Both anomeric carbons are locked in the alpha 1,2 link, so sucrose has no free aldehyde group left.

MCQ 3.3.15 **Upon initial hydrolysis starch yields: (UHS MDCAT 2023)**

A	Maltose	**B**	Glucose
C	Sucrose	**D**	Mannose

Solution: (a) Starch is broken first to maltose and only then to glucose.

MCQ 3.3.16 **Which of the following carbohydrates are sweetest among all? (SZABMU MDCAT 2023)**

A	Monosaccharides	**B**	Disaccharides
C	Oligosaccharides	**D**	Polysaccharides

Solution: (a) The simple sugars taste sweetest, and sweetness falls as the chains grow longer.

MCQ 3.3.17 **Chemically, cell wall of fungi is made up of: (SZABMU MDCAT 2023)**

A	Cellulose	**B**	Lignin
C	Chitin	**D**	Murein

Solution: (c) The fungal wall is chitin, the same polymer as the arthropod skeleton.

MCQ 3.3.18 **These carbohydrates are sweetest among all carbohydrates: (NUMS MDCAT 2023)**

A	Monosaccharides	**B**	Disaccharides
C	Oligosaccharides	**D**	Polysaccharides

Solution: (a) The simple sugars taste the sweetest of all the carbohydrates.

MCQ 3.3.19 **Most of the monosaccharides form a ring structure when in solution. For example ribose will form a five cornered ring known as (UHS MDCAT 2023)**

A	Glucopyranose	**B**	Ribofuranose
C	Glyceradehyde	**D**	Acetaldehyde

Solution: (b) Ribose closes into a five membered ring, the ribofuranose form.

MCQ 3.3.20 **Which statement is true about regarding both starch and cellulose? (UHS MDCAT 2023)**

A	They are both polymers of glucose.	**B**	They are geometric isomers of each other
C	They can both be digested by humans.	**D**	They are both used for energy storage in plants.

Solution: (a) Both are chains of glucose; they differ in the linkage, which is why we can digest only starch.

MCQ 3.3.21 **Which one of the following is a polymer of alpha-d glucose? (PMC MDCAT 2022)**

A	Cellulose	**B**	Glycogen
C	Insulin	**D**	Chitin

Solution: (b) Glycogen is a branched polymer of alpha glucose; cellulose is built of the beta form.

MCQ 3.3.22 **Which of the following is true about glucose and fructose? (PMC MDCAT 2022)**

A	Have the same structural formula	**B**	Have different molecular formula
C	They are building blocks of sucrose	**D**	They are aldohexoses

Solution: (c) Sucrose is glucose joined to fructose; the two sugars share a formula but differ in structure.

MCQ 3.3.23 **Which of the following is a respiratory fuel? (PMC MDCAT 2022)**

A	Sucrose	**B**	Glucose
C	Galactose	**D**	Mannose

Solution: (b) Glucose is the sugar that enters glycolysis directly.

MCQ 3.3.24 **When alpha glucose is condensed with beta fructose, which of the following can be produced? (PMC MDCAT 2022)**

A	Maltose	**B**	Lactose
C	Water	**D**	Peptide Bond

Solution: (c) The glycosidic link is made with the loss of a molecule of water.

MCQ 3.3.25 **Dietary fibers are (PMC MDCAT 2022)**

A	Cellulose	**B**	Glycogen
C	Starch	**D**	Proteoglycans

Solution: (a) Cellulose passes through us undigested and gives the diet its roughage.

MCQ 3.3.26 **Glucose and Ribose form ring structures when: (PMC MDCAT 2022)**

A	React with an appropriate enzyme	**B**	Dissolved in water
C	Immersed in oil	**D**	They are in crystalline state

Solution: (b) In water the open chain closes on itself and an equilibrium is set up between the forms.

MCQ 3.3.27 **At least, how many carbon atoms must be found in an amylose starch? (PMC MDCAT 2022)**

A	7	**B**	66
C	70	**D**	Many thousands

Solution: (d) Amylose is a long unbranched chain of glucose units, so its carbons run into thousands.

MCQ 3.3.28 **The temporary storage of energy in the human body is: (PMC MDCAT 2022)**

A	Cellulose	**B**	Glycogen
C	ATP	**D**	Fats

Solution: (b) Glycogen is the short-term carbohydrate store of liver and muscle.

MCQ 3.3.29 **Cellulose is _____ (PMC MDCAT 2022)**

A	hexose polysaccharlde	**B**	heptose polysaccharlde
C	heteropolysaccharlde	**D**	pentosepolysaccharlde

Solution: (a) Cellulose is a polymer of glucose, a six carbon sugar.

MCQ 3.3.30 **Amylopectin is _____ and insoluble in _____ (PMC MDCAT 2022)**

A	branched sugar, water	**B**	unbranched sugar, ethanol
C	branched sugar, cold water	**D**	unbranched sugar, hot water

Solution: (a) Amylopectin is the branched fraction of starch and does not dissolve in cold water.

MCQ 3.3.31 **Reducing sugar among the following is: (PMC MDCAT 2022)**

A	galactose	**B**	gluconic acid
C	glycogen	**D**	sucrose

Solution: (a) Galactose has a free aldehyde group, so it reduces Fehling's solution.

MCQ 3.3.32 **Maximum how many carbon atoms does an oligosaccharide contain? (PMC MDCAT 2022)**

A	3	**B**	7
C	70	**D**	Many thousands

Solution: (c) An oligosaccharide runs to ten units, and a hexose unit has six carbons, so about seventy at most.

MCQ 3.3.33 **Which of the following is milk sugar? (PMC MDCAT 2022)**

A	Sucrose	**B**	Lactose
C	Maltose	**D**	Starch

Solution: (b) Lactose is the sugar of milk.

MCQ 3.3.34 **Which of the following is not a carbohydrate: (NUMS MDCAT 2022)**

A	Glucose ($C_6H_{12}O_6$)	**B**	Sucrose ($C_{12}H_{22}O_{11}$)
C	Rhamnose ($C_6H_{12}O_5$)	**D**	Lactic acid ($C_2H_4O_2$)

Solution: (d) Lactic acid is a carboxylic acid, not a sugar or a polymer of one.

MCQ 3.3.35 **Which of the following molecules would yield glucose and fructose on hydrolysis? (NUMS MDCAT 2022)**

A	Starch	**B**	Maltose
C	Sucrose	**D**	Lactose

Solution: (c) Sucrose is glucose joined to fructose.

MCQ 3.3.36 **How many monosaccharide molecules do oligosaccharides yield upon hydrolysis? (PMC Practice 2021)**

A	2	**B**	5
C	10	**D**	All of these

Solution: (d) An oligosaccharide yields from two to ten monosaccharide units.

MCQ 3.3.37 **Which bond provides stability to complex carbohydrate molecules? (PMC Practice 2021)**

A	C-H	**B**	C-N
C	C-O	**D**	C-C

Solution: (c) The glycosidic link between sugar units is a carbon oxygen bond.

MCQ 3.3.38 **Starch is present in tubers, fruits, and grains but absent in animal cells. Instead, animals have a substance stored in liver and muscles known as: (UHS MDCAT 2019)**

A	Galactose	B	Glucagon
C	Glycogen	D	Glucose

Solution: (c) Glycogen is the storage polysaccharide of liver and muscle.

MCQ 3.3.39 **Which is an example of a Disaccharide? (UHS MDCAT 2019)**

A	Starch	B	Lactose
C	Fructose	D	Glycogen

Solution: (b) Lactose is glucose joined to galactose.

MCQ 3.3.40 **The covalent bond or bridge between two monosaccharides to form a disaccharide is called a: (UHS MDCAT 2019)**

A	Hydroxyl bond	B	Hydrogen bond
C	Carboxyl bond	D	Glycosidic bond

Solution: (d) The link between two sugar units is a glycosidic bond.

MCQ 3.3.41 **Glycosidic bond is formed by the: (UHS MDCAT 2018)**

A	Removal of Oxygen	B	Addition of Oxygen
C	Removal of water	D	Addition of water

Solution: (c) The glycosidic bond is made by condensation, with a molecule of water lost.

MCQ 3.3.42 **The type of carbohydrate which has high molecular weight and is sparingly soluble in water is: (UHS MDCAT 2017)**

A	Monosaccharides	B	Disaccharides
C	Polysaccharides	D	Maltose

Solution: (c) A polysaccharide is a long chain, so it is heavy and barely soluble.

MCQ 3.3.43 **Give the general formula of monosaccharides and polysaccharides. (UHS MDCAT 2017)**

A	(CH2O)n and Cn(H2O)2n	B	(CH2O)2n and Cn(H2O)n
C	(CH2O)n and Cn(H2O)n-1	D	(CH2O)n-1 and Cn(H2O)n+1

Solution: (c) A monosaccharide is $(CH_2O)_n$; a polysaccharide loses a water at each link.

MCQ 3.3.44 **In a laboratory experiment when an unknown compound was added in a test tube containing iodine, the colour became intense blue. What could be the unknown compound? (UHS MDCAT 2016)**

A	Cellulose	B	Raffinose
C	Ribose	D	Starch

Solution: (d) Starch gives the deep blue colour with iodine.

MCQ 3.3.45 **The compounds which on hydrolysis yield polyhydroxy aldehyde or ketone subunits are: (UHS MDCAT 2016)**

A	Lipids	B	Proteins
C	Polynucleotides	D	Carbohydrates

Solution: (d) A carbohydrate hydrolyses to polyhydroxy aldehydes or ketones, that is to simple sugars.

MCQ 3.3.46 **Monosaccharides are major components of: (UHS MDCAT 2015)**

A	DNA, ATP, Ribulose bisphosphate and Cysteine	B	DNA, NAD and Insulin
C	DNA, NADP, ATP and Ribulose bisphosphate	D	DNA, RNA and Myosin

Solution: (c) Ribose and deoxyribose are the sugars of the nucleic acids, of ATP and of ribulose bisphosphate.

Topic 3.4 Proteins

Past MDCAT Questions

MCQ 3.4.1 **The unique three-dimensional shape of a fully folded polypeptide constitutes its: (MDCAT 2022)**

A	primary structure	B	secondary structure
C	tertiary structure	D	quaternary structure

Solution: (c) The whole folded shape of one chain is its tertiary structure.

MCQ 3.4.2 **Which of the following processes is involved in the breakdown of protein into amino acids? (MDCAT 2024)**

A	condensation	B	hydrolysis
C	glycolysis	D	fixation

Solution: (b) A molecule of water is added across each peptide bond to break it.

MCQ 3.4.3 **Which of the following best highlights the importance of proteins in Immunity? (UHS MDCAT 2025)**

A	They act as receptors of pathogens	B	They are long term energy reserves
C	They act as antibodies	D	They act as mechanical barrier to pathogens

Solution: (c) Antibodies are proteins, and the specific defence of the body rests on them.

MCQ 3.4.4 **The secondary structure of proteins is stabilized by: (UHS MDCAT 2025)**

A	Ionic bonds	B	Hydrogen bonds
C	Disulfide bridges	D	Hydrophobic exclusion

Solution: (b) Hydrogen bonds between the peptide groups hold the alpha helix and the beta pleated sheet.

MCQ 3.4.5 **The following is an example of a globular protein. (UHS MDCAT 2025)**

A	Keratin	B	Collagen
C	Hemoglobin	D	Histone

Solution: (c) Haemoglobin is globular and soluble; keratin and collagen are fibrous.

MCQ 3.4.6 **Peptide bonds are Important In protein because they: (UHS MDCAT 2025)**

A	Affect solubility	B	Hold R-groups
C	Link amino acid	D	help in releasing oxygen

Solution: (c) The peptide bond joins the amino group of one amino acid to the carboxyl group of the next.

MCQ 3.4.7 **Which of the following is NOT a globular protein? (KMU MDCAT 2025)**

A	Enzyme	B	Albumin
C	Hemoglobin	D	Collagen

Solution: (d) Collagen is a fibrous structural protein; the other three are globular.

MCQ 3.4.8 **An experiment shows that heating a 'protein' disrupts the alpha helix structure. Which protein structure is mainly affected? (KMU MDCAT 2025)**

A	Primary structure	B	Secondary structure
C	Tertiary structure	D	Quaternary structure

Solution: (b) The alpha helix is secondary structure, held by hydrogen bonds that heat breaks first.

MCQ 3.4.9 **A food sample contains long chains of amino acids bounded together. This indicates the presence of: (SIBA MDCAT 2025)**

A	Carbohydrates	B	Lipids
C	Proteins	D	Nucleic acids

Solution: (c) A long chain of amino acids is a polypeptide, so the sample is protein.

MCQ 3.4.10 **Name the type of bond that join amino acids to form a polypeptide chain: (SIBA MDCAT 2025)**

A	Hydrogen bond	**B**	Ionic bond
C	Glycosidic bond	**D**	Peptide bond

Solution: (d) Amino acids are joined by peptide bonds between the amino group of one and the carboxyl group of the next.

MCQ 3.4.11 **A mutation prevents proper disulphide bond formation in a fibrous protein, causing brittle nails and slow hair growth. Which of the following proteinaceous substance would be affected? (SZABMU MDCAT 2025)**

A	Elastin	**B**	Actin
C	Keratin	**D**	Collagen

Solution: (c) Keratin of hair and nail owes its toughness to disulphide bridges between cysteine residues.

MCQ 3.4.12 **Which of the following process Is involved in breakdown of protein into Amino acids? (UHS MDCAT 2024)**

A	Condensation	**B**	Hydrolysis
C	Glycolysis	**D**	Fixation

Solution: (b) Hydrolysis adds water across each peptide bond and frees the amino acids.

MCQ 3.4.13 **Sickle cell anaemia results from? (KMU MDCAT 2024)**

A	Reduction in oxygen carrying capacity of haemoglobin	**B**	Linkage between the polypeptide chains
C	Single amino acid substitution in the haemoglobin molecule	**D**	Viral infections of RNA viruses

Solution: (c) A single valine in place of glutamic acid in the beta chain is the whole of the change.

MCQ 3.4.14 **Which is INCORRECT about the globular proteins? (KMU MDCAT 2024)**

A	Abundantly found in hair	**B**	Are spherical in shape
C	Have polypeptide chains	**D**	Soluble in water

Solution: (a) Hair is keratin, a fibrous protein; globular proteins are the soluble, rounded ones.

MCQ 3.4.15 **Protein present in haemoglobin has _____ structure. (KMU MDCAT 2024)**

A	Primary	**B**	Secondary
C	Tertiary	**D**	Quaternary

Solution: (d) Haemoglobin has four polypeptide chains fitted together, which is quaternary structure.

MCQ 3.4.16 **Proteins with tertiary structure are helpful in: (NUMS MDCAT 2024)**

A	Carrying messages from glands to target organs	**B**	Maintaining epithelial lining of skin
C	Making the matrix of connective tissue	**D**	Helping muscle contraction

Solution: (a) Peptide hormones are globular proteins folded into a tertiary shape that their receptors recognize.

MCQ 3.4.17 **Rebounding is process of straightening the curly hairs. Which bond is targeted by oxidizing agents used during this process? (NUMS MDCAT 2024)**

A	Peptide bond	**B**	Ionic bond
C	Disulphide bridge	**D**	Hydrogen bond

Solution: (c) The curl of hair is held by disulphide bridges, and the oxidizing agent breaks and remakes them.

MCQ 3.4.18 **Ions of heavy metal are harmful for living organisms because of their ability to: (NUMS MDCAT 2024)**

A	Cleave nucleic acid	**B**	Interfere with fat metabolism
C	Break glycosidic bonds	**D**	Destabilize proteins

Solution: (d) Heavy metal ions bind the sulphydryl groups and unfold the protein.

MCQ 3.4.19 **Unique three-dimensional shape of the fully folded polypeptide, constitutes: (UHS MDCAT 2023)**

A	Primary structure of protein	**B**	Secondary structure of protein
C	Tertiary structure of protein	**D**	Quaternary structure of protein

Solution: (c) The folded shape of a whole polypeptide is its tertiary structure.

MCQ 3.4.20 **Proteins are the main ---------- of the cell? (UHS MDCAT 2023)**

A	Physiological components	**B**	Functional components
C	Structural components	**D**	Biological components

Solution: (b) Enzymes, carriers, receptors and antibodies are all proteins, so proteins do the work of the cell.

MCQ 3.4.21 **Which of the following proteins acts as carrier of copper in blood plasma? (UHS MDCAT 2023)**

A	Hemoglobin	**B**	Glycoprotein
C	Ceruloplasmin	**D**	Histone

Solution: (c) Ceruloplasmin is the copper carrying protein of the plasma.

MCQ 3.4.22 **Select an example of fibrous protein: (SZABMU MDCAT 2023)**

A	Enzymes	**B**	Collagen
C	Hemoglobin	**D**	Hormones

Solution: (b) Collagen is a fibrous structural protein of tendon, skin and bone.

MCQ 3.4.23 **Which function is NOT performed by proteins? (SZABMU MDCAT 2023)**

A	Providing structural support to cell	**B**	Catalyzing biochemical reactions
C	Transporting materials across cell membrane	**D**	Providing insulation against heat loss

Solution: (d) Insulation against heat loss is the work of fat, not of protein.

MCQ 3.4.24 **Based on function, thyroxin can be classified as: (SZABMU MDCAT 2023)**

A	Hormonal protein	**B**	Structural protein
C	Transprt protein	**D**	Genetic protein

Solution: (a) Thyroxine carries a message from a gland to its target, so it is classed as a hormonal protein.

MCQ 3.4.25 **Which of the following protein establishes the matrix of bone and cartilage? (NUMS MDCAT 2023)**

A	Elastin	**B**	Keratin
C	Collagen	**D**	Histone

Solution: (c) Collagen fibres are the framework of the matrix of both bone and cartilage.

MCQ 3.4.26 **Insulin consists of two polypeptides containing 21 amino acids and 30 amino acids each. How many peptide bonds does the insuline contain? (PMC MDCAT 2022)**

A	51	**B**	50
C	49	**D**	2

Solution: (c) Each chain of n residues has $n-1$ bonds, so $20+29$ is 49.

MCQ 3.4.27 **If an α-helix of a polypeptide consist of 360 amino acids, how many turns does the helix contain? (PMC MDCAT 2022)**

A	3.6 turns	**B**	100 turns
C	360 turns	**D**	The number of turns can not be determind

Solution: (b) An alpha helix turns once every 3.6 residues, so 360 residues make 100 turns.

MCQ 3.4.28 **The R-group in glycine consists of: (PMC MDCAT 2022)**

A	A Hydrogen atom	**B**	Methyl group
C	Amino group	**D**	Carboxylic acid group

Solution: (a) Glycine is the simplest amino acid; its side chain is a single hydrogen atom.

MCQ 3.4.29 **The globular structure of enzymes shows: (PMC MDCAT 2022)**

A	Primary structure of protein	**B**	Secondary structure of protein
C	Tertiary structure of protein	**D**	That it's an organic catalysis

Solution: (c) A globular, folded shape is tertiary structure.

MCQ 3.4.30 **Which of the following is an example of a globular protein? (PMC MDCAT 2022)**

A	Keratin	**B**	An enzyme
C	Fibrinogen	**D**	Collagen

Solution: (b) Enzymes are globular and soluble; keratin, fibrinogen and collagen are fibrous.

MCQ 3.4.31 **The R group of an amino acid represents: (PMC MDCAT 2022)**

A	a hydrogen atom	**B**	A hydrocarbon
C	an additional atom or group of atoms	**D**	a methyl group

Solution: (c) The R group is whatever side chain is attached to the alpha carbon.

MCQ 3.4.32 **The osmotic pressure of blood Is maintained by: (PMC MDCAT 2022)**

A	Membrane proteins	**B**	Fibrous proteins
C	Plasma proteins	**D**	Myosln

Solution: (c) The plasma proteins, chiefly albumin, hold the osmotic pressure of the blood.

MCQ 3.4.33 **The tertiary structure of protein indicates its: (PMC MDCAT 2022)**

A	Chemical function	**B**	Biological function
C	Physical appereance	**D**	characterstics

Solution: (b) A protein works only when folded into its tertiary shape.

MCQ 3.4.34 **When two amino acids such as glycine and alanine are variously arranged to make dipeptides. How many different dipeptide combinations can be produced? (PMC MDCAT 2022)**

A	1	**B**	2
C	3	**D**	4

Solution: (d) Each of the two can come first and each can come second, so there are four arrangements.

MCQ 3.4.35 **Hydrogen bonding produces a regular coiled arrangement in proteins called: (PMC MDCAT 2022)**

A	α-hellx	**B**	β-hellx
C	Tertiary conformation	**D**	Quaternary structure

Solution: (a) Hydrogen bonds between the peptide groups hold the alpha helix.

MCQ 3.4.36 **Which of the following Is correct about globular proteins? (PMC MDCAT 2022)**

A	Insoluble In water	**B**	Elastic in nature
C	Can be crystalized	**D**	their final structure is secondary

Solution: (c) Globular proteins are soluble and can be crystallized; the fibrous ones cannot.

MCQ 3.4.37 **Plasma proteins are synthesized In: (PMC MDCAT 2022)**

A	Gall bladder	**B**	Liver
C	Spleen	**D**	Skin

Solution: (b) Albumin, globulins and fibrinogen are all made in the liver.

MCQ 3.4.38 **Which of the following bonds maintain the primary structure of a protein (PMC MDCAT 2022)**

A	Hydrogen bonds	**B**	Peptide bonds
C	Disulphide bonds	**D**	Hydrophobic Interaction

Solution: (b) The primary structure is the order of the amino acids, held by peptide bonds.

MCQ 3.4.39 **Which of the following molecule contains amino acid?: (NUMS MDCAT 2022)**

A	Cellulose	**B**	Collagen
C	Sucrose	**D**	Ascorbic acid

Solution: (b) Collagen is a protein, and proteins are chains of amino acids.

MCQ 3.4.40 **Which type of bond is not responsible in maintaining the tertiary structure of proteins? (PMC Practice 2021)**

A	Ionic	**B**	Hydrogen
C	Peptide	**D**	Glycosidic

Solution: (d) A glycosidic bond joins sugars; protein folding is held by hydrogen, ionic and disulphide bonds.

MCQ 3.4.41 **The structure of a fibrous protein comprises of polypeptide chains in the form of: (UHS MDCAT 2019)**

A	Cluster	**B**	Spherical or curried up ball
C	Long strands or fibrils	**D**	Flat uncoiled chains

Solution: (c) A fibrous protein is drawn out into long strands, which is what makes it strong and insoluble.

MCQ 3.4.42 **In glycine, R is _____. (UHS MDCAT 2019)**

A	Ethane	**B**	Fatty acid
C	H atom	**D**	Competitive reversible

Solution: (c) Glycine is the simplest amino acid; its side chain is a single hydrogen atom.

MCQ 3.4.43 **Most proteins are made up of: (UHS MDCAT 2019)**

A	10 types of Amino acids	**B**	20 types of Amino acids
C	170 types Of Amino acids	**D**	16 types of Amino acids

Solution: (b) Twenty amino acids are coded for and make up almost all proteins.

MCQ 3.4.44 **The number and sequence of amino acids along a polypeptide chain is called _____ structure of a protein. (UHS MDCAT 2018)**

A	Quaternary	**B**	Tertiary
C	Primary	**D**	Secondary

Solution: (c) The order of the amino acids is the primary structure.

MCQ 3.4.45 **Which of the following holds the alpha helix of protein in its place: (UHS MDCAT 2018)**

A	R group	**B**	Disulfide bond
C	Amino group	**D**	Hydrogen bond

Solution: (d) Hydrogen bonds between the peptide groups hold the coil of the alpha helix.

MCQ 3.4.46 **How many essential amino acids are there? (UHS MDCAT 2017)**

A	Three	**B**	Six
C	Nine	**D**	Twelve

Solution: (c) Nine of the twenty amino acids cannot be made by the body and must come in the diet.

MCQ 3.4.47 **The type of bonding in ?-Helix; (UHS MDCAT 2017)**

A	1,2 Glycosidic Linkage	B	Ionic Bond
C	Disulfide Bond	D	Hydrogen Bond

Solution: (d) Hydrogen bonds between the peptide groups hold the coil of the alpha helix.

MCQ 3.4.48 **The sequence of amino acids is major factor in which type of protein classification; (UHS MDCAT 2017)**

A	Primary Proteins	B	Secondary Proteins
C	Tertiary Proteins	D	Both Primary and Tertiary Proteins

Solution: (a) The order of the amino acids is the primary structure.

MCQ 3.4.49 **Secondary structure of protein is found in: (UHS MDCAT 2016)**

A	Trypsin	B	Keratin
C	Insulin	D	Glucagon

Solution: (b) Keratin is a fibrous protein whose chains are held in the alpha helix, its secondary structure.

Topic 3.5 Lipids

Past MDCAT Questions

MCQ 3.5.1 **Butyric acid is a _____ carbon fatty acid. (MDCAT 2022)**

A	4	B	6
C	12	D	3

Solution: (a) Butyric acid, the acid of rancid butter, has four carbons.

MCQ 3.5.2 **When glycerol reacts with a fatty acid, which type of chemical bond is formed? (MDCAT 2024)**

A	ester bond	B	ether bond
C	hydrogen bond	D	ionic bond

Solution: (a) The acid and the alcohol condense to an ester, with water as the other product.

MCQ 3.5.3 **The hydrophilic end of a phospholipid molecule is polar because of the presence of: (MDCAT 2024)**

A	glycerol	B	an amine group
C	a fatty acid	D	a phosphate group

Solution: (d) The charged phosphate head is what faces the water.

MCQ 3.5.4 **Fats are considered as a very efficient source of energy because they: (KMU MDCAT 2025)**

A	Produce ATP directly and without requiring respiration	B	Enter into glycolysis without any modification
C	Are highly oxidized compounds	D	Generate multiple acetyl groups that produce more ATP

Solution: (d) A fatty acid chain is cut into many acetyl groups, and each one takes a turn of the Krebs cycle.

MCQ 3.5.5 **Which of the following biological molecule releases highest energy from its one gram? (SIBA MDCAT 2025)**

A	Carbohydrates	B	Lipids
C	Protein	D	Water

Solution: (b) A gram of fat gives about 38 kJ, roughly twice what a gram of carbohydrate or protein gives.

MCQ 3.5.6 **The most abundant lipids in living things are: (SIBA MDCAT 2025)**

A	Terpenes	B	Waxes
C	Steroids	D	Acylglycerols

Solution: (d) The acylglycerols, the fats and oils, are much the commonest lipids.

MCQ 3.5.7 **Which of the following hormones in the body of animal is lipid-based in nature? (SZABMU MDCAT 2025)**

A	Insulin	B	FSH
C	Oxytocin	D	Aldosterone

Solution: (d) Aldosterone is a steroid, built on the cholesterol skeleton; the other three are proteins or peptides.

MCQ 3.5.8 **Which of the following is common between aldosterone, sex hormone and cortisone ? (SZABMU MDCAT 2025)**

A	They are peptides	B	They are Phospholipids
C	They are steroids	D	They are glycoproteins

Solution: (c) All three are built on the cholesterol ring system, so all three are steroids.

MCQ 3.5.9 **Arachidonic acid, which is the precursor molecule for prostaglandins is: (SZABMU MDCAT 2025)**

A	A saturated fatty acid with 18 carbons	B	An unsaturated fatty acid with 18 carbons
C	A tri-unsaturated fatty acid with 20 carbons	D	A tetra-unsaturated fatty acid with 20 carbons

Solution: (d) Arachidonic acid has twenty carbons and four double bonds.

MCQ 3.5.10 **When glycerol reacts with fatty acid, which type of chemical bond will form? (UHS MDCAT 2024)**

A	Ester Bond	B	Ether Linkage
C	Hydrogen Bond	D	Ionic Bond

Solution: (a) A fatty acid and an alcohol group condense into an ester linkage, with water lost.

MCQ 3.5.11 **The hydrophilic end of phospholplid molecule is polar because of the presence of (UHS MDCAT 2024)**

A	Glycerol	B	Amine group
C	Fatty Acid	D	Phosphate group

Solution: (d) The phosphate group carries a charge, which is what makes that end water loving.

MCQ 3.5.12 **What is the ester of fatty acids and long chain alcohol called? (KMU MDCAT 2024)**

A	Acylglycerol	B	Glycerol
C	Phospholipid	D	Wax

Solution: (d) A wax is the ester of a long chain fatty acid with a long chain alcohol.

MCQ 3.5.13 **Lipids, which do not contain fatty acid are: (KMU MDCAT 2024)**

A	Neutral lipids	B	Phosphatidic acids
C	Steroids	D	Waxes

Solution: (c) Steroids are built on a four ring skeleton and carry no fatty acid at all.

MCQ 3.5.14 **Three hydrophobic fatty acid tails and a glycerol molecule join to form a: (SZABMU MDCAT 2023)**

A	Monoglyceride	B	Diglyceride
C	Triglyceride	D	Phospholipid

Solution: (c) Glycerol esterified with three fatty acids is a triglyceride.

MCQ 3.5.15 **Which hormone is chemically a steroid? (NUMS MDCAT 2023)**

A	ADH	B	Thyroxin
C	Cortisone	D	Insulin

Solution: (c) Cortisone is built on the cholesterol ring system, so it is a steroid.

MCQ 3.5.16 **C-H bonds in lipids are important: (NUMS MDCAT 2023)**

A	As insulating material	**B**	Providing more energy
C	As exoskeleton	**D**	As cuticle of leaves

Solution: (b) Fats are rich in carbon hydrogen bonds, so a gram of fat yields about twice the energy of a gram of sugar.

MCQ 3.5.17 **How many fatty acid molecules does an acylglycerol contain at minimum? (PMC MDCAT 2022)**

A	1	**B**	2
C	3	**D**	4

Solution: (a) A monoacylglycerol carries a single fatty acid on the glycerol.

MCQ 3.5.18 **The palmitic acid melts at _____ (PMC MDCAT 2022)**

A	8 C	**B**	72 C
C	63.1 C	**D**	7 C

Solution: (c) Palmitic acid is saturated and solid at room temperature, melting at about $63^{\circ}\mathrm{C}$.

MCQ 3.5.19 **Cholesterol is not present in _____ (PMC MDCAT 2022)**

A	milk	**B**	egg white
C	egg yolk	**D**	fish

Solution: (b) Egg white is protein and water; the cholesterol of an egg is all in the yolk.

MCQ 3.5.20 **Which is a steroid hormone? (NUMS MDCAT 2022)**

A	Cortisone	**B**	Adrenaline
C	Insulin	**D**	Thyroxin

Solution: (a) Cortisone is built on the cholesterol ring system, so it is a steroid.

MCQ 3.5.21 **Cholesterol is: (PMC Practice 2021)**

A	Animal sterol	**B**	C27H46O
C	5 methyl groups	**D**	All of these

Solution: (d) Cholesterol is the animal sterol $\mathrm{C_{27}H_{46}O}$, built on the four ring steroid skeleton.

MCQ 3.5.22 **Nitrogenous bases such as choline and serine are a significant part of which of the following? (PMC Practice 2021)**

A	Sphingolipids	**B**	Phospholipids
C	Phosphodiester	**D**	None of these

Solution: (b) A phospholipid carries a phosphate esterified to a base such as choline or serine.

MCQ 3.5.23 **Saponification number describes _____. (PMC Practice 2021)**

A	Unsaturation in fat	**B**	Average molecular weight of fatty acid
C	Acetyl number	**D**	Acid number

Solution: (b) The saponification number is the alkali needed to hydrolyse a gram of fat, so it measures the mean chain length.

MCQ 3.5.24 **Lipids store double the amount of energy as compared to carbohydrates because of: (PMC MDCAT 2020)**

A	High proportion of oxygen	**B**	High C-O ratio
C	Low proportion of Carbon	**D**	High proportion of C-H

Solution: (d) A fat is rich in carbon hydrogen bonds and poor in oxygen, so more energy is released when it is oxidized.

MCQ 3.5.25 **Which of the following is an unsaturated fatty acid? (PMC MDCAT 2020)**

A	Oleic acid	**B**	Palmitic acid
C	Butyric acid	**D**	Acetic acid

Solution: (a) Oleic acid has one double bond in its chain; the others are saturated.

MCQ 3.5.26 **Lipids contain double amount of energy as compared to the same amount of carbohydrates due to the presence of: (UHS MDCAT 2019)**

A	Higher proportion of C-H	**B**	Higher proportion of C-O
C	Higher proportion of Oxygen	**D**	Low proportion of C-H bonds

Solution: (a) A fat is rich in carbon hydrogen bonds and poor in oxygen, so its oxidation yields more energy.

MCQ 3.5.27 **Which of the following is Unsaturated "Fatty Acid"? (UHS MDCAT 2018)**

A	Stearic Acid	**B**	Palmitic Acid
C	Butyric Acid	**D**	Oleic Acid

Solution: (d) Oleic acid has a double bond in its chain; the other three are saturated.

MCQ 3.5.28 **Which lipid is hydrophilic and soluble? (UHS MDCAT 2018)**

A	Triglycerides	**B**	Phospholipids
C	Waxes	**D**	Terpenoids

Solution: (b) A phospholipid has a charged phosphate head that dissolves in water and two tails that do not.

MCQ 3.5.29 **Among the following, which acid is an unsaturated acid: (UHS MDCAT 2017)**

A	Butyric Acid	**B**	Oleic Acid
C	Palmitic Acid	**D**	Both Oleic Acid and Palmitic Acid

Solution: (b) Oleic acid has a double bond in its chain; butyric and palmitic acids are saturated.

MCQ 3.5.30 **Waxes are formed by combination of fatty acids with: (UHS MDCAT 2016)**

A	Alcohol	**B**	Glycerol
C	Serine	**D**	Cysteine

Solution: (a) A wax is the ester of a fatty acid with a long chain alcohol.

MCQ 3.5.31 **Which one of the following is an example of unsaturated fatty acid? (UHS MDCAT 2015)**

A	Butyric Acid	**B**	Oleic Acid
C	Palmitic Acid	**D**	Acetic Acid

Solution: (b) Oleic acid has a double bond in its chain; the others are saturated.

Topic 3.7 Conjugated Molecules

Past MDCAT Questions

MCQ 3.7.1 **Which of the following is a conjugated molecule? (MDCAT 2022)**

A	glycoproteins	**B**	amino acids
C	vitamins	**D**	monosaccharides

Solution: (a) A conjugated molecule joins two classes of biomolecule, here a sugar with a protein.

MCQ 3.7.2 **Glycoproteins are formed as a result of the combination of: (UHS MDCAT 2025)**

A	Lipids and proteins	**B**	Carbohydrates and proteins
C	Nucleic acid and proteins	**D**	Fatty acids and carbohydrates

Solution: (b) A glycoprotein is a protein with a carbohydrate attached.

MCQ 3.7.3 **The glycoproteins are commonly found in: (KMU MDCAT 2025)**

A	Mitochondria	**B**	Chloroplasts
C	Ribosomes	**D**	Plasma membrane

Solution: (d) Glycoproteins stand on the outer face of the plasma membrane, where they act as markers and receptors.

MCQ 3.7.4 Which of the following best describes glycoproteins? (SIBA MDCAT 2025)

A	Proteins linked with carbohydrates	B	Proteins linked with DNA
C	Proteins linked with lipids	D	Proteins linked with minerals

Solution: (a) A glycoprotein is a protein carrying a carbohydrate chain.

Topic 3.6 Ribonucleic Acid (RNA)

Past MDCAT Questions

MCQ 3.6.1 Which of the following is the correct higher (left) to lower (right) sequence of molecules with respect to the amount in the cell? (UHS MDCAT 2025)

A	DNA → rRNA → tRNA → mRNA	B	rRNA → tRNA → mRNA → DNA
C	mRNA → tRNA → rRNA → DNA	D	DNA → mRNA → tRNA → rRNA

Solution: (b) About four fifths of the RNA of a cell is ribosomal, then transfer, then messenger, and DNA is a different molecule altogether.

MCQ 3.6.2 Which of the following is a key feature of RNA? (UHS MDCAT 2025)

A	Deoxyribose and thymine	B	Double stranded and thymine
C	Ribose and uracil	D	Ribose and thymine

Solution: (c) RNA carries ribose in place of deoxyribose and uracil in place of thymine.

MCQ 3.6.3 Which of the following types of RNA makeup the largest proportion of total cellular RNA? (UHS MDCAT 2025)

A	Messenger RNA	B	Ribosomal RNA
C	Transfer RNA	D	Catalytic RNA (ribozyme)

Solution: (b) Ribosomal RNA is the bulk of the cell's RNA because ribosomes are so numerous.

MCQ 3.6.4 The main role of mRNA during protein synthesis is to: (UHS MDCAT 2025)

A	Carry genetic information for protein synthesis	B	stabilize ribosome
C	deliver amino acids	D	provide platform for proteins synthesis

Solution: (a) Messenger RNA carries the base sequence of a gene from the nucleus to the ribosome.

MCQ 3.6.5 The structure of RNA consists of: (KMU MDCAT 2025)

A	Double polynucleotide strand	B	Deoxyribose sugar
C	Five different types of nucleotides	D	Base pairing instead of thymine

Solution: (d) RNA is a single strand carrying ribose, and uracil takes the place of thymine.

MCQ 3.6.6 Which process uses mRNA to make protein at ribosomes? (SIBA MDCAT 2025)

A	Replication	B	Transcription
C	Translation	D	Cell fractionation

Solution: (c) Translation is the reading of messenger RNA into a chain of amino acids at the ribosome.

MCQ 3.6.7 Which of the following is the best alternative term for ATP? (PMC MDCAT 2022)

A	Ribonucleotide triphosphate	B	Ribonucleotide
C	Nucleoside triphosphate	D	Nucleotide

Solution: (c) ATP is adenosine, a nucleoside, carrying three phosphate groups.

MCQ 3.6.8 If an mRNA consists of 150 nucleotides, how many amino acids would be present in the polypeptide which is encoded by this mRNA? (PMC MDCAT 2022)

A	50	B	100
C	150	D	300

Solution: (a) Three bases code for one amino acid, so $150/3$ is fifty.

MCQ 3.6.9 Transcription is the process in which an RNA copy of the DNA sequence and coding the gene is produced with the help of an enzyme called: (PMC MDCAT 2020)

A	DNA polymerase	B	RNA polymerase
C	DNA transcriptase	D	RNA transcriptase

Solution: (b) RNA polymerase reads the template strand and builds the RNA copy.

MCQ 3.6.10 Which statement correctly describes the transcription of DNA? (PMC MDCAT 2020)

A	It produces amino acids	B	It produces messenger RNA
C	It results in increased DNA synthesis	D	It is a semi conservative process

Solution: (b) Transcription copies a gene into messenger RNA.

MCQ 3.6.11 NAD is an example of: (PMC MDCAT 2020)

A	Mononucleotide	B	Dinucleotide
C	Trinucleotide	D	Tetranucleotide

Solution: (b) NAD is two nucleotides joined through their phosphates.

MCQ 3.6.12 Sequence of amino acids, in a polypeptide chain of protein molecule, corresponds to the sequence of nucleotides on mRNA for that protein. If the reading frame of mRNA for a human protein is 993 nucleotides, including a stop codon at the end, how many amino acids would be incorporated in the polypeptide chain? (UHS MDCAT 2019)

A	93	B	330
C	331	D	993

Solution: (b) $993/3$ is 331 codons, of which the last is a stop, so 330 amino acids.

MCQ 3.6.13 The process in which a complementary copy of the code from a gene is produced by RNA Polymerase in the nucleus: (UHS MDCAT 2019)

A	Transcription	B	Translation
C	Proofreading	D	DNA Replication

Solution: (a) Copying a gene into RNA is transcription.

MCQ 3.6.14 Which one is an example of a Nucleotide? (UHS MDCAT 2019)

A	Adenosine	B	NAD
C	ATP	D	Guanine

Solution: (c) A nucleotide is a base, a sugar and a phosphate; ATP is adenosine with three phosphates.

MCQ 3.6.15 If sequence in DNA is CCCTAGAG, then what would be the sequence in messenger RNA after transcription ? (UHS MDCAT 2019)

A	GGGAUCUC	B	GGGATCTC
C	GGAAUCUC	D	GGGGTCTC

Solution: (a) RNA pairs G with C and A with U, so CCCTAGAG is transcribed as GGGAUCUC.

MCQ 3.6.16 The process in which an RNA copy of the DNA sequence encoding the gene is produced (UHS MDCAT 2017)

A	Translation	B	Transcription
C	Polymerization	D	Genesis

Solution: (b) Copying a gene into RNA is transcription.

MCQ 3.6.17 **In translation, the termination codon is: (UHS MDCAT 2017)**

A	UAA	**B**	UCG
C	AUG	**D**	UUU

Solution: (a) UAA, UAG and UGA are the stop codons.

Topic 3.8 Structure of DNA

Past MDCAT Questions

MCQ 3.8.1 **DNA stores biological information in discrete units termed: (MDCAT 2022)**

A	genes	**B**	phenotypes
C	karyotypes	**D**	cells

Solution: (a) A gene is the length of nucleotides that codes for one polypeptide.

MCQ 3.8.2 **The complementary base pairing in DNA is important because it: (UHS MDCAT 2025)**

A	Maintains the tertiary structure of enzymes	**B**	Provides energy for all cell metabolism
C	Enables protein to fold properly	**D**	Allows DNA act as a genetic blueprint during replication

Solution: (d) Each strand specifies the other, so the base sequence can be copied faithfully and read as a blueprint.

MCQ 3.8.3 **In Watson and Crick's DNA model, which of the following pairs with Cytosine? (KMU MDCAT 2025)**

A	Adenine	**B**	Guanine
C	Thymine	**D**	Uracil

Solution: (b) Cytosine pairs with guanine through three hydrogen bonds.

MCQ 3.8.4 **Guanine - cytosine pairs enhance DNA stability due to: (SIBA MDCAT 2025)**

A	Larger size	**B**	Closer pairing
C	More hydrogen bonds	**D**	Double ring structure in both

Solution: (c) Guanine and cytosine are held by three hydrogen bonds against the two of adenine and thymine.

MCQ 3.8.5 **Which of the following is NOT related to DNA? (SIBA MDCAT 2025)**

A	Adenine	**B**	Thymine
C	Uracil	**D**	Guanine

Solution: (c) Uracil belongs to RNA; DNA carries thymine in its place.

MCQ 3.8.6 **Which of the following base pairing maintains the constant diameter of the DNA double helix as per Watson and Crick's model? (SZABMU MDCAT 2025)**

A	Purine - Purine	**B**	Pyrimidine - Pyrimidine
C	Purine - Pyrimidine	**D**	Sugar-Phosphate

Solution: (c) A large purine always pairs with a small pyrimidine, so every rung of the ladder is the same width.

MCQ 3.8.7 **DNA stores biological information in discrete units termed as: (UHS MDCAT 2023)**

A	Genes	**B**	Phenotypes
C	Karyotypes	**D**	Cells

Solution: (a) A gene is the length of DNA that codes for one polypeptide.

MCQ 3.8.8 **It is the basic unit of biological information: (PMC MDCAT 2022)**

A	Trait	**B**	Gene
C	Genotype	**D**	Phenotype

Solution: (b) A gene is the length of DNA carrying the information for one polypeptide.

MCQ 3.8.9 **The genetic Information for a specific character Is determined by (PMC MDCAT 2022)**

A	Genome	**B**	Transcription
C	Gene	**D**	Trait

Solution: (c) A gene is the length of DNA carrying the information for one character.

MCQ 3.8.10 **Which one of the following is found in both messenger RNA and DNA of a mammalian cell? (PMC MDCAT 2020)**

A	Double helical structure	**B**	Ribose sugar
C	Thymine	**D**	Sugar - phosphate backbone

Solution: (d) Both are built on a backbone of alternating sugar and phosphate.

MCQ 3.8.11 **What is the effect of enzyme DNA ligase? (PMC MDCAT 2020)**

A	DNA is broken up at specific sites	**B**	DNA fragments are joined together
C	DNA replication occurs	**D**	DNA transcription occurs

Solution: (b) DNA ligase seals the sugar phosphate backbone between two fragments.

MCQ 3.8.12 **The nitrogen-containing bases in nucleotide are of two types; Purines and Pyrimidines. The purines bases are: (UHS MDCAT 2019)**

A	Adenine, Guanine, and Cytosine	**B**	Guanine and Cytosine
C	Adenine and Guanine	**D**	Adenine and Thymine

Solution: (c) Adenine and guanine have the double ring of a purine; cytosine and thymine are pyrimidines.

MCQ 3.8.13 **As a result of replication, parental DNA would become completely dispersed and that each strand of all the daughter molecules would be a mixture of old and new DNA. This is called as: (UHS MDCAT 2019)**

A	Dispersive idea	**B**	Conservative idea
C	Disruptive idea	**D**	Semi-conservative idea

Solution: (a) The dispersive idea would have each daughter molecule a patchwork of old and new; replication is in fact semi-conservative.

MCQ 3.8.14 **Meselson and Stahl transferred few bacteria grown in N15 medium to N14 medium for replicating their DNA. What would be the result after two rounds of replication? (UHS MDCAT 2019)**

A	100% heavy duplex	**B**	100% hybrid duplex
C	50% hybrid duplex and 50% heavy duplex	**D**	50% hybrid duplex and 50% light duplex

Solution: (d) Each strand of the heavy duplex serves as a template, so after two rounds half is hybrid and half is fully light.

MCQ 3.8.15 **Ester linkages occur in: (UHS MDCAT 2019)**

A	Nucleic acids	**B**	Nucleus
C	Carbohydrates	**D**	Proteins

Solution: (a) The sugar and phosphate of the backbone are joined by phosphodiester, that is ester, linkages.

MCQ 3.8.16 **A complete turn of the double helix of DNA comprises of: (UHS MDCAT 2018)**

A	34 nm	**B**	3.4 Angstrom
C	3.4 nm	**D**	34 micrometers

Solution: (c) One complete turn of the helix is ten base pairs, that is $3.4\,\text{nm}$.

MCQ 3.8.17 **Single ringed pyrimidines are: (UHS MDCAT 2018)**

A	Uracil, Cytosine and Thymine	**B**	Cytosine, Guanine and Uracil
C	Adenine and Guanine	**D**	Cytosine, Adenine and Thymine

Solution: (a) The pyrimidines are cytosine, thymine and uracil, each with a single ring.

MCQ 3.8.18 **The region of the chromosome or, more specifically, the length of the DNA molecule, which has a particular function is called _____. (UHS MDCAT 2018)**

A	Kinetochore	**B**	Locus
C	Allele	**D**	Gene

Solution: (d) A gene is the length of DNA that carries the information for one function.

MCQ 3.8.19 **What is the subunit of DNA (UHS MDCAT 2017)**

A	Phosphoric Acid	**B**	Base
C	Nucleotide	**D**	Sugar

Solution: (c) The repeating unit of DNA is the nucleotide: a base, a sugar and a phosphate.

MCQ 3.8.20 **The process of DNA replication in which each strand acts as a template for new double helix, composed of one parental strand and one newly polymerized strand refers: (UHS MDCAT 2017)**

A	PCR	**B**	Semi conservative model
C	Conservative mode	**D**	Both PCR & Semi conseervative model

Solution: (b) Each daughter molecule keeps one old strand and one new, which is semi-conservative replication.

MCQ 3.8.21 **DNA polymerase III adds nucleotides to DNA strand, replication always proceeds from: (UHS MDCAT 2017)**

A	3′ → 5′	**B**	5′ → 3
C	Sometime "3′ → 5′ & "5′ → 3′ "	**D**	None of the given options

Solution: (b) A polymerase can only add to a free 3 prime end, so the new strand grows five to three.

MCQ 3.8.22 **Which one of the following nitrogen base is NOT present in DNA? (UHS MDCAT 2016)**

A	Adenine	**B**	Guanine
C	Uracil	**D**	Cytosine

Solution: (c) Uracil belongs to RNA; DNA carries thymine.

MCQ 3.8.23 **Phosphodiester bond is: (UHS MDCAT 2016)**

A	P–O–C–P–O–C	**B**	C–O–P
C	C–O–P–O–C	**D**	C–C–O–P

Solution: (c) A phosphate joins the third carbon of one sugar to the fifth carbon of the next.

Unit 4 Cell Structure and Function

Topic 4.1 Cell Structure

Past MDCAT Questions

MCQ 4.1.1 **The movement of molecules against a concentration gradient is: (MDCAT 2022)**

A	passive transport	**B**	active transport
C	facilitated diffusion	**D**	filtration

Solution: (b) Going uphill against the gradient needs a pump and ATP, which is active transport.

MCQ 4.1.2 **Cells of different types can be distinguished on the basis of surface: (MDCAT 2023)**

A	phospholipids	**B**	globular proteins
C	glycolipids and glycoproteins	**D**	cholesterol

Solution: (c) The sugar chains on the outer face of the membrane differ from one cell type to another and act as its markers.

MCQ 4.1.3 **A student observed a boundary In both plant and animal cells that controls entry and exit of substances. Which of the following structures is likely being observed? (UHS MDCAT 2025)**

A	Mitochondria	**B**	Golgi apparatus
C	Plasma membrane	**D**	Cell wall

Solution: (c) The plasma membrane bounds every cell and decides what passes in and out.

MCQ 4.1.4 **How are the phospholipid molecules arranged in the plasma membrane? (KMU MDCAT 2025)**

A	Hydrophilic heads face inwards and hydrophobic tails face outwards	**B**	Both Hydrophilic heads face each other in the membrane
C	Hydrophilic heads face outwards and hydrophobic tails face inwards	**D**	Hydrophilic heads and hydrophobic tails are randomly distributed

Solution: (c) The bilayer turns its water-loving heads out to the watery surroundings and its tails in.

MCQ 4.1.5 **Fluidity of biological membranes is maintained by: (NUMS MDCAT 2025)**

A	Glycoprotein	**B**	Saturated fatty acid
C	Fatty acids	**D**	Phospholipids

Solution: (d) The phospholipid bilayer itself is fluid, its molecules free to move sideways.

MCQ 4.1.6 **Under a microscope plant cells appeared rigid in shape, unlike flexible animal cells. Which structure explain this difference? (SIBA MDCAT 2025)**

A	Cell wall	**B**	Vacuole
C	Cytoskeleton	**D**	Plasma membrane

Solution: (a) The cellulose cell wall outside the membrane holds the plant cell in shape.

MCQ 4.1.7 **Plasma membrane is differentially permeable membrane due to the presence of? (KMU MDCAT 2024)**

A	Carbohydrates	**B**	Lipids
C	Proteins	**D**	Vitamins

Solution: (b) The lipid bilayer lets small non-polar molecules through and holds ions and polar molecules back.

MCQ 4.1.8 Which function cannot be attributed to plasma membrane lipids? (NUMS MDCAT 2024)

A	Recognition of cells having non-self surface markers	B	Maintaining cell membrane flexibility
C	Control of metabolic reaction across cell membrane	D	Binding ligands for intracellular response

Solution: (c) Lipids make the bilayer and keep it fluid; controlling what crosses it is the work of the proteins.

MCQ 4.1.9 Which one is the function of plasma membrane proteins? (NUMS MDCAT 2024)

A	Restrict entry of polar molecules	B	Prevention of freezing during cold weather
C	Movement of ions in and out of the cell	D	Maintenance of membrane flexibility

Solution: (c) Channel and carrier proteins are what let ions cross the lipid bilayer.

MCQ 4.1.10 Movement of molecules against the concentration gradient is? (UHS MDCAT 2023)

A	Passive transport	B	Active transport
C	Facilitated diffusion	D	Filtration

Solution: (b) Moving a substance against its gradient costs energy, which is what active transport means.

MCQ 4.1.11 Which molecules do not contribute to the formation of biological membranes? (SZABMU MDCAT 2023)

A	Glycoproteins	B	Glycolipids
C	Phospholipids	D	Nucleoproteins

Solution: (d) Membranes are built of phospholipids with glycolipids and glycoproteins in them; nucleoproteins belong to the chromosomes.

MCQ 4.1.12 Adenylate cyclase, in the cell membrane acts as: (SZABMU MDCAT 2023)

A	Channel protein	B	Carrier protein
C	Enzyme	D	Receptor

Solution: (c) Adenylate cyclase makes cyclic AMP, so it is an enzyme built into the membrane.

MCQ 4.1.13 Glycogen, lipid droplets form the most important_____of the cell. (SZABMU MDCAT 2023)

A	Cell organelles	B	Cell inclusions
C	Cytoplasmic matrix	D	Non membranous organelles

Solution: (b) Stored granules and droplets, with no membrane of their own, are the cell inclusions.

MCQ 4.1.14 According to the fluid mosaic model of cell membrane, which zone is embedded inside? (NUMS MDCAT 2023)

A	Hydrophobic	B	Hydrophilic
C	Globular	D	Filamentous

Solution: (a) The fatty tails of the phospholipids turn inwards, away from the water on both sides.

MCQ 4.1.15 Cell membrane also contains _____ place by active and passive transport: (NUMS MDCAT 2023)

A	Lipids	B	Corner Proteins
C	Charged pores	D	Carbohydrates

Solution: (c) Charged pores through the protein channels let ions cross the bilayer.

MCQ 4.1.16 Biologically, plays key roles in maintaining the integrity of lipid bilayer membranes. (UHS MDCAT 2023)

A	Hydrophilic exclusion	B	Hydrophobic
C	Specific heat capacity exclusion	D	Heat of vaporization

Solution: (b) The fatty tails are hydrophobic and turn away from water, which is what holds the bilayer together.

MCQ 4.1.17 What is incorrect about plasma membranes? (PMC MDCAT 2022)

A	They are involved in maintaining gradients between different compartments	B	They are involved In cell communication
C	They are Involved in the exchange of materials	D	They initiate nuclear division

Solution: (d) Nuclear division is begun by the centrosome and the spindle, not by the plasma membrane.

MCQ 4.1.18 The movement of water molecules from a region of higher water potential to a region of lower water potential through a semi-permeable membrane is referred to: (PMC MDCAT 2022)

A	Active transport	B	Osmosis
C	Diffusion	D	Photosynthesis

Solution: (b) Water moving down its potential gradient through a selectively permeable membrane is osmosis.

MCQ 4.1.19 What is the difference between facilitated transport and passive transport? (PMC MDCAT 2022)

A	All facilitated transport is passive	B	All passive transport is facilitated
C	Facilitated transport requires membrane proteins	D	Passive transport is downhill whereas facilitated transport Is uphill

Solution: (c) Both run downhill, but facilitated diffusion needs a channel or carrier protein to get through.

MCQ 4.1.20 The protoplast of a plant cell does not include: (PMC MDCAT 2022)

A	Cell wall	B	Cell membrane
C	Vacuoles	D	Nucleus

Solution: (a) The protoplast is everything inside the wall; the wall itself is outside it.

MCQ 4.1.21 Carbon dioxide passes through the plasma membrane of cells by: (PMC MDCAT 2022)

A	Active transport	B	Phagocytosis
C	Facilitated diffusion	D	Simple diffusion

Solution: (d) Carbon dioxide is small and non-polar, so it passes straight through the bilayer.

MCQ 4.1.22 Glycoproteins and glycolipids are present: (PMC MDCAT 2022)

A	Within lipid bilayer of plasma membrane	B	On the outer surface of the lipid bilayer of the plasma membrane
C	On the inner surface of the lipid bilayer of the plasma membrane	D	As the bilayer in plasma membrane

Solution: (b) Their sugar chains stand out into the surroundings, on the outer face of the membrane.

MCQ 4.1.23 Which interactions are responsible for the formation of lipid bilayer In the watery environment of the body? (PMC MDCAT 2022)

A	Hydrophobic interactions between fatty acid tails	B	Hydrophobic Interactions between phosphate heads
C	Hydrophilic Interactions between fatty acid tails	D	Hydrogen bonding between fatty acid tails

Solution: (a) The fatty tails are driven together away from the water, and that is what holds the bilayer.

MCQ 4.1.24 **Which of the following is responsible for giving finnesse and box-like shape to plant cells? (PMC MDCAT 2022)**

A	Cell wall	**B**	Cell wall and vacuole
C	Nucleus and vacuole	**D**	Cell membrane

Solution: (a) The rigid cellulose wall holds the plant cell in its box-like shape.

MCQ 4.1.25 **Which one of the following can easily pass through plasma membrane (PMC MDCAT 2022)**

A	Fat soluble substances	**B**	Protiens
C	Highly charged materials	**D**	polysacchrides

Solution: (a) A fat soluble molecule dissolves in the lipid bilayer and passes straight through.

MCQ 4.1.26 **Which of the following is correct for the cell wall: (NUMS MDCAT 2022)**

A	Semi-permeable	**B**	Differentially permeable
C	Permeable	**D**	Not permeable

Solution: (c) The cellulose wall is fully permeable; it is the membrane inside it that selects.

MCQ 4.1.27 **Cell membrane also contain through which movement of materials take place by active and passive transport: (NUMS MDCAT 2022)**

A	Lipid	**B**	Corner
C	Charge pores	**D**	Carbohydrates

Solution: (c) Charged pores through the protein channels let ions cross the bilayer.

MCQ 4.1.28 **The part of plasma membrane controls the fluidity of the membrane: (NUMS MDCAT 2022)**

A	Glycoprotein	**B**	Carrier protein
C	Lipid	**D**	Carbohydrates

Solution: (c) The lipid bilayer is what is fluid, and cholesterol among it sets how fluid.

MCQ 4.1.29 **The term 'cell' was given by (PMC Practice 2021)**

A	Leeuwenhoek	**B**	Robert Hooke
C	Flemming	**D**	Robert Brown

Solution: (b) Robert Hooke saw the empty boxes of cork and called them cells.

MCQ 4.1.30 **Which property of water helps to maintain the integrity of lipid-containing membranes? (PMC MDCAT 2020)**

A	Specific Heat Capacity	**B**	Hydrogen Bonding
C	Cohesion and Adhesion	**D**	Hydrophobic exclusion

Solution: (d) The fatty tails are driven together away from water, and that is what holds the bilayer.

MCQ 4.1.31 **In which type of cells, cell wall is not present? (PMC MDCAT 2020)**

A	Plant cells	**B**	Fungal cells
C	Bacterial cells	**D**	Liver cells

Solution: (d) Animal cells have only a plasma membrane; plants, fungi and bacteria all have walls.

MCQ 4.1.32 **Tissue is a (PMC MDCAT 2020)**

A	group of cells	**B**	group of organs
C	group of tissues	**D**	group of organisms

Solution: (a) A tissue is a group of similar cells doing the same work.

MCQ 4.1.33 **If 15 um size object is observed under light microscope, using 5X eyepiece and 10X objective, its magnified image size will be: (UHS MDCAT 2019)**

A	750 um	**B**	50 um
C	500 um	**D**	250 um

Solution: (a) The magnification is $5 \times 10 = 50$, and 15×50 is $750\,\mu\text{m}$.

MCQ 4.1.34 **Passive processes for the movement of molecules across cell surface membrane are: (UHS MDCAT 2019)**

A	osmosis and phagocytosis	**B**	pinocytosis and facilitated diffusion
C	facilitated diffusion and osmosis	**D**	diffusion and exocytosis

Solution: (c) Osmosis and facilitated diffusion both run down the gradient and cost no energy.

MCQ 4.1.35 **The ability to distinguish between two separate points/objects is: (UHS MDCAT 2018)**

A	Magnification	**B**	Fractionation
C	Centrifugation	**D**	Resolution

Solution: (d) Resolution is the power to show two close points as separate.

MCQ 4.1.36 **Engulfing of solid particle is termed as: (UHS MDCAT 2017)**

A	Engulfing	**B**	Pinocytosis
C	Phagocytosis	**D**	None of the given options

Solution: (c) Taking in a solid particle by engulfing it is phagocytosis.

MCQ 4.1.37 **What is the percentage of lipids in the chemical composition of plasma membrane? (UHS MDCAT 2017)**

A	60-80%	**B**	20-40%
C	40-80%	**D**	20-60%

Solution: (b) Lipids make up about a fifth to two fifths of the mass of a plasma membrane.

MCQ 4.1.38 **Which one is correctly matched with the tail of a phospholipid: (UHS MDCAT 2017)**

A	Hydrophilic	**B**	Hydrophobic
C	Light absorbing	**D**	Porphyrin ring

Solution: (b) The fatty acid tails are hydrophobic and turn away from the water.

MCQ 4.1.39 **The rapid exchange of materials through carrier proteins across the plasma membrane is called: (UHS MDCAT 2016)**

A	Passive Diffusion	**B**	Active Transport
C	Endocytosis	**D**	Facilitated Diffusion

Solution: (d) A carrier protein passes the molecule down its gradient without cost, which is facilitated diffusion.

MCQ 4.1.40 **The basic structure of plasma membrane is provided by: (UHS MDCAT 2016)**

A	Proteins	**B**	Cholesterols
C	Cytoskeleton	**D**	Phospholipids

Solution: (d) The phospholipid bilayer is the framework into which everything else is set.

MCQ 4.1.41 **Out of the given options, choose the one which shows the structures found only in plants (UHS MDCAT 2016)**

A	Vacuole, Chloroplast, Ribosomes	**B**	Chloroplast, Microtubules, Peroxisomes
C	Chloroplast, Cell Wall, Vacuole	**D**	Chloroplast, Cell Wall, Mitochondria

Solution: (c) A chloroplast, a cellulose wall and a large central vacuole are found in plant cells alone.

MCQ 4.1.42 **Presence of large central vacuole is the characteristic of: (UHS MDCAT 2016)**

A	Prokaryotes	B	Protists
C	Fungi	D	Plants

Solution: (d) A large central vacuole holding cell sap is a mark of the plant cell.

MCQ 4.1.43 **Fluid mosaic model of plasma membrane states that protein molecules float in a fluid layer. (UHS MDCAT 2015)**

A	Galactose	B	Phospholipids
C	Glucose	D	Carbohydrate

Solution: (b) The proteins float in a bilayer of phospholipid, which is what makes the model a fluid mosaic.

MCQ 4.1.44 **Blood group antigen contains: (UHS MDCAT 2015)**

A	Glycoproteins	B	Phospholipids
C	Glycolipids	D	Sphingolipids

Solution: (a) The A and B antigens are the sugar chains of glycoproteins on the red cell surface.

Topic 4.2 Prokaryotic and Eukaryotic Cells

Past MDCAT Questions

MCQ 4.2.1 **The structure formed by the invagination of the plasma membrane and involved in cell division and DNA replication of the prokaryotic cell is the: (MDCAT 2022)**

A	lysosome	B	mesosome
C	Golgi body	D	paragon

Solution: (b) Mesosomes are folds of the bacterial plasma membrane and carry out the work membrane bound organelles do elsewhere.

MCQ 4.2.2 **The cell wall of bacteria is made up of: (MDCAT 2022)**

A	chitin	B	murein
C	cellulose	D	hemicellulose

Solution: (b) Murein, or peptidoglycan, is the bacterial wall material; chitin is fungal and cellulose is plant.

MCQ 4.2.3 **Which of the following is a prokaryote? (MDCAT 2022)**

A	Protista	B	E. coli
C	Amoeba	D	Fungi

Solution: (b) E. coli is a bacterium, with no nucleus and no membrane bound organelles.

MCQ 4.2.4 **How many layers are there in a Gram-negative bacterial cell wall? (MDCAT 2022)**

A	one	B	two
C	three	D	four

Solution: (b) A thin peptidoglycan layer with an outer membrane over it makes two.

MCQ 4.2.5 **Which structure of a prokaryotic cell plays the role of the mitochondrion? (MDCAT 2023)**

A	spores	B	cyst
C	nucleoid	D	mesosomes

Solution: (d) The respiratory enzymes sit on the mesosome, the infolding of the plasma membrane.

MCQ 4.2.6 **The cell wall of a prokaryotic cell is composed of: (MDCAT 2023)**

A	carbohydrates	B	carbohydrates and proteins
C	proteins	D	proteins and lipids

Solution: (b) Peptidoglycan is a sugar backbone cross-linked by short peptides.

MCQ 4.2.7 **A bacterial cell maintains its shape through its: (MDCAT 2023)**

A	cell wall	B	capsule
C	cell membrane	D	slime layer

Solution: (a) The rigid peptidoglycan wall is what holds the shape against the turgor inside.

MCQ 4.2.8 **Prokaryotic cells lack: (MDCAT 2024)**

A	mesosomes	B	ribosomes
C	storage bodies	D	membrane bound organelles

Solution: (d) They have ribosomes and inclusions, but no nucleus, mitochondria or other membrane bound organelle.

MCQ 4.2.9 **Which option is CORRECT about an endospore? (MDCAT 2024)**

A	it has a short dormant period	B	it contains moisture for survival
C	it is metabolically active	D	it endures extreme conditions

Solution: (d) The endospore is dry and dormant, and survives heat, drought and disinfectants for years.

MCQ 4.2.10 **Mesosomes are invaginations of which bacterial cell structure? (MDCAT 2024)**

A	cell wall	B	cell membrane
C	plasmid	D	cyst

Solution: (b) They are folds of the plasma membrane that carry respiratory enzymes.

MCQ 4.2.11 **Which of the following statements best compares cell division in prokaryotic and Eukaryotic cells? (UHS MDCAT 2025)**

A	Eukaryotes divide by budding ; prokaryotes by mitosis	B	Eukaryotes use binary fission ; prokaryotes by meiosis
C	Eukaryotes divide by mitosis ; prokaryotes by binary fission	D	Both use mitosis by cell division

Solution: (c) A eukaryote divides its nucleus by mitosis; a prokaryote has no nucleus and divides by binary fission.

MCQ 4.2.12 **How would you classify a bacterium having a group of 2 or more flagella at one pole? (NUMS MDCAT 2025)**

A	Lophotrichous	B	Amphitrichous
C	Monotrichous	D	Peritrichous

Solution: (a) A tuft of flagella at one end is lophotrichous.

MCQ 4.2.13 **If a bacteria can grow in the presence or absence of oxygen it would be a(n): (NUMS MDCAT 2025)**

A	Aerobic	B	Anaerobic
C	Facultative anaerobe	D	Microaerophilic

Solution: (c) A facultative anaerobe respires when oxygen is present and ferments when it is not.

MCQ 4.2.14 **Which statement best describes difference of prokaryotic cell from eukaryotic cell? (NUMS MDCAT 2025)**

A	Prokaryote: Membrane bound organelle is present / Eukaryote: Membrane bound organelle is absent	B	Prokaryote: Ribosomal subunits are 50S & 30S / Eukaryote: Ribosomal subunits are 60S & 40S
C	Prokaryote: DNA is double stranded / Eukaryote: DNA is circular	D	Prokaryote: Multicellular / Eukaryote: Multicellular and unicellular

Solution: (b) The prokaryotic ribosome is 70S, of 50S and 30S subunits; the eukaryotic one is 80S, of 60S and 40S.

MCQ 4.2.15 **A student observes a microorganism under a microscope that lacks a nucleus and is made of a single cell. Which classification would best fit this organism? (SIBA MDCAT 2025)**

A	Unicellular prokaryote	**B**	Unicellular eukaryote
C	Multicellular eukaryote	**D**	Multicellular prokaryote

Solution: (a) A single cell with no nucleus is a unicellular prokaryote.

MCQ 4.2.16 **Respiration in Pseudomonas bacteria is (UHS MDCAT 2024)**

A	Aerobic	**B**	Anaerobic
C	Facultative	**D**	Microaerophili

Solution: (a) Pseudomonas needs oxygen to respire, so it is an aerobe.

MCQ 4.2.17 **Bacterial genome becomes diploid: (UHS MDCAT 2024)**

A	After fertilization of gametes	**B**	Before spore formation
C	During binary fission	**D**	After binary fission

Solution: (c) The chromosome is copied before the cell divides, so for a while there are two of it.

MCQ 4.2.18 **Which option is CORRECT about endospore? (UHS MDCAT 2024)**

A	Has a short dormant period	**B**	Contains moisture for survival
C	Metabolically actively	**D**	Endures extreme condition

Solution: (d) An endospore has almost no water and a tough coat, so it survives heat and drying for years.

MCQ 4.2.19 **Bacteria divide at exponential rate during which growth phase? (UHS MDCAT 2024)**

A	Lag	**B**	Log
C	Stationary	**D**	Decline

Solution: (b) Numbers double at a constant interval in the log, or exponential, phase.

MCQ 4.2.20 **Mesosomes are the invagination of bacterial cell structure (UHS MDCAT 2024)**

A	Cell wall	**B**	Cell membrane
C	Plasmid	**D**	Cysts

Solution: (b) A mesosome is an infolding of the cell membrane of a bacterium.

MCQ 4.2.21 **The peptidoglycan cell wall is specific to. (KMU MDCAT 2024)**

A	Amoeba	**B**	Bacteria
C	Protozoa	**D**	Virus

Solution: (b) Peptidoglycan, a mesh of sugars and peptides, is the bacterial cell wall.

MCQ 4.2.22 **Bacteria that lack flagella are called? (KMU MDCAT 2024)**

A	Amphitrichous	**B**	Atrichious
C	Lopho	**D**	Peritrichous

Solution: (b) A bacterium with no flagellum at all is atrichous.

MCQ 4.2.23 **Antibiotics can be used against: (KMU MDCAT 2024)**

A	Herpes simplex	**B**	Influenza
C	Polio	**D**	Salmonella typhi

Solution: (d) Antibiotics act on bacteria such as Salmonella typhi; they do nothing to viruses.

MCQ 4.2.24 **Which of the following is NOT true about plasmids found in streptococci? (KMU MDCAT 2024)**

A	Carry fewer genes than the chromosome	**B**	Replicate autonomously from the chromosome
C	They are considered as genetic element	**D**	The bacterial chromosome depends on plasmids for replication

Solution: (d) A plasmid copies itself; the chromosome does not depend on it for anything.

MCQ 4.2.25 **Which of the following bacteria produces endospores? (KMU MDCAT 2024)**

A	Both gram negative and positive bacteria	**B**	Gram negative
C	Gram positive	**D**	Mycobacteria

Solution: (c) Endospores are made by gram positive genera such as Bacillus and Clostridium.

MCQ 4.2.26 **All are the characteristics responsible for better survival of encapsulated bacteria except: (NUMS MDCAT 2024)**

A	High pathogenicity	**B**	Withstand dehydration
C	Strict adhesion to internal surfaces	**D**	Easy recognition by host

Solution: (d) The capsule hides the surface markers, so it makes the bacterium harder for the host to recognize.

MCQ 4.2.27 **Structure formed by invagination of plasma membrane and involved in cell division and DNA replication of prokaryotic cell: (UHS MDCAT 2023)**

A	Lysosomes	**B**	Mesosomes
C	Golgi bodies	**D**	Phragmoplasts

Solution: (b) A mesosome is an infolding of the bacterial membrane, and the chromosome is anchored to it.

MCQ 4.2.28 **Which one is common in both prokaryotic and eukaryotic cells? (UHS MDCAT 2023)**

A	Cytoplasmic streaming movement	**B**	Ribosome
C	Binary fission	**D**	Nuclear envelope

Solution: (b) Both kinds of cell make protein on ribosomes, though the ribosomes differ in size.

MCQ 4.2.29 **Number of layers present in Gram-negative bacterial cell wall : (UHS MDCAT 2023)**

A	one	**B**	two
C	three	**D**	four

Solution: (b) A gram negative wall has a thin peptidoglycan layer with an outer membrane over it.

MCQ 4.2.30 **The division of cocci in three planes form Sarcina, which is a cube of ---------- Cocci? (UHS MDCAT 2023)**

A	02	**B**	04
C	08	**D**	16

Solution: (c) Dividing in three planes gives a packet of eight cells.

MCQ 4.2.31 **Nitrifying bacteria are the examples of: (UHS MDCAT 2023)**

A	Heterotrophic bacteria	**B**	Chemosynthetic bacteria
C	Saprophytic bacteria	**D**	Parasitic bacteria

Solution: (b) Nitrifying bacteria get their energy by oxidizing ammonia and nitrite, so they are chemosynthetic.

MCQ 4.2.32 **The unique macro-molecule in the bacterial cell wall is: (SZABMU MDCAT 2023)**

A	Polysaccharides	**B**	Proteins
C	Peptidoglycan	**D**	Cholesterol

Solution: (c) Peptidoglycan is found in no other kind of cell.

MCQ 4.2.33 **Transfer of genetic material from one bacterium to another through a third party usually bacteriophage is called: (SZABMU MDCAT 2023)**

A	Conjugation	**B**	Transformation
C	Transduction	**D**	Transportation

Solution: (c) Transfer carried by a bacteriophage from one bacterium to another is transduction.

MCQ 4.2.34 **All of the following are physical methods to control bacteria except: (SZABMU MDCAT 2023)**

A	Sterilization	**B**	Boiling
C	Radiation	**D**	Antiseptics

Solution: (d) An antiseptic is a chemical; heat and radiation are the physical methods.

MCQ 4.2.35 **_____ increases the pathogenecity of bacteria: (NUMS MDCAT 2023)**

A	Capsule	**B**	Cell wall
C	Slime	**D**	Cell membrane

Solution: (a) The capsule hides the bacterium from the phagocytes and helps it stick to surfaces.

MCQ 4.2.36 **The smallest known bacteria belong to the genus: (NUMS MDCAT 2023)**

A	Mycoplasma	**B**	Streptococcus
C	Escherichia	**D**	Bacillus

Solution: (a) Mycoplasmas are the smallest bacteria and have no cell wall.

MCQ 4.2.37 **What distinguishes Prokaryotic cell wall from Fungal cell wall? (NUMS MDCAT 2023)**

A	Prokaryotic cell wall contains cellulose	**B**	Prokaryotic cell wall contains peptidoglycan
C	Prokaryotic cell wall contains cutin	**D**	Prokaryotic cell wall contains silica

Solution: (b) A bacterial wall is peptidoglycan; a fungal one is chitin.

MCQ 4.2.38 **Cell wall of prokaryotic cell is composed of: (UHS MDCAT 2023)**

A	Carbohydrates	**B**	Carbohydrates & Proteins
C	Proteins	**D**	Proteins & Lipids

Solution: (a) Peptidoglycan is a carbohydrate backbone cross linked by short peptides.

MCQ 4.2.39 **Number of layers of cell wall in Gram positive bacteria is: (UHS MDCAT 2023)**

A	1	**B**	2
C	3	**D**	4

Solution: (a) A gram positive wall is one thick layer of peptidoglycan with no outer membrane.

MCQ 4.2.40 **Which structure of prokaryotic cell will play the role of mitochondrion? (UHS MDCAT 2023)**

A	Spores	**B**	Cyst
C	Nucleotd	**D**	Mesosomes

Solution: (d) The mesosome carries the respiratory enzymes, which in a eukaryote sit in the mitochondrion.

MCQ 4.2.41 **Bacterial cell have ability to maintain its shape through (UHS MDCAT 2023)**

A	Cell wail	**B**	Capsule
C	Cell wall & slime	**D**	Slime

Solution: (a) The rigid peptidoglycan wall is what holds a bacterium in shape.

MCQ 4.2.42 **For sterilization purpose, generally X-rays are used in which cause: (PMC MDCAT 2022)**

A	Mutation in bacterial genome	**B**	Denaturation of bacterial proteins
C	Inactivation of bacteria	**D**	Bacteria to become pathogen

Solution: (a) X-rays are ionizing, so they damage the bacterial DNA beyond repair.

MCQ 4.2.43 **A bacterial cell envelope does not include: (PMC MDCAT 2022)**

A	Slime	**B**	Inner Membrane
C	Cell wall	**D**	Outer membrane

Solution: (b) The envelope is the wall with the slime or capsule outside it and, in gram negative forms, an outer membrane; the plasma membrane is inside it.

MCQ 4.2.44 **Photosythetic bacteria have the ability to release: (PMC MDCAT 2022)**

A	Sulphur	**B**	Oxygen
C	Hydrogen	**D**	Carbon dioxide

Solution: (a) Photosynthetic bacteria use hydrogen sulphide in place of water, so they give off sulphur, not oxygen.

MCQ 4.2.45 **A periplasmic space is: (PMC MDCAT 2022)**

A	The space between outer membrane and peptidoglycan layer of cell wall	**B**	The space between cell membrane and cell wall
C	The space within the cell	**D**	The space between phospholipld bilayer

Solution: (b) The periplasmic space lies between the plasma membrane and the wall.

MCQ 4.2.46 **Which of the following provides resistance against high temperature? (PMC MDCAT 2022)**

A	Cysts	**B**	Spores
C	Cell wall	**D**	Capsules

Solution: (b) An endospore has almost no water and a tough coat, so it survives boiling.

MCQ 4.2.47 **Protein factories in prokaryotic cells are: (PMC MDCAT 2022)**

A	Mesosomes	**B**	Ribosomes
C	Plasmids	**D**	Nucleotides

Solution: (b) Ribosomes make the proteins in every cell, prokaryotic or not.

MCQ 4.2.48 **Which of the following structures provide resistance against some antibiotics such as beta lactam? (PMC MDCAT 2022)**

A	Gram negative cell wall	**B**	Spores
C	Slime	**D**	Capsules

Solution: (a) The outer membrane of a gram negative wall keeps many antibiotics out.

MCQ 4.2.49 **During the sterilization process, in order to control pathogens, we use dry heat that causes? (PMC MDCAT 2022)**

A	Oxidation of bacterial compounds	**B**	Coagulation of bacterial proteins
C	Separate the bacteria from their media	**D**	Decrease in bacterial growth

Solution: (a) Dry heat kills by oxidizing the constituents of the cell; moist heat coagulates its proteins.

MCQ 4.2.50 **Which of the following are circular, double stranded DNA molecules present in some bacterial cells? (PMC MDCAT 2022)**

A	Nucleiod	**B**	Plasmids
C	Mesosomes	**D**	Chromosomes

Solution: (b) A plasmid is a small circle of double stranded DNA apart from the chromosome.

MCQ 4.2.51 **A very delicate surrounding structure that may result in the death of the bacterium if damaged is called : (PMC MDCAT 2022)**

A	Capsule	**B**	Flagella
C	Cell membrane	**D**	Cell wall

Solution: (c) The plasma membrane holds the contents in and controls what crosses, so damage to it is fatal.

MCQ 4.2.52 **A major component of bacterial cell walls: (PMC MDCAT 2022)**

A	Teichoicacid	**B**	Cartenoid
C	Chitin	**D**	Murein

Solution: (d) Murein, or peptidoglycan, is the material of the bacterial wall.

MCQ 4.2.53 **Nitrifying bacteria belong to following group : (PMC MDCAT 2022)**

A	Chemosynthetic	**B**	Photosynthetic
C	Parasitic	**D**	Pathogenic

Solution: (a) Nitrifying bacteria get their energy by oxidizing ammonia and nitrite.

MCQ 4.2.54 **The chemical substances that are used to inhibit the growth of micro organism on living surfaces, are called: (PMC MDCAT 2022)**

A	Disinfectants	**B**	Chemotherapeutics
C	Vaccines	**D**	Antiseptics

Solution: (d) An antiseptic is used on living tissue; a disinfectant on surfaces.

MCQ 4.2.55 **Which of the following bacteria are also called recyclers of nature? (PMC MDCAT 2022)**

A	Pathogenic bacteria	**B**	Parasitic bacteria
C	Photosynthetic bacteria	**D**	Saprotrophic bacteria

Solution: (d) Saprotrophic bacteria feed on dead matter and so return its elements to the soil.

MCQ 4.2.56 **A chemical which is applied on non living surface in order to control bacteria Is called: (PMC MDCAT 2022)**

A	Disinfectants	**B**	Antiseptic
C	Vaccines	**D**	Antibiotics

Solution: (a) A chemical used on a non-living surface is a disinfectant; on living tissue it is an antiseptic.

MCQ 4.2.57 **Which of the following Is true about staphylococcus? (PMC MDCAT 2022)**

A	It is chain of spherical bacteria	**B**	It is bunch of spherical bacteria
C	It is square of spherical bacteria	**D**	It is cube of spherical bacteria

Solution: (b) Staphylococci divide in several planes and stay together in an irregular cluster.

MCQ 4.2.58 **The function of a cell wall in prokaryotes is: (PMC Practice 2021)**

A	To give cells rigidity	**B**	To give specific shape
C	To protect from osmotic lysis	**D**	All of Above

Solution: (d) The peptidoglycan wall gives shape and rigidity and keeps the cell from bursting in dilute surroundings.

MCQ 4.2.59 **What is the name of the region where double-stranded single circular DNA is found in the prokaryotic cell? (PMC Practice 2021)**

A	Proton Nucleus	**B**	Nucleus
C	Nucleoplasm	**D**	Nucleoid

Solution: (d) The region of a prokaryote where the circular chromosome lies is the nucleoid.

MCQ 4.2.60 **Purple non-sulphur bacteria is an example of which of the following? (PMC Practice 2021)**

A	Heterotrophic bacteria	**B**	Saprotrophic bacteria
C	Chemosynthetic bacteria	**D**	Photosynthetic bacteria

Solution: (d) The purple bacteria photosynthesize without oxygen, using hydrogen donors other than water.

MCQ 4.2.61 **Who discovered the bacteria causing tuberculosis and also developed various techniques of media preparation and maintenance of pure culture? (PMC Practice 2021)**

A	Robert Koch	**B**	Louis Pasteur
C	Alexander Fleming	**D**	Antonie van Leeuwenhoek

Solution: (a) Robert Koch found the tubercle bacillus and worked out how to grow pure cultures.

MCQ 4.2.62 **Which of the following types of bacterial reproduction is most similar to mitosis? (PMC Practice 2021)**

A	Transduction	**B**	Transformation
C	Binary fission	**D**	Conjugation

Solution: (c) Binary fission copies the chromosome and separates the copies, as mitosis does.

MCQ 4.2.63 **Which of the following is a unique characteristic of prokaryotic cells? (PMC Practice 2021)**

A	Lack of a cytoplast	**B**	Presence of a cell wall
C	Inability to create proton gradients	**D**	mRNA translation simultaneous to transcription

Solution: (d) With no nuclear envelope, the ribosomes start translating the messenger while it is still being made.

MCQ 4.2.64 **Which of the following is TRUE about the structure of a typical bacterium? (PMC MDCAT 2020)**

A	It has cell wall	**B**	It has cytoplasm
C	It has genetic material	**D**	All of the above

Solution: (d) Every bacterium has a wall, cytoplasm and a chromosome.

MCQ 4.2.65 **70S sized ribosomes are found in the cytoplasm of: (PMC MDCAT 2020)**

A	Algae	**B**	Fungi
C	Protozoans	**D**	Bacteria

Solution: (d) Bacteria have 70S ribosomes; the eukaryotic ones are 80S.

MCQ 4.2.66 **Select a method which causes the oxidation of chemical constituent of a bacterial cell: (PMC MDCAT 2020)**

A	Steam	**B**	Dry heat
C	Filtration	**D**	Radiation

Solution: (b) Dry heat kills by oxidizing the constituents of the cell; moist heat coagulates its proteins.

MCQ 4.2.67 **The structure present in a eukaryotic cell but absent in prokaryotic cells is; (UHS MDCAT 2019)**

A	DNA	**B**	Ribosomes
C	Cell surface membrane	**D**	Nucleus

Solution: (d) A prokaryote has DNA, ribosomes and a membrane, but no nucleus.

MCQ 4.2.68 **The prokaryotes possess ribosome with larger subunit of: (UHS MDCAT 2019)**

A	70S	B	50S
C	60S	D	40S

Solution: (b) The prokaryotic ribosome is 70S, made of a 50S and a 30S subunit.

MCQ 4.2.69 **Rod-shaped bacteria are known as _____ (UHS MDCAT 2018)**

A	Spirilla	B	Bacilli
C	Spirochete	D	Cocci

Solution: (b) A rod shaped bacterium is a bacillus.

MCQ 4.2.70 **If lipopolysaccharides did not appear in the wall of bacteria on staining then it will be known as _____. (UHS MDCAT 2018)**

A	Gram negative	B	Gram positive
C	Capsule	D	Both Gram positive & negative

Solution: (b) Lipopolysaccharide belongs to the outer membrane of a gram negative wall.

MCQ 4.2.71 **When cocci form long chain of cells, the arrangement is termed as: (UHS MDCAT 2017)**

A	Staphylococcus	B	Sarcina
C	Streptococci	D	Cocci

Solution: (c) Cocci dividing in one plane and staying joined make a chain, a streptococcus.

MCQ 4.2.72 **Which type of bacteria has less amount of lipids in them: (UHS MDCAT 2017)**

A	Positive bacteria	B	Negative bacteria
C	Gram negative	D	Gram positive

Solution: (d) A gram positive wall is thick peptidoglycan with little lipid; the gram negative one has a lipid rich outer membrane.

MCQ 4.2.73 **Ribosomes in prokaryotes sediments at: (UHS MDCAT 2017)**

A	40S	B	70S
C	80S	D	60S

Solution: (b) The prokaryotic ribosome is 70S.

MCQ 4.2.74 **Many bacteria are motile due to presence of: (UHS MDCAT 2016)**

A	Flagella	B	Pilli
C	Cilia	D	Microtubules

Solution: (a) Bacteria swim by rotating their flagella.

MCQ 4.2.75 **_____ is an invagination of cell membrane which helps in cell division. (UHS MDCAT 2016)**

A	Fimbriae	B	Nucleoid
C	Mesosome	D	Endospore

Solution: (c) A mesosome is an infolding of the bacterial membrane to which the chromosome is anchored.

MCQ 4.2.76 **Which one of the following organelle is found in both prokaryotic and eukaryotic cells? (UHS MDCAT 2016)**

A	Centriole	B	Endoplasmic Reticulum
C	Nucleus	D	Ribosome

Solution: (d) Every cell makes protein on ribosomes, though the prokaryotic ones are smaller.

Topic 4.3 Cytoplasmic Organelles

Past MDCAT Questions

MCQ 4.3.1 **Which of the following are single membrane bound organelles? (MDCAT 2022)**

A	mitochondria and ribosomes	B	cytosol, mitochondria and ribosomes
C	Golgi bodies, lysosomes and endoplasmic reticulum	D	Golgi bodies, lysosomes and mitochondria

Solution: (c) Mitochondria have two membranes and ribosomes have none; these three have one each.

MCQ 4.3.2 **Digestive vacuoles and autophagosomes are also known as: (MDCAT 2022)**

A	phagocytosis	B	primary lysosomes
C	secondary lysosomes	D	peroxisomes

Solution: (c) A primary lysosome that has fused with something to be digested is a secondary lysosome.

MCQ 4.3.3 **Cyclosis and amoeboid movements are due to: (MDCAT 2023)**

A	microtubules	B	cilia
C	microfilaments	D	intermediate filaments

Solution: (c) Actin microfilaments slide past one another and drive both streaming and crawling.

MCQ 4.3.4 **Proteins and lipids are modified into glycoproteins and glycolipids by which cell organelle? (MDCAT 2023)**

A	Golgi complex	B	rough endoplasmic reticulum
C	smooth endoplasmic reticulum	D	ribosomes

Solution: (a) The Golgi apparatus is where the sugar chains are added.

MCQ 4.3.5 **Chloroplasts are membrane bound bodies containing: (MDCAT 2024)**

A	enzymes	B	cisternae
C	pigment	D	cristae

Solution: (c) The thylakoid membranes carry chlorophyll and the accessory pigments.

MCQ 4.3.6 **Which of the following is the function of the Golgi complex? (MDCAT 2024)**

A	intracellular digestion	B	autophagy
C	autolysis	D	processing of cell secretions

Solution: (d) The Golgi apparatus modifies, sorts and packages what the cell is about to secrete.

MCQ 4.3.7 **The organelles found only at the seedling stage in oil seed plants are: (MDCAT 2024)**

A	peroxisomes	B	glyoxisomes
C	microbodies	D	vacuoles

Solution: (b) Glyoxisomes turn stored fat into sugar while the seedling has no leaves of its own.

MCQ 4.3.8 **One of the following is CORRECT regarding flagella: (MDCAT 2024)**

A	they are made up of macrofilaments	B	they contain a centriole
C	they originate from basal bodies	D	they are immotile

Solution: (c) A eukaryotic flagellum grows from a basal body of the same nine-triplet structure as a centriole.

MCQ 4.3.9 **All are the functions of lysosome EXCEPT: (UHS MDCAT 2025)**

A	Intra cellular digestion	B	Removal of the waste
C	Autophagy	D	Lipid synthesis

Solution: (d) Lysosomes digest, recycle and dispose; lipids are made in the smooth endoplasmic reticulum.

MCQ 4.3.10 **The function of nucleolus is to make: (UHS MDCAT 2025)**

A	rDNA	**B**	Lysosomes
C	Ribosomes	**D**	Chromosomes

Solution: (c) The nucleolus makes ribosomal RNA and assembles it with protein into ribosomes.

MCQ 4.3.11 **An active athlete has more stamina of running compared to an officer of same age with physically inactive lifestyle. Which of the following organelles has greatly increased in the muscle cells of athlete? (UHS MDCAT 2025)**

A	Nucleus	**B**	Mitochondria
C	Golgi bodies	**D**	Smooth endoplasmic reticulum (SER)

Solution: (b) Training multiplies the mitochondria of a muscle fibre, so more ATP is made aerobically.

MCQ 4.3.12 **All of the following are the functions of Golgi bodies EXCEPT: (KMU MDCAT 2025)**

A	Processing of protein	**B**	Plasma membrane formation
C	Cellular respiration	**D**	Lysosome formation

Solution: (c) The Golgi body packs and dispatches; respiration belongs to the mitochondrion.

MCQ 4.3.13 **Which organelle of the cell is involved in the detoxification of toxins and poisonous compounds? (KMU MDCAT 2025)**

A	Lysosomes	**B**	Smooth Endoplasmic Reticulum
C	Ribosomes	**D**	Mitochondria

Solution: (b) The smooth endoplasmic reticulum of the liver carries the enzymes that break down drugs and poisons.

MCQ 4.3.14 **Which structure enables the exchange of material between nucleus and cytoplasm? (KMU MDCAT 2025)**

A	Plasma membrane	**B**	Nuclear pores
C	Lysosomes	**D**	Mitochondria

Solution: (b) Nuclear pores are the openings through which RNA leaves and proteins enter the nucleus.

MCQ 4.3.15 **The process by which unwanted structures are engulfed and digested within the lysosome is termed as: (NUMS MDCAT 2025)**

A	Autophagy	**B**	Autolysis
C	Endocytosis	**D**	Exocytosis

Solution: (a) Autophagy is the lysosome digesting the cell's own worn out structures.

MCQ 4.3.16 **Which of the following independently reproduces in the cell? (NUMS MDCAT 2025)**

A	Golgi complex	**B**	Nucleus
C	Chloroplast	**D**	Endoplasmic reticulum

Solution: (c) Chloroplasts carry their own DNA and ribosomes and divide by themselves.

MCQ 4.3.17 **The Golgi apparatus is structurally made of a series of flattened membrane bounded sacs. (SIBA MDCAT 2025)**

A	Grana	**B**	Cristae
C	Cisternae	**D**	Vesicles

Solution: (c) The flattened sacs of the Golgi body are its cisternae.

MCQ 4.3.18 **Which organelle give rise to primary lysosomes through budding in eukaryotic cells? (SZABMU MDCAT 2025)**

A	Smooth endoplasmic reticulum (SER)	**B**	Rough endoplasmic reticulum (RER)
C	Plasma membrane	**D**	Golgi cisternae

Solution: (d) Primary lysosomes bud off the Golgi cisternae carrying newly made hydrolytic enzymes.

MCQ 4.3.19 **Which of the following best describes the relationship between endoplasmic reticulum (ER) and Golgi apparatus? (SZABMU MDCAT 2025)**

A	Both ER and Golgi apparatus are completely separate organelles with no interaction	**B**	ER is precursor organelle to Golgi apparatus because material is transported from ER to Golgi
C	Golgi apparatus is precursor organelle to ER because material is transported from Golgi to ER	**D**	ER and Golgi apparatus have similar roles

Solution: (b) Vesicles bud from the endoplasmic reticulum and fuse with the forming face of the Golgi body.

MCQ 4.3.20 **Which organelle serves as a packaging and a distribution center for molecules within the cells? (SZABMU MDCAT 2025)**

A	Golgi apparatus	**B**	Mitochondria
C	Ribosome	**D**	Vacuole

Solution: (a) The Golgi body sorts, packages and dispatches the products of the cell.

MCQ 4.3.21 **Which of the following is the function of Golgi Complex? (UHS MDCAT 2024)**

A	Intracellular digestion	**B**	Autophagy
C	Autolysis	**D**	Processing of cell secretions

Solution: (d) The Golgi body modifies, packages and dispatches the secretions of the cell.

MCQ 4.3.22 **The organelles only found at seeding stage in oil seed plants are (UHS MDCAT 2024)**

A	Peroxiosomes	**B**	Glyoxisomes
C	Microbodies	**D**	Vacuoles

Solution: (b) Glyoxysomes appear in germinating oil seeds, where they turn stored fat into sugar.

MCQ 4.3.23 **Which organelle contribute towards steroid production? (KMU MDCAT 2024)**

A	Endoplasmic Reticulum	**B**	Golgi apparatus
C	Lysosome	**D**	Ribosomes

Solution: (a) Steroid hormones are made on the smooth endoplasmic reticulum.

MCQ 4.3.24 **The lysosomes found in eukaryotes contain: (KMU MDCAT 2024)**

A	Hydrolytic enzymes	**B**	Meiotic enzymes
C	Oxidative enzymes	**D**	Mitotic enzymes

Solution: (a) A lysosome is a bag of hydrolytic enzymes.

MCQ 4.3.25 **Which cytoplasmic organelle make their own proteins? (KMU MDCAT 2024)**

A	Chromosomes	**B**	Golgi apparatus
C	Mitochondria	**D**	Smooth endoplasmic reticulum

Solution: (c) Mitochondria carry their own DNA and ribosomes and make some of their own proteins.

MCQ 4.3.26 **The active mass movement of mitochondria in the cytoplasm is due to (KMU MDCAT 2024)**

A	Cyclosis	B	Endoplasmic streaming movements
C	Golgi apparatus	D	Transfer RNA

Solution: (a) Cyclosis is the streaming of the cytoplasm that carries the organelles round the cell.

MCQ 4.3.27 **Choose the option showing the correct set of characteristics for Intermediate filaments: (NUMS MDCAT 2024)**

A	Diameter 8-10nm, Vimentin, Mechanical support	B	Diameter 0.2-25um, Vimentin, Cilia flagella
C	Diameter 8-10nm, Tubulin, Muscle contraction	D	Diameter 7nm, Tubulin, Cyclosis

Solution: (a) Intermediate filaments are about 8 to 10 nm across, made of proteins such as vimentin, and give mechanical strength.

MCQ 4.3.28 **Which of the following are single membranous organelles? (UHS MDCAT 2023)**

A	Mitochondria and ribosomes	B	Cytosol, mitochondria and ribosomes
C	Golgi bodies, Lysosome and ER	D	Golgi bodies, lysosome and mitochondria

Solution: (c) Golgi bodies, lysosomes and the endoplasmic reticulum each have a single membrane; a mitochondrion has two.

MCQ 4.3.29 **The digestive vacuoles and autophagosomes are also known as? (UHS MDCAT 2023)**

A	Phagocytosis	B	Primary lysosome and autophagy
C	Secondary lysosome	D	Peroxisome

Solution: (c) A primary lysosome that has fused with a vacuole becomes a secondary lysosome.

MCQ 4.3.30 **Which organelles would be more abundant in a secretory cell than non-secretory cells? (SZABMU MDCAT 2023)**

A	Lysosomes	B	Golgi complex
C	Vacuoles	D	Centrioles

Solution: (b) The Golgi complex packages and dispatches secretions, so a secretory cell is full of it.

MCQ 4.3.31 **The structure which disappears during cell division is: (SZABMU MDCAT 2023)**

A	Vacuole	B	Lysosome
C	Nucleolus	D	Endoplasmic reticulum

Solution: (c) The nucleolus breaks up at prophase and is rebuilt at telophase.

MCQ 4.3.32 **The enzyme ATP synthase is located on the membrane of: (SZABMU MDCAT 2023)**

A	Nucleus	B	Mitochondria
C	Lysosome	D	Vacuole

Solution: (b) ATP synthase stands in the inner mitochondrial membrane, where the proton gradient drives it.

MCQ 4.3.33 **Intracellular digestion of food is done by the organelle: (SZABMU MDCAT 2023)**

A	Vacuole	B	Lysosome
C	Golgi apparatus	D	Ribosome

Solution: (b) Lysosomes carry the hydrolytic enzymes that digest what the cell takes in.

MCQ 4.3.34 **Which organelles of animal cells are called suicidal bags? (SZABMU MDCAT 2023)**

A	Peroxisomes	B	Glyoxisomes
C	Lysosomes	D	Food Vacuoles

Solution: (c) A lysosome that bursts digests the cell itself, which is why it is called a suicide bag.

MCQ 4.3.35 **The organelle which provides neurotransmitters in the nervous pathway is: (SZABMU MDCAT 2023)**

A	Glyoxisome	B	Peroxisome
C	Golgi apparatus	D	Endoplasmic reticulum

Solution: (c) The Golgi body packs the transmitter into the vesicles of the synaptic knob.

MCQ 4.3.36 **The inner membrane of the mitochondria is folded to form finger like: (SZABMU MDCAT 2023)**

A	Cisternae	B	Cristae
C	Chromatin	D	Chloroplast

Solution: (b) The inner membrane folds inwards as cristae, which multiply its area.

MCQ 4.3.37 **Each centriole is composed of _____ of Microtubules: (NUMS MDCAT 2023)**

A	Seven Triplets	B	Eleven Triplets
C	Nine Triplets	D	Five Triplets

Solution: (c) A centriole is a cylinder of nine triplets of microtubules.

MCQ 4.3.38 **The folds of Inner Membrane of mitochondria are called: (NUMS MDCAT 2023)**

A	Cisternae	B	Cristae
C	Mesosome	D	Infolds

Solution: (b) The infoldings of the inner mitochondrial membrane are the cristae.

MCQ 4.3.39 **Select the one which is NOT a function of Smooth Endoplasmic Reticulum (SER)? (NUMS MDCAT 2023)**

A	Metabolism of lipids	B	Transmission of impulses
C	Transport of materials	D	Processing of glycoproteins

Solution: (d) Glycoproteins are finished in the Golgi body; the smooth reticulum handles lipids and transport.

MCQ 4.3.40 **_____ are spherical sacs, surrounded by a single membrane and contain hydrolytic enzymes: (NUMS MDCAT 2023)**

A	Mitochondria	B	Golgi Bodies
C	Lysosomes	D	Chloroplast

Solution: (c) That describes the lysosome.

MCQ 4.3.41 **Proteins and lipids are modified into Glycoproteins & Glycolipids by which cell organelle? (UHS MDCAT 2023)**

A	Golgi complex	B	Rough Endoplasmic Reticulum
C	Smooth Endoplasmic Reticulum	D	Ribosomes & chromosomes

Solution: (a) The Golgi complex adds the sugar chains that make glycoproteins and glycolipids.

MCQ 4.3.42 **Lysosomes originate from which cell organelle? (PMC MDCAT 2022)**

A	Rough endoplasmic reticulum	B	Smooth endoplasmic reticulum
C	Golgi apparatus	D	Cell membrane

Solution: (c) Primary lysosomes bud off the Golgi apparatus.

MCQ 4.3.43 **Which organelle synthesizes proteins for export or repackaging elsewhere? (PMC MDCAT 2022)**

A	Rough endoplasmic reticulom	B	Smooth endoplasmic reticulum
C	Free ribosomes	D	Golgi complex

Solution: (a) Ribosomes on the rough endoplasmic reticulum make the proteins destined to leave the cell.

MCQ 4.3.44 **Which of these cell organelles are involved in the synthesis of new plant cell walls? (PMC MDCAT 2022)**

A	Rough endoplasmic reticulum	**B**	Smooth endoplasmic reticulum
C	Golgi complex	**D**	Cell membrane

Solution: (c) The Golgi complex makes the vesicles that carry the wall material to the cell plate.

MCQ 4.3.45 **In a eukaryotic cell, where are the proteins for electron transport chain located? (PMC MDCAT 2022)**

A	Smooth endoplasmic reticulum	**B**	Rough endoplasmic reticul•rn
C	Mitochondria	**D**	Cell membrane

Solution: (c) The chain sits in the inner membrane of the mitochondrion.

MCQ 4.3.46 **ATP synthase is located on the ____ of the mitochondrion: (PMC MDCAT 2022)**

A	Intermembranal space	**B**	Outer membrane
C	Matrix	**D**	Inner membrane

Solution: (d) ATP synthase stands in the inner membrane, where the proton gradient drives it.

MCQ 4.3.47 **Lysosomes originate from which cellular organelle? (PMC MDCAT 2022)**

A	Rough endoplasmic reticulum	**B**	Smooth endoplasmic reticulum
C	Golgi apparatus	**D**	Cell membrane

Solution: (c) Primary lysosomes bud off the Golgi apparatus.

MCQ 4.3.48 **Golgi complex was discovered by which scientist? (PMC MDCAT 2022)**

A	Robert Brown	**B**	Camillo Golgi
C	De Duve	**D**	Robert Hooke

Solution: (b) Camillo Golgi saw it in nerve cells in 1898, and it carries his name.

MCQ 4.3.49 **Which cell organelle is incorrectly matched with its function? (PMC MDCAT 2022)**

A	Chloroplast - carbon fixation	**B**	Mitochondria - ATP synthesis
C	Cell membrane - cell recognition	**D**	Golgi apparatus - intracellular digestion

Solution: (d) Intracellular digestion is the work of the lysosome; the Golgi body packs and dispatches.

MCQ 4.3.50 **Which of the following Is the system of elongated sac like structures (cisternae) or tubes linking the cell surface membrane and the nuclear envelope? (PMC MDCAT 2022)**

A	Microtubules	**B**	Endoplasmic reticulum
C	Golgi complex	**D**	Microfilaments

Solution: (b) The endoplasmic reticulum is a system of sacs and tubes running from the nuclear envelope outwards.

MCQ 4.3.51 **Which organelle would be more abundant in the se-cretory cell than the non-secretory cell: (NUMS MDCAT 2022)**

A	Lysosome	**B**	Golgi complex
C	Vacuole	**D**	Centrioles

Solution: (b) The Golgi complex packages and dispatches secretions, so a secretory cell is full of it.

MCQ 4.3.52 **The structure which disappeared during cell division is: (NUMS MDCAT 2022)**

A	Vacuole	**B**	Lysosome
C	Nucleus	**D**	Endoplasmic reticulum

Solution: (c) The nuclear envelope and the nucleolus break down at prophase and are rebuilt at telophase.

MCQ 4.3.53 **The enzyme ATP synthase is located on the mem-brane of the organelle: (NUMS MDCAT 2022)**

A	Nucleus	**B**	Mitochondria
C	Lysosome	**D**	Vacuole

Solution: (b) ATP synthase stands in the inner mitochondrial membrane.

MCQ 4.3.54 **------ are spherical sacs surrounded by a single membrane and containing hydrolytic enzymes: (NUMS MDCAT 2022)**

A	Mitochondria	**B**	Golgi bodies
C	Lysosome	**D**	Chloroplast

Solution: (c) That describes the lysosome.

MCQ 4.3.55 **Within the nucleus ------ are made by the nucleolus: (NUMS MDCAT 2022)**

A	Ribosomes	**B**	mRNA
C	Protein	**D**	Enzymes

Solution: (a) The nucleolus makes ribosomal RNA and assembles it into ribosomes.

MCQ 4.3.56 **A group of ribosomes attached to mRNA is known as a polysome and the attachment is controlled by: (NUMS MDCAT 2022)**

A	Na+ ions	**B**	Mg++ ions
C	Ca++ ions	**D**	K+ ions

Solution: (b) Magnesium ions hold the two ribosomal subunits together on the messenger.

MCQ 4.3.57 **Centrosome is found in: (PMC Practice 2021)**

A	Cytoplasm	**B**	Nucleus
C	Chromosomes	**D**	Nucleolus

Solution: (a) The centrosome lies in the cytoplasm beside the nucleus.

MCQ 4.3.58 **Proteins and lipids are converted into glycolipids and glycoproteins by adding carbohydrates by? (PMC Practice 2021)**

A	Ribosomes	**B**	Cytoplasm
C	Golgi apparatus	**D**	Endoplasmic reticulum

Solution: (c) The Golgi apparatus adds the sugar chains.

MCQ 4.3.59 **Ribonucleoprotein particles are the name of? (PMC Practice 2021)**

A	RNA	**B**	DNA
C	Nucleus	**D**	Eukaryotic ribosomes

Solution: (d) A ribosome is RNA and protein together, so it is a ribonucleoprotein particle.

MCQ 4.3.60 **Suggest which among the following is not a function attributed to endoplasmic reticulum? (PMC MDCAT 2020)**

A	Detoxification of poisons and drugs	**B**	Digestion/egestion of foreign materials outside the cell
C	Manufacture of fat and lipid molecules	**D**	Biogenesis of membrane proteins

Solution: (b) Digestion of engulfed material is the work of the lysosome.

MCQ 4.3.61 **Which of the following cell organelles involved in the synthesis of cell wall and middle lamella? (PMC MDCAT 2020)**

A	Endoplasmic reticulum	**B**	Golgi apparatus
C	Lysosomes	**D**	Peroxisomes

Solution: (b) The Golgi apparatus makes the vesicles that carry wall material to the cell plate.

MCQ 4.3.62 **The membrane separating the vacuole from cytoplasm is called (PMC MDCAT 2020)**

A	Cristae	B	Cisternae
C	Tonoplast	D	Vacuolar membrane

Solution: (c) The membrane round a plant vacuole is the tonoplast.

MCQ 4.3.63 **Among the following, which cellular organelle contains circular DNA, similar to those found in bacteria? (UHS MDCAT 2019)**

A	Lysosome	B	Nucleus
C	Nucleosome	D	Mitochondria

Solution: (d) Mitochondria carry a circular chromosome like a bacterium's.

MCQ 4.3.64 **Site of mRNA translation (UHS MDCAT 2019)**

A	Lysosomes	B	Ribosomes
C	Cisternae	D	Golgi body

Solution: (b) Translation happens on the ribosome.

MCQ 4.3.65 **Which cell organelle is responsible for protein modification? (UHS MDCAT 2019)**

A	Chloroplast	B	Golgi body
C	Ribosome	D	Mitochondrion

Solution: (b) The Golgi body trims, glycosylates and packages the proteins the reticulum sends it.

MCQ 4.3.66 **Smooth endoplasmic reticulum is responsible for the metabolism of: (UHS MDCAT 2019)**

A	Nucleic acids	B	Proteins
C	Carbohydrates	D	Lipids

Solution: (d) The smooth endoplasmic reticulum makes and breaks down lipids and steroids.

MCQ 4.3.67 **The finger like infoldings, which are formed by inner membrane of mitochondria, are called: (UHS MDCAT 2019)**

A	Ribosomes	B	Matrix
C	Porin	D	Cristae

Solution: (d) The infoldings of the inner mitochondrial membrane are the cristae.

MCQ 4.3.68 **The cisternae breaks up into vesicles form _____ , _____ of Golgi complex. (UHS MDCAT 2018)**

A	Convex, maturing face	B	Concave, forming face
C	Convex, forming face	D	Concave, maturing face

Solution: (d) Vesicles bud from the concave maturing face; the convex face receives from the reticulum.

MCQ 4.3.69 **Site of protein synthesis in cells are: (UHS MDCAT 2018)**

A	Ribosomes	B	Endoplasmic Reticulum
C	Nucleolus	D	Smooth Endoplasmic Reticulum

Solution: (a) Proteins are built on the ribosomes.

MCQ 4.3.70 **Tonoplast bounds which organelle: (UHS MDCAT 2018)**

A	Golgi complex	B	Nucleus
C	Endoplasmic Reticulum	D	Vacuoles

Solution: (d) The membrane round a vacuole is the tonoplast.

MCQ 4.3.71 **These structures are involved in the breakdown of old organelles: (UHS MDCAT 2018)**

A	Leucoplasts	B	Peroxisomes
C	Glyoxysomes	D	Lysosomes

Solution: (d) Lysosomes digest worn out organelles, which is autophagy.

MCQ 4.3.72 **In cross-section each Centriole consist of nine (each in triplets) of: (UHS MDCAT 2018)**

A	Microfilaments	B	Microvilli
C	Microtubules	D	Intermediate filaments

Solution: (c) A centriole is nine triplets of microtubules arranged in a cylinder.

MCQ 4.3.73 **Ribosomes are made up of _____ and _____. (UHS MDCAT 2018)**

A	Proteins and carbohydrates	B	RNA and lipid
C	RNA and proteins	D	RNA and carbohydrates

Solution: (c) A ribosome is ribosomal RNA together with protein.

MCQ 4.3.74 **The group of ribosomes joined by mRNA is called as: (UHS MDCAT 2017)**

A	Monosome	B	Polysomes
C	Polypeptide	D	Lysosome

Solution: (b) Several ribosomes reading one messenger together make a polysome.

MCQ 4.3.75 **Which organelle has two Subunits: (UHS MDCAT 2017)**

A	Endoplasmic reticulum	B	Ribosomes
C	Nucleus	D	Plastids

Solution: (b) A ribosome is built of a large and a small subunit.

MCQ 4.3.76 **Among the following which organelle has an outer membrane in it; (UHS MDCAT 2017)**

A	Cell Membrane	B	Mitochondria
C	Lysosome	D	Vacuole

Solution: (b) A mitochondrion has an outer membrane and a folded inner one.

MCQ 4.3.77 **Identity the common organelle in plant and animals: (UHS MDCAT 2017)**

A	Plastids	B	Chromoplasts
C	Mitochondria	D	Leucoplasts

Solution: (c) Plastids belong to plants alone; mitochondria are in both.

MCQ 4.3.78 **The site for the synthesis of ribosomal RNA is: (UHS MDCAT 2017)**

A	Nucleus	B	Cytosol
C	Nucleolus	D	Endoplasmic Reticulum

Solution: (c) Ribosomal RNA is made in the nucleolus.

MCQ 4.3.79 **A complex network of channels extending from plasma membrane to nuclear membrane: (UHS MDCAT 2017)**

A	Mitochondria	B	Lysosomes
C	Endoplasmic reticulum	D	Golgi Apparatus

Solution: (c) The endoplasmic reticulum runs as a network from the plasma membrane to the nuclear envelope.

MCQ 4.3.80 **Which function is associated with lysosomes: (UHS MDCAT 2017)**

A	Oxidative enzymes production	B	Conversion of fatty acids to carbohydrates
C	Phagocytosis	D	Both "Conversion of fatty acids to carbohydrates" and "Phagocytosis"

Solution: (c) Lysosomes digest what phagocytosis brings in.

MCQ 4.3.81 **The inner membrane of mitochondria form extensive infoldings called: (UHS MDCAT 2016)**

A	Cristae	B	Cisternae
C	Lamella	D	Bifidae

Solution: (a) The infoldings of the inner mitochondrial membrane are the cristae.

MCQ 4.3.82 **The organelle involved in detoxification of drugs and poisons in the liver cells is: (UHS MDCAT 2016)**

A	Smooth Endoplasmic Reticulum	B	Rough Endoplasmic Reticulum
C	Golgi Apparatus	D	Lysosomes

Solution: (a) The smooth endoplasmic reticulum of the liver carries the enzymes that break down drugs.

MCQ 4.3.83 **How many triplets of microtubules are present in centriole? (UHS MDCAT 2015)**

A	Ten	B	Eight
C	Nine	D	Seven

Solution: (c) A centriole is nine triplets of microtubules.

MCQ 4.3.84 **Ribosomes are tiny organisms, which are involved in the synthesis of: (UHS MDCAT 2015)**

A	Protein	B	RNA
C	Nucleus	D	Nuclosome

Solution: (a) Ribosomes are where protein is made.

MCQ 4.3.85 **Which organelle is bounded by two membranes? (UHS MDCAT 2015)**

A	Ribosome	B	Mitochondria
C	Lysosome	D	Nucleolus

Solution: (b) A mitochondrion has an outer membrane and a folded inner one.

MCQ 4.3.86 **At the beginning of nuclear division, the number of microtubule triplets in two pairs of centrioles that migrate to opposite poles are: (UHS MDCAT 2015)**

A	9	B	18
C	108	D	36

Solution: (d) Each centriole is nine triplets, and two pairs make four centrioles, that is thirty-six triplets.

Topic 4.4 Chromosomes

Past MDCAT Questions

MCQ 4.4.1 **The nucleus takes up dyes because of the presence of: (MDCAT 2024)**

A	chromatin	B	lipid
C	metal ions	D	thylakoids

Solution: (a) Chromatin, the DNA with its histones, is what the basic stains bind to.

MCQ 4.4.2 **Chromosomes were first observed by: (MDCAT 2024)**

A	T. H. Morgan	B	Griffith
C	Walther Flemming	D	Mendel

Solution: (c) Flemming saw and named the stained threads in dividing cells.

MCQ 4.4.3 **What is the function of a centromere? (UHS MDCAT 2025)**

A	To protect the ends of chromosomes	B	To hold sister chromatids together
C	To carry genetic information	D	To initiate DNA replication

Solution: (b) The centromere is the constriction that holds the two sister chromatids together until anaphase.

MCQ 4.4.4 **A mature duplicated chromosome consists of: (UHS MDCAT 2025)**

A	Two identical double helical DNA molecules	B	Two different double helical DNA molecules
C	A double helical DNA molecule distributed in both chromatids	D	Histone chains wrapped around DNA core

Solution: (a) Replication leaves two sister chromatids, and each is one complete double helix identical to the other.

MCQ 4.4.5 **Identify the most appropriate function of chromosomes (UHS MDCAT 2025)**

A	Energy production and storage	B	Protein synthesis and regulation
C	Storage of genetic information	D	Lipid metabolism and transport

Solution: (c) A chromosome is DNA wound on histones, and its work is to hold and pass on the genetic information.

MCQ 4.4.6 **_____ arranges the DNA Into the chromosomes in a eukaryotic cell. (UHS MDCAT 2025)**

A	Hormones	B	Elastin
C	Histone	D	Nucleosome

Solution: (c) Histones are the basic proteins the DNA winds around to make the nucleosomes of a chromosome.

MCQ 4.4.7 **The contracted region of a chromosome that attaches to spindle fiber is called: (KMU MDCAT 2025)**

A	Telomere	B	Chromatin
C	Centromere	D	Nucleosomes

Solution: (c) The centromere is the narrow region carrying the kinetochore to which the spindle fibres attach.

MCQ 4.4.8 **The number of chromosomes in a haploid cell are: (KMU MDCAT 2025)**

A	Half the chromosomes in a normal body cell	B	Double the chromosomes in a normal body cell
C	Quarter the chromosomes in a normal body cell	D	Equal to the chromosomes in a normal body cell

Solution: (a) A haploid cell carries one set of chromosomes, half the diploid number of a body cell.

MCQ 4.4.9 **What is the chemical composition of chromosomes? (SIBA MDCAT 2025)**

A	RNA and lipids	B	DNA and proteins
C	Carbohydrates and nucleic acids	D	Proteins and carbohydrates

Solution: (b) A chromosome is DNA wound on histone proteins.

MCQ 4.4.10 **In chromosome, positively charged histone proteins are organized with negatively charged DNA. The positive charges of histone are due to an abundance of basic amino acids: (SZABMU MDCAT 2025)**

A	arginine and alanine	B	arginine and lysine
C	lysine and alanine	D	phenylalanine and arginine

Solution: (b) Arginine and lysine carry basic side chains, which is what gives histones their positive charge.

MCQ 4.4.11 **The nucleus takes dyes due to the presence of (UHS MDCAT 2024)**

A	Chromatin	B	Lipid
C	Metal ions	D	Thylakoids

Solution: (a) Chromatin is the DNA and histone that take up basic stains.

MCQ 4.4.12 **Chromosomal abnormality in Turner syndrome is represented by? (UHS MDCAT 2024)**

A	XXX	B	XYY
C	XO	D	XXY

Solution: (c) Turner syndrome is a single X with no second sex chromosome.

MCQ 4.4.13 **The chromosomes was first observed by; (UHS MDCAT 2024)**

A	T. H Morgan	B	Griffith
C	Walther	D	Mendel

Solution: (c) Walther Flemming first saw and described the chromosomes in dividing cells.

MCQ 4.4.14 **Where are spindle fibres attached on a chromosome during cell division (KMU MDCAT 2024)**

A	Centromere	**B**	Histone proteins
C	Nucleolus	**D**	Telomere

Solution: (a) The spindle fibres attach at the kinetochore of the centromere.

MCQ 4.4.15 **Chromosome is typically made up from a combination of? (KMU MDCAT 2024)**

A	DNA and protein	**B**	DNA and RNA
C	RNA and lipids	**D**	RNA and proteins

Solution: (a) A chromosome is DNA wound on histone protein.

MCQ 4.4.16 **Nucleo proteins are involved in: (NUMS MDCAT 2024)**

A	Cell to cell recognition	**B**	Passing hereditary information to next generation
C	Ensuring fast speed of nerve impulse	**D**	Acting as a cell surface marker

Solution: (b) Nucleoproteins are the DNA and histone of the chromosomes, which carry the inheritance.

MCQ 4.4.17 **The terminal ends of chromosomes are called: (SZABMU MDCAT 2023)**

A	Satellite	**B**	Kinetochore
C	Nucleolar organizers	**D**	Telomeres

Solution: (d) The ends of a chromosome are capped by telomeres, which keep it from fraying.

MCQ 4.4.18 **Which of the following number of chromosomes are present in the somatic cells of Drosophila? (PMC MDCAT 2022)**

A	4	**B**	8
C	16	**D**	2

Solution: (b) Drosophila has four pairs, eight chromosomes in a body cell.

MCQ 4.4.19 **Which of the following is the number of chromosomes in human zygote? (PMC MDCAT 2022)**

A	n	**B**	2n
C	3n	**D**	4n

Solution: (b) The zygote has both sets, so it is diploid, 2n.

MCQ 4.4.20 **Except during nuclear division, the nucleus has the chromosome in a loosely coiled state known as: (NUMS MDCAT 2022)**

A	Genes	**B**	Ribosomes
C	DNA	**D**	Chromatin

Solution: (d) Between divisions the chromosomes are extended as chromatin.

MCQ 4.4.21 **The terminal ends of the chromosomes are called: (NUMS MDCAT 2022)**

A	Satellite	**B**	Kinetochore
C	Nucleolar organizer	**D**	Telomere

Solution: (d) The ends of a chromosome are its telomeres.

MCQ 4.4.22 **Extremely long molecule of DNA that is tightly folded to fit inside the cell component is called? (PMC Practice 2021)**

A	Nucleus	**B**	Chromosome
C	Chromatin body	**D**	Chromatid

Solution: (b) A chromosome is one very long DNA molecule folded on its histones.

MCQ 4.4.23 **How many pairs of homologous chromosomes are present in Pisum sativum? (PMC Practice 2021)**

A	5	**B**	6
C	7	**D**	8

Solution: (c) The garden pea has fourteen chromosomes, that is seven pairs.

MCQ 4.4.24 **At what phase the DNA content of a cell is doubled? (PMC MDCAT 2020)**

A	Prophase	**B**	Interphase
C	Anaphase	**D**	Telophase

Solution: (b) DNA is replicated in the S phase of interphase, before division begins.

MCQ 4.4.25 **The cells in our body are all genetically identical, apart from the: (PMC MDCAT 2020)**

A	Somatic cells	**B**	Reproductive cells
C	Muscle fibers	**D**	White blood cells

Solution: (b) Meiosis and crossing over make every gamete different.

MCQ 4.4.26 **The particular array of chromosomes that an individual possesses is called its: (PMC MDCAT 2020)**

A	Genotype	**B**	Phenotype
C	Karyotype	**D**	Allele

Solution: (c) The number, size and shape of the chromosomes of an individual is its karyotype.

MCQ 4.4.27 **Microtubule subunits (for spindle fibers) are synthesized in _____ phase. (UHS MDCAT 2019)**

A	G1	**B**	M
C	G2	**D**	S

Solution: (c) The proteins for the spindle are made in G2, after replication and before division.

MCQ 4.4.28 **The phase of mitosis in which sister chromatids move towards opposite poles: (UHS MDCAT 2019)**

A	Anaphase	**B**	Metaphase
C	Prophase	**D**	Telophase

Solution: (a) The sister chromatids are pulled apart at anaphase.

MCQ 4.4.29 **During the G2 phase: (UHS MDCAT 2019)**

A	Chromosome number is duplicated	**B**	The chromosomes are left with only one chromatid
C	Energy is stored for Chromosome movement and mitotic specific proteins(Tubulin) are produced	**D**	Specific enzymes are synthesized and DNA base units are accumulated

Solution: (c) G2 is the gap in which the proteins of the spindle are made and energy is laid in for division.

MCQ 4.4.30 **Synthesis of microtubules increases in: (UHS MDCAT 2018)**

A	M phase	**B**	S phase
C	G1 phase	**D**	G2 phase

Solution: (d) The tubulin of the spindle is made in G2, after replication and before division.

MCQ 4.4.31 **They serve as a scaffold for formation of higher order chromatin structure: (UHS MDCAT 2018)**

A	Nucleosome	**B**	Nucleus
C	Chromosomes	**D**	Histones

Solution: (a) The nucleosome, DNA wound on its histone octamer, is the first level of chromosome coiling.

MCQ 4.4.32 **Human female differs from human male in having (UHS MDCAT 2017)**

A	Y chromosome	**B**	X chromosome
C	XY chromosome	**D**	XX chromosome

Solution: (d) A woman has two X chromosomes; a man has an X and a Y.

MCQ 4.4.33 **Which of the following is an example of autosomal non-disjunction? (UHS MDCAT 2016)**

A	Turner's Syndrome	**B**	Jacob's Syndrome
C	Metastasis	**D**	Down's syndrome

Solution: (d) Down syndrome is an extra chromosome 21, an autosome that failed to separate.

MCQ 4.4.34 **Down's syndrome is characterized by _____ at chromosome 21. (UHS MDCAT 2016)**

A	Trisomy	**B**	Monosomy
C	Polysomy	**D**	Disomy

Solution: (a) Down syndrome is three copies of chromosome 21.

MCQ 4.4.35 **Infertility, short height, webbed neck and low hairline at lack are symptoms of _____ syndrome. (UHS MDCAT 2016)**

A	Turner's	**B**	Down's
C	Edward's	**D**	Patau's

Solution: (a) Turner syndrome is a single X chromosome with no partner.

MCQ 4.4.36 **During maternal mitosis, non-disjunction of autosomal chromosome pair results in the formation of an egg having 24 chromosomes in: (UHS MDCAT 2015)**

A	Klinefelter's Syndrome	**B**	Down's Syndrome
C	Turner's Syndrome	**D**	Jacob's Syndrome

Solution: (b) An egg with an extra chromosome 21 gives a child with three of them.

MCQ 4.4.37 **Typical symptoms like enlarged breasts and small testis in male are attributed to: (UHS MDCAT 2015)**

A	Down's Syndrome	**B**	Turner's Syndrome
C	Klinefelter's Syndrome	**D**	Phenylketonuria

Solution: (c) Klinefelter syndrome is XXY, with an extra X in the male.

MCQ 4.4.38 **Turner's syndrome is characterized by having: (UHS MDCAT 2015)**

A	Trisomy 21	**B**	44 + XXY
C	Trisomy 18	**D**	44 + XO

Solution: (d) Turner syndrome is a single X with no partner.

MCQ 4.4.39 **Number of pairs of autosomes in humans in: (UHS MDCAT 2015)**

A	23	**B**	24
C	21	**D**	22

Solution: (d) Of the twenty-three pairs, twenty-two are autosomes and one is the sex pair.

Unit 5 Coordination and Control

Topic 5.1 Receptors

Past MDCAT Questions

MCQ 5.1.1 **The pressure receptors that receive deep pressure stimuli in the human body are called: (MDCAT 2023)**

A	Meissner corpuscles	**B**	Pacinian corpuscles
C	red blood corpuscles	**D**	white blood corpuscles

Solution: (b) Pacinian corpuscles lie deep in the skin and respond to heavy pressure and vibration.

MCQ 5.1.2 **A taste receptor is an example of a: (MDCAT 2024)**

A	mechanoreceptor	**B**	nociceptor
C	photoreceptor	**D**	chemoreceptor

Solution: (d) It responds to dissolved chemicals, which is what a chemoreceptor does.

MCQ 5.1.3 **Olfactory receptors are the type of: (UHS MDCAT 2025)**

A	photoreceptors	**B**	mechanoreceptors
C	thermoreceptors	**D**	chemoreceptors

Solution: (d) Smell is sensed by chemoreceptors, which respond to molecules dissolved in the mucus.

MCQ 5.1.4 **Taste receptor is an example of (UHS MDCAT 2024)**

A	Mechano receptors	**B**	Nociceptors
C	Photo receptors	**D**	Chemo receptors

Solution: (d) Taste buds respond to molecules dissolved in saliva, so they are chemoreceptors.

MCQ 5.1.5 **The pressure receptors that receive deep pressure stimulus in human body are called. (UHS MDCAT 2023)**

A	Meisener Corpuscles	**B**	Pacinian Corpscles
C	Red Blood Corpuscles	**D**	Cholesterol

Solution: (b) Pacinian corpuscles lie deep in the skin and respond to pressure and vibration.

MCQ 5.1.6 **The blind spot in the eye is so-called due to the absence of which of the following? (PMC MDCAT 2022)**

A	Rods only	**B**	Cones only
C	Rods and cones	**D**	Retina

Solution: (c) Where the optic nerve leaves the retina there are no rods or cones, so nothing is seen.

MCQ 5.1.7 **The photosensitive cells present in the retina that are sensitive to dim light are called? (PMC MDCAT 2022)**

A	Optical disc	**B**	Rods
C	Cones	**D**	Ligaments

Solution: (b) The rods work at low light levels and give no colour.

MCQ 5.1.8 **The disorder which is caused when cones cannot distinguish between different colors is called? (PMC MDCAT 2022)**

A	Short sighted vision disorder	**B**	Night blindness
C	Long sighted vision disorder	**D**	Color blindness

Solution: (d) When a class of cone is missing or faulty, colours cannot be told apart.

MCQ 5.1.9 **Touch receptors are (NUMS MDCAT 2022)**

A	Paccinian's corpuscles	**B**	Olfactory receptors
C	Miessner's corpuscles	**D**	Nociceptors

Solution: (c) Meissner's corpuscles in the upper skin respond to light touch.

MCQ 5.1.10 **Taste buds on the tongue are example of: (UHS MDCAT 2018)**

A	Pressure receptors	B	Chemoreceptors
C	Thermoreceptors	D	Photoreceptors

Solution: (b) Taste buds respond to molecules dissolved in saliva, so they are chemoreceptors.

Topic 5.2 Neurons

Past MDCAT Questions

MCQ 5.2.1 **The neurotransmitter active outside the central nervous system is: (MDCAT 2022)**

A	acetylcholine	B	dopamine
C	serotonin	D	endorphin

Solution: (a) Acetylcholine works at the neuromuscular junction and in the autonomic nervous system.

MCQ 5.2.2 **The chemical messengers that transmit an action potential across a synapse are: (MDCAT 2023)**

A	the synaptic knob	B	reflex actions
C	neurotransmitters	D	acetylcholinesterase

Solution: (c) The vesicles of the synaptic knob release a neurotransmitter across the cleft.

MCQ 5.2.3 **During the resting membrane potential of a neuron: (MDCAT 2023)**

A	the outer surface is positive and the inner surface negative	B	the inner surface is positive and the outer surface negative
C	both surfaces are equally positive	D	both surfaces are equally negative

Solution: (a) The sodium-potassium pump and the potassium leak leave the inside about -70 mV with respect to the outside.

MCQ 5.2.4 **In a typical nerve, the action potential duration is: (MDCAT 2023)**

A	1 millisecond	B	1 microsecond
C	1 second	D	1 minute

Solution: (a) Depolarization and repolarization together take about a millisecond.

MCQ 5.2.5 **In human myelinated fibres a nerve impulse travels at how many metres per second? (MDCAT 2024)**

A	100-120	B	130-150
C	160-180	D	190-210

Solution: (a) Saltatory conduction along a myelinated fibre reaches about $100\text{-}120\ \mathrm{m\,s^{-1}}$.

MCQ 5.2.6 **Nissl's granules are groups of: (MDCAT 2024)**

A	mesosomes	B	lysosomes
C	ribosomes	D	chromosomes

Solution: (c) They are stacks of rough endoplasmic reticulum with their ribosomes in the cell body of a neuron.

MCQ 5.2.7 **During the non-conducting state, the neuron membrane is permeable to the efflux of: (MDCAT 2024)**

A	K^+	B	Na^+
C	Ca^{2+}	D	Cl^-

Solution: (a) At rest the membrane leaks potassium outwards, which is what leaves the inside negative.

MCQ 5.2.8 **Which of the following neurotransmitters lies outside the central nervous system? (MDCAT 2024)**

A	acetylcholine	B	endorphins
C	dopamine	D	gamma-aminobutyric acid

Solution: (a) Acetylcholine is the transmitter at the neuromuscular junction and in the autonomic ganglia.

MCQ 5.2.9 **Depolarization during the conduction of a nerve impulse is due to: (MDCAT 2024)**

A	inward movement of Na^+	B	inward movement of K^+
C	outward movement of K^+	D	outward movement of Na^+

Solution: (a) The sodium gates open and sodium floods in, reversing the sign of the membrane potential.

MCQ 5.2.10 **Which component of a reflex arc connects the sensory neuron to the motor neuron within the spinal cord? (UHS MDCAT 2025)**

A	Receptor	B	Effector
C	Muscle fiber	D	Associative neuron

Solution: (d) The associative (inter) neuron of the spinal cord is the link between the sensory and the motor neuron.

MCQ 5.2.11 **Nissls granule is a specialized structure in neuron formed by modification of : (UHS MDCAT 2025)**

A	Golgi bodies & Smooth ER	B	Peroxisome & Mitochondria
C	Lysosome & Vacuole	D	Ribosome & Rough ER

Solution: (d) Nissl granules are stacks of rough endoplasmic reticulum studded with ribosomes.

MCQ 5.2.12 **Which of the following is the correct pathway of nerve Impulse? (UHS MDCAT 2025)**

A	Receptors--> CNS--> Effectors	B	Effectors--> Receptors--> CNS
C	CNS--> Effectors--> Receptors	D	Effectors--> CNS --> Receptors

Solution: (a) A receptor picks up the stimulus, the central nervous system decides, and the effector acts.

MCQ 5.2.13 **The neurotransmitters are secreted by the neuron from: (UHS MDCAT 2025)**

A	Axon ends	B	Dendrite end
C	Nissl's granules	D	Cell body

Solution: (a) The vesicles of neurotransmitter lie in the synaptic knobs at the axon endings.

MCQ 5.2.14 **Which part of the neuron typically receives incoming signals from other neurons? (UHS MDCAT 2025)**

A	Axon	B	Dendrites
C	Myelin sheath	D	Synaptic knob

Solution: (b) Dendrites are the branched processes that carry impulses towards the cell body.

MCQ 5.2.15 **Which of the following cells possess Nissl's granules? (UHS MDCAT 2025)**

A	Nerve cells	B	WBC
C	RBC	D	Platelets

Solution: (a) Nissl granules are found only in neurons, where they mark the rough endoplasmic reticulum.

MCQ 5.2.16 **Which type of neurons stimulate muscles to contract In a reflex arc? (UHS MDCAT 2025)**

A	Motor neurons	B	Sensory neurons
C	Interneurons	D	Afferent neurons

Solution: (a) The motor neuron is the one that carries the impulse out to the effector muscle.

MCQ 5.2.17 **The junction between two consecutive neurons where information is transmitted from one neuron to the next is called: (KMU MDCAT 2025)**

A	Node-of Ranvier	B	Synapse
C	Axon terminal	D	Dendrite cleft

Solution: (b) The gap between two neurons, crossed by a neurotransmitter, is the synapse.

MCQ 5.2.18 **Which ion is tenfold higher in concentration outside the membrane of neuron during resting potential? (KMU MDCAT 2025)**

A	Potassium	B	Sodium
C	Calcium	D	Hydrogen

Solution: (b) The pump keeps sodium about ten times more concentrated outside the resting neuron.

MCQ 5.2.19 **Touching a sharp object stimulates pain receptors. This information is carried to the central nervous system by the: (KMU MDCAT 2025)**

A	Motor-neuron	B	Sensory neuron
C	Associative neuron	D	Effector neuron

Solution: (b) A sensory neuron carries the impulse from the receptor in to the central nervous system.

MCQ 5.2.20 **The state, when a neuron is NOT conducting an impulse during resting membrane potential is called; (KMU MDCAT 2025)**

A	Polarized	B	Depolarized
C	Repolarized	D	Hyperpolarized

Solution: (a) A resting neuron is polarized, negative inside and positive outside.

MCQ 5.2.21 **Which of the following waves travel along a neuron during nerve impulse conduction? (KMU MDCAT 2025)**

A	Thermal waves	B	Mechanical waves
C	Electromagnetic waves	D	Electrochemical waves

Solution: (d) The impulse is a wave of depolarization carried by ion movement, so it is electrochemical.

MCQ 5.2.22 **The CORRECT sequence of events in a reflex arc is: (KMU MDCAT 2025)**

A	Receptor, associative neuron, sensory neuron, motor neuron, effector	B	Receptor, motor neuron, associative neurone, sensory neuron, effector
C	Receptor, sensory neuron, associative neuron, motor neuron, effector	D	Receptor, sensory neuron, motor neuron, associative neuron, effector

Solution: (c) A reflex runs receptor, sensory neuron, associative neuron, motor neuron, effector.

MCQ 5.2.23 **Which one is the correct direction of action potential along the neuron? (NUMS MDCAT 2025)**

A	Axon → post synaptic terminal	B	Schwann cells → pre synaptic terminal
C	Cell body → pre synaptic terminal	D	Dendrite → post synaptic terminal

Solution: (a) The impulse runs down the axon to the synaptic terminal at its end.

MCQ 5.2.24 **Concentration of Na+ and K+ ions during resting membrane potential is: (Inside Neuron / Outside Neuron) (NUMS MDCAT 2025)**

A	K+ 30 times / Na+ 10 times	B	K+ 10 times / Na+ 30 times
C	Na+ 10 times / K+ 30 times	D	Na+ 30 times / K+ 10 times

Solution: (b) The pump keeps potassium about ten times higher inside and sodium about thirty times higher outside.

MCQ 5.2.25 **A brief phase in which neuron regains its original ionic distribution and polarity is called: (NUMS MDCAT 2025)**

A	Repolarization	B	Synaptic delay
C	Saltatory period	D	Refractory period

Solution: (d) During the refractory period the fibre restores its ionic gradient and will not carry another impulse.

MCQ 5.2.26 **Ions involved in synaptic transmission of nerve impulse: (NUMS MDCAT 2025)**

A	K+, Ca2+, Na+	B	Na+, K+
C	Na+, Ca2+	D	K+, Ca2+

Solution: (c) Calcium entering the terminal releases the transmitter, and sodium carries the impulse in the next fibre.

MCQ 5.2.27 **Correct sequence of the four elements of a neural pathway in simple-reflex circuit: (NUMS MDCAT 2025)**

A	Sensory neuron → associative neuron → motor neuron → muscles	B	Muscles → sensory neuron → associative neuron → motor neuron
C	Motor neurons → associate neuron → sensory neuron → muscles	D	Associate neuron → sensory neuron → motor neuron → muscles

Solution: (a) A reflex runs sensory neuron, associative neuron, motor neuron, muscle.

MCQ 5.2.28 **Automatic and rapid actions that do not involve the conscious part of brain is: (SIBA MDCAT 2025)**

A	Reflex actions	B	Conditioned reflexes
C	Taxes	D	Synapses

Solution: (a) A reflex is completed through the spinal cord, without waiting on the conscious brain.

MCQ 5.2.29 **Which of the following neurons conduct impulses from sensory receptors to CNS: (SIBA MDCAT 2025)**

A	Sensory neurons	B	Motor neurons
C	Efferent neurons.	D	Interneurons

Solution: (a) Sensory, or afferent, neurons carry the impulse in from the receptor.

MCQ 5.2.30 **A doctor taps below the knee and the leg kicks forward. What does this show? (SIBA MDCAT 2025)**

A	A conditional response	B	Voluntary muscle contractions
C	An involuntary reflex to external stimuli	D	A delayed response due to brain processing

Solution: (c) The knee jerk is a spinal reflex, involuntary and needing no decision from the brain.

MCQ 5.2.31 **Which type of change is a nerve impulse? (SIBA MDCAT 2025)**

A	Electrical and mechanical change	B	Chemical and mechanical change
C	Electrical and chemical change	D	Chemical change only

Solution: (c) The impulse is electrical along the fibre and chemical across the synapse.

MCQ 5.2.32 **The outer surface of the axon membrane in a resting neuron is: (SIBA MDCAT 2025)**

A	Negative due to sodium ions	B	Positive due to sodium ions
C	Positive due to potassium ions	D	Neutral due to balanced ions

Solution: (b) The pump drives sodium out, so the outside of the resting membrane is positive.

MCQ 5.2.33 **Which of the following best describes the direction of impulse traveling in a typical neuron? (SIBA MDCAT 2025)**

A	Axon ..... dendrite ..... cell body	B	Dendrite ..... cell body ..... axon
C	Synapse ..... axon ..... dendrite	D	Cell body ..... dendrite ..... axon

Solution: (b) The impulse comes in over the dendrites, passes the cell body and leaves along the axon.

MCQ 5.2.34 **Myelin sheath acts as; (SZABMU MDCAT 2025)**

A	Protector	**B**	Insulator
C	Sensor	**D**	Supporter

Solution: (b) The myelin sheath insulates the fibre, so the impulse jumps from node to node.

MCQ 5.2.35 **Nodes of Ranvier along the length of axons fibers allow: (SZABMU MDCAT 2025)**

A	More diffusion of neurotransmitters	**B**	Saltatory conduction of nerve impulse
C	Formation of new synaptic connections	**D**	Synthesis of new neurons

Solution: (b) The impulse leaps from node to node, which is saltatory conduction.

MCQ 5.2.36 **In human myelinated fibers nerve impulse travels at _____ meters per second. (UHS MDCAT 2024)**

A	100-120	**B**	130-150
C	160-180	**D**	190-210

Solution: (a) Saltatory conduction along a myelinated fibre reaches about 100 to $120\,\mathrm{m\,s^{-1}}$.

MCQ 5.2.37 **During non-conducting state, the neuron membrane is permeable to efflux of (UHS MDCAT 2024)**

A	K+	**B**	Na+
C	Ca+	**D**	Cl-

Solution: (a) The resting membrane leaks potassium outwards far more readily than it leaks sodium in.

MCQ 5.2.38 **Which of the following neurotransmitters is lying outside the central nervous system? (UHS MDCAT 2024)**

A	Acetylcholine	**B**	Endorphins
C	Dopamine	**D**	Gamma - aminobutyric acid

Solution: (a) Acetylcholine is the transmitter of the neuromuscular junction and of the autonomic ganglia.

MCQ 5.2.39 **Depolarization during conduction of nerve impulse is due to (UHS MDCAT 2024)**

A	Inward movement of Na+	**B**	Inward movement of K+
C	Outward movement of K+	**D**	Outward movement of Na+

Solution: (a) Sodium rushing in reverses the charge across the membrane.

MCQ 5.2.40 **Which of the following is NOT a feature of Autonomic Nervous System? (UHS MDCAT 2024)**

A	Regulate response of visceral organs	**B**	Regulate response of skeletal muscles
C	Regulate response of glands	**D**	Regulate response of smooth muscles

Solution: (b) The autonomic system serves smooth muscle, cardiac muscle and glands; skeletal muscle is voluntary.

MCQ 5.2.41 **The following function/activity is NOT controlled by the autonomic nervous system. (KMU MDCAT 2024)**

A	Cardiac muscles contraction	**B**	Salivation
C	Smooth muscles contraction	**D**	Thoughts and emotions

Solution: (d) The autonomic system serves the viscera; thought and emotion belong to the cerebrum.

MCQ 5.2.42 **A motor neuron: (KMU MDCAT 2024)**

A	Carries impulse from effectors to CNS	**B**	Carries impulse from receptors to CNS
C	Carries impulse from CNS to muscles	**D**	Connects sensory nerves to ganglions.

Solution: (c) A motor neuron carries the impulse out from the central nervous system to the effector.

MCQ 5.2.43 **Diffusion _____ across the post synaptic membrane causes it to depolarise: (KMU MDCAT 2024)**

A	Calcium ions	**B**	Chloride ions
C	Potassium ions	**D**	Sodium ions

Solution: (d) The transmitter opens sodium channels, and the inrush of sodium depolarizes the membrane.

MCQ 5.2.44 **A reflex action, does not involve the: (KMU MDCAT 2024)**

A	Brain	**B**	Motor neuron
C	Sensory neuron	**D**	Spinal cord

Solution: (a) A spinal reflex is completed in the cord; the brain learns of it only afterwards.

MCQ 5.2.45 **The neurotransmitter_____ is hydrolysed by monoamine oxidase (KMU MDCAT 2024)**

A	Acetylcholine	**B**	Adrenaline
C	Gluamate	**D**	Serotin

Solution: (b) Monoamine oxidase breaks down the catecholamines, of which adrenaline is one.

MCQ 5.2.46 **Most of the neurons in the CNS are? (KMU MDCAT 2024)**

A	Bipolar	**B**	Multipolar
C	Pseudounipolar	**D**	Unipolar

Solution: (b) Most neurons of the central nervous system have many dendrites and one axon, so they are multipolar.

MCQ 5.2.47 **What is the fate of a neurotransmitter after the transmission of nerve impulse across synapse? (NUMS MDCAT 2024)**

A	It is taken into post synaptic neuron	**B**	Released to post synaptic membrane
C	Released into the synaptic cleft	**D**	Broken down by enzymes

Solution: (d) An enzyme in the cleft breaks the transmitter down at once, so the signal does not linger.

MCQ 5.2.48 **Which immediate change is brought about in the post synaptic membrane on binding with excitatory neurotransmitter? (NUMS MDCAT 2024)**

A	Calcium gates open	**B**	Sodium gates open
C	Sodium gates close	**D**	Sodium potassium pump ceases to work

Solution: (b) The transmitter opens sodium gates, and the inrush begins to depolarize the membrane.

MCQ 5.2.49 **During the conduction of nerve impulse, hyperpolarization would not occur if: (NUMS MDCAT 2024)**

A	Sodium gates didn't close in time	**B**	Potassium gates were not so lousy
C	Sodium potassium pump stopped working	**D**	Calcium gates open instantly

Solution: (b) The potassium gates are slow to shut, so too much potassium leaves and the inside goes past its resting value.

MCQ 5.2.50 **Which of the following is a characteristic of electrical synapse? (NUMS MDCAT 2024)**

A	Presence of neurotransmitters	**B**	Transmission of nerve impulse
C	Sodium potassium gradient	**D**	Absence of neurotransmitter

Solution: (d) An electrical synapse passes the current directly through gap junctions, with no transmitter at all.

MCQ 5.2.51 **Which option given below characterizes refractory period? (NUMS MDCAT 2024)**

A	Reversal of charges across neural membrane	**B**	Change in the type of ions across the membrane
C	Next impulse can be conducted	**D**	Membrane potential +50mV

Solution: (a) During the refractory period the membrane is restoring its charges and cannot carry another impulse.

MCQ 5.2.52 **There is no clear difference between dendrites and axons in sensory neurons, except: (UHS MDCAT 2023)**

A	Thickness	**B**	Length
C	Terminal portions	**D**	None of the above

Solution: (b) In a sensory neuron both processes look alike, and only their length tells them apart.

MCQ 5.2.53 **The neurotransmitter active outside the CNS (Central Nervous System) is: (UHS MDCAT 2023)**

A	Acetylcholine	**B**	Dopamine
C	Glutamate	**D**	Serotonin

Solution: (a) Acetylcholine works at the neuromuscular junction and in the autonomic ganglia, outside the brain and cord.

MCQ 5.2.54 **Which axon would transmit an action potential most rapidly? (SZABMU MDCAT 2023)**

A	Imm diameter neuron lacking myelin	**B**	Imm diameter neuron with myelin
C	2mm diameter neuron lacking myelin	**D**	2mm diameter neuron with myelin

Solution: (d) Speed rises with the diameter of the fibre and again with myelination, so the thick myelinated axon is fastest.

MCQ 5.2.55 **In neurons, the message istransmitted across synapse in the form of chemical messenger called: (SZABMU MDCAT 2023)**

A	Communication	**B**	Neurotransmitter
C	Nerve impulse	**D**	Noci receptors

Solution: (b) The chemical released into the synaptic cleft is the neurotransmitter.

MCQ 5.2.56 **Microscopic gap between the two neurons is called: (SZABMU MDCAT 2023)**

A	Synapsis	**B**	Synapse
C	Collapse	**D**	Synaptic knob

Solution: (b) The gap between two neurons is the synapse.

MCQ 5.2.57 **In a reflex arc, the cell body of sensory neuron is located in: (SZABMU MDCAT 2023)**

A	Ventral root ganglion	**B**	Gray matter of spinal cord
C	White matter of spinal cord	**D**	Dorsal root ganglion

Solution: (d) The cell body of a sensory neuron sits in the dorsal root ganglion, outside the cord.

MCQ 5.2.58 **Na+ (sodium ions) are nearly _____ times greater in fluid outside the cell than inside: (NUMS MDCAT 2023)**

A	10	**B**	30
C	2	**D**	3

Solution: (a) The sodium pump keeps sodium about ten times more concentrated outside the resting cell.

MCQ 5.2.59 **The site of production of neurotransmitters is: (NUMS MDCAT 2023)**

A	Postsynaptic neuron	**B**	Presynaptic neuron
C	Synaptic cleft	**D**	Dendrite

Solution: (b) The transmitter is made in the presynaptic neuron and stored in the vesicles of its knobs.

MCQ 5.2.60 **Endorphins are produced in: (NUMS MDCAT 2023)**

A	Brain	**B**	Adrenal gland
C	Stomach	**D**	Thymus

Solution: (a) Endorphins are made in the brain and act as its own painkillers.

MCQ 5.2.61 **The junction between two neurons is: (NUMS MDCAT 2023)**

A	Impulse	**B**	Synapse
C	Axon	**D**	Cleft

Solution: (b) The junction between two neurons is the synapse.

MCQ 5.2.62 **During testing membrane potential condition: (UHS MDCAT 2023)**

A	Outer suite of neuron is more positive	**B**	Inner surface of neuron is more positive
C	Both of these surfaces are equally positive	**D**	Both of these surfaces are equally negative

Solution: (a) The pump drives sodium out, so the outside of the resting membrane is positive.

MCQ 5.2.63 **The chemical Messengers that transmit action potential across the synapse in the form of chemicals are? (UHS MDCAT 2023)**

A	Synaptic knob of synapse	**B**	Reflex actions
C	Neurotransmitters	**D**	Acetylcholinesterase

Solution: (c) Those chemicals are the neurotransmitters.

MCQ 5.2.64 **In which part of the nervous system will you find Schwann cells? (PMC MDCAT 2022)**

A	CentraI nervous system	**B**	Peripheral nervous system
C	Limbic system	**D**	Sympathetic nervous system

Solution: (b) Schwann cells make the myelin of the peripheral nerves.

MCQ 5.2.65 **Neurilemma cells are also known as? (PMC MDCAT 2022)**

A	Photoreceptors	**B**	Odontoblasts
C	Ganglion	**D**	Schwann cells

Solution: (d) The neurilemma is the sheath of Schwann cells round a peripheral fibre.

MCQ 5.2.66 **Which of these compounds generates a feeling of well-being and inhibits the sensation of pain? (PMC MDCAT 2022)**

A	Cortisol	**B**	Adrenaline
C	Endorphin	**D**	Dopamine

Solution: (c) Endorphins are the brain's own opiates.

MCQ 5.2.67 **Which of the following types of neurons has a single long dendron? (PMC MDCAT 2022)**

A	Sensory neuron	**B**	Associative neuron
C	Motor neuron	**D**	Interneuron

Solution: (a) A sensory neuron has one long dendron running in from the receptor.

MCQ 5.2.68 **The components of coordinated action (PMC MDCAT 2022)**

A	Stimulus and receptor	**B**	Coordinator and effectors
C	Response	**D**	Receptors, neurons & effectors

Solution: (d) A coordinated action needs a receptor to sense, neurons to carry and an effector to act.

MCQ 5.2.69 **What is the change in the resting potential when a neuron fires a nerve impulse? (PMC MDCAT 2022)**

A	It becomes more negative moving from the cell body to the axon	**B**	It becomes more positive moving from the cell body to the axon
C	It becomes more negative moving from the axon to the cell body	**D**	It becomes more positive moving from the axon to the cell body

Solution: (b) Sodium rushing in reverses the charge, so the inside becomes positive as the impulse passes.

MCQ 5.2.70 **When a neuron's membrane potentials is between – 70 mV and – 90 mV, it is said to be In a state of: (PMC MDCAT 2022)**

A	Depolarization	**B**	hyperpolarization
C	repolarization	**D**	No polarization

Solution: (b) A membrane more negative than its resting value is hyperpolarized.

MCQ 5.2.71 **An automatic, involuntary response to any change, external or internal is called: (NUMS MDCAT 2022)**

A	Reflex	**B**	Instinct
C	Taxis	**D**	Tropism

Solution: (a) An automatic involuntary response to a stimulus is a reflex.

MCQ 5.2.72 **Resting membrane potential measures: (NUMS MDCAT 2022)**

A	-70 mv	**B**	-70 Volt
C	70 mv	**D**	-90 mv

Solution: (a) The resting potential of a neuron is about $-70\,\mathrm{mV}$.

MCQ 5.2.73 **The gap between neurons at a synapse is: (NUMS MDCAT 2022)**

A	Synaptic knob	**B**	Synaptic cleft
C	Synaptic delay	**D**	Synaptic vesicle

Solution: (b) The gap between the two membranes at a synapse is the synaptic cleft.

MCQ 5.2.74 **A long extension of a nerve cell is called: (NUMS MDCAT 2022)**

A	Axon	**B**	Auxin
C	Schwann cell	**D**	Dendrites

Solution: (a) The axon is the long process that carries the impulse away.

MCQ 5.2.75 **The molecules responsible for conveying messages from one neuron to the next are called: (NUMS MDCAT 2022)**

A	Hormones	**B**	Activators
C	Neurotransmitters	**D**	Enzymes

Solution: (c) Those molecules are the neurotransmitters.

MCQ 5.2.76 **A single motor neuron may innervate as few as 3-5 fibers in muscles of: (PMC Practice 2021)**

A	Upper arms	**B**	Legs
C	Eyes	**D**	Heart

Solution: (c) The finer the control needed, the fewer fibres in a motor unit, and the eye muscles are the finest of all.

MCQ 5.2.77 **Most reflex arcsare: (PMC Practice 2021)**

A	Monosynaptic reflex	**B**	Polysynaptic reflex
C	Hemi Synaptic Reflex	**D**	None of these

Solution: (b) Most reflexes have an associative neuron between the sensory and the motor one, so they are polysynaptic.

MCQ 5.2.78 **The spinal cord is part of: (PMC Practice 2021)**

A	Brain	**B**	Central nervous system
C	Peripheral nervous system	**D**	Somatic division

Solution: (b) The brain and the spinal cord together are the central nervous system.

MCQ 5.2.79 **A neural pathway that controls an action reflex is called: (PMC Practice 2021)**

A	Nerve cell	**B**	Reflex arc
C	Receptor cells	**D**	Mixed nerve

Solution: (b) The path from receptor through the cord to the effector is the reflex arc.

MCQ 5.2.80 **What is a typical value for the resting membrane potential of a neuron? (PMC Practice 2021)**

A	-70 mV	**B**	-120 mV
C	0.05 V	**D**	Both Options A and B are correct

Solution: (a) The resting potential is about $-70\,\mathrm{mV}$.

MCQ 5.2.81 **Which of the following is an example of superficial reflexes? (PMC Practice 2021)**

A	Ankle jerk	**B**	Knee jerk
C	Abdominal reflex	**D**	Both Options A and B are correct

Solution: (c) Stroking the abdominal skin brings a superficial reflex; the knee and ankle jerks are deep tendon reflexes.

MCQ 5.2.82 **Which of the following neurotransmitters function, both as neurotransmitter and hormones, decreasing our perception of pain? (PMC MDCAT 2020)**

A	Epinephrine	**B**	Serotonin
C	Dopamine	**D**	Endorphins

Solution: (d) Endorphins are the brain's own opiates and damp down the sense of pain.

MCQ 5.2.83 **Which one of the following is common to all neurons? (PMC MDCAT 2020)**

A	A cell body which contains a nucleus	**B**	A thick myelin sheath
C	Presence of node of Ranvier	**D**	Presence of Schwann cells

Solution: (a) Every neuron has a cell body with a nucleus; myelin, nodes and Schwann cells belong only to some.

MCQ 5.2.84 **Neurons are cells adapted for the rapid transmission of electrical impulses. To do this, they have long thin processes called: (PMC MDCAT 2020)**

A	Axons	**B**	Dendrites
C	Myelin sheath	**D**	Schwann cell

Solution: (a) The long process that carries the impulse away is the axon.

MCQ 5.2.85 **A _____ is a junction between two neurons or between a motor neuron and a muscle cell: (PMC MDCAT 2020)**

A	Impulse	**B**	Synapse
C	Axon	**D**	Cleft

Solution: (b) That junction is the synapse.

MCQ 5.2.86 **If stimulation is above _____, impulses travel to the brain along the sensory neuron. (UHS MDCAT 2019)**

A	Refractory period	**B**	Resting potential
C	Action potential	**D**	Threshold potential

Solution: (d) A stimulus below the threshold sets off nothing; above it the impulse is full sized.

MCQ 5.2.87 **In an action potential, the permeability of sodium ions in the neurons increases due to; (UHS MDCAT 2019)**

A	Repolarization	**B**	Sodium ions forming an ionic bonding
C	The opening of sodium channels/gates	**D**	The action of the acetylcholinesterase enzyme

Solution: (c) The sodium gates open and sodium rushes in down its gradient.

MCQ 5.2.88 **The reflex action is the phenomena which only involves: (UHS MDCAT 2019)**

A	receptors and effectors	B	receptors, effectors, and spinal cord
C	brain, receptors, and spinal cord	D	receptors, neurons, and the brain

Solution: (b) A spinal reflex needs only the receptor, the cord and the effector; the brain learns of it afterwards.

MCQ 5.2.89 **Acetylcholine and Noradrenaline are two types of _____ used in our nervous system: (UHS MDCAT 2019)**

A	Enzymes	B	Channel and carrier proteins in the cell membrane of a neuron.
C	Neurotransmitters	D	Hormones

Solution: (c) Both are neurotransmitters, acetylcholine in the parasympathetic and noradrenaline in the sympathetic system.

MCQ 5.2.90 **The main neurotransmitter for synapses is _____, which lie outside the central nervous system. (UHS MDCAT 2019)**

A	Acetylcholine	B	Acetaldehyde
C	Choline	D	Phosphatidylcholine

Solution: (a) Acetylcholine is the transmitter of the neuromuscular junction and the autonomic ganglia.

MCQ 5.2.91 **How many sodium ions are pumped out in response to two potassium ions transported into the membrane? (UHS MDCAT 2018)**

A	2	B	3
C	4	D	1

Solution: (b) The pump drives three sodium ions out for every two potassium ions in.

MCQ 5.2.92 **When a nerve impulse jumps from one node of Ranvier to the next in a myelinated neuron, it's called _____. (UHS MDCAT 2018)**

A	Synapses	B	Saltatory conduction
C	Resting potential	D	Membrane potential

Solution: (b) The impulse jumps from node to node, which is saltatory conduction.

MCQ 5.2.93 **In the nervous system chemical messengers are called _____. (UHS MDCAT 2018)**

A	Neurotransmitters	B	Hormones
C	CHemoreceptors	D	Enzymes

Solution: (a) The chemicals that cross a synapse are the neurotransmitters.

MCQ 5.2.94 **Name the structures which produce response: (UHS MDCAT 2017)**

A	Inhibitors	B	Receptors
C	Neurons	D	Effectors

Solution: (d) The muscle or gland that carries out the response is the effector.

MCQ 5.2.95 **Neurotransmitter secreted at synapse outside the central nervous system is: (UHS MDCAT 2015)**

A	Dopamine	B	Polypeptide
C	Androgen	D	Acetylcholine

Solution: (d) Acetylcholine is the transmitter of the neuromuscular junction and the autonomic ganglia.

MCQ 5.2.96 **Conduction of action potentials from one mode of Ranvier to another in myelinated neurons is through: (UHS MDCAT 2015)**

A	Hyperpolarization	B	Resting Membrane Potential
C	Depolarization	D	Saltatory Conduction

Solution: (d) The impulse leaps from node to node, which is saltatory conduction.

Topic 5.3 Brain

Past MDCAT Questions

MCQ 5.3.1 **The middle layer of the meninges is the: (MDCAT 2022)**

A	arachnoid mater	B	pia mater
C	dura mater	D	perimysium

Solution: (a) From outside in the order is dura, arachnoid, pia.

MCQ 5.3.2 **The part of the brain which coordinates motions and maintains body position is the: (MDCAT 2022)**

A	cerebellum	B	cerebrum
C	pons	D	medulla oblongata

Solution: (a) The cerebellum keeps balance and makes movement smooth.

MCQ 5.3.3 **The medulla oblongata is a part of the: (MDCAT 2024)**

A	forebrain	B	midbrain
C	hindbrain	D	hippocampus

Solution: (c) With the cerebellum and pons it makes up the hindbrain, and it holds the vital centres.

MCQ 5.3.4 **Which part of brain controls transition between sleeping and wakefulness? (UHS MDCAT 2025)**

A	Medulla oblongata	B	Cerebellum
C	Cerebrum	D	Pons

Solution: (d) The pons carries the centres that switch the brain between sleep and wakefulness.

MCQ 5.3.5 **Which part of the brain contains central chemoreceptors that monitor CO2 levels in blood? (UHS MDCAT 2025)**

A	Pons	B	Midbrain
C	Hypothalamus	D	Medulla oblongata

Solution: (d) The central chemoreceptors of the medulla oblongata sense the carbon dioxide of the blood and set the breathing rate.

MCQ 5.3.6 **Hippocampus plays an important role in the: (UHS MDCAT 2025)**

A	Formation of short-term memory	B	Formation of image on retina
C	Formation of long-term memory	D	Formation of emotions

Solution: (c) The hippocampus turns short-term memory into long-term memory.

MCQ 5.3.7 **Left and right cerebral hemispheres are connected with each other by: (UHS MDCAT 2025)**

A	Corpus luteum	B	Corpus callosum
C	A band of dendrites	D	Dorsal and ventral nerve roots

Solution: (b) The corpus callosum is the thick band of nerve fibres joining the two cerebral hemispheres.

MCQ 5.3.8 **Which part of human brain is involved in maintaining the posture and balance of the body? (UHS MDCAT 2025)**

A	Cerebrum	B	Cerebellum
C	Hypothalamus	D	Medulla oblongata

Solution: (b) The cerebellum coordinates muscle tone, posture and balance.

MCQ 5.3.9 **The reticular formation in the brain runs through which structures? (KMU MDCAT 2025)**

A	Forebrain and Midbrain	B	Hindbrain and Midbrain
C	Cerebellum and Forebrain	D	Telencephalon and Cerebellum

Solution: (b) The reticular formation runs up through the medulla and pons into the midbrain.

MCQ 5.3.10 **Match the CORRECT structure of the brain with its function: (KMU MDCAT 2025)**

A	Medulla: Breathing	**B**	Pons: Memory
C	Cerebellum: Dreaming	**D**	Midbrain: Balance

Solution: (a) The medulla oblongata carries the breathing centre.

MCQ 5.3.11 **Parts of brain that comprise the limbic system: (NUMS MDCAT 2025)**

A	Thalamus, amygdala, hippocampus	**B**	Hypothalamus, amygdala, hippocampus
C	Hypothalamus, corpus callosum, hippocampus	**D**	Thalamus, hypothalamus, pons

Solution: (b) The limbic system is made of the hypothalamus, the amygdala and the hippocampus.

MCQ 5.3.12 **In humans memory storage for behavior and coordination is well developed in the: (NUMS MDCAT 2025)**

A	Amygdala	**B**	Cerebrum
C	Medulla	**D**	Cerebellum

Solution: (d) The cerebellum stores the learned patterns of movement and coordination.

MCQ 5.3.13 **The function which is common between Cerebellum and Hippocampus is; (SIBA MDCAT 2025)**

A	Equilibrium	**B**	Memory formation
C	Body positioning	**D**	Sexual arousal

Solution: (b) Both store memory: the hippocampus the memory of facts, the cerebellum the memory of movement.

MCQ 5.3.14 **Which of the following is correct about the structure of brain? (SIBA MDCAT 2025)**

A	Cerebral cortex is outer part consists of grey matter	**B**	Cerebral medulla is inner part consists of grey matter
C	Cerebral cortex is inner part consists of white matter	**D**	Cerebral medulla is outer part consists of white matter

Solution: (a) The cerebral cortex is the outer layer of grey matter, with white matter beneath it.

MCQ 5.3.15 **Hippocampus mainly involved in: (SIBA MDCAT 2025)**

A	Vision and hearing reflexes	**B**	Voluntary muscles movement
C	Memory storage	**D**	Speech production

Solution: (c) The hippocampus lays down long-term memory.

MCQ 5.3.16 **All of the following are the characteristics of limbic system EXCEPT: (SZABMU MDCAT 2025)**

A	Produce most basic and primitive emotions and drives	**B**	formation of memories
C	Consists of hypothalamus, amygdala and hippocampus	**D**	controls reflex movement of eyes

Solution: (d) Reflex movements of the eye are directed from the midbrain, not from the limbic system.

MCQ 5.3.17 **Sensory input from auditory and visual pathways, skin and within the body is received by _____ and distributed to _____ (SZABMU MDCAT 2025)**

A	Hypothalamus: Cerebellum	**B**	Thalamus: cerebrum
C	Cerebrum: rest of the brain	**D**	Cerebellum: rest of the brain

Solution: (b) The thalamus is the relay station that sorts incoming sensation and sends it up to the cerebrum.

MCQ 5.3.18 **Medulla Oblongata is a part of: (UHS MDCAT 2024)**

A	Forebrain	**B**	Mid brain
C	Hind brain	**D**	Hippocampus

Solution: (c) The medulla oblongata, the pons and the cerebellum make up the hindbrain.

MCQ 5.3.19 **Which part of the brain is controlling your sense of balance? (KMU MDCAT 2024)**

A	Amygdala	**B**	Cerebellum
C	Hippocampus	**D**	Medulla Oblongata

Solution: (b) The cerebellum keeps posture and balance.

MCQ 5.3.20 **During complex activity of flight, birds require coordination of many skeletal muscles. Which part of their brain has to be well developed? (NUMS MDCAT 2024)**

A	Amygdala	**B**	Cerebrum
C	Cerebellum	**D**	Thalamus

Solution: (c) The cerebellum coordinates the muscles, and in a flying bird it is very large.

MCQ 5.3.21 **Which part of the brain is actively used by mathematician trying to formulate a new equation? (NUMS MDCAT 2024)**

A	Hippocampus	**B**	Cerebrum
C	Amygdala	**D**	Pons

Solution: (b) Reasoning and abstract thought belong to the cerebral cortex.

MCQ 5.3.22 **The middle layer of meninges is: (UHS MDCAT 2023)**

A	Arachnoid mater	**B**	Pia mater
C	Dura mater	**D**	Cranium

Solution: (a) The three membranes are the dura outside, the arachnoid between and the pia against the brain.

MCQ 5.3.23 **The part of brain which guides smooth and accurate motions and maintains body position is: (UHS MDCAT 2023)**

A	Cerebrum	**B**	Cerebellum
C	Pons	**D**	Medulla

Solution: (b) The cerebellum smooths movement and holds the body in position.

MCQ 5.3.24 **Which function is not controlled by hypothalamus? (SZABMU MDCAT 2023)**

A	Regulate hunger	**B**	Regulate sleep
C	Regulate water balance	**D**	Storing long time memories

Solution: (d) Long-term memory is laid down by the hippocampus, not the hypothalamus.

MCQ 5.3.25 **The feelings and emotions of love and hate are controlled by: (SZABMU MDCAT 2023)**

A	Amygdalae	**B**	Hippocampus
C	Thalamus	**D**	Hypothalamus

Solution: (a) The amygdala of the limbic system handles fear, rage and affection.

MCQ 5.3.26 **The relay center between various parts of the brain and the spinal cord is called? (PMC MDCAT 2022)**

A	Hypothalamus	**B**	Thalamus
C	Midbrain	**D**	Hindbrain

Solution: (b) The thalamus relays traffic between the cord, the brain stem and the cortex.

MCQ 5.3.27 **Which of the following are collectively called the brain stem? (PMC MDCAT 2022)**

A	Thalamus, hypothalamus and midbrain	**B**	Cerebellum, pons and medulla oblongata
C	Thalamus, hypothalamus and medulla	**D**	Medulla oblongata, pons and midbrain

Solution: (d) The brain stem is the medulla oblongata, the pons and the midbrain.

MCQ 5.3.28 **The reflexes such as vomiting, coughing, and sneezing are controlled by which of the following (PMC MDCAT 2022)**

A	Pons	**B**	Cerebrum
C	Cerebellum	**D**	Medulla oblongata

Solution: (d) The medulla oblongata carries the centres for vomiting, coughing and sneezing.

MCQ 5.3.29 **Which of the following is second largest part of the brain? (PMC MDCAT 2022)**

A	Cerebellum	**B**	Cerebrum
C	Hypothalamus	**D**	Thalamus

Solution: (a) After the cerebrum the cerebellum is the largest part of the brain.

MCQ 5.3.30 **The anterior part of cerebral hemisphere located in the cerebrum is classified as (PMC MDCAT 2022)**

A	Ganglion bulbs	**B**	Axon bulbs
C	Dendrite bulbs	**D**	Olfactory bulbs

Solution: (d) The olfactory bulbs lie at the front of the cerebral hemispheres.

MCQ 5.3.31 **Which of these is involved in coordinated movements of the body? (PMC Practice 2021)**

A	Cerebellum	**B**	Cerebrum
C	Medulla	**D**	Pons

Solution: (a) The cerebellum coordinates the muscles and holds the body in balance.

MCQ 5.3.32 **Which portion of the brain is primarily responsible for transmitting the information to other parts of the nervous system? (PMC Practice 2021)**

A	White matter	**B**	Grey matter
C	Medulla	**D**	All A, B and C

Solution: (b) Grey matter is the cell bodies and synapses where the traffic is sorted before it is sent on.

MCQ 5.3.33 **Gray matter is primarily composed of: (PMC Practice 2021)**

A	Axons	**B**	Synapse
C	Neuron somas	**D**	None of these

Solution: (c) Grey matter is made of the cell bodies of the neurons; white matter is their myelinated fibres.

MCQ 5.3.34 **The brain that coordinates skeletal muscle movements is: (PMC Practice 2021)**

A	Thalamus	**B**	Amygdala
C	Hypothalamus	**D**	Cerebellum

Solution: (d) The cerebellum coordinates skeletal muscle and holds the body balanced.

MCQ 5.3.35 **What is the length of spinal cord? (PMC Practice 2021)**

A	10-20 cm	**B**	20-30 cm
C	40-50 cm	**D**	60-90 cm

Solution: (c) The spinal cord of an adult is about 45 cm long.

MCQ 5.3.36 **The spinal cord is protected by how many layers of meninges: (UHS MDCAT 2017)**

A	2	**B**	3
C	4	**D**	5

Solution: (b) The dura, the arachnoid and the pia mater are the three meninges.

MCQ 5.3.37 **A band of axons between two hemispheres is termed as: (UHS MDCAT 2017)**

A	Cerebrum	**B**	Hemisphere band
C	Corpus luteum	**D**	Corpus Callosum

Solution: (d) The corpus callosum is the band of fibres joining the two hemispheres.

MCQ 5.3.38 **Reflexes of the eyes are received in: (UHS MDCAT 2017)**

A	Hypothalamus	**B**	Forebrain
C	Hindbrain	**D**	Midbrain

Solution: (d) The reflex movements of the eye are directed from the midbrain.

MCQ 5.3.39 **Part of hind brain responsible for the balance and equilibrium of body is called: (UHS MDCAT 2016)**

A	Medulla	**B**	Cerebellum
C	Pons	**D**	Thalamus

Solution: (b) The cerebellum of the hindbrain keeps balance and coordinates movement.

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Topic 6.1 Enzymes

Past MDCAT Questions

MCQ 6.1.1 NAD is an important: (MDCAT 2023)

A	enzyme	B	coenzyme
C	hormone	D	vitamin

Solution: (b) It is a non-protein carrier of hydrogen that an enzyme needs to work, which is what a coenzyme is.

MCQ 6.1.2 Which enzyme is different from the others? (MDCAT 2023)

A	pepsin	B	trypsin
C	chymotrypsin	D	lactase

Solution: (d) The first three digest protein; lactase splits a sugar.

MCQ 6.1.3 Enzymes belong to which class of biomolecules? (UHS MDCAT 2025)

A	Carbohydrates	B	Lipids
C	Proteins	D	Nucleic acids

Solution: (c) Almost every enzyme is a protein; only the ribozymes are not.

MCQ 6.1.4 Select the one which is used by hexokinase as an activator: (NUMS MDCAT 2025)

A	Cu++	B	Zn++
C	Mg++	D	Fe++

Solution: (c) Hexokinase needs magnesium ions to work on ATP.

MCQ 6.1.5 Activated pepsin in which polypeptide fragment is removed is an example of: (NUMS MDCAT 2025)

A	Apo-enzyme	B	Holoenzyme
C	Regulatory enzyme	D	Non-regulatory enzyme

Solution: (d) Pepsinogen loses a length of its chain once and for all, so the enzyme is not one whose activity is switched up and down.

MCQ 6.1.6 Transfer of phosphate from one compound to the other compound requires an enzyme called: (SIBA MDCAT 2025)

A	Oxidoreductase	B	Transferase
C	Hydrolase	D	Ligase

Solution: (b) An enzyme that moves a group from one molecule to another is a transferase.

MCQ 6.1.7 The covalently bonded non protein part of enzyme is called: - (SIBA MDCAT 2025)

A	Activator	B	Prosthetic group
C	Coenzyme	D	Apoenzyme

Solution: (b) A non-protein part bound to the enzyme by covalent bonds is a prosthetic group.

MCQ 6.1.8 Ribozymes are the biocatalysts that are made up of: (SZABMU MDCAT 2025)

A	DNA	B	RNA
C	Protein	D	Fatty acid

Solution: (b) A ribozyme is a length of RNA that acts as a catalyst.

MCQ 6.1.9 What happens to the enzyme after an enzyme-catalysed reaction? (KMU MDCAT 2024)

A	Reduced to inactive form	B	Becomes inert
C	Changes into substrate	D	Used for another reaction

Solution: (d) An enzyme is not used up, so it is free to catalyse the next molecule.

MCQ 6.1.10 An enzyme is capable of acting on a wide range of related substrates. Which of the following is a property of this enzyme? (NUMS MDCAT 2024)

A	Inflexible active site	B	Regulatory enzyme
C	Non-regulatory enzyme	D	Highly specific enzyme

Solution: (c) A broad specificity belongs to the ordinary non-regulatory enzymes; the regulatory ones are tightly controlled.

MCQ 6.1.11 Zinc ion is attached at the active site of the enzyme carboxypeptidase. The zinc ion functions as (UHS MDCAT 2023)

A	A coenzyme molecule	B	An activator
C	An inhibitor molecule	D	Controller of Allosteric site

Solution: (b) A metal ion held at the active site and needed for activity is an activator, or cofactor.

MCQ 6.1.12 Enzyme is a natural substance that: (SZABMU MDCAT 2023)

A	Increases the rate of chemical reaction	B	Decreases the rate of chemical reaction
C	Has no effect on the rate of chemical reaction	D	Stops the chemical reaction

Solution: (a) An enzyme is a biological catalyst; it speeds the reaction up.

MCQ 6.1.13 The major enzymes involved in transfer of phosphate group from ATP to Glucose is: (UHS MDCAT 2023)

A	Isomerase	B	Dehydrogenase
C	Kinase	D	Decarboxylase

Solution: (c) An enzyme that moves a phosphate group from ATP to another molecule is a kinase.

MCQ 6.1.14 An activated enzyme consisting of a polypeptide chain and a cofactor is called? (PMC MDCAT 2022)

A	Apoenzyme	B	Holoenzyme
C	Conjugated enzyme	D	Hybrid enzyme

Solution: (b) Apoenzyme with its cofactor makes the active holoenzyme.

MCQ 6.1.15 All enzymes are composed of: (PMC MDCAT 2022)

A	Triglycerides	B	Amino acids
C	Monosaccharides	D	Phospholipids

Solution: (b) Enzymes are proteins, and proteins are chains of amino acids.

MCQ 6.1.16 A non-protein chemical compound which is required for enzyme's catalytic activity is? (PMC MDCAT 2022)

A	Substrate	B	Co-factor
C	DNA	D	RNA

Solution: (b) A cofactor is the non-protein part an enzyme needs before it will work.

MCQ 6.1.17 Catalysts that increase the rate of biological chemical reaction are called? (PMC MDCAT 2022)

A	proteins	B	vitamins
C	enzymes	D	minerals

Solution: (c) Biological catalysts are enzymes.

MCQ 6.1.18 Inactive enzyme precursors such as pepsinogen for pepsin are called as: (PMC Practice 2021)

A	Holoenzymes	B	Actinases
C	Zymogens	D	Mucopolysaccharides

Solution: (c) An inactive precursor of an enzyme is a zymogen.

MCQ 6.1.19 **An activated enzyme made of polypeptide chain and a cofactor is? (PMC Practice 2021)**

A	Substrate	B	Coenzyme
C	Apoenzyme	D	Holoenzyme

Solution: (d) Apoenzyme with its cofactor is the active holoenzyme.

MCQ 6.1.20 **A non-protein part which is essential for proper functioning of enzyme is called: (UHS MDCAT 2018)**

A	Additional factor	B	Cofactor
C	Efficient co factor	D	Extra factor

Solution: (b) A non-protein part an enzyme needs is a cofactor.

MCQ 6.1.21 **Enzymes have what effect on the end-product? (UHS MDCAT 2017)**

A	They alter the product	B	The nature of the product is completely changed
C	No effect	D	The end product is not obtained

Solution: (c) A catalyst changes the rate, not the product or the position of equilibrium.

MCQ 6.1.22 **An enzyme required Mg2+ to catalyze the substrate. The Mg2+ is best identified as: (UHS MDCAT 2016)**

A	Prosthetic group	B	Activator
C	Co-enzyme	D	Inhibitor

Solution: (b) A metal ion needed for activity is an activator, or cofactor.

MCQ 6.1.23 **Some enzymes require helper which is non-protein part for its efficient functioning that is called: (UHS MDCAT 2015)**

A	Accelerator	B	Cofactor
C	Prosthetic group	D	Apoenzyme

Solution: (b) A non-protein part an enzyme needs is a cofactor.

Topic 6.2 Mode of Enzyme Action

Past MDCAT Questions

MCQ 6.2.1 **Enzymes lower the energy of the transition state of a metabolic reaction by: (MDCAT 2022)**

A	changing the substrate into a product directly	B	distorting the molecules bound in the active site
C	binding the fatty acids in the active site	D	raising the temperature of the medium

Solution: (b) Strain put on the bound substrate brings it closer to the transition state, so less activation energy is needed.

MCQ 6.2.2 **The active sites of enzymes are composed of: (MDCAT 2023)**

A	a few nucleotides	B	a few nucleosides
C	a few saccharides	D	a few amino acids

Solution: (d) A handful of amino acid side chains, brought together by the folding of the chain, make the active site.

MCQ 6.2.3 **The induced fit model of enzyme activity suggests that an enzyme: (MDCAT 2024)**

A	cannot modify its active site	B	can bind to a single substrate
C	can catalyze related reactions	D	usually belongs to the non-regulatory enzymes

Solution: (c) The active site is flexible and moulds itself around the substrate, so related substrates can be accepted.

MCQ 6.2.4 **According to Lock and Key model, the active site is regarded as: (UHS MDCAT 2025)**

A	Rigid and specific	B	Flexible and specific
C	Rigid and non specific	D	Flexible and non specific

Solution: (a) The lock and key model treats the active site as a rigid shape that only its own substrate fits.

MCQ 6.2.5 **The active site is important in enzyme action because: (KMU MDCAT 2025)**

A	It binds to the substrate	B	It maintains the pH of reaction
C	It provides energy for reaction	D	It changes the shape of the enzyme

Solution: (a) The active site is the pocket the substrate fits into, where the reaction is catalysed.

MCQ 6.2.6 **Enzymes increase the rate of reaction by: (KMU MDCAT 2025)**

A	Increasing activation energy	B	Lowering activation energy
C	Increasing pH	D	Decreasing pH

Solution: (b) An enzyme offers a path of lower activation energy, so more collisions succeed.

MCQ 6.2.7 **Induced fit model of enzyme activity suggests that an enzyme: (NUMS MDCAT 2025)**

A	Cannot modify its active sites	B	Can bind to a single substrate
C	Can catalyze related specific reaction	D	Usually belongs to non-regulatory enzyme

Solution: (c) The active site is moulded around the substrate as it binds, so an enzyme can serve a group of related reactions.

MCQ 6.2.8 **The linkage between substrate molecule and active site is: (NUMS MDCAT 2025)**

A	Ionic bonding	B	Disulfide bonding
C	Hydrogen bonding	D	Covalent bonding

Solution: (c) The substrate is held in the active site by weak bonds, chiefly hydrogen bonds, so it can be released again.

MCQ 6.2.9 **The induced fit model differs from the Lock and Key model because the enzyme in this model: (SZABMU MDCAT 2025)**

A	Has a rigid and fixed active site	B	Changes shape to fit the substrate
C	Is non-specific in its action	D	Is denatured during reaction

Solution: (b) In the induced fit model the active site is moulded around the substrate as it binds.

MCQ 6.2.10 **The enzymes enable the conversion of substrates into products by (KMU MDCAT 2024)**

A	Changing equilibrium in the direction of the substrate	B	Increasing the activation energy
C	Increasing the substrate concentration	D	Lowering the activation energy

Solution: (d) An enzyme offers a path over a lower energy barrier; it does not shift the equilibrium.

MCQ 6.2.11 **Enzymes lower the activation energy by stabilizing the transition state of a metabolic reaction due to? (UHS MDCAT 2023)**

A	Changing conditions within the active site	B	Changing conditions within the protein framework
C	Rearranging the fatty acids in active site	D	Distorting the molecules in the allosteric site

Solution: (a) The chemical surroundings inside the active site hold the transition state and lower the barrier to it.

MCQ 6.2.12 **The catalytic activity of an enzyme is restricted to its small portion: (SZABMU MDCAT 2023)**

A	Active site	B	Passive site
C	Allosteric site	D	Regulation site

Solution: (a) Only the active site, a small pocket in the molecule, does the catalysis.

MCQ 6.2.13 **Enzyme work by lowering the of the reaction they catalyze: (SZABMU MDCAT 2023)**

A	Kinetic energy	B	Activation energy
C	Heat energy	D	Potential energy

Solution: (b) An enzyme offers a path over a lower energy barrier, so more collisions succeed.

MCQ 6.2.14 **Catalytic activity of an enzyme is restricted to its: (PMC MDCAT 2022)**

A	Active site	B	Catalytic site
C	Binding site	D	Allosteric site

Solution: (a) Only the active site catalyses; the rest of the molecule holds it in shape.

MCQ 6.2.15 **The energy required in order to start a reaction is (PMC MDCAT 2022)**

A	Startup energy	B	Initial energy
C	point energy	D	Activation energy

Solution: (d) That least energy is the activation energy.

MCQ 6.2.16 **What does the active site of the enzyme do? (PMC MDCAT 2022)**

A	Looks like a lump projection from the surface of an enzyme	B	Forms no chemical bond with substrate
C	Never changes	D	The specificity of an enzyme is determined by its structure

Solution: (d) The shape of the active site is what decides which substrate will fit it.

MCQ 6.2.17 **An enzyme can: (PMC MDCAT 2022)**

A	Maintain the biochemical reaction	B	Decrease the biochemical reaction
C	Lower the need of activation energy	D	Be the substitute of activation energy

Solution: (c) An enzyme offers a path over a lower energy barrier.

MCQ 6.2.18 **What is correct about the active site of the enzyme? (PMC MDCAT 2022)**

A	it detaches itself from the product after catalysis	B	It's shape is complementary to the substrate
C	It Is Involved in feedback inhibition	D	It Is Involved In irreversible, non-competitive Inhibition

Solution: (b) The active site is shaped to fit its own substrate and no other.

MCQ 6.2.19 **Which of the following part of enzyme recognize the substrate? (PMC MDCAT 2022)**

A	Binding site	B	Active site
C	Catalytic site	D	Overall structure of an enzyme

Solution: (a) The binding site of the active site is what the substrate is held by.

MCQ 6.2.20 **The enzyme substrate complex is formed in which part of the enzyme molecule? (PMC MDCAT 2022)**

A	Binding site	B	Allosteric site
C	Catalytic site	D	On all over the surface of enzyme

Solution: (a) The substrate is held at the binding site of the active site while it is worked on.

MCQ 6.2.21 **Which type of bonds are never formed when a substrate fits into the active site of an enzyme? (PMC Practice 2021)**

A	Hydrogen bonds	B	Ionic interactions
C	Hydrophobic interactions	D	Covalent linkages

Solution: (d) The substrate is held by weak bonds so that it can be released again; a covalent link would trap it.

MCQ 6.2.22 **In 1959, Koshland proposed which of the following? (PMC Practice 2021)**

A	Unit membrane model	B	Fluid mosaic model
C	Reflective index model	D	Induced fit model

Solution: (d) Koshland's induced fit model has the active site moulded round the substrate as it binds.

MCQ 6.2.23 **The substance that is attached to the enzyme at specific place and converted into product is called as? (PMC Practice 2021)**

A	Co-factor	B	Iso-zyme
C	Active site	D	Substrate

Solution: (d) The molecule the enzyme acts upon is the substrate.

MCQ 6.2.24 **Enzymes work by which of the following? (PMC Practice 2021)**

A	Increasing the activation energy	B	Reducing the activation energy
C	Making exergonic reactions endergonic	D	Making endergonic reactions exergonic

Solution: (b) An enzyme offers a path over a lower energy barrier.

MCQ 6.2.25 **The number of substrate molecules converted into the product by one molecule of enzyme active site per unit time is called? (PMC Practice 2021)**

A	Turnover number	B	Substrate number
C	Reaction number	D	None of these options is correct

Solution: (a) That number is the turnover number of the enzyme.

MCQ 6.2.26 **Enzymes work by lowering the _____ of the reactions they catalyse: (PMC MDCAT 2020)**

A	Kinetic energy	B	Activation energy
C	Heat energy	D	Potential energy

Solution: (b) An enzyme offers a path over a lower energy barrier.

MCQ 6.2.27 **Lock and Key Model for enzyme action propose by Emil Fischer suggests that: (PMC MDCAT 2020)**

A	Enzymes are unbiased for the substrate	B	Enzymes can modify their active sites
C	Enzymes are restricted to one reaction type	D	An enzyme can catalyze variety of reactions

Solution: (c) The lock and key model treats the active site as a rigid shape that only its own substrate fits.

MCQ 6.2.28 **The type of energy, reduced by the enzymes, for biological reactions to occur is called the: (UHS MDCAT 2019)**

A	Light Energy	B	Heat energy
C	Active energy	D	Activation energy

Solution: (d) An enzyme lowers the activation energy of the reaction.

MCQ 6.2.29 **Lock and Key model ws explained by: (UHS MDCAT 2017)**

A	Koshland	B	Emil Fischer
C	De Duve	D	De Duve

Solution: (b) Emil Fischer put forward the lock and key model.

MCQ 6.2.30 **According to _____ model the active site of enzyme is modified as the substrate interacts with enzyme. (UHS MDCAT 2016)**

A	Induced fit	B	Lock and Key
C	Emil Fischer	D	Fluid Mosaic

Solution: (a) In the induced fit model the active site is moulded round the substrate.

MCQ 6.2.31 **Which molecular structure of enzyme is essential for activity of enzyme? (UHS MDCAT 2015)**

A	Primary Structure	**B**	Quaternary Structure
C	Secondary Structure	**D**	Tertiary Structure

Solution: (d) The folded tertiary shape is what makes the active site, so activity depends on it.

Topic 6.3 Factors Affecting the Rate of Enzyme Reactions

Past MDCAT Questions

MCQ 6.3.1 **What is the best physiological pH for the working of most of the cellular enzymes of humans? (MDCAT 2022)**

A	2-3	**B**	3-5
C	6-8	**D**	8-10

Solution: (c) Most enzymes inside the cell work near neutrality; pepsin in the stomach is the well-known exception.

MCQ 6.3.2 **Which enzyme can work at pH 7 of the medium? (MDCAT 2023)**

A	pepsin	**B**	sucrase
C	chymotrypsin	**D**	pancreatic lipase

Solution: (b) Sucrase works near neutrality; pepsin needs a strong acid and the pancreatic enzymes an alkaline medium.

MCQ 6.3.3 **Which of the following statements is incorrect regarding the rate of enzymatic action? (MDCAT 2024)**

A	an increase in enzyme concentration increases the rate	**B**	an increase in enzyme concentration reduces the rate
C	all enzymes work at their maximum rate at their optimum temperature	**D**	all enzymes work at their maximum rate at their optimum pH

Solution: (b) More enzyme means more active sites, so with substrate to spare the rate rises rather than falls.

MCQ 6.3.4 **Enzymes activity decreases at very low or high pH because: (UHS MDCAT 2025)**

A	Substrate concentration increases	**B**	Enzymes become denatured
C	Product formation increases	**D**	Temperature becomes constant

Solution: (b) An extreme pH breaks the bonds holding the tertiary structure, so the active site loses its shape.

MCQ 6.3.5 **Effect of increased substrate concentration on enzyme activity: (UHS MDCAT 2025)**

A	Decrease the rate of reaction	**B**	Increase the reaction rate until all active sites are saturated
C	Have no effect on the reaction rate	**D**	Increase the rate of reaction in a straight diagonal line

Solution: (b) The rate climbs with substrate until every active site is occupied, after which it levels off.

MCQ 6.3.6 **What is the required medium for the maximum activity of the given enzymes? (Lipase / Pepsin) (NUMS MDCAT 2025)**

A	Acidic / Basic	**B**	Acidic / Acidic
C	Basic / Acidic	**D**	Basic / Basic

Solution: (c) Pancreatic lipase works in the alkaline intestine, pepsin in the acid of the stomach.

MCQ 6.3.7 **Which of the following statement is incorrect regarding rate of enzymatic action (UHS MDCAT 2024)**

A	Increase in enzyme concentration increases the rate	**B**	Increase in enzyme concentration reduces the rate
C	All enzymes work at their maximum rate at optimum temperature	**D**	All enzymes work at their maximum rate at optimum pH

Solution: (b) More enzyme means more active sites, so the rate rises, not falls.

MCQ 6.3.8 **Optimum pH for pancreatic lipase is: (KMU MDCAT 2024)**

A	2	**B**	4
C	6	**D**	8

Solution: (d) Pancreatic lipase works in the alkaline intestine, at about pH 8.

MCQ 6.3.9 **Catalase can be activated at pH: (KMU MDCAT 2024)**

A	1	**B**	3
C	5	**D**	7

Solution: (d) Catalase works best at about neutral pH.

MCQ 6.3.10 **What is the best physiological pH for optimum functioning for most of the cellular enzymes of human? (UHS MDCAT 2023)**

A	2-3 pH	**B**	3-5 pH
C	6-8 pH	**D**	8-10 pH

Solution: (c) Most enzymes of the human cell work best near neutrality, about pH 7.

MCQ 6.3.11 **The maximum enzymatic activity of trypsin is shown at: (SZABMU MDCAT 2023)**

A	pH 2	**B**	pH 4
C	pH 6	**D**	pH 8

Solution: (d) Trypsin works in the alkaline intestine, at about pH 8.

MCQ 6.3.12 **Most enzyme have an optimum temperature of around: (SZABMU MDCAT 2023)**

A	30 0 C	**B**	40 0 C
C	50 0 C	**D**	20 0 C

Solution: (b) Most human enzymes are fastest near body temperature, about $40^{\circ}\mathrm{C}$.

MCQ 6.3.13 **In terms of enzyme action, maximum temperature refers to a temperature at which: (SZABMU MDCAT 2023)**

A	Enzyme start to denature	**B**	Enzyme start to re-nature
C	Enzyme work best	**D**	Enzyme are reactivated

Solution: (a) Above the maximum temperature the bonds holding the shape give way and the enzyme is denatured.

MCQ 6.3.14 **Most enzymes work the best at the following temperature: (NUMS MDCAT 2023)**

A	30°C	**B**	40°C
C	50°C	**D**	20°C

Solution: (b) Most human enzymes are fastest near body temperature, about $40^{\circ}\mathrm{C}$.

MCQ 6.3.15 **In term of enzyme action, 'maximum temperature' refers to a temperature at which: (NUMS MDCAT 2023)**

A	Enzymes start to denature	**B**	Enzymes start to re-nature
C	Enzymes work best	**D**	Enzymes are reactivated

Solution: (a) Above that temperature the bonds holding the shape give way.

MCQ 6.3.16 **The rate of an enzyme catalyzed reaction: (PMC MDCAT 2022)**

A	Can be reduced by inhibitors	B	Is constant under all conditions
C	Cannot be measured	D	Has no relation with substrate concentration

Solution: (a) An inhibitor slows it; temperature, pH and substrate all change it too.

MCQ 6.3.17 **What is meant by enzyme denaturation? (PMC MDCAT 2022)**

A	An enzyme begin to catalyze reverse reaction	B	The enzyme loses its three dimensional structure
C	Enzyme stops its activity temporarily	D	Enzyme becomes apoenzyme

Solution: (b) Denaturation is the loss of the folded shape, and with it of the active site.

MCQ 6.3.18 **What happens when an enzyme gets denatured by extreme pH? (PMC MDCAT 2022)**

A	Its amino acids are ionized	B	Its number of amino acids Is changed
C	Its Tertiary structure gets disrupted.	D	It temporarily stops its activation

Solution: (c) The bonds holding the folded shape give way, so the active site loses its form.

MCQ 6.3.19 **Which of the following is the optimum temperature for all enzymes to work in body? (PMC MDCAT 2022)**

A	0oC	B	15oC
C	25°C	D	370C

Solution: (d) Human enzymes work best at body temperature, about 37°C.

MCQ 6.3.20 **Optimum pH for salivary amylase Is: (PMC MDCAT 2022)**

A	2	B	6.8
C	7.6	D	9

Solution: (b) Salivary amylase works best at about pH 6.8, near neutral.

MCQ 6.3.21 **Which enzyme works in alkaline pH? (NUMS MDCAT 2022)**

A	Pepsin	B	Sucrose
C	Enterokinase	D	Pancreatic lipase

Solution: (d) Pancreatic lipase works in the alkaline intestine; pepsin needs acid.

MCQ 6.3.22 **Considering enzyme action minimum temperature is the term used when: (NUMS MDCAT 2022)**

A	Enzymes start denaturing	B	Enzyme becomes hyperactive
C	Enzyme work at their best	D	Inactive enzyme getting reactivated

Solution: (d) Below the minimum temperature the enzyme is inactive but unharmed, and warming brings it back.

MCQ 6.3.23 **If we add more substrate to an already occurring enzymatic reaction and it has no affect on the rate of reaction, the process is called? (PMC Practice 2021)**

A	Denaturation	B	Saturation
C	Composition	D	Inhibition

Solution: (b) Once every active site is occupied, more substrate can make no difference.

MCQ 6.3.24 **Most enzymes have an optimum temperature of around: (PMC MDCAT 2020)**

A	30 C	B	40 C
C	50 C	D	20 C

Solution: (b) Human enzymes work fastest near body temperature.

MCQ 6.3.25 **The temperature that promotes the maximum activity of enzymes is referred to as _____. (UHS MDCAT 2018)**

A	Fixed temperature	B	Optimum temperature
C	Controlled temperature	D	Active temperature

Solution: (b) The temperature at which an enzyme is fastest is its optimum temperature.

MCQ 6.3.26 **Pepsin, protein digesting enzymes, sets best pH: (UHS MDCAT 2015)**

A	3.00	B	4.50
C	2.00	D	6.00

Solution: (c) Pepsin works in the acid of the stomach, at about pH 2.

Topic 6.4 Inhibitors

Past MDCAT Questions

MCQ 6.4.1 **Competitive inhibitors compete with the: (MDCAT 2022)**

A	substrate	B	enzyme
C	product	D	coenzyme

Solution: (a) They resemble the substrate and take its place in the active site.

MCQ 6.4.2 **Competitive inhibitors are: (MDCAT 2023)**

A	homologous to the substrate	B	analogous to the substrate
C	smaller than the substrate	D	larger than the substrate

Solution: (b) They resemble the substrate closely enough in shape to occupy its active site.

MCQ 6.4.3 **Reversible inhibitors differ from Irreversible Inhibitors because they: (UHS MDCAT 2025)**

A	Binds permanently and cannot be removed	B	Bind temporarily and can be removed
C	Permanently inactivate the enzyme	D	Change enzyme structure permanently

Solution: (b) A reversible inhibitor is held by weak bonds and lets go, so the enzyme recovers.

MCQ 6.4.4 **A substance that binds to an enzyme, but NOT at the active site and reduces the enzyme activity is called: (KMU MDCAT 2025)**

A	Competitive inhibitor	B	Substrate
C	Non-Competitive inhibitor	D	Cofactor

Solution: (c) A non-competitive inhibitor binds elsewhere and distorts the active site from a distance.

MCQ 6.4.5 **Reversible inhibitors affect the enzyme catalyzed reaction by: (NUMS MDCAT 2025)**

A	Forming covalent bonds with active site	B	Destroying the globular structure
C	Forming weak linkages with enzymes	D	Activating the catalytic sites

Solution: (c) A reversible inhibitor is held by weak bonds and can be washed out, leaving the enzyme unharmed.

MCQ 6.4.6 **Which of the following is a characteristic of a non-competitive enzyme inhibitor? (SIBA MDCAT 2025)**

A	Binds to the enzyme active site	B	Can be overcome by increasing substrate concentration
C	Increases the speed of the reaction	D	Point of action is allosteric site

Solution: (d) A non-competitive inhibitor binds at an allosteric site and cannot be displaced by more substrate.

MCQ 6.4.7 **Which of the following statement is incorrect with reference to the enzyme action? (SZABMU MDCAT 2025)**

A	Substrate binds with the enzyme at its active site	**B**	Non-competitive inhibitor binds the enzyme at a site distinct from that of active site
C	Addition of a lot of succinate do not reverse the inhibition of succinic dehydrogenase by malonate	**D**	malonate is a competitive inhibitor of succinic dehydogenase

Solution: (c) Malonate is a competitive inhibitor, so flooding the enzyme with succinate does reverse it.

MCQ 6.4.8 **Which competitive inhibitor blocks the enzyme responsible for bacterial cell wall synthesis? (SZABMU MDCAT 2025)**

A	Sulphonamide	**B**	Streptomycin
C	Tetracycline	**D**	Penicillin

Solution: (d) Penicillin competes with the substrate of the enzyme that cross links the bacterial cell wall.

MCQ 6.4.9 **Enzymatic activity can be inhibited by? (KMU MDCAT 2024)**

A	Heavy metal ions	**B**	Methane
C	Mutase	**D**	Noble gases

Solution: (a) Heavy metal ions bind the sulphydryl groups of the enzyme and destroy its shape.

MCQ 6.4.10 **A competitive inhibitor: (KMU MDCAT 2024)**

A	Accelerates the chemical reaction	**B**	Competes with the enzyme
C	Is irreversible	**D**	Is reversible

Solution: (d) A competitive inhibitor merely occupies the active site for a while and can be displaced by more substrate.

MCQ 6.4.11 **In competitive inhibition, the inhibitor (KMU MDCAT 2024)**

A	Binds with substrate	**B**	Competes with enzyme
C	Competes with substrate	**D**	Irreversibly binds with enzyme

Solution: (c) A competitive inhibitor resembles the substrate and takes its place in the active site.

MCQ 6.4.12 **Competitive inhibitors compete with? (UHS MDCAT 2023)**

A	Enzyme	**B**	Substrate
C	Product	**D**	Coenzyme

Solution: (b) It resembles the substrate and takes its place in the active site, so the two compete.

MCQ 6.4.13 **Non-competitive inhibitor molecules have: (UHS MDCAT 2023)**

A	A similar structure to the normal substrate molecule	**B**	A quite different structure from the substrate molecule
C	A different conformation but fit into the active site	**D**	A similar conformation but does not fit into the active site

Solution: (b) It bears no resemblance to the substrate and binds elsewhere, at an allosteric site.

MCQ 6.4.14 **_____ reduces the enzyme activity by blocking the substrate from entering the active site due to similar shapes: (SZABMU MDCAT 2023)**

A	Competitive inhibitors	**B**	Non-competitive inhibitors
C	Co-enzymes	**D**	Activators

Solution: (a) A competitive inhibitor resembles the substrate closely enough to sit in the active site.

MCQ 6.4.15 **Non-competitive inhibitors react with enzymes at: (NUMS MDCAT 2023)**

A	Allosteric site	**B**	Active site
C	Passive site	**D**	Regulatory site

Solution: (a) A non-competitive inhibitor binds at an allosteric site away from the active site.

MCQ 6.4.16 **_____ reduce the enzymes productivity by blocking the substrate from entering into the active site due to similar shapes: (NUMS MDCAT 2023)**

A	Competitive inhibitors	**B**	Non-competitive inhibitors
C	Co-enzymes	**D**	Activators

Solution: (a) A competitive inhibitor resembles the substrate and occupies the active site.

MCQ 6.4.17 **Competitive inhibitors stop an enzyme from working by: (UHS MDCAT 2023)**

A	Changing the shape of the enzyme	**B**	Merging with the substrate instead
C	Blocking the active site of the enzyme	**D**	Combining with the product of the reaction

Solution: (c) A competitive inhibitor takes the place of the substrate in the active site.

MCQ 6.4.18 **Competitive inhibhnors are _____? (UHS MDCAT 2023)**

A	Homologous to substrate	**B**	Analogous to substrate
C	Smaller than substrate	**D**	Larger than substrate

Solution: (a) A competitive inhibitor is close enough in shape to the substrate to sit in the active site.

MCQ 6.4.19 **Inhibitors which block the enzyme by forming weak bonds are called? (PMC MDCAT 2022)**

A	Competitive inhibitors	**B**	Non-competitive inhibitors
C	Irreversible Inhibitors	**D**	Reversible inhibitors

Solution: (d) Weak bonds let go again, so the inhibition is reversible.

MCQ 6.4.20 **Inhibiting enzymatic activity by blocking its active site is: (PMC MDCAT 2022)**

A	Competitive inhibition	**B**	Non-competitive inhibition
C	Feedback inhibition	**D**	Allosteric inhibition

Solution: (a) A competitive inhibitor takes the place of the substrate in the active site.

MCQ 6.4.21 **Which of the following react with enzyme at other than active site? (PMC MDCAT 2022)**

A	Activator	**B**	Coenzymes
C	Non-Competitive Inhibitor	**D**	End-Product Inhibitor

Solution: (c) A non-competitive inhibitor binds at an allosteric site elsewhere on the molecule.

MCQ 6.4.22 **Which of the following may attach on active site of an enzyme? (PMC MDCAT 2022)**

A	Products	**B**	Coenzyme
C	Activator	**D**	Inhibitor

Solution: (d) A competitive inhibitor is what fits the active site itself.

MCQ 6.4.23 **In non-competitive inhibition, the extent of inhibition depends only on? (PMC MDCAT 2022)**

A	Concentration of enzyme	**B**	Concentration of substrate
C	Concentration of ES complex	**D**	Concentration of Inhibitor

Solution: (d) More substrate cannot displace it, so only how much inhibitor there is matters.

MCQ 6.4.24 **Which option is correct about non-competitive inhibition: (NUMS MDCAT 2022)**

A	Malonate act as inhibitor	**B**	Enzyme shape distorted
C	Competition for active site	**D**	Inactive enzyme getting reactivated

Solution: (b) A non-competitive inhibitor binds elsewhere and distorts the shape of the active site.

MCQ 6.4.25 **Which of the following statements is incorrect? (PMC Practice 2021)**

A	The competitive inhibitor affects the rate of breakdown of the enzyme-substrate complex	**B**	The presence of the competitive inhibitor decreases the Km of the enzyme for the substrate
C	A competitive inhibitor reacts reversibly with the enzyme to form an enzyme-inhibitor complex	**D**	In competitive inhibition, the inhibitor molecule is not chemically changed by the enzyme

Solution: (b) A competitive inhibitor raises the apparent K_m, since more substrate is needed to reach half the maximum rate.

MCQ 6.4.26 **An example of competitive inhibition of an enzyme is the inhibition of; (UHS MDCAT 2019)**

A	Succinic dehydrogenase by malonic acid	**B**	Cytochrome oxidase by cyanide
C	Hexokinase by glucose	**D**	Carbonic anhydrase by carbon dioxide

Solution: (a) Malonic acid resembles succinic acid closely enough to occupy the active site of the dehydrogenase.

MCQ 6.4.27 **A student of chemical engineering mistakenly engulfed the toxic compound "A" which was a potent inhibitor of a certain enzyme. He was immediately brought to a hospital where the doctor injected, intravenously, substrate "B" to minimize the toxic effect of Compound A. His life was saved from serious damage. The treatment method shows that compound A was a _____ inhibitor. (UHS MDCAT 2019)**

A	Non competitive	**B**	Irreversible
C	Temperature sensitive	**D**	Competitive reversible

Solution: (d) Flooding the enzyme with substrate displaced the inhibitor, which is the mark of competitive reversible inhibition.

MCQ 6.4.28 **If the molecule can bind to another site of the enzyme rather than the true active site, it is referred to as _____ (UHS MDCAT 2018)**

A	Competitive inhibitors	**B**	Allosteric inhibition
C	Noncompetitive inhibitors	**D**	Irreversible inhibition

Solution: (c) A molecule binding away from the active site is a non-competitive inhibitor.

MCQ 6.4.29 **Name the inhibitors which can be neutralized by adding more substrate: (UHS MDCAT 2017)**

A	Competitive Inhibitors	**B**	Permanent inhibitors
C	Non-competitive inhibitors	**D**	Irreversible inhibitors

Solution: (a) A competitive inhibitor is displaced from the active site when the substrate is in excess.

MCQ 6.4.30 **Which one of the following is an example of competitive inhibitor? (UHS MDCAT 2015)**

A	Glucose	**B**	Fumerate
C	Succinic Acid	**D**	Melonate

Solution: (d) Malonate resembles succinate closely enough to occupy the active site of the dehydrogenase.

Unit 7 Evolution

Topic 7.1 Concept of Evolution

Past MDCAT Questions

MCQ 7.1.1 For an evolutionary process to occur, which of the following is NOT a geographical barrier? (MDCAT 2022)

A	ocean	B	river
C	mountains	D	atmosphere

Solution: (d) The atmosphere is continuous over the whole earth, so it separates no two populations.

MCQ 7.1.2 According to the biogenetic law of Ernst Haeckel: (MDCAT 2022)

A	there is survival of the fittest	B	there is use and disuse of organs
C	phylogeny recapitulates ontogeny	D	ontogeny recapitulates phylogeny

Solution: (d) Haeckel held that an embryo passes through the stages of its ancestry as it develops.

MCQ 7.1.3 According to evolutionary studies, prokaryotes may have arisen around: (MDCAT 2023)

A	2.5 billion years ago	B	3.5 billion years ago
C	4.5 billion years ago	D	5.5 billion years ago

Solution: (b) The oldest fossil bacteria are about 3.5 billion years old.

MCQ 7.1.4 Which of the following types of organs are supposed to have been functional in ancestral species rather than in present day species? (MDCAT 2023)

A	vestigial organs	B	homologous organs
C	analogous organs	D	embryonic organs

Solution: (a) A vestigial organ is the reduced remnant of one that worked in an ancestor.

MCQ 7.1.5 What distinguishes the concept of special creation from concept of evolution? (NUMS MDCAT 2025)

A	Life is not the product of sudden creative act	B	Unicellular prokaryotes might be the life ancestors
C	Rely on inspiration and meditation for life origin	D	Life results from innumerable changes

Solution: (c) Special creation appeals to revelation rather than to evidence.

MCQ 7.1.6 The reduction of population carrying a specific allele and genotype due to natural disaster is called: (NUMS MDCAT 2025)

A	Mutation	B	Bottle neck effect
C	Founder effect	D	Speciation

Solution: (b) A disaster that cuts a population to a few survivors leaves their alleles over-represented, which is the bottleneck effect.

MCQ 7.1.7 Which of the following increases variation within a gene pool? (NUMS MDCAT 2025)

A	Adaptation	B	Genetic drift
C	Gene mutation	D	Neutral selection

Solution: (c) Mutation is the only original source of new alleles in a gene pool.

MCQ 7.1.8 The change in frequency of alleles at a locus that occurs by chance is known as: (UHS MDCAT 2024)

A	Mutation	B	Genetic Drift
C	Non Random mating	D	Speciation

Solution: (b) Genetic drift is the chance change in allele frequency from one generation to the next.

MCQ 7.1.9 The formula calculating the frequency of genotypes and alleles in a population gene pool is known as: (UHS MDCAT 2024)

A	Hardy-Weinberg Equation	B	Lamarck Equation
C	Darwin Equation	D	James Hutton Equation

Solution: (a) The Hardy-Weinberg equation relates allele frequencies to genotype frequencies in a population.

MCQ 7.1.10 According to endosymbiosis theory, flagella may have derived by the ingestion of prokaryotes similar to (UHS MDCAT 2024)

A	Amoeboid prokaryote	B	Aerobic bacterium
C	Spirochete	D	Spirillum

Solution: (c) The theory traces flagella to spirochaetes taken up and kept by an early cell.

MCQ 7.1.11 For evolutionary process to occur, which of the following is NOT a geographical barrier? (UHS MDCAT 2023)

A	Ocean	B	River
C	Mountains	D	Atmosphere

Solution: (d) The atmosphere is continuous, so it separates no population from another.

MCQ 7.1.12 Among the oldest known fossils comes the: (SZABMU MDCAT 2023)

A	Prokaryotes	B	Amphibians
C	Reptiles	D	Fishes

Solution: (a) The oldest fossils are of prokaryotes, some three and a half thousand million years old.

MCQ 7.1.13 This theory says that 'mitochondria and chloroplasts are, in effect, ancient bacteria which now live inside the larger cells'? (NUMS MDCAT 2023)

A	Darwin's theory of evolution	B	Lamarckism
C	Neo-darwinism	D	Endosymbiotic theory

Solution: (d) The endosymbiotic theory traces mitochondria and chloroplasts to bacteria taken up by an early cell.

MCQ 7.1.14 A group of individuals that have the potential to interbreed in nature is: (PMC MDCAT 2022)

A	Genus	B	Species
C	Population	D	Community

Solution: (b) A species is a group whose members can breed together and produce fertile offspring.

MCQ 7.1.15 According to the Hardy-Weinberg theorem, frequencies of alleles and genotypes in a population's gene pool remain: (PMC MDCAT 2022)

A	unaffected by environmental factors	B	Dynamic unless acted upon by agents other than recombination
C	static unless acted upon by agents other than recombination	D	Constant in the absence of other evolutionary influences

Solution: (c) The Hardy-Weinberg equilibrium holds only while no evolutionary force is acting.

MCQ 7.1.16 Which of the following is the major souce of variation in the origin of new species? (PMC MDCAT 2022)

A	Migration	B	Mutation
C	Selection	D	Genetic drift

Solution: (b) Mutation is the only original source of new alleles.

MCQ 7.1.17 The variations in indiviuals that lead to evolution are because of differences in: (PMC MDCAT 2022)

A	genes	B	anatomy
C	physiology	D	.Acquired characters

Solution: (a) Only variation that lies in the genes can be passed on and acted upon.

MCQ 7.1.18 **The origin of new species from already existing species over a period of time Is called: (PMC MDCAT 2022)**

A	adaptation	B	Evolution
C	Neo.Darwinsm	D	Special creation

Solution: (b) Evolution is the origin of new species from those already living.

MCQ 7.1.19 **Evolution is the process that demostrates: (PMC MDCAT 2022)**

A	how characters are passed from one generation to the next	B	How organisms perform their activities in different environment
C	How new species originate from existing species	D	How new species are formed specially and specifically by the nature

Solution: (c) Evolution accounts for the origin of new species from existing ones.

MCQ 7.1.20 **Which of the following shows significant effect of Genetic drift ? (PMC MDCAT 2022)**

A	Animal population	B	Plant population
C	Large population .	D	Small population

Solution: (d) Chance has the largest effect where the numbers are small.

MCQ 7.1.21 **A group of organisms with similar morphology and physiology, which can breed together to produce fertile offspring is called: (NUMS MDCAT 2022)**

A	Species	B	Domain
C	Kingdom	D	diversity

Solution: (a) That is the definition of a species.

MCQ 7.1.22 **Primordial soup is a set of hypothetical conditions on ancient earth first proposed by? (PMC Practice 2021)**

A	Dmitri Ivanovsky	B	Dmitry Anuchin
C	Nikolay Shatsky	D	Alexander Oparin

Solution: (d) Oparin proposed that life arose in a warm sea of organic molecules, the primordial soup.

MCQ 7.1.23 **When two or more clearly different phenotypes exists in same population of species, the phenomenon is called? (PMC Practice 2021)**

A	Replication	B	Polymorphism
C	Gene linkage	D	Gene expression

Solution: (b) Two or more distinct forms in one population is polymorphism.

MCQ 7.1.24 **The abiogenesis theory of origin supports: (PMC Practice 2021)**

A	Spontaneous generation	B	Origin of life from blue-green algae
C	Origin of life is due to pre-existing organisms	D	Organic evolution is due to chemical reactions

Solution: (a) Abiogenesis is the old idea that living things arise of themselves from non-living matter.

MCQ 7.1.25 **Which statement best describes the Hardy-Weinberg principle? (PMC Practice 2021)**

A	Recessive alleles eventually disappear in large populations	B	Expected frequencies of alleles are impossible to predict mathematically
C	Dominant alleles become more prevalent in large populations	D	When there is a large population, the mechanism of inheritance does not change allele frequencies

Solution: (d) In a large population with no selection, mutation or drift, the allele frequencies stay as they are.

MCQ 7.1.26 **Change in frequency of alleles that occurs by chance Is called as: (UHS MDCAT 2019)**

A	Genetic drift	B	Mutation
C	Migration	D	Natural selection

Solution: (a) Chance changes in allele frequency are genetic drift.

MCQ 7.1.27 **The change in frequency of alleles at a locus that occurs by chance is termed as (UHS MDCAT 2017)**

A	Migration	B	Genetic drift
C	Mutation	D	Non-random mating

Solution: (b) Chance changes in allele frequency are genetic drift.

MCQ 7.1.28 **The total number of genes in a population is called: (UHS MDCAT 2016)**

A	Gene pool	B	Allele pool
C	Genome	D	Genomic library

Solution: (a) All the alleles of all the genes in a population make its gene pool.

Topic 7.2 Lamarckism

Past MDCAT Questions

MCQ 7.2.1 **Adaptations that an organism acquires by its own actions during its life span, without modifying its genome, are: (MDCAT 2022)**

A	heritable	B	non-heritable
C	able to be made heritable through some modification	D	sometimes heritable and other times non-heritable

Solution: (b) Nothing is passed on unless the genes change, which is where Lamarck's account fails.

MCQ 7.2.2 **The idea of inheritance of acquired characteristics was presented by: (MDCAT 2024)**

A	Jean Baptiste Lamarck	B	Charles Darwin
C	Thomas Malthus	D	Alfred Wallace

Solution: (a) Lamarck held that what an organism gained in its lifetime passed to its offspring.

MCQ 7.2.3 **Which of the following best describes "acquired characteristics" according to Lamarckism? (UHS MDCAT 2025)**

A	Traits caused by mutation	B	Traits inherited from parents
C	Traits developed by use or disuse	D	Traits selected by nature

Solution: (c) Lamarck held that an organ grows with use and wastes with disuse, and that the change is passed on.

MCQ 7.2.4 **According to Lamarck, the evolution of long necks in giraffes is explained by: (UHS MDCAT 2025)**

A	Natural selection	B	Genetic mutation
C	Survival of the fittest	D	Stretching of necks over generations

Solution: (d) Lamarck explained the long neck as stretching that was passed to the offspring.

MCQ 7.2.5 **The idea that acquired characters are inherited is part of: (KMU MDCAT 2025)**

A	Darwinism	B	Neo Darwinism
C	Lamarckism	D	Biogenesis

Solution: (c) The inheritance of acquired characters is Lamarck's idea, not Darwin's.

MCQ 7.2.6 **A scientist cuts the tails of mice for several generations, but their offspring are always born with tails. This rejects: (KMU MDCAT 2025)**

A	Darwinism	B	Neo Darwinism
C	Lamarckism	D	Mutation theory

Solution: (c) Cutting the tails is an acquired change, and its failure to be inherited tells against Lamarck.

MCQ 7.2.7 **Which of the following idea is a part of Lamarckism? (NUMS MDCAT 2025)**

A	Use and disuse of organs	B	Survival of the fittest
C	Origin of species	D	Variation

Solution: (a) Lamarck held that an organ develops with use and wastes away with disuse.

MCQ 7.2.8 **Why Lamarck is being remembered till today? (SIBA MDCAT 2025)**

A	Due to his rejected but appealing theory of heredity .	B	Due to his universally acceptable theory of evolution
C	Due to his accepted theory of heredity	D	Due to his theory of evolution by natural selection

Solution: (a) His account of inherited acquired characters was wrong, but it was the first serious mechanism offered for evolution.

MCQ 7.2.9 **According to the Lamarck theory of evolution, the organ that has not been used in several generations will: (SZABMU MDCAT 2025)**

A	Become strong	B	Get amputated
C	Disappear	D	Become developed

Solution: (c) Lamarck held that an organ left unused wastes away and is finally lost.

MCQ 7.2.10 **Lamarck theory of evolution was rejected experimentally by: (SZABMU MDCAT 2025)**

A	Earnest Hackle	B	Charles Darwin
C	August Weismann	D	Thomas R Malthas

Solution: (c) Weismann cut the tails of mice for generations and the offspring were still born with tails.

MCQ 7.2.11 **According to Lamarckism, the basis of evolution is: (KMU MDCAT 2024)**

A	Inheritance of acquired characteristics	B	Mutation
C	Natural selection	D	Survival of the fittest

Solution: (a) Lamarck held that characters gained in a lifetime are passed to the offspring.

MCQ 7.2.12 **Children of a mason do not inherit strong muscles developed by father due to hard labour. This is an example of: (NUMS MDCAT 2024)**

A	Survival of the fittest	B	Over production of offspring
C	Not inheriting acquired characters	D	Use and disuse of organs

Solution: (c) Muscle built by work is an acquired character, and acquired characters are not inherited.

MCQ 7.2.13 **Which of the following was proposed by Lamarck in his theory? (PMC MDCAT 2022)**

A	Overproduction	B	Struggle for existence
C	Natural selection	D	Use and disuse of organs

Solution: (d) Use and disuse of organs is Lamarck's idea; the other three are Darwin's.

MCQ 7.2.14 **Most likely people who perform tough manual work can develop (PMC MDCAT 2022)**

A	thick subcutaneous fat in their palms	B	greater quantity of melanin all over the body.
C	Strong calf muscles	D	certain aquired characters

Solution: (d) Muscle and callus built by work are acquired characters, gained in a lifetime and not inherited.

MCQ 7.2.15 **Which condition can be explained by Lamarckism? (PMC Practice 2021)**

A	How giraffes got their long neck	B	How humans lost their tail
C	How humans became bipedal	D	All of these options are correct

Solution: (d) Lamarck would explain each of these as an organ developed or lost by use and disuse and then inherited.

MCQ 7.2.16 **The idea of inheritance of acquired characteristics was proposed by: (UHS MDCAT 2017)**

A	Darwin	B	Lamarck
C	Mendel	D	Wallace

Solution: (b) Lamarck held that characters gained in a lifetime are passed on.

Topic 7.3 Darwinism

Past MDCAT Questions

MCQ 7.3.1 **The finches of the Galapagos Islands resemble species living on the: (MDCAT 2022)**

A	northern Europe	B	Great Britain
C	North American mainland	D	South American mainland

Solution: (d) They descend from South American birds that reached the islands, which is why Darwin found the resemblance telling.

MCQ 7.3.2 **Which of the following is the main point of Darwinism? (MDCAT 2023)**

A	overproduction	B	variation
C	disuse of organs	D	perceived unity of life

Solution: (b) Natural selection needs heritable variation to act on, and that is the heart of Darwin's argument.

MCQ 7.3.3 **Which of the following statements about natural selection is not true? (MDCAT 2024)**

A	it acts on variations that are heritable	B	it is selected by a breeder
C	it can improve the adaptation of a species	D	it is regional in nature

Solution: (b) Selection by a breeder is artificial selection; natural selection is done by the environment.

MCQ 7.3.4 **The main idea in Darwin's Theory of "Origin of species by natural selection" is: (UHS MDCAT 2025)**

A	Inheritance of acquired traits	B	Use and disuse of organs
C	Species never change	D	Evolution occurs through gradual accumulation of adaptation through successive generations

Solution: (d) Darwin held that small favourable variations accumulate under natural selection until a new species is formed.

MCQ 7.3.5 **Choose the correct pair for homology? (NUMS MDCAT 2025)**

A	Wings of birds and wings of butterfly	B	Forelimbs of birds and fins of whales
C	Leaves of pines and cactus	D	Gills of fish and lungs of humans

Solution: (b) A bird's forelimb and a whale's flipper are built on the same pentadactyl plan, so they are homologous.

MCQ 7.3.6 **Which chronological sequence is correct among the classes of vertebrates as evidence of evolution? (NUMS MDCAT 2025)**

A	Birds → fish → amphibians → reptiles	B	Reptiles → birds → fishes → amphibians
C	Fish → amphibians → reptiles → birds	D	Amphibians → reptiles → birds → fish

Solution: (c) The fossil record runs fish, then amphibians, then reptiles, then birds.

MCQ 7.3.7 **Name the idea of Darwin that best explains the ability of populations to reproduce those individuals who possess beneficial traits. (SIBA MDCAT 2025)**

A	Gene flow	B	Genetic drift
C	Artificial selection	D	Natural selection

Solution: (d) Natural selection is the leaving of more offspring by the individuals whose variations suit them best.

MCQ 7.3.8 **According to Darwin, the main force behind evolution is: (SIBA MDCAT 2025)**

A	Migration	B	Genetic mutation
C	Artificial selection	D	Natural selection

Solution: (d) Darwin put natural selection at the centre of his account of evolution.

MCQ 7.3.9 **Identify the correct pair of vestigial organs: (UHS MDCAT 2024)**

A	Ear Muscles & Vermiform appendix	B	Heart & Liver
C	Ear Muscles & Liver	D	Vermiform appendix & Heart

Solution: (a) The ear muscles and the vermiform appendix are reduced remnants of organs once useful.

MCQ 7.3.10 **Wings of birds and that of flying lizards provide evidence of: (KMU MDCAT 2024)**

A	Convergent evolution	B	Divergent evolution
C	No evolution	D	Same origin

Solution: (a) Unrelated animals meeting the same problem arrive at the same solution, which is convergence.

MCQ 7.3.11 **The embryological stages of _____ show similarity in anatomical features. (KMU MDCAT 2024)**

A	All living things	B	All non-vertebrates
C	All vertebrates	D	Human, jelly fish and mouse

Solution: (c) All vertebrate embryos pass through a stage with a notochord, gill slits and a tail.

MCQ 7.3.12 **What best describes the hind leg bones seen in the whale? (KMU MDCAT 2024)**

A	Analogous to the fin of living fish	B	Fossil structure from an extinct ancestor
C	Homologous structure of the wings of a bat	D	Vestigial structures that had a function in an ancestor

Solution: (d) The reduced hind limb bones of a whale are vestiges of the legs of its land ancestors.

MCQ 7.3.13 **The animal species on Galapagos resemble species living on the: (UHS MDCAT 2023)**

A	Northern Europe	B	Great Britain
C	North American mainland	D	South American mainland

Solution: (d) The Galapagos species are closest to those of South America, from which their ancestors came.

MCQ 7.3.14 **He presented the theory of origin of species by means of natural selection: (SZABMU MDCAT 2023)**

A	Lamarck	B	Linnaeus
C	Hardy-Weinberg	D	Darwin

Solution: (d) Darwin published On the Origin of Species by Means of Natural Selection.

MCQ 7.3.15 **The organs which are similar in function but differ in structure are called: (NUMS MDCAT 2023)**

A	Analogous organs	B	Homologous organs
C	Convergent organs	D	Divergent organs

Solution: (a) Organs alike in work but unlike in build are analogous, and they point to convergence.

MCQ 7.3.16 **Which of the following type of organs are supposed to be functional in ancestral species rather than in present day species: (UHS MDCAT 2023)**

A	Vestigial organs	B	Homologous organs
C	Homologous organs	D	Embryonic organs

Solution: (a) A vestigial organ is a reduced remnant of one that worked in the ancestor.

MCQ 7.3.17 **Survival of the fittest depends upon: (PMC MDCAT 2022)**

A	Acquired characters of the organisms	B	Genetic drift
C	Depends in part on the hereditary consulation of the surviving individuals	D	Natural catastrophes

Solution: (c) Only heritable variation can be passed on, so selection works on what is in the genes.

MCQ 7.3.18 **In terrestrial vertebrates, the gill slits are modified to form: (PMC MDCAT 2022)**

A	Ear muscles	B	Eustachian tube
C	Larynx	D	Lungs

Solution: (b) The first gill slit of the fish becomes the Eustachian tube of the land vertebrate.

MCQ 7.3.19 **According to Darwin, a diverse life-form could arise from: (PMC MDCAT 2022)**

A	Common ancestor	B	Random mutation
C	The process of special creation	D	Inheritance of aquired characters

Solution: (a) Darwin traced the diversity of life to descent from a common ancestor.

MCQ 7.3.20 **Descent with modification means: (PMC MDCAT 2022)**

A	All organisms show resemblance	B	Organisms do not show resemblances
C	The organisms show resemblances but later change	D	The organisms do not show resemblances but later become alike

Solution: (c) Descent with modification is Darwin's phrase for species changing as they descend from an ancestor.

MCQ 7.3.21 **Darwin belived that: (PMC MDCAT 2022)**

A	Natural selection and adaptations are closely related	B	Natural selection and special creation are closely related processes
C	Use and disuse of organs and inheritance of acquired characteristics are closely related processes	D	Evolution and mutation are closely related processes

Solution: (a) Selection preserves the variations that suit the organism, and those are its adaptations.

MCQ 7.3.22 **Which of these is a vestigial organ in whale? (PMC MDCAT 2022)**

A	Flipers	B	Fins
C	Lungs	D	Pelvis and leg bones

Solution: (d) The reduced pelvis and leg bones of a whale are the remains of the hind limbs of its land ancestor.

MCQ 7.3.23 **Homologous organs indicate the: (PMC MDCAT 2022)**

A	Convergent evolution	B	Divergent evolution
C	Co-evolution	D	Artificial selection

Solution: (b) Organs built on one plan but put to different uses point to descent from a common ancestor.

MCQ 7.3.24 **According to Darwin, the most critical factor for evolution Is: (PMC MDCAT 2022)**

A	Migration	B	Mutation
C	Natural selection	D	Genetic drift

Solution: (c) Darwin put natural selection at the centre of his account.

MCQ 7.3.25 **The wings of a bird and the wings of a beetle are considered? (PMC Practice 2021)**

A	Taxonomic	B	Phylogenetic
C	Homologous	D	Analogous

Solution: (d) They do the same work but are built on quite different plans, so they are analogous.

MCQ 7.3.26 **The ability of an individual to pass on its phenotype to future generations is known as: (PMC Practice 2021)**

A	Fitness	B	Heritability
C	Limited environmental resources	D	Overproduction of offspring

Solution: (a) Fitness in the Darwinian sense is the ability to leave offspring like oneself.

MCQ 7.3.27 **The homologous organs show similarity in: (PMC Practice 2021)**

A	Shape	B	Origin
C	Function	D	Size

Solution: (b) Homologous organs share a plan and an origin, whatever work they are put to.

MCQ 7.3.28 **_____ occurs because natural selection gives some alleles a better chance of survival than others: (PMC MDCAT 2020)**

A	Fitness	B	Evolution
C	Crossing over	D	Artificial Selection

Solution: (b) Evolution follows from some alleles leaving more descendants than others.

MCQ 7.3.29 **According to the theory of natural selection, organisms produce: (UHS MDCAT 2019)**

A	Offspring according to the resources available	B	Offspring to create resources
C	To create resources	D	More offspring than supported

Solution: (d) More young are born than can survive, and it is among these that selection works.

MCQ 7.3.30 **Divergent Evolution produces: (UHS MDCAT 2018)**

A	Vital Organs	B	Homologous Organs
C	Vestigial Organs	D	Analogous Organs

Solution: (b) Divergence from a common ancestor leaves organs of one plan put to different uses.

MCQ 7.3.31 **Organs specialized to perform different functions but structurally alike are: (UHS MDCAT 2018)**

A	Analogous organs	B	Homologous organs
C	Autologous organs	D	Anuclogous organs

Solution: (b) Organs of the same plan put to different work are homologous.

MCQ 7.3.32 **Organs that are functionally different but structurally alike are termed as: (UHS MDCAT 2017)**

A	Vestigial Organs	B	Comparative embryology organs
C	Homologous organs	D	None of the given options

Solution: (c) Organs built on one plan but put to different uses are homologous.

MCQ 7.3.33 **Structures found in different species which are believed to have a common evolutionary origin are called: (UHS MDCAT 2016)**

A	Homologous	B	Analogous
C	Vestigial	D	Fossilized

Solution: (a) Structures of common ancestry are homologous, whatever work they now do.

MCQ 7.3.34 **Which one of the following is considered as strong evidence of evolution? (UHS MDCAT 2016)**

A	Embryology Record	B	Molecular Record
C	Biochemical Record	D	Fossil Record

Solution: (d) The fossil record is the direct evidence of what lived and in what order.

MCQ 7.3.35 **From evolutionary point of view, which respiratory protein is common in many organisms? (UHS MDCAT 2015)**

A	Cytochrome a	B	Cytochrome b
C	Cytochrome c	D	Cytochrome d

Solution: (c) Cytochrome c is found in almost every aerobic organism, and its sequence traces their relationships.

Unit 8 Reproduction

Topic 8.1 Human Reproductive System

Past MDCAT Questions

MCQ 8.1.1 **Each human testis is divided into: (MDCAT 2022)**

A	50-100 lobules	B	100-200 lobules
C	200-300 lobules	D	250-300 lobules

Solution: (c) About 200 to 300 lobules, each packed with seminiferous tubules.

MCQ 8.1.2 **Which cells in the human male are responsible for the release of testosterone? (MDCAT 2022)**

A	pituitary gland cells	B	Leydig cells
C	Sertoli cells	D	spermatogonia

Solution: (b) The interstitial cells of Leydig lie between the tubules and secrete testosterone.

MCQ 8.1.3 **The fertilized ovum is implanted and undergoes further development in the: (MDCAT 2022)**

A	uterus	B	ovary
C	oviduct	D	cervix

Solution: (a) It implants in the endometrium of the uterus.

MCQ 8.1.4 **What is true about oxytocin? (MDCAT 2023)**

A	it acts on the kidney tubules	B	it stimulates ICSH
C	it performs cellular functions	D	it dilates the milk ducts of the mammary glands

Solution: (d) Oxytocin contracts the uterus in labour and drives milk out along the ducts.

MCQ 8.1.5 **The function of the hyaluronidase enzyme is: (MDCAT 2023)**

A	penetration of the sperm into the ovum	B	entrance of the sperm into the vagina
C	entrance of the sperm into the fallopian tube	D	inactivation of sperms after their failure to fertilize the ovum

Solution: (a) The enzyme of the acrosome digests a path through the coats of the egg.

MCQ 8.1.6 **In human females, what is the small, pear-shaped, muscular, distensible, sac-like organ where gestation takes place? (MDCAT 2023)**

A	uterus	B	kidney
C	fallopian tube	D	cervix

Solution: (a) The uterus holds and nourishes the embryo through pregnancy.

MCQ 8.1.7 **The labour pains to expel the foetus are due to the action of oxytocin on the: (MDCAT 2023)**

A	endometrium	B	myometrium
C	perimetrium	D	ovaries

Solution: (b) The myometrium is the muscular coat of the uterus, and it is what contracts.

MCQ 8.1.8 **The female reproductive system consists of all of the following EXCEPT: (MDCAT 2024)**

A	ovaries	B	oviduct
C	cervix	D	seminiferous tubules

Solution: (d) The seminiferous tubules are in the testis, where sperm are made.

MCQ 8.1.9 **Which hormone is responsible for the labour pains in the human female at the time of birth? (MDCAT 2024)**

A	estrogen	B	progesterone
C	oxytocin	D	corticosteroid

Solution: (c) Oxytocin from the posterior pituitary drives the contractions of the uterus.

MCQ 8.1.10 **The fluid secreted by Sertoli cells provides a liquid medium, protection and nourishment to: (MDCAT 2024)**

A	the oocyte	B	the sperms
C	the polar body	D	the spermatogonia

Solution: (b) Sertoli cells nurse the developing sperm inside the seminiferous tubule.

MCQ 8.1.11 **The main function of the epididymis is to: (MDCAT 2024)**

A	transport sperms	B	connect with the urethra
C	produce semen	D	hold the process of spermatogenesis

Solution: (a) Sperm mature and are stored as they pass along it towards the vas deferens.

MCQ 8.1.12 **The immediate next stage of spermatogonial differentiation is: (MDCAT 2024)**

A	secondary spermatocyte	B	spermatids
C	primary spermatocytes	D	sperms

Solution: (c) A spermatogonium grows into a primary spermatocyte before the first meiotic division.

MCQ 8.1.13 **Receive, retain and nourish a fertilized ovum is the main function of: (UHS MDCAT 2025)**

A	Cervix	B	Uterus
C	Ovary	D	Oviduct

Solution: (b) The uterus receives the embryo, holds it and nourishes it through the placenta.

MCQ 8.1.14 **The process of spermatogenesis occurs in which part of the male reproductive system? (UHS MDCAT 2025)**

A	Seminiferous tubules	B	Vas deferens
C	Scrotum	D	Epididymis

Solution: (a) Sperms are made in the seminiferous tubules of the testis and mature in the epididymis.

MCQ 8.1.15 **Which layer of uterus nourishes the embryo after implantation? (UHS MDCAT 2025)**

A	Cervical epithelium	B	Myometrium
C	Endometrium	D	Perimetrium

Solution: (c) The embryo implants in the endometrium, which then feeds it.

MCQ 8.1.16 **Fertilisation normally occurs in the: (KMU MDCAT 2025)**

A	Uterus	B	Ovary
C	Vagina	D	Fallopian tubes

Solution: (d) The ovum meets the sperm in the upper third of the oviduct.

MCQ 8.1.17 **Which cells of the fallopian tube moisten and nourish the ovum? (KMU MDCAT 2025)**

A	Ciliated epithelial cells	B	Non ciliated epithelial cells
C	Germ cells	D	Endometrial cells

Solution: (b) The non-ciliated (secretory) cells of the oviduct lining make the fluid that keeps the ovum moist and fed.

MCQ 8.1.18 **Which testicular cells in a human male with high testosterone level will start the endocrine activity? (NUMS MDCAT 2025)**

A	Interstitial cell	B	Sertoli cells
C	Spermatogonial cells	D	Leydig cells

Solution: (d) The Leydig cells lie between the tubules and make testosterone.

MCQ 8.1.19 **Which layer of uterus is composed of contractile muscles? (NUMS MDCAT 2025)**

A	Endometrium	B	Perimetrium
C	Myometrium	D	Both endo and myometrium

Solution: (c) The myometrium is the thick smooth muscle layer that contracts in labour.

MCQ 8.1.20 **One of the endocrine glands responsible for failure in ovulation is: (NUMS MDCAT 2025)**

A	Pituitary	B	Placenta
C	Thyroid	D	Adrenal

Solution: (a) Ovulation depends on the LH surge from the anterior pituitary.

MCQ 8.1.21 **In males, which of the following is considered a urogenital organ? (SIBA MDCAT 2025)**

A	Urethra	B	Ureter
C	Urinary bladder	D	Vas deferens

Solution: (a) The male urethra carries both urine and semen, so it serves both systems.

MCQ 8.1.22 **The other name for Interstitial cells in male testes is: (SIBA MDCAT 2025)**

A	Leydig cell	B	Spermatogonia cell
C	Sertoli cell	D	Spermatocyte

Solution: (a) The interstitial cells between the seminiferous tubules are the Leydig cells.

MCQ 8.1.23 **Beside fertilization, the function of fallopian tube is: (SIBA MDCAT 2025)**

A	Nourishment of embryo	B	Transport of ovum towards uterus
C	Secretion of female hormones	D	Implantation of zygote

Solution: (b) The cilia and the muscle of the oviduct carry the ovum down towards the uterus.

MCQ 8.1.24 **Which of the following hormone is not produced in older women? (SZABMU MDCAT 2025)**

A	Estrogen	B	Gastrin
C	Secretin	D	Renin

Solution: (a) After the menopause the ovaries stop making oestrogen; the gut hormones go on as before.

MCQ 8.1.25 **The part of male reproductive system that maintains the temperature for sperm production is: (SZABMU MDCAT 2025)**

A	Testes	**B**	Scrotum
C	Vas deferens	**D**	Epididymis

Solution: (b) The scrotum holds the testes outside the body, a few degrees below core temperature.

MCQ 8.1.26 **Female reproductive system consists all of the following EXCEPT (UHS MDCAT 2024)**

A	Ovaries	**B**	Oviduct
C	Cervix	**D**	Seminiferous tubules

Solution: (d) Seminiferous tubules are in the testis, which belongs to the male system.

MCQ 8.1.27 **Which one of the following hormone is responsible for the labor pains in human female at the time of birth of baby? (UHS MDCAT 2024)**

A	Estrogen	**B**	Progesterone
C	Oxytocin	**D**	Corticosteroid

Solution: (c) Oxytocin from the posterior pituitary drives the contractions of labour.

MCQ 8.1.28 **Fluid secreted by sertoli cells provides liquid medium, protection and nourishment to: (UHS MDCAT 2024)**

A	Oocyte	**B**	Sperms
C	Polar body	**D**	Spermatogonia

Solution: (b) The Sertoli cells nurse the developing sperms and feed them.

MCQ 8.1.29 **Main function of the epididymis is to: (UHS MDCAT 2024)**

A	Transport sperms	**B**	Connect with urethra
C	Produce semen	**D**	Hold the process of spermatogenesis

Solution: (a) The epididymis stores the sperms and passes them on to the vas deferens.

MCQ 8.1.30 **Immediate next stage of spermatogonia differentiation is: (UHS MDCAT 2024)**

A	Secondary spermatocyte	**B**	Spermatids
C	Primary spermatocytes	**D**	Sperms

Solution: (c) A spermatogonium grows into a primary spermatocyte before meiosis begins.

MCQ 8.1.31 **The _____ in semen facilitate the transport of sperms. (KMU MDCAT 2024)**

A	Androgen	**B**	Prostaglandins
C	Oxytocin	**D**	Testosterone

Solution: (b) The prostaglandins of the semen set the female tract contracting and help the sperms along.

MCQ 8.1.32 **The acidity of urine is neutralized by? (KMU MDCAT 2024)**

A	Cowpers gland	**B**	Prostate gland
C	Seminal vesicle	**D**	Vas deferens

Solution: (a) Cowper's glands pour an alkaline fluid into the urethra ahead of the semen.

MCQ 8.1.33 **The outer layer of uterus is called as: (KMU MDCAT 2024)**

A	Endometrium	**B**	Myometrium
C	Mesometrium	**D**	Perimetrium

Solution: (d) The perimetrium is the outer serous coat of the uterus.

MCQ 8.1.34 **Which of the following would be produced as a result of reduction division during gametogenesis? (NUMS MDCAT 2024)**

A	Oogonium	**B**	Primary oocyte
C	Primary spermatocyte	**D**	Secondary oocyte

Solution: (d) The first meiotic division of the primary oocyte gives the secondary oocyte.

MCQ 8.1.35 **Which cells in the human males are responsible for the release of testosterone? (UHS MDCAT 2023)**

A	Pituitary Gland	**B**	Hypothalamus
C	Sertoli cells	**D**	Leydig cells or interstitial cells

Solution: (d) The interstitial, or Leydig, cells between the tubules secrete testosterone.

MCQ 8.1.36 **Fertilized ovum is implanted and undergoes further development in the: (UHS MDCAT 2023)**

A	Ovary	**B**	Uterus
C	Oviduct	**D**	Cervix

Solution: (b) The embryo implants in the endometrium of the uterus and develops there.

MCQ 8.1.37 **After fertilization, zygote takes_____for its journey from fallopian tube to uterus: (SZABMU MDCAT 2023)**

A	6-7 days	**B**	3-6 days
C	10-12 days	**D**	12-15 days

Solution: (a) The zygote takes about six or seven days to reach the uterus and implant.

MCQ 8.1.38 **The best temperature forspermatogenesis is: (SZABMU MDCAT 2023)**

A	37 0 C	**B**	30 0 C
C	32 0 C	**D**	35 0 C

Solution: (d) Sperms are made a couple of degrees below core temperature, at about $35^{\circ}\mathrm{C}$.

MCQ 8.1.39 **Leydig cells in testes are responsible for: (SZABMU MDCAT 2023)**

A	Testosterone production	**B**	FSH production
C	Sperm production	**D**	Testosterone inhibition

Solution: (a) The Leydig cells between the tubules secrete testosterone.

MCQ 8.1.40 **The hormone responsible for production of sperm cells and male secondary sexual characteristics is: (NUMS MDCAT 2023)**

A	Estrogen	**B**	Progesterone
C	Testosterone	**D**	Thyroxin

Solution: (c) Testosterone from the Leydig cells drives spermatogenesis and the male secondary characters.

MCQ 8.1.41 **Leydig cells are responsible for: (NUMS MDCAT 2023)**

A	Testosterone production	**B**	FSH production
C	Sperm production	**D**	Testosterone inhibition

Solution: (a) The Leydig, or interstitial, cells secrete testosterone.

MCQ 8.1.42 **The function of hyaluronidase enzyme is: (UHS MDCAT 2023)**

A	Penetration of the sperm into the Ovum	**B**	Entrance of the sperm into the vagina tube
C	Entrance of the sperm into the fallopian	**D**	Inactivation of sperms after their failure to fertilize ovum

Solution: (c) Hyaluronidase from the acrosome digests a path through the layers round the ovum.

MCQ 8.1.43 **During birth, which of following acts as a birth canal? (PMC MDCAT 2022)**

A	Oviduct	**B**	Ovary
C	Uterus	**D**	Vagina

Solution: (d) The vagina is the passage through which the baby is born.

MCQ 8.1.44 **Which of the following part of the male reproductive system is located outside the testes? (PMC MDCAT 2022)**

A	Seminiferous tubules	**B**	Epididymis
C	Efferent ducts	**D**	Urinogenital duct

Solution: (d) The urinogenital duct runs outside the testis; the other three lie within it.

MCQ 8.1.45 **Which cells synthesize testosterone? (PMC MDCAT 2022)**

A	Adrenal medulla of adrenal glands	**B**	Adrenal cortex of adrenal glands
C	Interstitial cells of testis	**D**	Graffian follicle

Solution: (c) The interstitial, or Leydig, cells of the testis make testosterone.

MCQ 8.1.46 **The second meiotic division in oocyte is completed during? (PMC MDCAT 2022)**

A	When ovum is discharged from the ovary	**B**	Just before fertilization
C	Before the onset of menstruation	**D**	When the oocyte is fertilized by sperm

Solution: (d) The second meiotic division is finished only when the sperm enters.

MCQ 8.1.47 **Where are Sertoli cells present in the male reproductive system? (PMC MDCAT 2022)**

A	In germinal epithelium	**B**	In seminiferous tubules
C	In seminal vesicle	**D**	In prostate gland

Solution: (b) Sertoli cells line the seminiferous tubules and nurse the developing sperms.

MCQ 8.1.48 **An egg is fertilized in a laboratory and implanted in uterus for development. Which of the following term is related to this procedure: (PMC MDCAT 2022)**

A	Leutinizatioin	**B**	Menopause
C	In vitro fertilisation	**D**	Incubation

Solution: (c) Fertilizing the egg outside the body and returning it to the uterus is in vitro fertilization.

MCQ 8.1.49 **Which of the following is haploid cell? (PMC MDCAT 2022)**

A	Spermatogonia stem cell	**B**	Spermatogonium
C	Primary spermatocyte	**D**	Secondary spermatocyte

Solution: (d) The first meiotic division halves the chromosome number, so the secondary spermatocyte is haploid.

MCQ 8.1.50 **Which of the following is included in male (PMC MDCAT 2022)**

A	Cervix	**B**	Seminepherous tubules
C	Corpus luteum	**D**	Graafian follicle

Solution: (b) The seminiferous tubules of the testis are where sperms are made.

MCQ 8.1.51 **Which of the following is a hormone produced by the testes? (PMC MDCAT 2022)**

A	Progesterone	**B**	Estrogen
C	Testosterone	**D**	Interstitial cell stimulating hormone

Solution: (c) The Leydig cells of the testis secrete testosterone.

MCQ 8.1.52 **If the sperms are too weak to fertilize the egg in oviduct, which of the following procedure can be used to overcome this problem of infertility? (PMC MDCAT 2022)**

A	In vitro fertilization	**B**	Incubation
C	Hatching	**D**	Amniocentesis

Solution: (a) In vitro fertilization brings the sperm and the egg together outside the body.

MCQ 8.1.53 **Which one of the following occurs at puberty in boys? (PMC MDCAT 2022)**

A	Ovulation	**B**	Pubic hair growth
C	Hips broaden	**D**	Menarche

Solution: (b) Pubic hair appears at puberty in both sexes; the other three are female.

MCQ 8.1.54 **Which of the following is the part of male reproductive system? (PMC MDCAT 2022)**

A	Cervix	**B**	Leydig cells
C	Myometrium	**D**	Corpus luteum

Solution: (b) The Leydig cells lie between the seminiferous tubules of the testis.

MCQ 8.1.55 **The uterus of the female reproductive system opens up to the? (PMC MDCAT 2022)**

A	Placenta	**B**	Ovary
C	Cervix	**D**	Oviduct

Solution: (c) The neck of the uterus, the cervix, opens into the vagina.

MCQ 8.1.56 **What Is the function of the fluid secreted by Sertoli cells? (PMC MDCAT 2022)**

A	Stimulate spermatogenesis	**B**	Stimulates secondary sexual dveleopment
C	Provides nourishment to sperms	**D**	Inhibits spermatogenesis

Solution: (c) The Sertoli cells nurse the developing sperms and feed them.

MCQ 8.1.57 **Where does fertilization occur in human body? (PMC MDCAT 2022)**

A	Ovary	**B**	Uterus
C	Fallopian Tube	**D**	Vagina

Solution: (c) Fertilization takes place in the upper third of the oviduct.

MCQ 8.1.58 **In reproduction, semen refers to which of the following? (PMC MDCAT 2022)**

A	Fluid and sperms	**B**	Blood cells and plasma
C	Blood and sperms	**D**	Egg and sperms

Solution: (a) Semen is the sperms together with the secretions of the accessory glands.

MCQ 8.1.59 **The union of meiotically produced specialized sex cells from each parents produce? (PMC MDCAT 2022)**

A	Corpus luteum	**B**	Embryo
C	Zygote	**D**	Neuroglial cells

Solution: (c) A sperm and an ovum fusing give the zygote.

MCQ 8.1.60 **Which of the following part of sperm cell penetrates into the ovum during fertilization? (PMC MDCAT 2022)**

A	Cytoplasm	**B**	Nucleus
C	Acrosome	**D**	Mitochondria

Solution: (c) The acrosome at the head of the sperm digests a way through the coats of the ovum.

MCQ 8.1.61 **In the male reproductive system, the hormone involved in the regulation of the rate of spermatogenesis is called: (NUMS MDCAT 2022)**

A	Luteinizing hormone	B	Follicle-stimulating hormone
C	Testosterone	D	Inhibin

Solution: (d) Inhibin from the Sertoli cells damps down FSH and so holds the rate of sperm production.

MCQ 8.1.62 **Cervix is the part of: (NUMS MDCAT 2022)**

A	Vagina	B	Oviduct
C	Uterus	D	Ovary

Solution: (c) The cervix is the neck of the uterus.

MCQ 8.1.63 **Human embryo remains enclosed in: (PMC Practice 2021)**

A	Amniotic sac	B	Placenta
C	Chorion	D	Allantois

Solution: (a) The embryo develops inside the amnion, cushioned by the amniotic fluid.

MCQ 8.1.64 **The scrotum is responsiblefor·which of the following in the male reproductive system? (PMC Practice 2021)**

A	Synthesis of sperm	B	Lubrication
C	Nourishment of sperm	D	Temperature regulation

Solution: (d) The scrotum holds the testes a few degrees below core temperature.

MCQ 8.1.65 **Which one of the following is most likely to occur in a boy during puberty? (PMC Practice 2021)**

A	He produces eggs	B	His shoulders broaden
C	The colour of his eyes change	D	None of these options is correct

Solution: (b) Testosterone at puberty broadens the shoulders and deepens the voice.

MCQ 8.1.66 **The spermatic cord and spermatic duct are? (PMC Practice 2021)**

A	The same	B	Different
C	Same in function	D	Same in location

Solution: (b) The spermatic duct carries the sperms; the cord is the bundle of duct, vessels and nerves together.

MCQ 8.1.67 **Which of the following is not a true characteristic of spermatogonia? (PMC Practice 2021)**

A	They develop into primary spermatocytes through mitosis	B	They are undifferentiated
C	They are germ line cells	D	They are haploid

Solution: (d) Spermatogonia are diploid; the haploid stage begins with the secondary spermatocyte.

MCQ 8.1.68 **Gametes in animals are produced by which of the following? (PMC Practice 2021)**

A	Mitosis	B	Meiosis
C	Fission	D	All of these options are correct

Solution: (b) Gametes are haploid, so they are made by meiosis.

MCQ 8.1.69 **During spermatogenesis, the _____, which are haploid cells eventually mature into spermatozoa/mature sperms: (UHS MDCAT 2019)**

A	Spermatogonia	B	Primary spermatocytes
C	Spermatids	D	Secondary spermatocytes

Solution: (c) The spermatids are the haploid cells that grow tails and become spermatozoa.

MCQ 8.1.70 **Process ensuring the survival of species over long periods of time, even though individual members of the species die. (UHS MDCAT 2018)**

A	Reproduction	B	Adaptability
C	Mitosis	D	Respiration

Solution: (a) Reproduction is what carries the species on after its members die.

MCQ 8.1.71 **In human female, the egg is fertilized in: (UHS MDCAT 2018)**

A	Ovary	B	Vagina
C	Oviduct	D	Uterus

Solution: (c) Fertilization takes place in the upper third of the oviduct.

MCQ 8.1.72 **Which structure from the following is not present in the male reproductive system: (UHS MDCAT 2017)**

A	Urethra	B	Seminiferous tubules
C	Vas deferens	D	Cervix

Solution: (d) The cervix is the neck of the uterus, in the female system.

MCQ 8.1.73 **From among the following, which hormone is the interstitial cell stimulating hormone: (UHS MDCAT 2017)**

A	FSH	B	GH
C	LH	D	Prolactin

Solution: (c) Luteinizing hormone in the male is called interstitial cell stimulating hormone.

MCQ 8.1.74 **In human testis, which structure is responsible for carrying sperm from inside the testis? (UHS MDCAT 2015)**

A	Seminiferous tubules	B	Urinogenital duct
C	Seminal Vesicles	D	Vasa efferentia

Solution: (d) The vasa efferentia carry the sperms from the testis to the epididymis.

MCQ 8.1.75 **In which part of female reproductive system fertilization takes place? (UHS MDCAT 2015)**

A	Proximal part of oviduct	B	Uterus
C	Placenta	D	Vagina PLSPOT 18 of 20

Solution: (a) Fertilization happens in the upper third of the oviduct.

Topic 8.2 Menstrual Cycle

Past MDCAT Questions

MCQ 8.2.1 **Luteinizing hormone is maximum in the blood during which stage of the ovarian cycle? (MDCAT 2022)**

A	menstrual phase	B	proliferative phase
C	ovulation	D	secretory phase

Solution: (c) The LH surge is what triggers the release of the ovum.

MCQ 8.2.2 **The term menopause means: (MDCAT 2023)**

A	start of menstruation	B	start of ovulation
C	stop of ova production	D	degeneration of the ovaries

Solution: (c) The ovaries stop releasing ova and the cycles come to an end.

MCQ 8.2.3 **The production of follicle-stimulating hormone and luteinizing hormone from the pituitary gland of the female is controlled by the: (MDCAT 2023)**

A	ovary	B	uterus
C	stimulated follicles	D	hypothalamus

Solution: (d) Gonadotrophin releasing hormone from the hypothalamus governs the anterior pituitary.

MCQ 8.2.4 **The corpus luteum during the female reproductive cycle produces: (MDCAT 2024)**

A	testosterone	**B**	follicle stimulating hormone
C	luteinizing hormone	**D**	progesterone

Solution: (d) Progesterone from the corpus luteum holds the uterine lining ready for implantation.

MCQ 8.2.5 **Due to the process of follicle atresia: (MDCAT 2024)**

A	follicles reach maximum size	**B**	the follicle degenerates
C	the Graafian follicle ovulates	**D**	the follicle starts to mature

Solution: (b) All but one of the follicles recruited in a cycle break down, and that breakdown is atresia.

MCQ 8.2.6 **During menstrual cycle, luteinizing hormone (LH) is secreted due to; (UHS MDCAT 2025)**

A	Decrease in Estrogen	**B**	Decrease in FSH
C	Increase in FSH	**D**	Environmental effect

Solution: (c) Rising FSH raises the oestrogen of the growing follicle, and that in turn triggers the LH surge.

MCQ 8.2.7 **In a normal 28 days menstrual cycle when would you expect the LH surge to occur? (UHS MDCAT 2025)**

A	Days 7-10	**B**	Days 11-14
C	Days 15-18	**D**	Days 19-22

Solution: (b) The LH surge comes just before ovulation, about day 12 to 14 of a 28 day cycle.

MCQ 8.2.8 **Which changes occur in the endometrium during the proliferate phase of the menstrual cycle? (SIBA MDCAT 2025)**

A	It begins to shed	**B**	It regenerates and thickens
C	It becomes secretory	**D**	No change occurs

Solution: (b) Under rising oestrogen the lining left after menstruation is rebuilt and thickened.

MCQ 8.2.9 **If fertilization does not occur, which part of uterus degenerate? (SIBA MDCAT 2025)**

A	Myometrium	**B**	Endometrium
C	Perimetrium	**D**	Cervix

Solution: (b) Without implantation the corpus luteum fails, oestrogen and progesterone fall, and the endometrium is shed.

MCQ 8.2.10 **In human female normally ovulation occurs at day _____ of menstrual cycle. (SZABMU MDCAT 2025)**

A	9	**B**	11
C	14	**D**	15

Solution: (c) Ovulation falls on about the fourteenth day of a twenty-eight day cycle.

MCQ 8.2.11 **Decreased level of FSH hormone during menstrual cycle triggers the release of: (SZABMU MDCAT 2025)**

A	hcg	**B**	LH
C	Oxytocin	**D**	progesterone

Solution: (b) As FSH falls the ripe follicle drives the LH surge that brings on ovulation.

MCQ 8.2.12 **Corpus luteum during female reproductive cycle produces (UHS MDCAT 2024)**

A	Testosterone	**B**	Follicle stimulating hormone
C	Luteinizing Hormone	**D**	Progesterone

Solution: (d) The corpus luteum secretes progesterone, which holds the endometrium ready.

MCQ 8.2.13 **The corpus luteum is essentially formed from (KMU MDCAT 2024)**

A	Graafian follicle	**B**	Ovum
C	Oogonium	**D**	Oocyte

Solution: (a) What is left of the Graafian follicle after ovulation becomes the corpus luteum.

MCQ 8.2.14 **Choose the mismatched pair: (NUMS MDCAT 2024)**

A	Graffian follicle - progesterone	**B**	ICSH - interstitial cell
C	Estrogen - inhibits FSH	**D**	LH - ovulation

Solution: (a) The Graafian follicle secretes oestrogen; progesterone comes from the corpus luteum it becomes.

MCQ 8.2.15 **If reproductive cycle of a female starts on 10th of July, ovulation is most likely to occur on: (NUMS MDCAT 2024)**

A	1st August	**B**	28th of July
C	24th of July	**D**	5th August

Solution: (c) Ovulation falls about fourteen days after the cycle begins, that is the 24th of July.

MCQ 8.2.16 **A hormone that plays a major role in social bonding, childbirth, milk ejection and sexual reproduction is: (UHS MDCAT 2023)**

A	Estrogen	**B**	Oxytocin
C	Prolactin	**D**	Secretin

Solution: (b) Oxytocin drives the contractions of labour and the let-down of milk.

MCQ 8.2.17 **Hormone produced by placenta is: (UHS MDCAT 2023)**

A	Follicle-Stimulating Hormone (FSH)	**B**	Luteinizing Hormone (LH)
C	Progesterone	**D**	Testosterone

Solution: (c) The placenta takes over from the corpus luteum and secretes progesterone through the pregnancy.

MCQ 8.2.18 **Level of luteinizing hormone (LH) is maximum in blood during which stage of menstrual cycle? (UHS MDCAT 2023)**

A	Menstrual stage	**B**	Proliferative stage
C	Ovulation stage	**D**	Secretory stage

Solution: (c) The LH surge comes at ovulation, about the middle of the cycle.

MCQ 8.2.19 **In human females, FSH stimulates: (SZABMU MDCAT 2023)**

A	Follicle development	**B**	Ovulation
C	Embryo implantation	**D**	Menstruation

Solution: (a) Follicle stimulating hormone ripens the follicle in the ovary.

MCQ 8.2.20 **Which hormone induces labour pains? (NUMS MDCAT 2023)**

A	Estrogen	**B**	Oxytocin
C	Progesterone	**D**	LH

Solution: (b) Oxytocin from the posterior pituitary drives the contractions of labour.

MCQ 8.2.21 **The estrogen hormone secretion during the oogenesis is stimulated by: (NUMS MDCAT 2023)**

A	Leutinizing Hormone	**B**	Inhibin Hormone
C	Follicle Stimulating Hormone	**D**	Testosterone Hormone

Solution: (c) Follicle stimulating hormone ripens the follicle, and the growing follicle makes the oestrogen.

MCQ 8.2.22 **Which of the following hormones of the pituitary gland regulate the menstrual cycle? (NUMS MDCAT 2023)**

A	Follicle Stimulating Hormone and estrogen	B	Luteinizing hormone and estrogen
C	Follicle Stimulating Hormone and Luteinizing hormone	D	Estrogen and progesterone

Solution: (c) FSH and LH from the anterior pituitary drive the ovarian cycle.

MCQ 8.2.23 **The labour pains to expel fetus are due to action of oxytocin on: (UHS MDCAT 2023)**

A	Endometrium	B	Myometrium
C	Perimetrium	D	Ovaries

Solution: (b) Oxytocin acts on the myometrium, the muscular layer of the uterus.

MCQ 8.2.24 **What is true about Ozytocin? (UHS MDCAT 2023)**

A	Acts on kidney tubules	B	Stimulates ICSH
C	Perform cellular fun	D	Dilate milk ducts of mammary glands

Solution: (d) Oxytocin contracts the muscle round the milk ducts, so the milk is let down.

MCQ 8.2.25 **Production of Follicle-stimulating hormone (FSH) and Luteinizing Hormone (LH) from the pituitary gland of female is controlled by: (UHS MDCAT 2023)**

A	Ovary	B	Uterus
C	Stimulated follicles	D	Hypothalamus

Solution: (d) Gonadotrophin releasing hormone from the hypothalamus sets the pituitary secreting FSH and LH.

MCQ 8.2.26 **Nutrition to the developing egg in an ovary is provided by which of the following? (PMC MDCAT 2022)**

A	Germ cells	B	Egg mother cells
C	Follicular cells	D	Endometrial cells

Solution: (c) The follicular cells round the oocyte feed it as it grows.

MCQ 8.2.27 **The human menstrual cycle generally repeats after how many days? (PMC MDCAT 2022)**

A	20 days	B	28 days
C	10 days	D	40 days

Solution: (b) The cycle runs about twenty-eight days.

MCQ 8.2.28 **When puberty is achieved in girls, which one of the following occurs in them but not in boys? (PMC MDCAT 2022)**

A	Excessive growth of hairs on skin	B	Pubic hair growth
C	Menarche	D	Heaviness of voice

Solution: (c) Menarche is the first menstrual period, and only girls have it.

MCQ 8.2.29 **Gonadotropin-releasing hormone is secreted by: (PMC MDCAT 2022)**

A	Hypothalamus	B	Pitutary gland
C	Thyroid	D	Parathyroid gland

Solution: (a) Gonadotrophin releasing hormone comes from the hypothalamus and drives the pituitary.

MCQ 8.2.30 **The release of ovum from ovary is called: (PMC MDCAT 2022)**

A	Lactation	B	Ovulation
C	Placentation	D	Menstruation

Solution: (b) The release of the ovum from the follicle is ovulation.

MCQ 8.2.31 **Proliferative phase is also termed as: (PMC MDCAT 2022)**

A	Secretory phase	B	Menstruations phase
C	Follicular or preoculatory phase	D	Secondary phase

Solution: (c) The proliferative phase is the follicular phase, before ovulation.

MCQ 8.2.32 **End of menstrual cycle in old age is called? (PMC MDCAT 2022)**

A	Menarche	B	Abortion
C	Menopause	D	Telophase

Solution: (c) The end of menstruation with age is the menopause.

MCQ 8.2.33 **During the menstrual cycle, after the female gamete is released from the ovary is ovulation, the remains of the follicle secrets: (NUMS MDCAT 2022)**

A	Progesterone	B	FSH
C	LH	D	Testosterone

Solution: (a) What is left of the follicle becomes the corpus luteum and secretes progesterone.

MCQ 8.2.34 **Nutrition to egg in ovary is provided by which of the following? (PMC Practice 2021)**

A	Germ cells	B	Milk cells
C	Follicle cells	D	All of these

Solution: (c) The follicle cells round the oocyte feed it as it grows.

MCQ 8.2.35 **In a typical menstrual cycle of 28 days, what is the most likely fertile period? (PMC Practice 2021)**

A	Days 5 to 10	B	Days 1 to 5
C	Days 14 to 15	D	Days11to14

Solution: (d) Ovulation falls about day fourteen and the ovum lives only a day, so the fertile days are just before it.

MCQ 8.2.36 **Which one of the following represents the changes that occur in the ovary and the uterus approximately every 28 days involving ovulation with the breakdown and loss of the lining of the uterus? (PMC MDCAT 2020)**

A	Ovulation	B	Menstrual cycle
C	Uterine cycle	D	Embryo formation

Solution: (b) That monthly round of ovulation and shedding is the menstrual cycle.

MCQ 8.2.37 **Which of the following hormones of the pituitary gland regulates the menstrual cycle? (PMC MDCAT 2020)**

A	Follicle Stimulating hormone and Estrogen	B	Luteinizing hormone and Estrogen
C	Follicle Stimulating hormone and Luteinizing hormone	D	Estrogen and Progesterone

Solution: (c) FSH and LH from the anterior pituitary drive the ovarian cycle.

MCQ 8.2.38 **Which body function is controlled through a positive feedback mechanism? (PMC MDCAT 2020)**

A	Labor contractions	B	Body temperature
C	Insulin production	D	Thyroxine release

Solution: (a) Each contraction of labour drives the head further down, which brings on a stronger contraction still.

MCQ 8.2.39 **Which hormonal pair would maintain the endometrium and make it receptive for implantation of embryo? (UHS MDCAT 2019)**

A	Luteinising Hormone and Progesterone	B	Estrogen and Progesterone
C	Estrogen and Follicle Stimulating Hormone	D	Luteinising Hormone and Follicle Stimulating Hormone

Solution: (b) Oestrogen builds the lining and progesterone holds it ready for the embryo.

MCQ 8.2.40 **Which of the following hormone stimulates the ovulation from the follicle into oviduct? (UHS MDCAT 2019)**

A	Estrogen	B	Progesterone
C	Luteinizing hormone	D	Follicle stimulating hormone

Solution: (c) The surge of luteinizing hormone bursts the follicle and releases the ovum.

MCQ 8.2.41 **Inside ovary, primary oocyte divides through first meiotic division, forming two haploid cells, the secondary oocyte and: (UHS MDCAT 2019)**

A	Ovum	B	Oogonium
C	Follicle cell	D	Polar body

Solution: (d) The first meiotic division is unequal: one large secondary oocyte and one small polar body.

MCQ 8.2.42 **Which hormone is released in females in response to FSH from the pituitary gland? (UHS MDCAT 2018)**

A	Estrogen	B	ADH
C	Oxytocin	D	Progesterone

Solution: (a) FSH ripens the follicle, and the growing follicle secretes oestrogen.

MCQ 8.2.43 **Which of the following hormones acts on the uterus wall for thickening? (UHS MDCAT 2018)**

A	Progesterone	B	Zona pellucida
C	Follicle stimulating hormone	D	Oxytocin

Solution: (a) Progesterone from the corpus luteum thickens the endometrium and holds it ready.

MCQ 8.2.44 **Which hormone causes the contraction walls of the uterus during the process of birth? (UHS MDCAT 2018)**

A	FSH	B	STH
C	Oxytocin	D	LTH

Solution: (c) Oxytocin drives the contractions of labour.

MCQ 8.2.45 **Among the following which hormone is responsible for the suppression of ovulation: (UHS MDCAT 2017)**

A	LH	B	Progesterone
C	FSH	D	Oestrogen

Solution: (b) Progesterone from the corpus luteum holds back FSH and LH, so no further follicle ripens.

MCQ 8.2.46 **The hormone which causes ovulation: (UHS MDCAT 2017)**

A	Progesterone	B	FSH
C	LH	D	Oestrogen

Solution: (c) The surge of luteinizing hormone bursts the follicle.

MCQ 8.2.47 **In females, meiosis occurs during which stage: (UHS MDCAT 2017)**

A	Spermatogenesis	B	Gametogenesis
C	Ovulation	D	None of these

Solution: (b) Meiosis in the female happens during oogenesis, the making of the gametes.

MCQ 8.2.48 **Events of menstrual cycle are regulated by the: (UHS MDCAT 2016)**

A	Ethylene	B	Gonadotrophins
C	Auxins	D	Gibberellins

Solution: (b) The gonadotrophins FSH and LH from the pituitary drive the cycle.

MCQ 8.2.49 **Decrease of FSH and increase of estrogen cause pituitary gland to secrete: (UHS MDCAT 2016)**

A	Somatotropin	B	Luteinizing Hormone
C	Testosterone	D	Spermatogonium

Solution: (b) As FSH falls and oestrogen rises, the pituitary answers with the surge of luteinizing hormone.

MCQ 8.2.50 **In females, FSH stimulates the ovary to produce: (UHS MDCAT 2015)**

A	Progesterone	B	Lactin
C	Oestrogen	D	Oxytocin

Solution: (c) FSH ripens the follicle, and the growing follicle secretes oestrogen.

MCQ 8.2.51 **In which phase of human female menstrual cycle, endometrium prepares for the implantation of embryo? (UHS MDCAT 2015)**

A	Proliferative phase	B	Menstrual phase
C	Secretory phase	D	Ovulation phase

Solution: (c) In the secretory phase progesterone thickens the lining and fills its glands.

MCQ 8.2.52 **Ejection of milk from mammary glands is under the control of which one of the following hormones? (UHS MDCAT 2015)**

A	Androgen	B	Oxytocin
C	Progesterone	D	Estrogen

Solution: (b) Oxytocin contracts the muscle round the milk ducts and lets the milk down.

Topic 8.3 Sexually Transmitted Diseases

Past MDCAT Questions

MCQ 8.3.1 **The major source of transmission of syphilis is: (MDCAT 2022)**

A	blood transfusion	B	insect bite
C	contaminated water	D	sexual contact

Solution: (d) Syphilis is a sexually transmitted disease caused by Treponema pallidum.

MCQ 8.3.2 **The bacterium Treponema Pallidum is responsible for which sexually transmitted disease? (UHS MDCAT 2025)**

A	Syphilis	B	Chlamydia
C	Gonorrhea	D	Genital herpes

Solution: (a) Syphilis is caused by the spirochaete Treponema pallidum.

MCQ 8.3.3 **Syphilis is caused by what kind of bacteria: (KMU MDCAT 2025)**

A	Spirochaete	B	Cocci
C	Bacillus	D	Vibrio

Solution: (a) Treponema pallidum is a spiral bacterium, that is, a spirochaete.

MCQ 8.3.4 **Which of the following is the sexually transmitted disease? (SIBA MDCAT 2025)**

A	Syphilis	B	Lung Cancer
C	Tuberculosis	D	Autoimmune disorders

Solution: (a) Syphilis passes by sexual contact; the others do not.

MCQ 8.3.5 **____ is spread through sexual contact. (KMU MDCAT 2024)**

A	Gonorrhoea	B	Influenza
C	Tuberculosis	D	Typhoid

Solution: (a) Gonorrhoea is caused by Neisseria gonorrhoeae and passes by sexual contact.

MCQ 8.3.6 **Major source of transmission of syphilis is: (UHS MDCAT 2023)**

A	Blood transfusion	B	Insect bite
C	Contaminated water	D	Sexual contact

Solution: (d) Syphilis is spread by sexual contact with an infected person.

MCQ 8.3.7 **Which of the following is a typical symptom of AIDS? (PMC MDCAT 2022)**

A	Sudden weight loss	B	Active immune function
C	Vision impairment	D	Kaposi's sarcoma, a rare form of skin cancer

Solution: (a) Rapid unexplained weight loss is one of the first signs as the immune system fails.

MCQ 8.3.8 **How can syphilis be transferred? (PMC MDCAT 2022)**

A	Sexual transmission	B	Fecal oral
C	Respiratory droplets	D	Injection

Solution: (a) Syphilis passes by sexual contact with an infected person.

MCQ 8.3.9 **Which of the following diseases is sexually transmitted? (PMC MDCAT 2020)**

A	Tuberculosis	B	AIDS
C	Dengue Fever	D	Cholera

Solution: (b) AIDS is passed by sexual contact as well as by blood.

MCQ 8.3.10 **Transmission of Neisseria gonorrhea is best described by which one of the following? (UHS MDCAT 2016)**

A	Oro-fecal Route	B	Unsafe Sex
C	Vector Borne	D	Droplet Infection

Solution: (b) Gonorrhoea is passed by sexual contact.

MCQ 8.3.11 **Syphilis, sexually transmitted disease is caused by: (UHS MDCAT 2015)**

A	HIV	B	Treponema pallidum
C	Neisseria gonorhoeae	D	Type '2' virus

Solution: (b) Syphilis is caused by Treponema pallidum.

Unit 9 Support and Movement

Topic 9.1 Human Skeleton

Past MDCAT Questions

MCQ 9.1.1 **What is FALSE about cartilage? (MDCAT 2022)**

A	there are many blood vessels in cartilage	B	it is a form of connective tissue
C	it covers the ends of the bones at joints	D	it is much softer than bone

Solution: (a) Cartilage has no blood vessels of its own, which is why it heals so slowly.

MCQ 9.1.2 **Cartilage is a type of which tissue? (MDCAT 2023)**

A	connective tissue	B	epithelial tissue
C	muscular tissue	D	nervous tissue

Solution: (a) Cells in a matrix they have secreted themselves is the pattern of connective tissue.

MCQ 9.1.3 **Which of the following is included in the paired cranial bones? (MDCAT 2024)**

A	temporal	B	occipital
C	frontal	D	vomer

Solution: (a) There is a temporal bone on each side; the occipital and the vomer are single.

MCQ 9.1.4 **Which of the following is NOT a bone of the upper limb? (MDCAT 2024)**

A	humerus	B	ulna
C	femur	D	radius

Solution: (c) The femur is the thigh bone of the lower limb.

MCQ 9.1.5 **Bone forming cells are: (MDCAT 2024)**

A	osteoblasts	B	osteocytes
C	osteoclasts	D	osteons

Solution: (a) Osteoblasts lay down bone matrix; osteoclasts break it down again.

MCQ 9.1.6 **In which of the following combination, both components have Hyaline cartilage? (UHS MDCAT 2025)**

A	Epiglottis & intervertebral disc	B	Trachea & intervertebral disc
C	Nose & pinna	D	Nose & trachea

Solution: (d) Hyaline cartilage supports the nose and the rings of the trachea.

MCQ 9.1.7 **What is FALSE about cartilages? (KMU MDCAT 2025)**

A	Cells are called chondrocytes	B	Consist of Type II collagen
C	Heal very slowly	D	Have an extensive blood supply

Solution: (d) Cartilage has no blood vessels of its own, which is exactly why it heals so slowly.

MCQ 9.1.8 **Bones provide a rigid framework with an inorganic matrix of: (KMU MDCAT 2025)**

A	35%	B	45%
C	55%	D	65%

Solution: (d) About two thirds of the mass of dry bone is the inorganic salt that makes it rigid.

MCQ 9.1.9 **An important feature of bone remodeling is bone breakdown. Which cell carries out this function? (KMU MDCAT 2025)**

A	Chondrocyte	B	Osteocyte
C	Osteoclast	D	Osteoblast

Solution: (c) Osteoclasts dissolve the matrix; osteoblasts lay it down again.

MCQ 9.1.10 **The reason behind the slow healing of cartilage is: (NUMS MDCAT 2025)**

A	Absence of minerals in matrix	B	Absence of nervous supply
C	Absence of blood supply	D	Loose arrangement of cells

Solution: (c) Cartilage has no blood vessels, so repair materials reach it only by slow diffusion.

MCQ 9.1.11 **Which cell is most important to cause bone resorption? (NUMS MDCAT 2025)**

A	Osteoblast	B	Osteoclast
C	Osteocyte	D	Fibroblast

Solution: (b) Osteoclasts dissolve the bone matrix and release its calcium.

MCQ 9.1.12 **Living cells of cartilage are called as: (SIBA MDCAT 2025)**

A	Osteocytes	B	Thrombocytes
C	Chondrocytes	D	Osteoblasts

Solution: (c) Chondrocytes are the living cells of cartilage, each in its own lacuna.

MCQ 9.1.13 **Which of the following connective tissue is completely avascular and heals slowly? (SZABMU MDCAT 2025)**

A	Bone	**B**	Cartilage
C	Adipose tissue	**D**	Areolar tissue

Solution: (b) Cartilage carries no blood vessels, so its cells are fed only by diffusion and repair is slow.

MCQ 9.1.14 **The end of skeletal muscle attached with moveable bone is: (SZABMU MDCAT 2025)**

A	Insertion	**B**	Origin
C	Tendons	**D**	Belly

Solution: (a) The insertion is the attachment to the bone that moves; the origin is the fixed end.

MCQ 9.1.15 **Fibrocartilage is found in: (SZABMU MDCAT 2025)**

A	Trachea	**B**	Nose
C	Knee joint	**D**	Ear flaps

Solution: (c) Fibrocartilage makes the menisci of the knee and the intervertebral discs.

MCQ 9.1.16 **What is the percentage of H2O in bone cells? (UHS MDCAT 2024)**

A	70 %	**B**	20 %
C	99 %	**D**	60 %

Solution: (b) Bone cells hold about a fifth of their mass as water, far less than soft tissue.

MCQ 9.1.17 **Which of the following is included in paired cranial bones? (UHS MDCAT 2024)**

A	Temporal	**B**	Occipital
C	Frontal	**D**	Vomer

Solution: (a) The temporal and parietal bones come in pairs; the frontal and occipital are single.

MCQ 9.1.18 **Which of the following is NOT a bone of upper limb? (UHS MDCAT 2024)**

A	Humerus	**B**	Ulna
C	Femur	**D**	Radius

Solution: (c) The femur is the thigh bone; humerus, radius and ulna are all in the arm.

MCQ 9.1.19 **The cells contained in the lacunae of the bone are called (KMU MDCAT 2024)**

A	Chondrocytes	**B**	Osteoblast
C	Osteocytes	**D**	Osteoclast

Solution: (c) Osteocytes are the mature bone cells, each shut in its own lacuna.

MCQ 9.1.20 **Which of the following is correct about hamstring muscles? (NUMS MDCAT 2024)**

A	It is an extensor muscle	**B**	Its insertion is on tibia
C	Originate from pelvic girdle and top of femur	**D**	Originate from ilium and femur

Solution: (b) The hamstrings run from the pelvis down behind the thigh and are inserted on the tibia.

MCQ 9.1.21 **Human Bone cells contain. .....% of water? (UHS MDCAT 2023)**

A	20	**B**	40
C	85	**D**	90

Solution: (a) Bone cells hold about a fifth of their mass as water.

MCQ 9.1.22 **Cartilage is more difficult to heal than bone because cartilage: (NUMS MDCAT 2023)**

A	Lacks vascular supply	**B**	Lacks mineral deposits in matrix
C	Has less number of cells deep down	**D**	Lacks protein in matrix

Solution: (a) Cartilage has no blood vessels, so repair materials reach it only by slow diffusion.

MCQ 9.1.23 **The skeletal system consists of: (PMC MDCAT 2022)**

A	All bones in body	**B**	All muscles and tendons
C	All body organs both soft and hard tissues	**D**	All the bones in the body and tissues that connect them

Solution: (d) The skeletal system is the bones with the cartilage and ligaments that join them.

MCQ 9.1.24 **Which of the following is most abundant in human body: (NUMS MDCAT 2022)**

A	Fibrous	**B**	Hyaline
C	Elastic	**D**	Flexible

Solution: (b) Hyaline cartilage covers the joint surfaces and supports the nose and trachea, and is much the commonest.

MCQ 9.1.25 **Which cells secrete flexible, elastic, non-living matrix collagen that surrounds the chondrocytes? (PMC Practice 2021)**

A	Osteocytes	**B**	Osteoclasts
C	Chondrocytes	**D**	Osteoblasts

Solution: (c) Chondrocytes are the cells of cartilage and they lay down its matrix.

MCQ 9.1.26 **Scapula is a: (UHS MDCAT 2018)**

A	Tail bone	**B**	Hip bone
C	Skull bone	**D**	Shoulder bone

Solution: (d) The scapula is the shoulder blade.

MCQ 9.1.27 **Skull, vertebral column, ribs, and sternum forms: (UHS MDCAT 2018)**

A	Appendicular skeleton	**B**	Hydrostatic skeleton
C	Exoskeleton	**D**	Axial skeleton

Solution: (d) The skull, vertebral column, ribs and sternum make the axial skeleton.

MCQ 9.1.28 **Coccyx vertebrae are located in: (UHS MDCAT 2018)**

A	Cervical region	**B**	Lumbar region
C	Pelvic region	**D**	Thoracic region

Solution: (c) The coccyx is the tail bone at the base of the vertebral column, in the pelvis.

MCQ 9.1.29 **Clavicle is present in: (UHS MDCAT 2017)**

A	Back bone	**B**	Skull
C	Pelvic girdle	**D**	Pectoral girdle

Solution: (d) The clavicle, or collar bone, is part of the pectoral girdle.

MCQ 9.1.30 **Name of second vertebrae in the neck region is: (UHS MDCAT 2017)**

A	Atlas	**B**	Axis
C	Neck vertebra	**D**	Floating rib

Solution: (b) The first cervical vertebra is the atlas and the second the axis.

MCQ 9.1.31 **The structure which joins a muscle to a bone: (UHS MDCAT 2017)**

A	Tendon	**B**	Ligament
C	Clavicle	**D**	Sternum

Solution: (a) A tendon joins muscle to bone; a ligament joins bone to bone.

MCQ 9.1.32 **Longest bone in the human skeleton is: (UHS MDCAT 2016)**

A	Ulna	B	Fibula
C	Tibia	D	Femur

Solution: (d) The femur, the thigh bone, is the longest bone in the body.

MCQ 9.1.33 **In pelvic region of human body, sacrum is formed by the fusion of: (UHS MDCAT 2016)**

A	4 Vertebrae	B	5 Vertebrae
C	6 Vertebrae	D	3 Vertebrae

Solution: (b) Five sacral vertebrae fuse into the sacrum.

MCQ 9.1.34 **Brain is protected and enclosed in: (UHS MDCAT 2016)**

A	Lumbar vertebrae	B	Coccyx
C	Vertebral column	D	Cranium

Solution: (d) The cranium of the skull encloses the brain.

MCQ 9.1.35 **The total number of cervical and thoracic vertebrate in human vertebral column is: (UHS MDCAT 2015)**

A	7	B	19
C	14	D	33

Solution: (b) Seven cervical and twelve thoracic vertebrae make nineteen.

Topic 9.2 Muscles

Past MDCAT Questions

MCQ 9.2.1 **Irregular striations and involuntary control are related to: (MDCAT 2023)**

A	cardiac muscle cells	B	fibroelastic cartilage cells
C	skeletal muscle cells	D	smooth muscle cells

Solution: (a) Cardiac muscle is striated like skeletal muscle but works without the will, and its striations are less regular.

MCQ 9.2.2 **Which feature is possessed by smooth muscles? (MDCAT 2024)**

A	voluntary control	B	branched fibres
C	uninucleate cells	D	striated appearance

Solution: (c) A smooth muscle cell is spindle shaped with one central nucleus and no striations.

MCQ 9.2.3 **Which is the common feature between cardiac and smooth muscles? (UHS MDCAT 2025)**

A	Voluntary	B	Involuntary
C	Branched	D	Unbranched

Solution: (b) Cardiac and smooth muscle are both involuntary; only cardiac muscle is branched.

MCQ 9.2.4 **Which of the following characters is shared by both skeletal and cardiac muscles? (UHS MDCAT 2025)**

A	Presence of Striation	B	Involuntary control
C	Multinucleated fibers	D	Intercalated discs

Solution: (a) Both are striated; only cardiac muscle is involuntary and has intercalated discs.

MCQ 9.2.5 **Which of the following muscle types are involuntary in action? (UHS MDCAT 2025)**

A	Skeletal and smooth	B	Skeletal and cardiac
C	Cardiac and smooth	D	Smooth muscle only

Solution: (c) Cardiac and smooth muscle both work without conscious control.

MCQ 9.2.6 **In which of the following combinations, both components have non-striated muscle fibers? (UHS MDCAT 2025)**

A	Intestine & biceps	B	Intestine & blood vessels
C	Heart & lungs	D	Stomach & heart

Solution: (b) Smooth, unstriated fibres line the gut and the walls of the blood vessels.

MCQ 9.2.7 **Which muscle type is under conscious control and is multinucleated? (KMU MDCAT 2025)**

A	Smooth muscle	B	Skeletal muscle
C	Cardiac muscle	D	Ciliary muscle

Solution: (b) Skeletal muscle alone is both voluntary and multinucleated.

MCQ 9.2.8 **Activity of which organ would be compromised with impaired function of smooth muscles? (NUMS MDCAT 2025)**

A	Heart	B	Lungs
C	Stomach	D	Tongue

Solution: (c) The wall of the stomach is smooth muscle, and its churning depends on it.

MCQ 9.2.9 **Cardiac muscles are different from skeletal muscles because they: (SZABMU MDCAT 2025)**

A	Lack striations	B	Are voluntary and multinucleated
C	Are involuntary and multinucleated	D	Are striated but involuntary

Solution: (d) Cardiac muscle is striated like skeletal muscle but works without conscious control.

MCQ 9.2.10 **Which of the following does NOT relate to smooth muscles? (KMU MDCAT 2024)**

A	Controlled by the autonomic nervous system	B	Have spindle shaped cells
C	Line the wall of heart	D	Lack striations

Solution: (c) The heart wall is cardiac muscle, which is striated; smooth muscle lines the gut and vessels.

MCQ 9.2.11 **Which feature is absent from cardiac muscles? (NUMS MDCAT 2023)**

A	Intercalated disc	B	Multinucleate cells
C	Light and dark bands	D	Contractile sarcomeres

Solution: (b) Cardiac muscle cells have a single nucleus each; it is skeletal muscle that is multinucleate.

MCQ 9.2.12 **Smooth muscles are found in all mentioned below except (UHS MDCAT 2023)**

A	Trachea	B	Bronchi
C	Bronchioles	D	Alveoli

Solution: (d) The alveolar wall is a single layer of flat cells with no muscle in it.

MCQ 9.2.13 **Irregular striations and involuntary control is related to? (UHS MDCAT 2023)**

A	Cardiac muscle cells	B	Fibroelastic cartilage cell
C	Skeletal muscle cells	D	Smooth muscle cells

Solution: (a) Cardiac muscle is faintly striated and beats without conscious control.

MCQ 9.2.14 **Tricep muscles are: (PMC MDCAT 2022)**

A	Flexor muscles	B	Extensor muscles
C	Adductor muscles	D	Abductor muscles

Solution: (b) The triceps straightens the elbow, so it is an extensor.

MCQ 9.2.15 **Bicep muscles are: (PMC MDCAT 2022)**

A	Flexor muscles	B	Extensor muscles
C	Adductor muscles	D	Abductor muscles

Solution: (a) The biceps bends the elbow, so it is a flexor.

MCQ 9.2.16 **Which of the following muscles are controlled by somatic nervous system: (PMC MDCAT 2022)**

A	heart muscles	B	Skeletal muscles
C	Involuntary muscles	D	Smooth muscles

Solution: (b) The somatic nervous system serves the skeletal muscles, which we control at will.

MCQ 9.2.17 **Which is incorrect for cardiac muscles? (PMC MDCAT 2022)**

A	Show involuntary control	B	Branched cells
C	Have no striations	D	Have intercalated disc

Solution: (c) Cardiac muscle is striated, though less regularly than skeletal muscle.

MCQ 9.2.18 **Cardiac muscles are the muscles of: (PMC MDCAT 2022)**

A	Aorta	B	Comary vein
C	Heart	D	Liver

Solution: (c) Cardiac muscle is found only in the wall of the heart.

MCQ 9.2.19 **Which one of the following is the character of Cardiac Muscles? (PMC MDCAT 2022)**

A	Made up of unstrained and branched cells	B	Voluntary in action
C	Self excitatory or myogenic	D	Striated and unbranched

Solution: (c) Cardiac muscle sets its own rhythm, so its beat is myogenic.

MCQ 9.2.20 **Cardiac tissue is made up of : (PMC MDCAT 2022)**

A	Cardiac muscle	B	Smooth muscles
C	Skeletal muscles	D	Gut muscles

Solution: (a) The wall of the heart is cardiac muscle and nothing else.

MCQ 9.2.21 **Smooth muscles are long and spindle-shaped with nucleus ---- per cell: (NUMS MDCAT 2022)**

A	One	B	Two
C	Three	D	Many

Solution: (a) A smooth muscle cell is spindle shaped with one central nucleus.

MCQ 9.2.22 **Which one of the following are "myogenic" type of muscles? (PMC MDCAT 2020)**

A	Glandular muscles	B	Cardiac muscles
C	Skeletal muscles	D	Smooth muscles

Solution: (b) Cardiac muscle sets its own rhythm, so its contraction is myogenic.

MCQ 9.2.23 **Which one of the following muscles are considered as "Voluntary muscles"? (PMC MDCAT 2020)**

A	Smooth muscles	B	Cardiac muscles
C	Skeletal muscles	D	Glandular muscles

Solution: (c) Skeletal muscle alone is under conscious control.

Topic 9.3 Skeletal Muscles

Past MDCAT Questions

MCQ 9.3.1 **Which of the following is NOT found in skeletal muscle fibres in humans? (MDCAT 2022)**

A	multiple nuclei	B	multiple mitochondria
C	a large amount of myoglobin	D	a large amount of haemoglobin

Solution: (d) Haemoglobin is in the red blood cells; the muscle's own oxygen store is myoglobin.

MCQ 9.3.2 **The cell membrane of a muscle cell is the: (MDCAT 2023)**

A	sarcoplasm	B	sarcolemma
C	sarcomere	D	myofibril

Solution: (b) Sarcolemma is the name of the plasma membrane of a muscle fibre.

MCQ 9.3.3 **The thick filaments in skeletal muscle are composed of: (MDCAT 2024)**

A	actin	B	myosin
C	tropomyosin	D	troponin

Solution: (b) Myosin makes the thick filament; actin with tropomyosin and troponin makes the thin one.

MCQ 9.3.4 **A sarcomere is the part of a myofibril between: (MDCAT 2024)**

A	two I bands	B	two A bands
C	two M lines	D	two Z lines

Solution: (d) The sarcomere, the unit of contraction, runs from one Z line to the next.

MCQ 9.3.5 **Myofibrils consist of small contractile units called___ (KMU MDCAT 2025)**

A	Sarcoplasm	B	Sarcolemma
C	Sarcomere	D	Sarcoplasmic reticulum

Solution: (c) The sarcomere, from one Z line to the next, is the contractile unit of the myofibril.

MCQ 9.3.6 **Which part of the sarcomere contain both actin and myosin filament? (KMU MDCAT 2025)**

A	I-band	B	Z-line
C	A-band	D	H-zone

Solution: (c) The A band is the length of the thick filament, and the thin filaments overlap its ends.

MCQ 9.3.7 **H zone of sarcomere consists of: (NUMS MDCAT 2025)**

A	Proteins supporting myosin filaments	B	Myosin overlapped by actin
C	Only actin filament	D	Only myosin filament

Solution: (d) The H zone is the middle of the A band, where the thick filaments are not overlapped by thin ones.

MCQ 9.3.8 **Skeletal muscle cells are having: (NUMS MDCAT 2025)**

A	Less SER & more RER	B	More SER & less RER
C	Equal amount of SER & RER	D	No SER & RER

Solution: (b) The sarcoplasmic reticulum is a specialized smooth endoplasmic reticulum, and a muscle fibre is full of it.

MCQ 9.3.9 **Which of the following surrounds myofibril in skeletal muscle that stores and distributes calcium ions during muscle functioning? (SIBA MDCAT 2025)**

A	Sarcolemma	B	Sarcoplasmic reticulum
C	Transverse tubules	D	Sarcoplasm

Solution: (b) The sarcoplasmic reticulum wraps each myofibril and holds the calcium the fibre needs.

MCQ 9.3.10 **In muscle fibers, T-tubules are extension of the sarcolemma that penetrate into the cell's interior. What is their main function during muscle contraction? (SZABMU MDCAT 2025)**

A	Unblock actin's binding sites.	B	Conduct nerve impulses deep into the muscle cell.
C	Synthesize glycogen in the sarcoplasm.	D	Store calcium ions within the sarcoplasmic reticulum.

Solution: (b) The T tubules carry the action potential from the surface into the depth of the fibre.

MCQ 9.3.11 **Thick filaments In skeletal muscles are composed of: (UHS MDCAT 2024)**

A	Actin	**B**	Myosin
C	Tropomyosin	**D**	Troponin

Solution: (b) The thick filament is myosin; actin makes the thin one.

MCQ 9.3.12 **Sarcomere is part of myofibril between: (UHS MDCAT 2024)**

A	Two I bands	**B**	Two A bands
C	Two M lines	**D**	Two Z lines

Solution: (d) A sarcomere runs from one Z line to the next.

MCQ 9.3.13 **The ____ surrounds the muscle fibre of the skeletal muscle. (KMU MDCAT 2024)**

A	Cytoplasm	**B**	Lacunae
C	Myofibrils	**D**	Sarcoplasm

Solution: (d) The sarcoplasm is the cytoplasm around the myofibrils inside the fibre.

MCQ 9.3.14 **Choose the correct for muscle in relaxed position: (NUMS MDCAT 2024)**

A	Exposed binding sites on actin	**B**	Broad H-zone in sarcomere
C	Formation of cross bridges	**D**	Ca2+ released in cytosol

Solution: (b) At rest the thin filaments are drawn back, so the H zone between them is at its widest.

MCQ 9.3.15 **Which of the following is a muscle component that act as store for energy? (UHS MDCAT 2023)**

A	ATP	**B**	Creatine-PO4
C	Myoglobin	**D**	Creatinine-PO4

Solution: (b) Creatine phosphate is the quick store that rebuilds ATP in a working muscle.

MCQ 9.3.16 **Which of the following is NOT found in skeletal muscle fibers in human? (UHS MDCAT 2023)**

A	Multiple nuclei	**B**	Multiple mitochondria
C	Large amount of myoglobin	**D**	Large amount of hemoglobin

Solution: (d) Muscle stores its oxygen on myoglobin; haemoglobin belongs to the red cells of the blood.

MCQ 9.3.17 **What is the function of myoglobin? (SZABMU MDCAT 2023)**

A	Store oxygen	**B**	Store CO2
C	Transport oxygen	**D**	Transport CO2

Solution: (a) Myoglobin holds a reserve of oxygen in the muscle fibre.

MCQ 9.3.18 **Sarcoplasmic reticulum of muscle fibers is mainly responsible for: (NUMS MDCAT 2023)**

A	Calcium storage	**B**	Protein synthesis
C	Lipid metabolism	**D**	Storing cell wastes

Solution: (a) The sarcoplasmic reticulum holds the calcium and releases it when the impulse arrives.

MCQ 9.3.19 **The cell membrane of muscle cell is: (UHS MDCAT 2023)**

A	Sarcoplasm	**B**	Sarcolemma
C	Sarcomere	**D**	Myofibrils

Solution: (b) The membrane of a muscle fibre is the sarcolemma.

MCQ 9.3.20 **Which of the following is the separation point between two sarcomere? (PMC MDCAT 2022)**

A	H-zone	**B**	A-band
C	Z-line	**D**	M-line

Solution: (c) A sarcomere runs from one Z line to the next, so the Z line divides them.

MCQ 9.3.21 **Many sarcomere placed end to end and form a: (PMC MDCAT 2022)**

A	Muscle	**B**	Fiber
C	Myofibril	**D**	Muscle fiber

Solution: (c) Sarcomeres end to end make a myofibril, and myofibrils fill the muscle fibre.

MCQ 9.3.22 **The composition of skeletal muscle is: (PMC MDCAT 2022)**

A	Myosin only	**B**	Actin only
C	Actin, myosin and troponin	**D**	Actin, myosin and tropomyosin

Solution: (d) The thin filament is actin with tropomyosin and troponin along it, and the thick one is myosin.

MCQ 9.3.23 **Which of the following is the name of the modified endoplasmic reticulum foundin muscle cells? (PMC Practice 2021)**

A	T-tubule	**B**	Sarcomere
C	Myoplasmic reticulum	**D**	Sarcoplasmic reticulum

Solution: (d) The sarcoplasmic reticulum is the specialized endoplasmic reticulum of a muscle fibre.

MCQ 9.3.24 **Many sarcomeres in series make up the length of a: (PMC Practice 2021)**

A	Microtubules	**B**	Myofibril
C	Myosin filament	**D**	M-line

Solution: (b) Sarcomeres end to end make up the length of a myofibril.

MCQ 9.3.25 **What structure marks the separation between two sarcomeres? (PMC Practice 2021)**

A	I band	**B**	H zone
C	A band	**D**	Z line

Solution: (d) A sarcomere runs from one Z line to the next.

MCQ 9.3.26 **What do we call the cell surface membrane of a muscle fibre? (PMC MDCAT 2020)**

A	Sarcolemma	**B**	Plasma membrane
C	Sarcoplasm	**D**	Myofibrils

Solution: (a) The membrane of a muscle fibre is the sarcolemma.

MCQ 9.3.27 **Thin filaments of muscles contain _____ chains of actin molecules. (UHS MDCAT 2019)**

A	Two	**B**	One
C	Three	**D**	Four

Solution: (a) The thin filament is two chains of actin monomers twisted round each other.

MCQ 9.3.28 **The thick filaments, in a myofibril of muscles, are made of _____. (UHS MDCAT 2019)**

A	Myoglobin	**B**	Myosin
C	Actin	**D**	Haemoglobin

Solution: (b) The thick filament is myosin.

MCQ 9.3.29 **Overlapping of thick and thin filament occur in: (UHS MDCAT 2017)**

A	I band	**B**	A band
C	M band	**D**	Z band

Solution: (b) The A band is the length of the thick filament, and the thin ones overlap its ends.

MCQ 9.3.30 **Each muscle fibre is surrounded by a modified cell membrance called: (UHS MDCAT 2016)**

A	Sarcolemma	**B**	Sarcomere
C	Myosin Filament	**D**	Myofilament

Solution: (a) The membrane of a muscle fibre is the sarcolemma.

MCQ 9.3.31 **A sarcomere is the region of a myofibril between two successive: (UHS MDCAT 2015)**

A	M-lines	B	Z-lines
C	I-bands	D	T-tubules

Solution: (b) A sarcomere runs from one Z line to the next.

MCQ 9.3.32 **The sarcolemma of muscle fibre folds inwards and forms a system of tubes which runs through the sarcoplasm called: (UHS MDCAT 2015)**

A	Myofilaments	B	Sarcoplasmic reticulum
C	Z-lines	D	Transverse tubules

Solution: (d) The infoldings of the sarcolemma are the transverse, or T, tubules.

Topic 9.4 Muscle Contraction

Past MDCAT Questions

MCQ 9.4.1 **Which of the following is a muscle component that acts as a store of energy? (MDCAT 2022)**

A	ATP	B	creatine phosphate
C	myoglobin	D	creatinine phosphate

Solution: (b) Creatine phosphate hands its phosphate to ADP and so keeps ATP topped up during hard work.

MCQ 9.4.2 **During the sliding filament mechanism, ATP is used for: (MDCAT 2023)**

A	cross bridge formation	B	cross bridge breaking
C	dragging the filaments	D	shortening of the filaments

Solution: (b) The head attaches and pulls without ATP; hydrolysing ATP is what releases it for the next stroke.

MCQ 9.4.3 **The accumulation of lactic acid in the muscles results in: (MDCAT 2024)**

A	extreme fatigue	B	muscle contraction
C	paralysis	D	convulsion

Solution: (a) Lactic acid builds up when the oxygen supply falls short, and the muscle tires.

MCQ 9.4.4 **Why thick filaments are unable to bind with thin filament in a relaxed muscle fiber? (UHS MDCAT 2025)**

A	Actin blocks the myosin binding site	B	Tropomyosin blocks the myosin binding site
C	Troponin blocks the myosin binding site	D	Tropomyosin blocks the troponin binding site

Solution: (b) Tropomyosin lies over the myosin binding sites of actin until calcium shifts it aside.

MCQ 9.4.5 **Once an action potential reaches the membrane of a skeletal muscle fiber, what is the first event that occurs in the contraction process? (UHS MDCAT 2025)**

A	Actin and myosin form a cross-bridge	B	Calcium is pumped back into the sarcoplasmic reticulum
C	Calcium is released from the sarcoplasmic reticulum	D	ATP is hydrolyzed by troponin

Solution: (c) The action potential runs down the T tubules and the sarcoplasmic reticulum releases its calcium.

MCQ 9.4.6 **The primary role of calcium ions in muscle contraction is to: (KMU MDCAT 2025)**

A	Produce energy	B	Bind with troponin
C	Carry nerve impulses	D	Breakdown ATP

Solution: (b) Calcium binds troponin, which pulls the tropomyosin off the binding sites of actin.

MCQ 9.4.7 **The regulator of muscle contraction, which is released from sarcoplasmic reticulum is: (SIBA MDCAT 2025)**

A	Tropomyosin	B	Troponin
C	Calcium ions	D	ATP

Solution: (c) Calcium is the ion released from the sarcoplasmic reticulum that lets the cross bridges form.

MCQ 9.4.8 **The event that occurs first during skeletal muscle contraction? (SZABMU MDCAT 2025)**

A	Cross-bridge formation	B	Release of calcium from sarcoplasmic reticulum
C	Power stroke	D	Myosin head binds to ATP

Solution: (b) The impulse first releases calcium from the sarcoplasmic reticulum; everything else follows from that.

MCQ 9.4.9 **What happens to calcium when skeletal muscles recover from contraction? (KMU MDCAT 2024)**

A	Released from the sarcoplasmic reticulum	B	Released from the myosin head
C	Pumped into the sarcoplasmic reticulum	D	Exchanged for sodium ions

Solution: (c) Calcium pumps return it to the sarcoplasmic reticulum, and the fibre relaxes.

MCQ 9.4.10 **The muscle contraction involve the breakdown of cross bridges of active myosin filaments due to the following process: (SZABMU MDCAT 2023)**

A	ATP is oxidized	B	ATP is reduced
C	ATP is hydrolyzed	D	ATP is synthesized

Solution: (c) Splitting ATP on the myosin head is what breaks the cross bridge and cocks it again.

MCQ 9.4.11 **Tetany is caused by _____ in blood. (SZABMU MDCAT 2023)**

A	Low Ca++	B	High Ca++
C	Low Mg++	D	High Mg++

Solution: (a) Too little calcium in the blood leaves the nerves over-excitable and the muscles in spasm.

MCQ 9.4.12 **Under activity of parathyroid glands causes a drop in blood of: (NUMS MDCAT 2023)**

A	Mg2+	B	Na+
C	K+	D	Ca2+

Solution: (d) Parathyroid hormone raises blood calcium, so too little of it lets the calcium fall.

MCQ 9.4.13 **During sliding of actin filaments, ATP is used for? (UHS MDCAT 2023)**

A	Cross bridge formation	B	Cross bridge breaking
C	Dragging filaments	D	Shortening of filaments

Solution: (a) ATP is split on the myosin head, which cocks it ready to form the cross bridge.

MCQ 9.4.14 **Which event does not occur during muscle contraction: (NUMS MDCAT 2022)**

A	I-band shorten	B	A-band shortens
C	H-zone disappear	D	Z-lines move closer

Solution: (b) The A band is the length of the thick filament, which does not change; the thin filaments slide past it.

MCQ 9.4.15 **Which of the following sections of a sarcomere does not shorten during contraction? (PMC Practice 2021)**

A	I band	B	H zone
C	A band	D	None of these

Solution: (c) The A band is the length of the thick filament, which does not change as the thin ones slide in.

MCQ 9.4.16 **When a muscle fibre shortens, the following also shortens: (PMC Practice 2021)**

A	Actin filament	B	Sarcomere
C	Both Options A and B are correct	D	Myosin

Solution: (b) The filaments keep their length; it is the sarcomere between the Z lines that shortens.

MCQ 9.4.17 **The function of calcium ions in muscle contraction is to: (UHS MDCAT 2019)**

A	polarize visible light	B	Aid in the transmission of nerve impulse
C	Bind to troponin molecule and cause them to move	D	Bind to tropomyosin molecule and cause them to form cross bridges

Solution: (c) Calcium binds troponin, which shifts the tropomyosin off the binding sites of actin.

MCQ 9.4.18 **According to sliding filament theory, when muscle fibers are stimulated by nervous system, which of the following changes occurs? (UHS MDCAT 2015)**

A	I-bands shorten	B	H-zone becomes more visible
C	Z-lines move further apart	D	A-bands shorten

Solution: (a) The thin filaments slide in, so the I band and the H zone narrow while the A band holds its length.

MCQ 9.4.19 **If lactic acid build up in thigh muscles, it causes muscle tiredness and pain. This condition is called: (UHS MDCAT 2015)**

A	Muscle Fatigue	B	Tetany
C	Cramps	D	Oxygen debt in muscles

Solution: (a) Lactic acid built up in a working muscle brings on muscle fatigue.

Topic 9.5 Joints

Past MDCAT Questions

MCQ 9.5.1 **A hinge joint is present between which of the following bones? (MDCAT 2022)**

A	humerus and radio-ulna	B	femur and pectoral girdle
C	humerus and pectoral girdle	D	femur and pelvic girdle

Solution: (a) The elbow allows movement in one plane only, which is what a hinge joint is; the girdle joints are ball and socket.

MCQ 9.5.2 **The joints which cause rotational movements are (UHS MDCAT 2025)**

A	Hinge	B	Ball and Socket
C	Cartilage	D	Sutures

Solution: (b) A ball and socket joint, as at the shoulder and the hip, allows rotation as well as movement in every plane.

MCQ 9.5.3 **The pubic symphysis is a slightly moveable joint joined by which of the following tissue? (UHS MDCAT 2025)**

A	Elastic cartilage	B	Fibrocartilage
C	Costal cartilage	D	Articular cartilage

Solution: (b) The pubic symphysis is a cartilaginous joint held by a pad of fibrocartilage.

MCQ 9.5.4 **Which type of joint is present in pubis? (UHS MDCAT 2025)**

A	Fibrous joints	B	Immoveable joints
C	Cartilaginous joints	D	Freely moveable joints

Solution: (c) The pubic symphysis is cartilaginous, and so slightly moveable.

MCQ 9.5.5 **Which of the following is an example of a fibrous joint? (KMU MDCAT 2025)**

A	Shoulder joint	B	Elbow joint
C	Intervertebral discs	D	Skull sutures

Solution: (d) The sutures of the skull are fibrous and immoveable.

MCQ 9.5.6 **Which type of joint allows bending of the elbow joint and has a synovial cavity? (SIBA MDCAT 2025)**

A	Cartilaginous joint	B	Fibrous joint
C	Pubic symphysis	D	Hinge joint

Solution: (d) The elbow is a synovial hinge joint, allowing movement in one plane only.

MCQ 9.5.7 **Hinge joint is present between which of the following bones? (UHS MDCAT 2023)**

A	Humerus and radio-ulna	B	Femur and pectoral girdle
C	Femur and acetabulum	D	Humerus and pectoral girdle

Solution: (a) The elbow, between the humerus and the radius and ulna, is a hinge joint.

MCQ 9.5.8 **A joint in which ends of bones are covered with hyaline cartilage and held together by surrounding tube like capsule of dense fibrous tissue: (SZABMU MDCAT 2023)**

A	Cartilaginous Joint	B	Synovial Joint
C	Fibrous Joint	D	Immoveable Joint

Solution: (b) A synovial joint has cartilage-covered ends within a fibrous capsule lined by synovial membrane.

MCQ 9.5.9 **Pubic symphysis and inter vertebral disc are the example of: (NUMS MDCAT 2023)**

A	Fibrous joints	B	Synovial joints
C	Cartilaginous joints	D	Gliding joints

Solution: (c) Both are cartilaginous joints, allowing a little movement.

MCQ 9.5.10 **Which type of joints are connected by dense, tough, connective tissue that is rich in collagen fibers? (PMC MDCAT 2022)**

A	Fibrous joints	B	Cartilaginous joints
C	Synovial Joints	D	Gomphosis joints

Solution: (a) A fibrous joint is held by tough collagen fibres and allows no movement.

MCQ 9.5.11 **Name the joint that allows the skull to rotate on your spine. (PMC MDCAT 2022)**

A	Hinge joint	B	Sliding joint
C	Fibrous joint	D	Pivotal Joint

Solution: (d) The atlas turns on the axis at a pivot joint, which is what lets the head shake.

MCQ 9.5.12 **The humerus makes a baII and socket joint with the: (PMC MDCAT 2022)**

A	Clavicle	B	Sternum
C	Innominate	D	Scapula

Solution: (d) The head of the humerus sits in the glenoid cavity of the scapula.

MCQ 9.5.13 **Hip joint is an example of: (PMC MDCAT 2022)**

A	Ball and socket joint	B	Hinge joint
C	Multistage joint	D	Cartilaginous Joints

Solution: (a) The head of the femur in the acetabulum makes a ball and socket joint.

MCQ 9.5.14 **What is the meaning of articulation? (PMC MDCAT 2022)**

A	Connections between Joints	B	Connections between cartilages
C	Connections between bones	D	Connections between muscles

Solution: (c) An articulation is a joint, that is a connection between bones.

MCQ 9.5.15 **Synovial cavity is filled with: (PMC MDCAT 2022)**

A	blood	B	salts
C	synovial fluid	D	proteins

Solution: (c) The synovial cavity holds the synovial fluid, which lubricates the joint.

MCQ 9.5.16 **Hip Joint and shoulder joint are the examples of: (PMC MDCAT 2022)**

A	Ball and Socket Joint	B	Hinge Joint
C	Fibrous Joint	D	Cartilaginous Joints

Solution: (a) Both are ball and socket joints, allowing movement in every plane.

MCQ 9.5.17 **Which of the following is an example of a joint called suture: (NUMS MDCAT 2022)**

A	Intervertebral disc	B	Skull bone
C	Costal cartilage	D	Pubic symphysis

Solution: (b) The sutures between the skull bones are fibrous and immoveable.

MCQ 9.5.18 **Which combination is the example of ball and socket joints: (UHS MDCAT 2018)**

A	Hip and shoulder joints	B	Hip and knee joints
C	Shoulder and knee joints	D	Hip and elbow joints

Solution: (a) The hip and the shoulder are both ball and socket joints.

MCQ 9.5.19 **Hips and shoulder joints are examples of: (UHS MDCAT 2016)**

A	Hinge Joints	B	Ball and Socket Joints
C	Synovial Joints	D	Cartilaginous Joints

Solution: (b) Both are ball and socket joints.

Topic 9.6 Arthritis

Past MDCAT Questions

MCQ 9.6.1 **Which of the following skeletal disorders is an example of an autoimmune disorder? (MDCAT 2024)**

A	sciatica	B	spondylosis
C	rheumatoid arthritis	D	rickets

Solution: (c) In rheumatoid arthritis the body's own immune system attacks the synovial membranes.

MCQ 9.6.2 **Arthritis is: (UHS MDCAT 2025)**

A	Inflammation of joints	B	Herniation of intervertebral disc
C	Fusion of vertebral joint	D	tingling along the length of legs

Solution: (a) Arthritis is inflammation of a joint, with pain, swelling and stiffness.

MCQ 9.6.3 **The most common type of arthritis is: (SIBA MDCAT 2025)**

A	Gout	B	Rheumatoid arthritis
C	Osteoarthritis	D	Spondylitis

Solution: (c) Osteoarthritis, the wearing away of the joint cartilage with age, is much the commonest form.

MCQ 9.6.4 **Arthritis is a disease that primarily affects the: (SZABMU MDCAT 2025)**

A	Kidneys	B	Lungs
C	Joints	D	Muscles

Solution: (c) Arthritis is inflammation of the joints.

MCQ 9.6.5 **Which of the following skeletal disorder Is an example of autoimmune disorder? (UHS MDCAT 2024)**

A	Sciatica	B	Spondylosis
C	Rheumatoid arthritis	D	Rickets

Solution: (c) In rheumatoid arthritis the immune system attacks the synovial membrane of the joint.

MCQ 9.6.6 **_____ is the inflammation of joints: (SZABMU MDCAT 2023)**

A	Osteoarthritis	B	Osteoporosis
C	Arteriosclerosis	D	Osteosclerosis

Solution: (a) Osteoarthritis is inflammation of a joint as its cartilage wears away.

MCQ 9.6.7 **Septic arthritis is caused by: (PMC MDCAT 2022)**

A	Aging	B	Bacteria
C	Metabolic	D	Physical contact

Solution: (b) Septic arthritis follows infection of the joint by bacteria.

MCQ 9.6.8 **Which of these is a type of arthritis that Is primarily due to aging? (PMC MDCAT 2022)**

A	Septic arthritis	B	Rheumatoid arthritis
C	Osteoarthritis	D	Rheumatoid and oesteoarthritis

Solution: (c) Osteoarthritis is the wearing away of the joint cartilage with age.

Unit 10 Inheritance

Topic 10.1 Mendel's Laws of Inheritance

Past MDCAT Questions

MCQ 10.1.1 **A test cross is made to check the genotype of a trait. Which of the following crosses is a test cross? (MDCAT 2022)**

A	unknown × Tt	B	unknown × tt
C	unknown × AB	D	unknown × TT

Solution: (b) The homozygous recessive parent contributes no dominant allele, so the offspring reveal what the unknown carried.

MCQ 10.1.2 **A test cross is made to check the genotype of a trait. Which of the following crosses is a test cross? (MDCAT 2023)**

A	unknown × Tt	B	unknown × tt
C	unknown × AB	D	unknown × TT

Solution: (b) Crossing with the homozygous recessive lets the unknown's alleles show in the offspring.

MCQ 10.1.3 **According to Mendel's law of segregation, one individual out of four in the F_2 generation had a phenotype that failed to express in which generation? (MDCAT 2023)**

A	F_1	B	F_3
C	F_2	D	P_1

Solution: (a) The recessive phenotype is hidden in the F_1 and reappears in a quarter of the F_2.

MCQ 10.1.4 **Only those genes can assort independently whose loci are on: (MDCAT 2023)**

A	the same chromatid	B	the same chromosome
C	non-homologous chromosomes	D	homologous chromosomes

Solution: (c) Genes on different chromosomes are dealt out independently at meiosis; genes on one chromosome tend to travel together.

MCQ 10.1.5 **Self-fertilization in plants through successive generations can lead to the development of: (UHS MDCAT 2025)**

A	Hybrid breeds of plants	**B**	Variations in coming generation
C	True breeding plants	**D**	Adaptation with their environment

Solution: (c) Selfing raises homozygosity generation by generation until the line breeds true.

MCQ 10.1.6 **Mendel crossed a plant with round yellow seeds (RRYY) and a plant with wrinkled green seeds (rryy). what was the phenotype of all F1 offspring? (UHS MDCAT 2025)**

A	All round green	**B**	All round yellow
C	All wrinkled yellow	**D**	All wrinkled green

Solution: (b) Round and yellow are dominant, so every RrYy offspring of the F1 shows both.

MCQ 10.1.7 **Which of Mendel's laws can best explain why a child may inherit brown eyes even if one parent has blue eyes? (KMU MDCAT 2025)**

A	Law of Dominance	**B**	Law of Segregation
C	Law of Independent Assortment	**D**	Law of Recombination

Solution: (a) The brown allele is dominant, so one copy is enough to show it.

MCQ 10.1.8 **What is the significance of the 9:3:3:1ratio in a dihybrid cross? (KMU MDCAT 2025)**

A	It proves that all genes are linked	**B**	It demonstrates that traits assort independently
C	It indicates co-dominance between alleles	**D**	It confirms that mutations have occurred

Solution: (b) A 9:3:3:1 ratio is what two unlinked pairs of alleles give when each assorts independently.

MCQ 10.1.9 **If a round seeded pea plant is self-fertilized and all of its offspring are also round seeded: (SIBA MDCAT 2025)**

A	Both parents and offspring must be true breed	**B**	Both parents and offspring may be true breed
C	Only parents but not offspring will be true breed	**D**	Only offspring but not parents will be true breed

Solution: (a) A plant that breeds true for a trait on selfing is homozygous for it, and so is its offspring.

MCQ 10.1.10 **The genetic makeup that your parents have transferred to you for your hair color, makes up your: (KMU MDCAT 2024)**

A	Genotype	**B**	Karyotype
C	Phenotype	**D**	None of the above

Solution: (a) The alleles inherited are the genotype; what shows is the phenotype.

MCQ 10.1.11 **Which term best describes an organism's physical characteristic. (KMU MDCAT 2024)**

A	Allele	**B**	Genetic code
C	Genotype	**D**	Trait

Solution: (d) A trait is a physical characteristic; the genotype is the alleles behind it.

MCQ 10.1.12 **What will be the probability of purple and terminal flower in Pea plant in F2 generation, if we cross true breeding purple axial with white terminal? (NUMS MDCAT 2024)**

A	1/16	**B**	3/16
C	9/16	**D**	1/2

Solution: (b) Purple and axial are dominant, so purple with terminal is $3/4 \times 1/4$, that is $3/16$.

MCQ 10.1.13 **Mode of inheritance in humans can be traced through: (UHS MDCAT 2023)**

A	Experimental Mating	**B**	Chi Square Chart
C	Pedigree Analysis	**D**	Probability Analysis

Solution: (c) Human families cannot be bred to order, so the record of a trait through the generations is what is read.

MCQ 10.1.14 **Mendelian inheritance follows which form of dominance relation? (SZABMU MDCAT 2023)**

A	Complete dominance	**B**	Incomplete dominance
C	Co-dominance	**D**	Multiple allelic dominance

Solution: (a) In each of Mendel's pairs one allele masked the other completely.

MCQ 10.1.15 **When both the alleles of a gene pair are same, the organism is said to be: (NUMS MDCAT 2023)**

A	Heterozygous	**B**	Genotype
C	Homozygous	**D**	Phenotype

Solution: (c) Two identical alleles make the organism homozygous for that gene.

MCQ 10.1.16 **According to Mendel Law of Segregation, the one individual out of four in F2 generation had phenotype that failed to express in generation. (UHS MDCAT 2023)**

A	F1	**B**	F2
C	F3	**D**	P1

Solution: (a) The recessive phenotype is hidden in the F1 and reappears in a quarter of the F2.

MCQ 10.1.17 **Test cross is made to check the genotype of a trait. Which of the following crosses is a test cross? (UHS MDCAT 2023)**

A	Unknown x At	**B**	Unknown x tt
C	Unknown x AB	**D**	Unknown x IT

Solution: (b) A test cross is with the homozygous recessive, whose gametes carry nothing to mask the unknown allele.

MCQ 10.1.18 **What is the ratio of homozygous dominant to homozygous recessive genotypes in F2 generation of monohybrid cross? (PMC MDCAT 2022)**

A	1:1	**B**	1:2
C	1:3	**D**	3:1

Solution: (a) The F2 is $1:2:1$, so the two homozygotes are in the ratio one to one.

MCQ 10.1.19 **Relatives who have children together have a much higher risk of having children affected by: (PMC MDCAT 2022)**

A	Environmental condition	**B**	Dominant condition
C	Recessive condition	**D**	Undetected condition

Solution: (c) Relatives share alleles, so a rare recessive is far more likely to meet its like.

MCQ 10.1.20 **If a heterozygous round pea plant is crossed with a wrinkled pea plant, what is the probability of homozygous phenotypes in the progeny? (PMC MDCAT 2022)**

A	25%	**B**	50%
C	75%	**D**	100%

Solution: (b) A heterozygote crossed with the recessive gives half round and half wrinkled, and the wrinkled half is homozygous.

MCQ 10.1.21 **The traits that show autosomal inheritance have: (PMC MDCAT 2022)**

A	Equal probabilty in both male and female individuaIs	**B**	Different probabilty in male and female indivi ual
C	More probabilty in male than female individuIs	**D**	More probabilty in female than male individuIs

Solution: (a) An autosome is inherited alike by both sexes, so the trait falls equally on sons and daughters.

MCQ 10.1.22 **Two phenotypically normal individuals have an affected child.What can we conclude about the parents? (PMC MDCAT 2022)**

A	Both parent carried the disease allele	**B**	Both parents are homozygous for their trait
C	They are not the parents of the child	**D**	No conclusion can be drawn

Solution: (a) The condition is recessive and neither parent shows it, so each must carry one copy.

MCQ 10.1.23 **When Mendel conducted his experiments, he needed to transfer pollen grains from a male reproductive organ to the female reproductive organ of the same plant. What is this process called: (PMC MDCAT 2022)**

A	Cross pollination	**B**	Self polination
C	Hybridization	**D**	Test cross

Solution: (b) Pollinating a flower with its own pollen is self-pollination.

MCQ 10.1.24 **Homozygous dominants are represented with a : (PMC MDCAT 2022)**

A	Lower case letter	**B**	Roman numeral
C	Capital letter	**D**	Numerical value

Solution: (c) A dominant allele is written as a capital letter, the recessive as the small one.

MCQ 10.1.25 **The alternative form of a given gene is called: (PMC MDCAT 2022)**

A	Trait	**B**	Phenotype
C	Allele	**D**	Genotype

Solution: (c) The alternative forms of a gene are its alleles.

MCQ 10.1.26 **Physical appearance of a trait is called: (PMC MDCAT 2022)**

A	Genotype	**B**	Alleles
C	Phenotype	**D**	Genome

Solution: (c) What shows is the phenotype; what is carried is the genotype.

MCQ 10.1.27 **Albinism is an autosomal recessive trait. A woman with albino father marries an albino man. What Is the probability of albinism in her children? (PMC MDCAT 2022)**

A	25%	**B**	50%
C	75%	**D**	100%

Solution: (b) Her father was albino, so she is a carrier; with an albino husband half the children are affected.

MCQ 10.1.28 **Phenotype represents: (PMC MDCAT 2022)**

A	Physical appereance of the trait	**B**	Genetic makeup of the trait
C	Normal trait	**D**	Mutant trait

Solution: (a) The phenotype is what shows; the genotype is what is carried.

MCQ 10.1.29 **Mendel's idea that pair of characters separate during gamete formation is called: (PMC MDCAT 2022)**

A	Law of particulate inheritance	**B**	Law of segregation
C	Law of dominance	**D**	Law of independant assortment

Solution: (b) The law of segregation says the two alleles of a pair separate into different gametes.

MCQ 10.1.30 **A test cross is performed: (PMC MDCAT 2022)**

A	Only with hybrids	**B**	Only with pure types
C	Only with recessives	**D**	To determine whether an organism Is heterozygous or homozygous dominant

Solution: (d) Crossing with the homozygous recessive shows at once whether the unknown carries a recessive allele.

MCQ 10.1.31 **What is the ratio of homozygous to heterozygous individuals in F2 generation of monohybrid cross? (PMC MDCAT 2022)**

A	1 : 1	**B**	1 : 2
C	1 : 3	**D**	3 : 1

Solution: (a) The F2 is 1 : 2 : 1, so the two homozygotes together match the heterozygotes.

MCQ 10.1.32 **If both the alleles are same with respect to genes, then they are called? (PMC Practice 2021)**

A	Heterozygous	**B**	Unicellular
C	Homozygous	**D**	None of these

Solution: (c) Two identical alleles make the organism homozygous.

MCQ 10.1.33 **All of the following are continuously varying traits except? (PMC Practice 2021)**

A	Kernel colour in wheat	**B**	Skin colour in humans
C	Height in humans	**D**	Tongue rolling in humans

Solution: (d) Tongue rolling is either present or absent; the other three vary continuously.

MCQ 10.1.34 **True breeding variety is produced by which of the following? (PMC Practice 2021)**

A	Cross-fertilization	**B**	Self-fertilization
C	Both Options A and B are correct	**D**	None of these options is correct

Solution: (b) Selfing raises homozygosity generation by generation until the line breeds true.

MCQ 10.1.35 **In 'Complete Dominance': (PMC MDCAT 2020)**

A	Different alleles of a gene are both expressed in heterozygous condition	**B**	One allele (R) is completely dominant over the other (r) and the presence of the recessive allele is functionally hidden, so the heterozygote (Rr) has the same round phenotype as (RR) homozygote.
C	The phenotype of the heterozygote is intermediate between phenotypes of the two homozygotes	**D**	Gene mutations may produce many different alleles of a gene

Solution: (b) Under complete dominance the heterozygote looks exactly like the dominant homozygote.

MCQ 10.1.36 **"Law of independent assortment" states: (PMC MDCAT 2020)**

A	That each pair of alleles assort independently of other pairs of alleles during gamete formation	**B**	That alleles of each pair of contrasting trait have unequal probability to assort with the alleles of other pair
C	That the two coexisting alleles for each trait segregate (separate) from each other at meiosis so that each gamete receives only one of the two alleles	**D**	That pertain to inheritance of single trait (monohybrid cross)

Solution: (a) Each pair of alleles goes into the gametes independently of every other pair.

MCQ 10.1.37 **_____ alleles both have an effect on the phenotype of a heterozygous organism: (PMC MDCAT 2020)**

A	Dominant	**B**	Recessive
C	Co-dominant	**D**	Multiple

Solution: (c) Codominant alleles are both expressed in the heterozygote.

MCQ 10.1.38 **Phenotype is: (PMC MDCAT 2020)**

A	The genetic component i.e. the genes in an individual for a particular trait	B	Partner of gene pair
C	The form of appearance of a trait	D	The position of a gene on the chromosome

Solution: (c) The phenotype is what shows; the genotype is what is carried.

MCQ 10.1.39 **Homozygous means: (UHS MDCAT 2019)**

A	alleles in an organism	B	two different alleles of a gene.
C	having two identical genes	D	having two identical alleles of a gene.

Solution: (d) Homozygous means the two alleles of the gene are alike.

MCQ 10.1.40 **A person was married to his cousin and both are heterozygous for Sickle Cell anemia. Among their four kids, what will be proportion of homozygotes? (UHS MDCAT 2019)**

A	75%	B	50%
C	100%	D	25%

Solution: (b) The cross gives $1:2:1$, so half the children are homozygous, one way or the other.

MCQ 10.1.41 **Blood group AB is an example of _____ . (UHS MDCAT 2019)**

A	Complete dominance	B	Recessive alleles
C	Co-dominance	D	Incomplete dominance

Solution: (c) Both alleles are expressed, so both antigens appear on the cells.

MCQ 10.1.42 **When two or more alleles do not show complete dominance or both the alleles are expressing independently in heterozygotic condition. Such a condition is called: (UHS MDCAT 2018)**

A	Complete dominance	B	Over dominance
C	Codominance	D	Incomplete dominance

Solution: (c) Codominant alleles are both expressed in the heterozygote.

MCQ 10.1.43 **Which one of the following is Multiple allelic characters? (UHS MDCAT 2018)**

A	Colour of flower in pea plant	B	Blood group of the human being
C	Shape of seed in pea plant	D	Length of stem in pea plant

Solution: (b) The ABO system has three alleles, so it is an example of multiple alleles.

MCQ 10.1.44 **The phenotype of heterozygote is distinct from those of the two homozygotes, not an intermediate expression, this is termed as: (UHS MDCAT 2017)**

A	Dominance	B	Complete
C	Incomplete dominance	D	Codominance

Solution: (d) Codominance shows both alleles in the heterozygote rather than a blend.

MCQ 10.1.45 **When an effect caused by a gene or gene pair at one locus interferes with or or hides the effect caused by another gene or gene pair at another locus, the phenomena is called (UHS MDCAT 2017)**

A	Bombay phenotype	B	Codominance
C	Epistasis	D	Pleiotropy

Solution: (c) One gene masking the effect of another at a different locus is epistasis.

MCQ 10.1.46 **A character determined by three alleles is: (UHS MDCAT 2016)**

A	Human skin colour	B	Human blood group
C	Human eye colour	D	Human Rh factor

Solution: (b) The ABO system has three alleles, of which each person carries two.

MCQ 10.1.47 **Human skin colour is a good example of? (UHS MDCAT 2015)**

A	Sex-linked inheritance	B	Polygenic inheritance
C	x-linked inheritance	D	y-linked inheritance

Solution: (b) Skin colour is set by several genes together, which is polygenic inheritance.

MCQ 10.1.48 **ABO blood system is an example of: (UHS MDCAT 2015)**

A	Polygenes	B	Multiple genes
C	Multiple Alleles	D	Multiple Mutation www.PakLearningSpot.com

Solution: (c) The ABO system has three alleles, of which each person carries two.

Topic 10.3 X-linked Inheritance

Past MDCAT Questions

MCQ 10.3.1 **To study sex linkage in Drosophila, Morgan mated white eyed males with wild type red eyed females. What will be the phenotype of the offspring? (MDCAT 2022)**

A	all red eyed males and females	B	red eyed females and white eyed males
C	white eyed females and red eyed males	D	all white eyed females and males

Solution: (a) Every daughter gets a red allele from her mother and every son gets his single X from her too, so the whole F_1 is red eyed.

MCQ 10.3.2 **The mode of inheritance in humans can be traced through: (MDCAT 2022)**

A	experimental mating	B	chi square charts
C	pedigree analysis	D	probability analysis

Solution: (c) Human families cannot be bred to order, so the record of a trait through the generations is what is studied.

MCQ 10.3.3 **Which one of the following is an X-linked dominant disorder? (MDCAT 2023)**

A	haemophilia	B	colour blindness
C	hypophosphataemic rickets	D	hypertrichosis

Solution: (c) Hypophosphataemic rickets is carried on the X chromosome and shows in the heterozygote; haemophilia and colour blindness are X-linked recessive.

MCQ 10.3.4 **A baby girl is born with hemophilia, which is an X-linked recessive disorder. What are the most likely genotypes of her parents? (UHS MDCAT 2025)**

A	The mother is a carrier and the father is normal.	B	The mother is hemophiliac and the father is normal.
C	The mother is carrier and the father is hemophiliac	D	Both are normal.

Solution: (c) A girl needs the allele on both X chromosomes, so her father must be affected and her mother at least a carrier.

MCQ 10.3.5 **If a normal person marries with colour blind female what will be the possibility of normal male child: (UHS MDCAT 2025)**

A	0%	B	25%
C	50%	D	75%

Solution: (a) A son takes his only X from his mother, and both of hers carry the allele, so none can be normal.

MCQ 10.3.6 **A carrier female for an X-linked recessive disorder: (KMU MDCAT 2025)**

A	Expresses the disorder fully	**B**	Cannot pass the disorder to her sons
C	Can pass the disorder to her sons	**D**	Only pases the disorder to her sons

Solution: (c) A son takes his single X from his mother, so half the sons of a carrier are affected.

MCQ 10.3.7 **Which of the following is an X-linked recessive disorder in humans? (KMU MDCAT 2025)**

A	Cystic fibrosis	**B**	Thalassemia
C	Hemophilia	**D**	Sickle cell anemia

Solution: (c) Haemophilia is carried on the X chromosome; the other three are autosomal.

MCQ 10.3.8 **Which of the following CORRECTLY describes the expected outcome of children from a carrier mother for hemophilia (X^h X^h) and a normal father (X^Y)? (KMU MDCAT 2025)**

A	All sons will have hemophilia	**B**	All daughters will be carriers
C	50% of sons will have hemophilia, and 50% of daughters will be carriers	**D**	All offspring will be unaffected

Solution: (c) Half her sons take the affected X and half her daughters take it and become carriers.

MCQ 10.3.9 **If a male with hemophilia marries a non-carrier female, what is the likelihood of their sons inheriting the condition? (SIBA MDCAT 2025)**

A	50%	**B**	100%
C	0%	**D**	25%

Solution: (c) A son takes his X from his mother, and hers are both normal, so no son can be affected.

MCQ 10.3.10 **If the disease is caused due to a defective gene located on the X chromosome, then defectives gene can only be transmitted to male offspring by the: (SIBA MDCAT 2025)**

A	Female gamete	**B**	Male gamete
C	Bacteria	**D**	Mutation

Solution: (a) A son takes his X only from his mother, so the defective gene reaches him through the egg.

MCQ 10.3.11 **A carrier mother for hemophilia and a normal father can produce: (SZABMU MDCAT 2025)**

A	All hemophilic sons	**B**	25 % Hemophilic among sons
C	50 % hemophilic among sons	**D**	All normal sons and daughter

Solution: (c) Half the sons take her affected X, so half of them are haemophilic.

MCQ 10.3.12 **Y-linked inheritance refers to which mode of the inheritance? (SZABMU MDCAT 2025)**

A	Crisscross	**B**	Straight
C	Loop	**D**	Jumping

Solution: (b) A Y-linked gene passes from father to son in every generation, so the inheritance is straight.

MCQ 10.3.13 **If a colorblind lady marries a normal man, their children will be: (SZABMU MDCAT 2025)**

A	Normal daughters and normal sons	**B**	Normal sons and carrier daughters
C	Colorblind sons and carrier daughters	**D**	Colorblind sons and colorblind daughters

Solution: (c) Every son takes her affected X and every daughter takes one affected and one normal X.

MCQ 10.3.14 **Which is true for an X linked dominant trait? (KMU MDCAT 2024)**

A	All female offspring of the affected father will be affected	**B**	Half of the female offsprings of the affected father will be affected
C	No male offspring of an affected mother will be affected	**D**	No female offspring of the affected father will be affected

Solution: (a) An affected father passes his only X to every daughter, so all of them show a dominant trait.

MCQ 10.3.15 **A carrier female for hemophilia is married to an affected male. What would be the probable percentage for their sons to be affected? (NUMS MDCAT 2024)**

A	100%	**B**	50%
C	25%	**D**	0%

Solution: (b) Half her sons take the affected X from her, so half of them are affected.

MCQ 10.3.16 **Which is correct for pattern baldness? (NUMS MDCAT 2024)**

A	It is sex linked trait	**B**	Occurs due to hormonal differences between sexes
C	Heterozygous male is normal	**D**	Heterozygous female is affected

Solution: (b) Baldness is autosomal but sex influenced: the heterozygote is bald in a man and not in a woman.

MCQ 10.3.17 **To study sex linkages in Drosophila, Morgan mated white eyed males with wild type red eyed females. What will be the phenotype of offspring? (UHS MDCAT 2023)**

A	All red eyed males and females	**B**	Red eyed females and white eyed males
C	White eyed females and red eyed males	**D**	All white eyed females and males

Solution: (a) Red is dominant and the mother gives every offspring a red-bearing X, so all the F1 are red eyed.

MCQ 10.3.18 **Which one of the following is X Linked Dominant disorder? (UHS MDCAT 2023)**

A	Haemophilia	**B**	Color blindness
C	Hypophosphatemic rickets	**D**	Hypertrichosis

Solution: (c) Hypophosphataemic rickets is carried on the X chromosome and is dominant.

MCQ 10.3.19 **Which of the following traits is transmitted directly from an affected father to only his son? (NUMS MDCAT 2023)**

A	Autosomal	**B**	X-linked
C	Y-linked	**D**	X-Y linked

Solution: (c) A gene on the Y chromosome goes from father to son and to no daughter.

MCQ 10.3.20 **Which of the following is a dominant x-linked trait in human? (PMC MDCAT 2022)**

A	Testicular feminization	**B**	Haemophllia
C	Colorblindness	**D**	Hypophosphatemic rickets

Solution: (d) Hypophosphataemic rickets is carried on the X chromosome and is dominant.

MCQ 10.3.21 **A diseased man marries a normal woman.They have five daughters and three sons.All the daughters were diseased and sons were normal. The gene of this disease is: (PMC MDCAT 2022)**

A	X linked dominant	**B**	X-linked recessive
C	Autosomal recessive	**D**	Autosomal dominant

Solution: (a) Every daughter takes her father's X and shows the trait; no son does, so it is X-linked dominant.

MCQ 10.3.22 **A man receives his X chromosome from: (PMC MDCAT 2022)**

A	His mother only	B	Part from his father and part from his mother
C	His father only	D	Either his mother or his father, It depends upon luck

Solution: (a) A man has one X and one Y; the Y came from his father, so the X came from his mother.

MCQ 10.3.23 **Which of the following is the wildtype phenotype of eye color in Drosophila (PMC MDCAT 2022)**

A	Black eyes	B	White eyes
C	Light red eyes	D	Bright red eyes

Solution: (d) The wild type Drosophila has bright red eyes; white is the mutant Morgan studied.

MCQ 10.3.24 **Which of the following disease has greater incidence in human male than female? (PMC MDCAT 2022)**

A	Haemophilia	B	Cystic fibrosis
C	Thalassemia	D	Cretinism

Solution: (a) Haemophilia is X-linked recessive, so a man needs only one copy to show it.

MCQ 10.3.25 **Which traits are most likely to affect men than women? (PMC MDCAT 2020)**

A	X linked recessive	B	X linked dominant
C	Autosomal dominant	D	Autosomal recessive

Solution: (a) A man has only one X, so a single recessive allele on it shows at once.

MCQ 10.3.26 **Haemophilia occurs because of: (PMC MDCAT 2020)**

A	Mutation in an autosome	B	Mutation of Y-chromosome
C	Mutation of X-chromosome	D	Deficiency of iron

Solution: (c) The gene for the missing clotting factor lies on the X chromosome.

MCQ 10.3.27 **If a carrier haemophilic female (XHXh) is married to a haemophilic male (XhY). What will be the ratio of presence of haemophilia in the children. (UHS MDCAT 2019)**

A	100% all females and males will be haemophilic	B	Females have 50% chances of getting haemophilia and males will be 100% haemophilic
C	Carrier female 25%, haemophilic female 25%, normal male 25% and 25% haemophilic male	D	Females and males both have 50% chances of getting haemophilia

Solution: (c) Half the daughters are carriers and half affected; half the sons are normal and half affected.

MCQ 10.3.28 **XO-XX is associated with: (UHS MDCAT 2017)**

A	Fishes	B	Man
C	Drosophila	D	Grasshopper

Solution: (d) In the grasshopper the female is XX and the male has a single X and no Y.

MCQ 10.3.29 **Which one of the following is X-linked trait? (UHS MDCAT 2016)**

A	Male pattern baldness	B	Diabetes mellitus
C	Haemophilia	D	Erythroblastosis fetalis

Solution: (c) Haemophilia is carried on the X chromosome.

MCQ 10.3.30 **X-linked recessive trait is: (UHS MDCAT 2015)**

A	Hypophosphatemia	B	Vitamin-D resistant rickets
C	Haemophilia	D	Diabetes Mellitus

Solution: (c) Haemophilia is carried on the X chromosome and is recessive.

Topic 10.2 Gene Linkage and Crossing Over

Past MDCAT Questions

MCQ 10.2.1 **The 9.3.3.1 ratio of law of Independent assortment can be affected by (UHS MDCAT 2025)**

A	Genetic drift	B	Small population
C	Gene linkage	D	Gene duplication

Solution: (c) Genes on the same chromosome are inherited together, so linkage upsets the 9:3:3:1 ratio independent assortment predicts.

MCQ 10.2.2 **Best description of the process of crossing over during meiosis: (UHS MDCAT 2025)**

A	Duplication of chromosome	B	Exchange of genes between non-sister chromatids
C	Movement of chromosome to opposite poles	D	Separation of sister chromatids

Solution: (b) Crossing over is the exchange of segments between non-sister chromatids of homologous chromosomes at prophase I.

MCQ 10.2.3 **Total number of linkage groups in a normal human is: (UHS MDCAT 2025)**

A	02	B	23
C	46	D	92

Solution: (b) A linkage group is one chromosome of a haploid set, and the human haploid number is 23.

MCQ 10.2.4 **In crossing over, an exchange of maternal and paternal chromatid parts occurs while homologous chromosomes are paired _____ stage of meiosis. (KMU MDCAT 2025)**

A	Metaphase I	B	Prophase I
C	Anaphase II	D	Telophase I

Solution: (b) Homologues pair and exchange segments at prophase I, in the pachytene of that stage.

MCQ 10.2.5 **Linked genes DO NOT follow Mendel's Law of Independent Assortment because (KMU MDCAT 2025)**

A	They are located on different chromosomes	B	They always undergo crossing over
C	They are physically close together on the same chromosome	D	They rarely separate during meiosis

Solution: (c) Genes close together on one chromosome travel together, so they cannot assort independently.

MCQ 10.2.6 **The phenomena of gene linkage rejects the concept of: (NUMS MDCAT 2025)**

A	Law of segregation	B	Polygenic traits
C	Epistasis	D	Law of independent assortment

Solution: (d) Linked genes travel together, so they cannot assort independently.

MCQ 10.2.7 **Which of the following is used to determine linkage between two gene pairs? (NUMS MDCAT 2025)**

A	Test cross	B	Back cross
C	Monohybrid cross	D	Dihybrid cross

Solution: (a) Crossing the heterozygote with the double recessive shows the parental types directly, which reveals linkage.

MCQ 10.2.8 **Crossing over involves exchange of genetic material between: (SIBA MDCAT 2025)**

A	Sister chromatids of same chromosome	B	Non-sister chromatids of homologous chromosomes
C	Chromatids of non-homologous chromosomes	D	Sister chromatids of homologous chromosomes

Solution: (b) Segments are swapped between non-sister chromatids of a homologous pair.

MCQ 10.2.9 **Linkage of genes in Drosophila was first discovered by: (SIBA MDCAT 2025)**

A	Thomas Hunt Morgan	**B**	Alfred Sturtevant
C	Gregor Mendel	**D**	Hugo de Vries

Solution: (a) Morgan found linkage while breeding the fruit fly Drosophila melanogaster.

MCQ 10.2.10 **Which phenomenon increases the chances of variations? (SIBA MDCAT 2025)**

A	Crossing Over	**B**	Linkage
C	Epistasis	**D**	Dominance

Solution: (a) Crossing over recombines the alleles of a chromosome, so it makes new combinations.

MCQ 10.2.11 **When genes are linked, they tend to: (SZABMU MDCAT 2025)**

A	Segregate randomly	**B**	Cross over every time
C	Stay together during inheritance	**D**	Be inherited separately

Solution: (c) Genes on one chromosome are carried together into the same gamete.

MCQ 10.2.12 **According to Morgan's experiment, which of the following is essential for detecting gene linkage accurately? (SZABMU MDCAT 2025)**

A	Large number of progeny	**B**	Small sample size
C	Use of male flies only	**D**	Mutation induction

Solution: (a) Recombinants are a small fraction, so a large brood is needed before the ratio means anything.

MCQ 10.2.13 **What is the primary outcome of crossing over during prophase of meiosis I? (KMU MDCAT 2024)**

A	Chromosomes duplicate without any exchange of parts	**B**	Homologous chromosomes exchange different pairs leading to recombinant chromatids and increased genetic variation
C	Homologous chromosomes exchange identical parts, resulting in no genetic variation	**D**	Non-homologous chromosomes exchange part

Solution: (b) Homologues swap segments, so the chromatids that result carry new combinations of alleles.

MCQ 10.2.14 **These are the genes which tend to be inherited together and do not assort independently: (SZABMU MDCAT 2023)**

A	Linked genes	**B**	Dependent genes
C	Recombinant genes	**D**	Independent genes

Solution: (a) Genes on the same chromosome are linked and travel together.

MCQ 10.2.15 **Linkage reduces the frequency of: (PMC MDCAT 2022)**

A	Recombinants or hybrids	**B**	Parental phenotypes
C	Dominant homozygotes	**D**	Recessive homozygotes

Solution: (a) Linked genes travel together, so few recombinant gametes are made.

MCQ 10.2.16 **Crossing over brings: (PMC MDCAT 2022)**

A	recombination of genes	**B**	New trait into species
C	Reduction in number of chromosomes	**D**	Segregation of genes

Solution: (a) Crossing over exchanges segments between homologues, so the chromatids carry new combinations.

MCQ 10.2.17 **One map unit is supposed to be equal to: (PMC MDCAT 2022)**

A	1%recombination frequency	**B**	5%recombination frequency
C	10%recombination frequency	**D**	15%recombination frequency

Solution: (a) A map unit, or centimorgan, is one per cent recombination.

MCQ 10.2.18 **In Morgan's linkage experiment, when males and females of F2 generation mate with each other and produce offspring, the percentage of recombinants was: (PMC Practice 2021)**

A	37	**B**	22
C	2	**D**	70

Solution: (a) Morgan found about 37% recombinants, well below the fifty per cent independent assortment would give.

MCQ 10.2.19 **The process of determining the locus for particular biological traits includes? (PMC Practice 2021)**

A	Replication	**B**	Recombination
C	Gene mapping	**D**	None of these options is correct

Solution: (c) Working out where a gene lies on its chromosome is gene mapping.

MCQ 10.2.20 **During meiosis, the homologous chromosomes come together and form pairs, this process is called: (PMC MDCAT 2020)**

A	Linkage	**B**	Synapsis
C	Pairing	**D**	Crossing over

Solution: (b) The pairing of homologues at prophase I is synapsis.

MCQ 10.2.21 **In which situation are genes, are not assorted independently, during meiosis in a chromosome? (UHS MDCAT 2019)**

A	When genes are linked and their loci are close to each other	**B**	When some genes have mutated on the chromosome
C	When there are too many Genes on a chromosome	**D**	When genes are not linked and their loci are far apart

Solution: (a) Genes close together on one chromosome are carried into the same gamete.

MCQ 10.2.22 **In genetics, the term locus refers to the _____ of the gene on the chromosome. (UHS MDCAT 2019)**

A	Position	**B**	Frequency
C	Copy	**D**	Inversion

Solution: (a) The place a gene occupies on its chromosome is its locus.

MCQ 10.2.23 **Chance of a cross over between two loci is directly proportional to their (UHS MDCAT 2018)**

A	Thickens	**B**	Width
C	Length	**D**	Distance

Solution: (d) The further apart two loci lie, the likelier a chiasma falls between them.

MCQ 10.2.24 **There are _____ number of linkage groups in humans. (UHS MDCAT 2018)**

A	46	**B**	22
C	80	**D**	23

Solution: (d) A linkage group is one chromosome of a haploid set, and the human haploid number is 23.

MCQ 10.2.25 **_____ is the exact position of a gene on the chromosome. (UHS MDCAT 2018)**

A	Trait	**B**	Centromere
C	Genotype	**D**	Locus

Solution: (d) The place a gene occupies on the chromosome is its locus.

MCQ 10.2.26 **Crossing over takes place during _____ of meiosis. (UHS MDCAT 2018)**

A	Prophase I	**B**	Telophase I
C	Metaphase I	**D**	Anaphase I

Solution: (a) Homologues pair and exchange segments at prophase I.

Topic 11.3 Blood Vessels

Past MDCAT Questions

MCQ 11.3.1 The descending aorta bifurcates into two vessels which on further division form the femoral artery that supplies blood to the muscles of the legs. These two vessels are the: (MDCAT 2023)

A	iliac veins	B	iliac arteries
C	temporal arteries	D	sciatic arteries

Solution: (b) The aorta ends by dividing into the two common iliac arteries.

MCQ 11.3.2 Which of the following blood vessels have lowest blood velocity with correct reason for low blood velocity? (UHS MDCAT 2025)

A	Arteries: Due to thick walls	B	Capillaries: due to highest overall cross-sectional area
C	Veins: due to blood flow against the gravity	D	Capillaries: Due to two-way blood flow in capillaries

Solution: (b) The capillary bed has by far the largest total cross-section, and flow is slowest where the section is greatest.

MCQ 11.3.3 Blood flow in vessels least depends on: (NUMS MDCAT 2025)

A	Total cross sectional area of vessels	B	Blood pressure
C	Skeletal muscle contraction	D	Heart beat

Solution: (c) Muscle contraction helps the venous return, but the flow itself is set by the heart, the pressure and the vessel bore.

MCQ 11.3.4 Which structural characteristic is most accurate for arteries? (SIBA MDCAT 2025)

A	Thin walls with valves	B	Thick and muscular walls
C	Highly permeable walls	D	Large lumen lacking muscle

Solution: (b) An artery meets the full pressure of each heartbeat, so its wall is thick, muscular and elastic.

MCQ 11.3.5 Which of the following set of characteristics are related to veins? (NUMS MDCAT 2024)

A	Valves: Present, Wall thickness: Thick, Diameter: 7-9mm	B	Valves: Absent, Wall thickness: Thick, Diameter: 40-50mm
C	Valves: Present, Wall thickness: Thinner, Diameter: 40-50mm	D	Valves: Absent, Wall thickness: Thinner, Diameter: 40-50mm

Solution: (c) A vein has a wide bore, a thin wall and valves to stop the blood falling back.

MCQ 11.3.6 Flow of blood in the capillaries is adjusted by? (UHS MDCAT 2023)

A	Heart directly	B	Pre-capillary sphincters
C	Meta-arteriole	D	Valves

Solution: (b) A ring of muscle at the mouth of each capillary bed opens or closes it as the tissue needs.

MCQ 11.3.7 Mesenteric veins drain the blood from: (NUMS MDCAT 2023)

A	Liver	B	Large intestine
C	Stomach	D	Gall bladder

Solution: (b) The mesenteric veins drain the intestine and join to form the hepatic portal vein.

MCQ 11.3.8 Descending aorta is bifurcated into two vessels which on further division from femoral artery that supply blood to high muscles of legs: (UHS MDCAT 2023)

A	iliac vein	B	iliac artery
C	temporal artery	D	sciatic artery

Solution: (b) The descending aorta divides into the two iliac arteries, which become the femoral arteries of the legs.

MCQ 11.3.9 The medium through which exchange of material between blood and cells occurs is (PMC MDCAT 2022)

A	Interstitial fluid	B	Cytoplasm
C	Water	D	Lymph

Solution: (a) Everything passing between blood and cell crosses the interstitial, or tissue, fluid.

MCQ 11.3.10 Vena-Cava receives deoxygenated blood of kidney through : (PMC MDCAT 2022)

A	Hepatic vein	B	Renal vein
C	Subclavian vein	D	Renal artery

Solution: (b) The renal vein carries the blood of the kidney into the inferior vena cava.

MCQ 11.3.11 Iliac vein from the lower limb's unite to form: (PMC MDCAT 2022)

A	Vena cava	B	Renal vein
C	Hepatic portal vein	D	Cardiac vein

Solution: (a) The two iliac veins join to form the inferior vena cava.

MCQ 11.3.12 Which of the following blood vessels have the highest pressure of blood? (PMC MDCAT 2020)

A	Aorta	B	Pulmonary arteries
C	Pulmonary veins	D	Vena cava

Solution: (a) The aorta takes the full force of the left ventricle, so the pressure there is highest.

MCQ 11.3.13 The only vein in human carrying oxygenated blood is: (PMC MDCAT 2020)

A	Femoral	B	Pulmonary
C	Real	D	Iliac

Solution: (b) The pulmonary vein brings oxygenated blood back from the lungs.

MCQ 11.3.14 Which of the following blood vessels contain semilunar valves? (UHS MDCAT 2019)

A	Arteries	B	Capillaries
C	Veins	D	Arterioles

Solution: (c) Veins carry semilunar valves that stop the blood falling back.

MCQ 11.3.15 The major function of basophils is to: (UHS MDCAT 2019)

A	Destroy small particles by phagocytosis	B	Release heparin to prevent blood clotting
C	Transport oxygen	D	Inactivate inflammation producing substances

Solution: (b) Basophils release heparin, which keeps the blood from clotting, and histamine.

MCQ 11.3.16 Which one of the following cells does not have nucleus: (UHS MDCAT 2018)

A	Eosinophils	B	Neutrophils
C	Basophils	D	Platelets

Solution: (d) Platelets are fragments of megakaryocytes and carry no nucleus.

MCQ 11.3.17 **Among the following, identify the agranulocytes: (UHS MDCAT 2017)**

A	Neutrophils	B	Basophils
C	Monocytes	D	Both Neutrophils and Basophils

Solution: (c) Monocytes and lymphocytes have no granules, so they are agranulocytes.

Topic 11.1 Human Heart

Past MDCAT Questions

MCQ 11.1.1 **The heart is surrounded by a tough, inelastic double membranous covering called: (KMU MDCAT 2025)**

A	Pleura	B	Peritoneum
C	Pericardium	D	Meninges

Solution: (c) The pericardium is the double bag around the heart, with fluid between its layers.

MCQ 11.1.2 **Identify the location of mitral valve in human heart: (NUMS MDCAT 2025)**

A	Between right ventricle and pulmonary trunk	B	Between left ventricle and aorta
C	Between right atrium and right ventricle	D	Between left atrium and left ventricle

Solution: (d) The mitral, or bicuspid, valve guards the opening between the left atrium and the left ventricle.

MCQ 11.1.3 **Atrial walls are thinner as compared to ventricles because: (SZABMU MDCAT 2025)**

A	Atria are small in size	B	Atria are present above the ventricles
C	Atria has to force blood into the ventricles which lie very close to them	D	Blood enters into the atria by osmosis

Solution: (c) An atrium has only to push blood into the ventricle just below, so it needs little muscle.

MCQ 11.1.4 **Weakened papillary muscles of right ventricle would result in constant back flow of blood into: (NUMS MDCAT 2024)**

A	Right atrium	B	Left ventricle
C	Right ventricle	D	Left atrium

Solution: (a) The papillary muscles hold the tricuspid valve shut, so weak ones let blood back into the right atrium.

MCQ 11.1.5 **In human heart, the left atrium receives: (SZABMU MDCAT 2023)**

A	The Superior Vena Cava	B	The Inferior Vena Cava
C	The Coronary Sinus	D	The four Pulmonary Veins

Solution: (d) Four pulmonary veins bring oxygenated blood from the lungs into the left atrium.

MCQ 11.1.6 **The heart chamber from where aorta originates: (NUMS MDCAT 2023)**

A	Left ventricle	B	Right ventricle
C	Left atrium	D	Right atrium

Solution: (a) The aorta leaves the left ventricle, which drives blood round the whole body.

MCQ 11.1.7 **Regarding structure of the human heart, Chordae Tendinae are present in: (PMC MDCAT 2020)**

A	Atria	B	Pulmonary valve
C	Ventricles	D	Aortic valve

Solution: (c) The chordae tendineae run from the papillary muscles of the ventricles to the cusps of the valves.

MCQ 11.1.8 **The thickest chamber of the human heart is: (UHS MDCAT 2018)**

A	Left atrium	B	Right atrium
C	Right ventricle	D	Left ventricle

Solution: (d) The left ventricle drives blood round the whole body, so its wall is the thickest.

MCQ 11.1.9 **Bicuspid valve is present between: (UHS MDCAT 2017)**

A	Left atrium and left ventricle	B	Right atrium and left ventricle
C	Left atrium and right ventricle	D	Right ventricle and right ventricle

Solution: (a) The bicuspid, or mitral, valve guards the left atrioventricular opening.

MCQ 11.1.10 **In human the closed sac which surrounds the heart is: (UHS MDCAT 2016)**

A	Endocardium	B	Myocardium
C	Pericardium	D	Epicardium

Solution: (c) The pericardium is the double sac round the heart.

MCQ 11.1.11 **Chordae tendinea are fibrous cords attached with: (UHS MDCAT 2016)**

A	Cardiac end of stomach valve	B	Tricuspid valve of heart
C	Pyloric sphincter of stomach	D	Eyelid

Solution: (b) The chordae tendineae hold the cusps of the atrioventricular valves against the pressure of systole.

MCQ 11.1.12 **Right atrium is separated from right ventricle by: (UHS MDCAT 2015)**

A	Bicuspid Valve	B	Semilunar Valve
C	Tricuspid Valve	D	Interatrial Septum

Solution: (c) The tricuspid valve guards the right atrioventricular opening.

MCQ 11.1.13 **The flaps of tricuspid valves are attached to muscular extensions of right ventricle known as: (UHS MDCAT 2015)**

A	Smooth Muscles	B	Papillary Muscles
C	Intercostal Muscles	D	Skeletal Muscles

Solution: (b) The chordae tendineae run from the papillary muscles to the cusps.

Topic 11.4 Lymphatic System

Past MDCAT Questions

MCQ 11.4.1 **The lymphatic vessels of the body empty the lymph into the blood stream at the: (MDCAT 2022)**

A	abdominal vein	B	jugular vein
C	subclavian vein	D	thoracic duct

Solution: (c) The thoracic duct is the vessel that carries it, and it drains into the subclavian vein.

MCQ 11.4.2 **The final destination of lymph is the: (MDCAT 2023)**

A	lymph node	B	lymphoid organs
C	subclavian vein	D	spleen

Solution: (c) The thoracic duct returns lymph to the blood at the subclavian vein.

MCQ 11.4.3 **The first consequence of lymphatic blockage in tissues is: (UHS MDCAT 2025)**

A	Deficiency of oxygen	B	Loss of nerve signals
C	Drop in blood pressure	D	Excess fluid accumulation in tissue

Solution: (d) Lymph vessels drain the tissue fluid, so a blockage leaves it to collect in the tissue as oedema.

MCQ 11.4.4 **Tissue fluid in a lymphatic system is called as: (UHS MDCAT 2025)**

A	Plasma	B	Matrix
C	Lymph	D	Blood

Solution: (c) Tissue fluid that has drained into the lymph vessels is called lymph.

MCQ 11.4.5 **What is the primary function of lymphatic vessels? (KMU MDCAT 2025)**

A	Transport oxygenated blood	B	Drain excess interstitial fluid
C	Produce antibodies	D	Store metabolic waste

Solution: (b) Lymph vessels take back the tissue fluid the capillaries have left behind and return it to the blood.

MCQ 11.4.6 **Which of the following components are present both in blood and lymph? (NUMS MDCAT 2025)**

A	O2, water, large proteins	B	RBCs, electrolytes, amino acids
C	CO2, RBCs and water	D	CO2, glucose and water

Solution: (d) Lymph is tissue fluid, so it carries water, glucose and carbon dioxide but no red cells.

MCQ 11.4.7 **Which of the following fluid flows through the lymphatic vessels? (SIBA MDCAT 2025)**

A	Plasma	B	Lymph
C	Bile	D	Serum

Solution: (b) The lymph vessels carry lymph, the tissue fluid they have drained.

MCQ 11.4.8 **Which lymphatic structure absorbs dietary fats in the intestine? (SZABMU MDCAT 2025)**

A	Peyer's patches	B	Lacteals in villi
C	Pancreatic duct	D	Lymph nodes

Solution: (b) The lacteal in the centre of each villus takes up the fat as chyle.

MCQ 11.4.9 **Which of the following would not be compromised in the absence of lymphatic system? (NUMS MDCAT 2024)**

A	Blood pressure	B	Oxygen carrying capacity of blood
C	Blood composition	D	Defense mechanism

Solution: (b) Oxygen is carried by the red cells of the blood, which the lymphatic system has nothing to do with.

MCQ 11.4.10 **The presence of which molecules distinguishes blood from interstitial fluid? (NUMS MDCAT 2024)**

A	Large proteins and electrolytes	B	Glucose and RBCs
C	Antibodies and electrolytes	D	RBCs and large proteins

Solution: (d) Red cells and the plasma proteins stay in the vessel; the rest of the plasma filters out as tissue fluid.

MCQ 11.4.11 **The lymphatic vessels of the body empty the lymph into blood stream at ? (UHS MDCAT 2023)**

A	Abdominal vein	B	Jugular vein
C	Subclavian vein	D	Bile duct

Solution: (c) The thoracic duct empties the lymph into the left subclavian vein.

MCQ 11.4.12 **Lymphatic system contains all of the following organs / structures except: (SZABMU MDCAT 2023)**

A	Lymphoid masses	B	Lymph vessels
C	Spleen	D	Lungs

Solution: (d) The lungs belong to the respiratory system; the lymphatic system is vessels, nodes, spleen and thymus.

MCQ 11.4.13 **The final destination of lymph is: (UHS MDCAT 2023)**

A	Lymph node	B	Lymphoid organs
C	Lymph capillaries	D	Subclavian vein

Solution: (d) The thoracic duct empties the lymph into the subclavian vein.

MCQ 11.4.14 **Lacteals within the villi of the small intestine are a type of: (PMC MDCAT 2022)**

A	Blood capillaries	B	Arterioles
C	Lymph capillaries	D	Venules

Solution: (c) A lacteal is the lymph capillary at the centre of a villus, which takes up the fat.

MCQ 11.4.15 **Where do lymph capillaries end blindly? (PMC MDCAT 2022)**

A	Lymmph vessels	B	Tissues
C	Abdominal Cavity	D	Thoracic cavity

Solution: (b) The lymph capillaries begin blindly among the cells of the tissues.

MCQ 11.4.16 **Backflow of lymph is prevented by : (PMC MDCAT 2022)**

A	Breathing movement	B	Valves
C	Lymph nodes	D	Thoracic lymphatic duct

Solution: (b) Valves in the lymph vessels let the lymph pass one way only.

MCQ 11.4.17 **Which of the following vessels have larger intercellular spaces in their walls? (PMC MDCAT 2022)**

A	Lymph vessels	B	Blood capillaries
C	Arterioles	D	Venules

Solution: (a) The wide gaps between the cells of a lymph capillary let proteins and cell debris in.

MCQ 11.4.18 **lymph vessels deposit the lymph into: (PMC MDCAT 2022)**

A	Blood capillaries	B	Veins
C	Arterioles	D	Lymph nodes

Solution: (b) The lymph is returned to the blood through the great veins at the root of the neck.

Topic 11.2 Cardiac Cycle and Phases of the Heartbeat

Past MDCAT Questions

MCQ 11.2.1 **Which phase of the cardiac cycle is characterized by the opening of semilunar valves? (KMU MDCAT 2025)**

A	Atrial systole	B	Atrial diastole
C	Ventricular systole	D	Ventricular diastole

Solution: (c) The semilunar valves open when the ventricles contract and drive blood into the arteries.

MCQ 11.2.2 **Which part of the heart's conducting system delays the impulse from atria to the ventricles? (KMU MDCAT 2025)**

A	Sino-atrial node	B	Atrio-ventricular node
C	Purkinje fibers	D	Atrio-ventricular valves

Solution: (b) The atrioventricular node holds the impulse back long enough for the atria to empty first.

MCQ 11.2.3 **The heartbeat sound "LUB" is produced on closure of (KMU MDCAT 2025)**

A	Aortic valve	B	Atro-ventricular valves
C	Pulmonary valves	D	Semilunar valves

Solution: (b) The first sound is the shutting of the atrioventricular valves at the start of ventricular systole.

MCQ 11.2.4 **Which of the following event prevent backflow of blood from ventricles to atria during ventricular systole? (SIBA MDCAT 2025)**

A	Contraction of the atrial wall musles	**B**	Closure of tricuspid and bicuspid valves
C	Opening of semilunar valve	**D**	Opening of tricuspid and bicuspid valves

Solution: (b) The rising ventricular pressure snaps the tricuspid and bicuspid valves shut.

MCQ 11.2.5 **During diastole, the heart chambers: (SIBA MDCAT 2025)**

A	Relax and fill with blood	**B**	Contract strongly
C	Eject blood into arteries	**D**	Remain closed

Solution: (a) Diastole is the relaxation during which the chambers fill.

MCQ 11.2.6 **Atrioventricular valve closed during which phase of cardiac cycle: (SIBA MDCAT 2025)**

A	Ventricular systole	**B**	Ventricular diastole
C	Atrial systole	**D**	Atrial diastole

Solution: (a) They shut as the ventricles begin to contract, which is what makes the first heart sound.

MCQ 11.2.7 **During ventricular systole, which pressure changes occur? (SZABMU MDCAT 2025)**

A	Ventricular pressure rises above atrial and arterial pressures	**B**	Atrial pressure rises above Ventricular pressure
C	Ventricular pressure falls below arterial pressures	**D**	Ventricular pressure falls below Atrial pressure

Solution: (a) The contracting ventricle raises its pressure above both the atrium behind and the artery ahead.

MCQ 11.2.8 **Select the duration of cardiac cycle: (SZABMU MDCAT 2023)**

A	0.6 sec	**B**	0.4 sec
C	0.7sec	**D**	0.8 sec

Solution: (d) A cardiac cycle at seventy-five beats a minute lasts $0.8\,\mathrm{s}$.

MCQ 11.2.9 **Heartbeat is normally regulated by: (NUMS MDCAT 2022)**

A	Purkinje fibers	**B**	AV bundle
C	Sinoatrial node	**D**	Bundle of His

Solution: (c) The sinoatrial node is the pacemaker that sets the rhythm.

MCQ 11.2.10 **The number of stages involved in a heart beat is: (PMC Practice 2021)**

A	2	**B**	3
C	4	**D**	5

Solution: (b) A heartbeat runs atrial systole, ventricular systole and then diastole.

MCQ 11.2.11 **Which statement is correct about atrial systole? (UHS MDCAT 2018)**

A	Atria relax and ventricles contract	**B**	Atria contract and ventricle also contract
C	Ventricles remain relaxed while atria contracts	**D**	Atria and ventricles are relaxed

Solution: (c) In atrial systole the atria contract while the ventricles are still relaxed and filling.

MCQ 11.2.12 **Which one of the following act as a PACEMAKER in heart: (UHS MDCAT 2018)**

A	Bundle of His	**B**	Atrioventricular node
C	Atrioventricular bundles of fibers	**D**	Sinoatrial node

Solution: (d) The sinoatrial node sets the rhythm of the heart.

MCQ 11.2.13 **A single cardiac cycle lasts about: (UHS MDCAT 2017)**

A	0.008 sec	**B**	0.8 sec
C	8 sec	**D**	0.088 sec

Solution: (b) At seventy-five beats a minute a cycle lasts $0.8\,\mathrm{s}$.

MCQ 11.2.14 **One complete heart beat consists of one systole and one diastole and lasts for about: (UHS MDCAT 2015)**

A	0.8 sec	**B**	0.2 sec
C	0.4 sec	**D**	0.5 sec

Solution: (a) At seventy-five beats a minute one cycle lasts $0.8\,\mathrm{s}$.

MCQ 11.2.15 **The heart beat cycle starts when electric impulses are generated from; (UHS MDCAT 2015)**

A	AV Node	**B**	SV Node
C	SA Node	**D**	PQ Node

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Solution: (c) The sinoatrial node is the pacemaker.

Topic 12.1 Specific Defence Mechanism

Past MDCAT Questions

MCQ 12.1.1 ______ proteins are produced by white blood cells in response to ______ and provide immunity. (MDCAT 2022)

A	antibiotics, antigens	B	antibodies, red blood cells
C	globulins, histamine	D	antibodies, antigens

Solution: (d) Lymphocytes make antibodies against a specific antigen, which is what specific immunity rests on.

MCQ 12.1.2 Which statement best explains the difference between humoral and cell mediated Immune response? (UHS MDCAT 2025)

A	Humoral immunity involves B-Lymphocytes and cell mediated immunity involves T-Lymphocytes	B	Humoral immunity destroys viruses and cell mediated immunity destroys bacteria
C	Humoral immunity is specific and cell mediated immunity is nonspecific	D	Humoral immunity uses antibodies and cell mediated immunity does not involve immune cells

Solution: (a) Humoral immunity is the work of the B lymphocytes and their antibodies; cell mediated immunity is the work of the T lymphocytes.

MCQ 12.1.3 The primary role of helper T cells in immune response is: (KMU MDCAT 2025)

A	Secreting perforins to destroy target cells	B	Assisting B-cells and other T-cells in their function
C	Inhibiting over activity of the immune system	D	Engulfing and digesting pathogens

Solution: (b) Helper T cells recognize the antigen and then switch on the B cells and the killer T cells.

MCQ 12.1.4 Identify the primary component of innate immune defense. (KMU MDCAT 2025)

A	Complement system and interferons	B	Physical component of skin defense
C	Specific recognition and memory of pathogens	D	General inflammation and the site of infection

Solution: (b) Innate defence is non-specific, and the skin is its first physical barrier.

MCQ 12.1.5 A woman cuts her finger while working in kitchen. Which chemical substance will cause inflammation around wound? (NUMS MDCAT 2025)

A	Interleukin - I	B	Histamine
C	Interleukin - II	D	Heparin

Solution: (b) Damaged mast cells release histamine, which widens the vessels and brings the redness and swelling.

MCQ 12.1.6 When antibodies produced by B-cells, kill the antigens then it is called: (SIBA MDCAT 2025)

A	Cell mediated response	B	Passive response
C	Humoral response	D	Cells collaborated response

Solution: (c) Immunity carried by antibodies in the body fluids is the humoral response.

MCQ 12.1.7 B-Lymphocytes are formed and matured in: (SIBA MDCAT 2025)

A	Liver	B	Spleen
C	Bone marrow	D	Thymus

Solution: (c) B lymphocytes are made in the bone marrow and mature there; T cells finish in the thymus.

MCQ 12.1.8 A person has swollen lymph nodes after throat infection. What does this indicate? (SIBA MDCAT 2025)

A	Failure of circulatory system	B	Extra glucose storage
C	Active immune response	D	Blockage of digestive track

Solution: (c) Lymphocytes multiply in the node draining an infection, and the node swells.

MCQ 12.1.9 Which cell type is essential for stimulating cell division of both B-cells and T-cells? (SZABMU MDCAT 2025)

A	Plasma cells	B	Memory cells
C	Helper T-cells	D	Neutrophils

Solution: (c) Helper T cells release the interleukins that set both B and T cells dividing.

MCQ 12.1.10 After Liver transplant, doctors suppress the T-lymphocyte activity in patient. Why? (SZABMU MDCAT 2025)

A	To increase the rate of antibody production	B	To prevent infections
C	To avoid graft rejection immune system	D	To produce memory cells faster

Solution: (c) T cells would attack the graft as foreign, so their activity is damped down.

MCQ 12.1.11 In an inflammatory response, bradykinin causes? (KMU MDCAT 2024)

A	Activation of natural killer cells	B	Blockage in blood vessels
C	Constriction of blood vessels	D	Leakage of fluid from blood vessels

Solution: (d) Bradykinin makes the capillaries leaky, so fluid escapes into the tissue and it swells.

MCQ 12.1.12 Which of the following is an example of passive immunity? (KMU MDCAT 2024)

A	Antibodies from mother's milk	B	Previous chickenpox infection
C	Inactivated polio vaccine	D	Live polio vaccine

Solution: (a) Antibodies received ready made, as in breast milk, give passive immunity.

MCQ 12.1.13 What directly triggers the activation of natural killer cells? (KMU MDCAT 2024)

A	Free radicals	B	Hydrogen peroxide
C	Interferons	D	Oxygen

Solution: (c) Interferons released by infected cells rouse the natural killer cells.

MCQ 12.1.14 During Covid-19 epidemic, plasma of recovered patients was injected in covid patients. Which component of plasma was responsible for this? (NUMS MDCAT 2024)

A	Plasminogen	B	Interferons
C	Antibodies	D	Interleukin-I

Solution: (c) The plasma of a recovered patient carries ready made antibodies against the virus.

MCQ 12.1.15 Choose the one which is an example of artificial active immunity: (NUMS MDCAT 2024)

A	Fetus receiving antibodies of mother through placenta	B	Mother receiving antibodies
C	Baby receiving MMR shots	D	Prevention of disease due to previous infection

Solution: (c) A vaccine makes the body raise its own antibodies, so the immunity is active and artificially induced.

MCQ 12.1.16 **Which of the following type of T cells are required for the activation of B cells? (NUMS MDCAT 2024)**

A	Helper T cells	**B**	Cytotoxic T cells
C	Suppressor T cells	**D**	Memory T cells

Solution: (a) A helper T cell must recognize the antigen before the B cell will divide and make antibody.

MCQ 12.1.17 **---------- proteins are produced by WBCs in response to -------- and provide immunity? (UHS MDCAT 2023)**

A	Antibiotics, antigen	**B**	Antibodies, RBC
C	Globulin, histamine	**D**	Antibodies, antigen

Solution: (d) Lymphocytes make antibodies against a specific antigen.

MCQ 12.1.18 **Vaccination is an example of: (SZABMU MDCAT 2023)**

A	Natural passive immunity	**B**	Natural active immunity
C	Acquired/Artificial active immunity	**D**	Acquired/Artificial passive immunity

Solution: (c) A vaccine makes the body raise its own antibodies, so the immunity is active and artificially given.

MCQ 12.1.19 **Which of the following helps in developing immunity against germs? (SZABMU MDCAT 2023)**

A	Radiotherapy	**B**	Chemotherapy
C	Vaccines	**D**	Antibiotics

Solution: (c) A vaccine primes the body to make its own antibodies before the germ arrives.

MCQ 12.1.20 **Which may NOT be a mode of action of an antibody? (NUMS MDCAT 2023)**

A	Neutralizing an antigen	**B**	Precipitating an antigen
C	Secretion of cytokines	**D**	Enhancing phagocytosis

Solution: (c) Antibodies neutralize, precipitate and mark antigens for phagocytes; cytokines come from the cells themselves.

MCQ 12.1.21 **The cells which play very important role in developing immunity are: (NUMS MDCAT 2023)**

A	Monocytes	**B**	Neutrophils
C	Lymphocytes	**D**	Thrombocytes

Solution: (c) The lymphocytes, B cells and T cells, carry the specific immune response.

MCQ 12.1.22 **The molecules used to control virus during infection of animal cells are: (UHS MDCAT 2023)**

A	Interferon	**B**	Histone
C	Antigen	**D**	Serum

Solution: (a) An infected cell releases interferon, which warns its neighbours to resist the virus.

MCQ 12.1.23 **Human immunodeficiency virus attack which of the following cells for its multiplication? (PMC MDCAT 2022)**

A	Neutrophils	**B**	Macrophages
C	Cytotoxic T cells	**D**	Helper T cells

Solution: (d) HIV enters the helper T cell through its CD4 receptor and destroys it.

MCQ 12.1.24 **Which of the following provides long lasting protection against any infection? (PMC MDCAT 2022)**

A	Active immunity	**B**	Passive immunity
C	Skin	**D**	Phagocytes

Solution: (a) Active immunity leaves memory cells, so the protection lasts for years.

MCQ 12.1.25 **The method which helps in developing immunity against bacteria is: (NUMS MDCAT 2022)**

A	Radiotherapy	**B**	Chemotherapy
C	Vaccination	**D**	Antibiotics

Solution: (c) A vaccine primes the body to make its own antibodies.

MCQ 12.1.26 **Which is not a mode of action of an antibody? (NUMS MDCAT 2022)**

A	Precipitating an antigen	**B**	Neutralizing an antigen
C	Secreting cytokines	**D**	Enhancing phagocytosis

Solution: (c) Antibodies neutralize, precipitate and mark antigens for phagocytes; cytokines come from the cells themselves.

MCQ 12.1.27 **Thymus is found in the human body in _____. (PMC Practice 2021)**

A	The medulla oblongata	**B**	The mediastinum of the upper thorax
C	Both Options A and B are correct	**D**	None of these options is correct

Solution: (b) The thymus lies in the mediastinum behind the sternum.

MCQ 12.1.28 **The cells which play a very important role in developing immunity are: (PMC MDCAT 2020)**

A	Monocytes	**B**	Neutrophils
C	Lymphocytes	**D**	Thrombocytes

Solution: (c) The lymphocytes, B cells and T cells, carry the specific immune response.

MCQ 12.1.29 **Antibodies are manufactured in: (PMC MDCAT 2020)**

A	T Lymphocytes	**B**	Red Blood Cells
C	Platelets	**D**	B Lymphocytes

Solution: (d) B lymphocytes turn into plasma cells and those make the antibody.

MCQ 12.1.30 **Autoimmune diseases act as the principle of: (PMC MDCAT 2020)**

A	Self against antigens	**B**	Antigen against self
C	Self against self	**D**	Antigen self destroyed

Solution: (c) In an autoimmune disease the immune system fails to tell self from foreign and attacks the body.

MCQ 12.1.31 **Now-a-days every newborn gets regular shots of vaccine for polio. It contains _____ for polio to make a child immune against this disease. (UHS MDCAT 2019)**

A	Antibiotics	**B**	Antibodies
C	Antigens	**D**	Antisera

Solution: (c) A vaccine carries the antigen, and the body makes its own antibodies against it.

MCQ 12.1.32 **A person got an infection, he became ill but then he survived. What do you think which of immunity he would have developed? (UHS MDCAT 2019)**

A	Active immunity	**B**	Artificially induced active immunity
C	Passive immunity	**D**	Naturally induced active immunity

Solution: (d) He made his own antibodies in answer to a natural infection, so the immunity is naturally acquired and active.

MCQ 12.1.33 **Cell-mediated immune response is given by: (UHS MDCAT 2018)**

A	T-lymphocytes	**B**	B lymphocytes
C	Neutrophils	**D**	Macrophages

Solution: (a) Cell mediated immunity is carried by the T lymphocytes.

MCQ 12.1.34 **In immunoglobulins / antibodies, Two light chains and two heavy chains are linked to each other by: (UHS MDCAT 2018)**

A	Covalent bonds	B	Hydrogen bonds
C	Ionic bonds	D	Disulphide bonds

Solution: (d) The four chains of an antibody are held together by disulphide bridges.

MCQ 12.1.35 **Antivenom given after a snake bite venom is an example of: (UHS MDCAT 2018)**

A	Natural passive immunity	B	Artificial active immunity
C	Natural active immunity	D	Artificial passive immunity

Solution: (d) Antibodies received ready made give passive immunity, and here they are given artificially.

MCQ 12.1.36 **The induction of immunity by artificially introducing antigens refers to: (UHS MDCAT 2017)**

A	Passive immunity	B	Active immunity
C	Artificial active immunity	D	Passive active immunity

Solution: (c) A vaccine makes the body raise its own antibodies, so the immunity is active and artificially given.

MCQ 12.1.37 **In case of snake bite venom, passive immunity is produced by antitoxins, so the serum is called as: (UHS MDCAT 2017)**

A	Antivenom serum	B	Antiserum
C	Passive immunity serum	D	Anti snake serum

Solution: (a) Antivenom serum carries ready made antibodies against the venom.

MCQ 12.1.38 **An antibody molecule has total number of how many polypeptide chains: (UHS MDCAT 2017)**

A	1	B	2
C	3	D	4

Solution: (d) An antibody has two light chains and two heavy chains.

MCQ 12.1.39 **To combat the active infections of tetanus, rabies and snakes the _____ method of immunization is used: (UHS MDCAT 2016)**

A	Active	B	Humoral
C	Active Artificial	D	Passive

Solution: (d) Ready made antitoxin is injected, so the immunity is passive and acts at once.

MCQ 12.1.40 **The type of immunity in which antibodies are passed from one individual to another is called: (UHS MDCAT 2016)**

A	Passive Immunity	B	Artificial Active Immunity
C	Natural Active Immunity	D	Humoral Immunity

Solution: (a) Antibodies received ready made give passive immunity.

MCQ 12.1.41 **Variable amino acid sequences in antibody molecule are found in _____. (UHS MDCAT 2016)**

A	Both light chains only	B	Both heavy chains only
C	One heavy and one light chain	D	Both heavy and light chains

Solution: (d) Both the heavy and the light chains have a variable region, and together they make the binding site.

MCQ 12.1.42 **B-cells release antibodies in blood plasma, tissue fluid and lymph. This kind of immune response is called: (UHS MDCAT 2016)**

A	Cell Mediated Response	B	Humoral Response
C	Active Response	D	Compound Response

Solution: (b) Immunity carried by antibodies in the body fluids is the humoral response.

MCQ 12.1.43 **In antibody molecule, two heavy and two light chains are bonded by: (UHS MDCAT 2016)**

A	Disulphide Bond	B	Monosulphide Bond
C	Hydrogen Bond	D	Ionic Bond

Solution: (a) The four chains of an antibody are held by disulphide bridges.

MCQ 12.1.44 **In response, β-cells produce plasma cells that synthesize antibodies and release in blood plasma and tissue fluid. (UHS MDCAT 2015)**

A	Cell-Mediated	B	Hormonal
C	Humoral	D	Phototactic

Solution: (c) Antibodies released into the body fluids carry the humoral response.

MCQ 12.1.45 **B-lymphocytes are named due to their relationship with: (UHS MDCAT 2015)**

A	Blood	B	Bursa of Fabricius
C	Bone Marrow	D	Bile Duct

Solution: (b) B cells were first found maturing in the bursa of Fabricius of the bird.

MCQ 12.1.46 **Response of body against the transplanted organ is: (UHS MDCAT 2015)**

A	Homeostatic Response	B	Behavioral Response
C	Primary Response	D	Cell-mediated Response

Solution: (d) The graft is attacked by T lymphocytes, so the rejection is cell mediated.

Unit 13 Respiration

Topic 13.1 Human Respiratory System

Past MDCAT Questions

MCQ 13.1.1 **Respiratory surfaces exhibit which characteristic? (MDCAT 2022)**

A	it must be permeable	B	it must be thick for low diffusion
C	it should be non-vascularized	D	it should have a low surface area

Solution: (a) Gases must pass through it, so it is thin, moist, permeable and richly supplied with blood.

MCQ 13.1.2 **Smooth muscles are found in all of the following except the: (MDCAT 2023)**

A	trachea	B	bronchi
C	bronchioles	D	alveoli

Solution: (d) The alveolar wall is one cell thick, for gas exchange, and carries no muscle.

MCQ 13.1.3 **The method of bringing oxygenated air into contact with a gas exchange surface is called: (MDCAT 2023)**

A	photorespiration	B	ventilation
C	gas transport	D	respiration

Solution: (b) Ventilation is the movement of the medium over the surface; respiration is what the cells then do with the oxygen.

MCQ 13.1.4 About 70% of the carbon dioxide is carried in the blood as: (MDCAT 2024)

A	carbonate	**B**	bicarbonate
C	carbaminohaemoglobin	**D**	dissolved gas in plasma

Solution: (b) Most of it travels as hydrogen carbonate ions in the plasma.

MCQ 13.1.5 The range of normal total lung capacity in humans is: (MDCAT 2024)

A	5-6 litres	**B**	8-9 litres
C	10-11 litres	**D**	12-13 litres

Solution: (a) Total lung capacity is about 5 to 6 litres in an adult.

MCQ 13.1.6 The primary function of larynx is: (UHS MDCAT 2025)

A	Humidifying air	**B**	Filtering dust
C	Gaseous exchange	**D**	Voice production

Solution: (d) The larynx carries the vocal cords, so it is the voice box.

MCQ 13.1.7 Which of the following best describes Inspiratory Reserve Volume (IRV)? (KMU MDCAT 2025)

A	The volume of air forcibly exhaled after normal tidal volume	**B**	The volume of air remaining in the lungs after tidal
C	The volume of air exchanged during normal breathing	**D**	The volume of air forcibly inhaled after normal tidal volume

Solution: (d) The inspiratory reserve is the extra air that can still be drawn in after a normal breath.

MCQ 13.1.8 During gaseous exchange in human respiration, enzyme carbonic anhydrase is directly involved in the: (KMU MDCAT 2025)

A	Release of oxygen from hemoglobin	**B**	Combination of water with carbon dioxide
C	Breakdown of oxyhemoglobin	**D**	Binding of oxygen to myoglobin

Solution: (b) Carbonic anhydrase of the red cell joins carbon dioxide to water to give carbonic acid.

MCQ 13.1.9 What happens when the external intercostal muscles contract during inhalation in humans? (KMU MDCAT 2025)

A	The rib cage compresses	**B**	The ribs move outward
C	The sternum moves inwards	**D**	The diaphragm muscles relax

Solution: (b) The external intercostals swing the ribs up and out, enlarging the chest.

MCQ 13.1.10 The primary effect of smoking on the respiratory system: (KMU MDCAT 2025)

A	Increased lung function due to presence of nicotine	**B**	Reduced risk of lung cancer due to tolerance
C	Damage to alveoli reducing gaseous exchange	**D**	Improves oxygenation of the blood by activating hemoglobin

Solution: (c) Smoke destroys the alveolar walls, so the surface left for gas exchange shrinks.

MCQ 13.1.11 Which protein is present in the walls of alveoli? (NUMS MDCAT 2025)

A	Collagen	**B**	Hemoglobin
C	Myoglobin	**D**	Myosin

Solution: (a) The alveolar wall is a thin sheet of collagen and elastin fibres under the squamous epithelium.

MCQ 13.1.12 The main function of the pharynx in respiratory system: (SIBA MDCAT 2025)

A	Serves as passage for both food and air	**B**	Produces mucus
C	Produces voice	**D**	Filters air

Solution: (a) The pharynx is the shared passage behind the mouth through which both food and air travel.

MCQ 13.1.13 About 70% of the carbon dioxide is carried in blood as: (UHS MDCAT 2024)

A	Carbonate	**B**	Bicarbonate
C	Tricarbonate	**D**	Carbonic anhydrase

Solution: (b) Most carbon dioxide is carried as hydrogen carbonate ions in the plasma.

MCQ 13.1.14 Range of normal total lung capacity in humans is (UHS MDCAT 2024)

A	5-6 liter	**B**	8-9 liter
C	10-11 liter	**D**	12-13 liter

Solution: (a) Total lung capacity in an adult is about five to six litres.

MCQ 13.1.15 Most CO2 in blood is transported as bicarbonate ions. Choose the event NOT taking place during gaseous exchange at tissue level: (NUMS MDCAT 2024)

A	Formation of HHb	**B**	Formation of sodium bicarbonate
C	Formation of oxyhemoglobin	**D**	Chloride shift

Solution: (c) At the tissues oxyhaemoglobin is giving up its oxygen, not being formed.

MCQ 13.1.16 The respiratory surfaces exhibit following characteristic? (UHS MDCAT 2023)

A	It must be permeable	**B**	It must be thick for low diffusion
C	It should be non-vascularized	**D**	It should have low ventilation mechanism

Solution: (a) Gases must pass through it, so it is thin, moist and permeable.

MCQ 13.1.17 The area between the two lungs is called: (SZABMU MDCAT 2023)

A	Periosteum	**B**	Infundibulum
C	Mediastinum	**D**	Hilum

Solution: (c) The space between the lungs, holding the heart and great vessels, is the mediastinum.

MCQ 13.1.18 The percentage of CO2 carried as carboxyhemoglobin is? (PMC MDCAT 2022)

A	10	**B**	15
C	23	**D**	28

Solution: (c) About 23% of the carbon dioxide is carried bound to haemoglobin as carbamino-haemoglobin.

MCQ 13.1.19 Which one is a contagious disease (PMC MDCAT 2022)

A	lung cancer	**B**	asthma
C	pulmonary tuberculosis	**D**	emphysema

Solution: (c) Tuberculosis is spread from person to person in droplets; the other three are not caught.

MCQ 13.1.20 Lungs are spongy due to the presence of million of? (PMC MDCAT 2022)

A	Alveoli	**B**	Parabronchi
C	Air sacs	**D**	Bronchioles

Solution: (a) The lungs are filled with millions of alveoli, which is what makes them spongy.

MCQ 13.1.21 **The following part is common in both the digestive system and respiratory systems of human beings (NUMS MDCAT 2022)**

A	Trachea	B	Pharynx
C	Larynx	D	Oesophagus

Solution: (b) The pharynx is the shared passage for food and for air.

MCQ 13.1.22 **Which of the following parts of the respiratory system has no cartilage? (NUMS MDCAT 2022)**

A	Larynx	B	Trachea
C	Bronchioles	D	Bronchi

Solution: (c) The bronchioles have no cartilage rings, only smooth muscle in their walls.

MCQ 13.1.23 **The infection of lungs is called: (PMC Practice 2021)**

A	Emphysema	B	Asthma
C	Pneumonia	D	Bronchitis

Solution: (c) Pneumonia is inflammation of the lungs, usually from infection.

MCQ 13.1.24 **Breathing is considered as a: (PMC Practice 2021)**

A	Chemical process	B	Biochemical process
C	Mechanical process	D	Both A and B

Solution: (c) Breathing is the muscular movement that ventilates the lungs, a mechanical process.

MCQ 13.1.25 **The voice box leads to the trachea which is also called (PMC Practice 2021)**

A	Bronchi	B	Bronchioles
C	Windpipe	D	Alveolar duct

Solution: (c) The trachea is commonly called the windpipe.

MCQ 13.1.26 **The structural and functional unit of the lungs is: (PMC Practice 2021)**

A	Alveoli	B	Trachea
C	Bronchiole	D	Bronchus

Solution: (a) The alveolus is where the exchange of gases happens, so it is the functional unit.

MCQ 13.1.27 **During the transport of carbon dioxide, blood does not become acidic due to: (PMC Practice 2021)**

A	Blood buffer	B	Neutralization of H_2CO_3 by Na_2CO_3
C	Absorption by leukocytes	D	Non-accumulation

Solution: (a) The hydrogen carbonate and protein buffers of the blood take up the protons as they are formed.

MCQ 13.1.28 **A disease caused by gradual breakdown of the thin walls of alveoli is; (UHS MDCAT 2019)**

A	Tuberculosis	B	Asthma
C	Emphysema	D	Bronchitis

Solution: (c) Emphysema is the breakdown of the alveolar walls, which cuts the surface for gas exchange.

MCQ 13.1.29 **During inspiration, the space inside the chest cavity is increased due to: (UHS MDCAT 2019)**

A	The relaxation of the muscles of the diaphragm	B	Relaxation of the external intercostal muscles
C	Increased pressure	D	The contraction of the muscles of the diaphragm

Solution: (d) The diaphragm contracts and flattens, which deepens the chest cavity.

MCQ 13.1.30 **Which of the following statements is correct about the respiratory pigments? (UHS MDCAT 2018)**

A	Myoglobin and Haemoglobin has higher affinity for nitrogen	B	Cyanide and Haemoglobin has a low affinity for oxygen
C	Myoglobin has more affinity for oxygen as compared to haemoglobin	D	Albumin, Globulin and Globin proteins are present in respiratory pigments

Solution: (c) Myoglobin holds oxygen more tightly than haemoglobin, so it takes it up in the muscle.

MCQ 13.1.31 **During breathing air from Pharynx enters to: (UHS MDCAT 2018)**

A	Trachea	B	Bronchioles
C	Alveoli	D	Bronchi

Solution: (a) Air passes from the pharynx through the larynx into the trachea.

MCQ 13.1.32 **The low levels of Surfactant produced by Alveolar epithelium causes: (UHS MDCAT 2018)**

A	Respiratory distress syndrome	B	Emphysema
C	Bronchitis	D	Asthma

Solution: (a) Without surfactant the alveoli collapse at each breath out, which is respiratory distress syndrome.

MCQ 13.1.33 **Gradual breakdown of the alveolar wall leads to which type of disease in a smoker? (UHS MDCAT 2018)**

A	Coronary heart disease	B	Bronchitis
C	Emphysema	D	Asthma

Solution: (c) Emphysema is the destruction of the alveolar walls, which cuts the surface for gas exchange.

MCQ 13.1.34 **The site of gaseous exchange in humans is: (UHS MDCAT 2017)**

A	Bronchioles	B	Trachea
C	Alveolar Sacs	D	Alveoli

Solution: (d) The alveoli are the thin walled sacs across which the gases pass.

MCQ 13.1.35 **The disease in which there is a breakdown of thin walls of alveoli: (UHS MDCAT 2017)**

A	Asthma	B	Emphysema
C	Tuberculosis	D	Cancer

Solution: (b) Emphysema is the breakdown of the alveolar walls.

MCQ 13.1.36 **Gaseous exchange in animals takes place through: (UHS MDCAT 2017)**

A	Active Transport	B	Osmosis
C	Diffusion	D	Active Transport and Diffusion

Solution: (c) Gases cross the respiratory surface by simple diffusion down their gradients.

MCQ 13.1.37 **The amount of CO_2 exhaled from lungs during expiration is: (UHS MDCAT 2017)**

A	4%	B	0.04%
C	0.4%	D	0.0045%

Solution: (a) Exhaled air carries about four per cent carbon dioxide against 0.04% in the air breathed in.

MCQ 13.1.38 **Breathing consists of: (UHS MDCAT 2016)**

A	Four phases	B	Three phases
C	One phase	D	Two phases

Solution: (d) Breathing has two phases, inspiration and expiration.

MCQ 13.1.39 **Carboxyhaemoglobin (10-20%) is formed when CO_2 combines with: (UHS MDCAT 2016)**

A	Amino group of haemoglobin	B	Iron part of haemoglobin
C	Haem portion of haemoglobin	D	Plasma proteins

Solution: (a) Carbon dioxide combines with the terminal amino groups of the globin chains.

Topic 14.1 Human Digestive System

Past MDCAT Questions

MCQ 14.1.1 Digested food from the intestine is carried to the liver by the: (MDCAT 2022)

A	hepatic artery	B	hepatic vein
C	hepatic portal vein	D	hepatic portal artery

Solution: (c) The hepatic portal vein takes the absorbed food straight from the gut to the liver.

MCQ 14.1.2 Which is an enzyme activator secreted by the Intestinal glands: (UHS MDCAT 2025)

A	Amylase	B	Pepsinogens
C	Enterokinase	D	Lipase

Solution: (c) Enterokinase of the intestinal glands turns trypsinogen into active trypsin.

MCQ 14.1.3 An enzyme used to decompose the lipids into fatty acids in our alimentary canal is (UHS MDCAT 2025)

A	Amylase	B	Protease
C	Lipase	D	Urease

Solution: (c) Lipase splits triglycerides into fatty acids and glycerol.

MCQ 14.1.4 Intrinsic factor secreted by parietal cells is essential for: (KMU MDCAT 2025)

A	Activation of pepsinogen to pepsin	B	Absorption of vitamin B12 in the intestine
C	Emulsification of dietary fats	D	Neutralization of stomach acid in the duodenum

Solution: (b) Intrinsic factor from the parietal cells binds vitamin B12 so the ileum can absorb it.

MCQ 14.1.5 The δ (delta) cells in the islets of Langerhans secrete: (KMU MDCAT 2025)

A	Insulin	B	Somatostatin
C	Glucagon	D	Pancreatic polypeptide

Solution: (b) The delta cells make somatostatin, which damps down both insulin and glucagon.

MCQ 14.1.6 Identify the main function of duodenum: (KMU MDCAT 2025)

A	Bile storage	B	Absorption of water
C	Digestion of food	D	Waste storage

Solution: (c) Bile and pancreatic juice pour into the duodenum, so most digestion is completed there.

MCQ 14.1.7 Which stage of the swallowing process prevents food or liquid from being aspirated to the lungs? (KMU MDCAT 2025)

A	Oral	B	Pharyngeal
C	Oesophageal	D	Peristalsis

Solution: (b) In the pharyngeal stage the epiglottis closes the larynx and breathing stops for a moment.

MCQ 14.1.8 A patient with pancreatic insufficiency shows reduced activity of an enzyme that hydrolyzes the first peptide bond at the carboxyl end of proteins and peptides. Which enzyme is deficient? (KMU MDCAT 2025)

A	Elastase	B	Pepsin
C	Carboxypeptidase	D	Collagenase

Solution: (c) Carboxypeptidase of the pancreas removes amino acids from the carboxyl end of a peptide.

MCQ 14.1.9 Which of the following acts as an enzyme activator in human digestive system? (NUMS MDCAT 2025)

A	Erepsin	B	Enterokinase
C	Pepsinogen	D	Trypsinogen

Solution: (b) Enterokinase of the intestinal juice activates trypsinogen, which then activates the rest.

MCQ 14.1.10 Which part of small intestine is responsible for nutrient absorption? (SIBA MDCAT 2025)

A	Duodenum	B	Jejunum
C	Ileum	D	Rectum

Solution: (b) Most of the absorption happens in the jejunum, over its villi.

MCQ 14.1.11 The appendix is attached to which part of large intestine? (SIBA MDCAT 2025)

A	Rectum	B	Caecum
C	Colon	D	Ileum

Solution: (b) The appendix is a blind tube hanging from the caecum.

MCQ 14.1.12 Which specialized cells of liver perform phagocyte function? (SIBA MDCAT 2025)

A	Kupffer cells	B	Schwann cells
C	Parietal cells	D	Chief cells

Solution: (a) The Kupffer cells lining the liver sinusoids engulf bacteria and worn out red cells.

MCQ 14.1.13 Digestion of protein started when food enters in: (SIBA MDCAT 2025)

A	Mouth	B	Stomach
C	Intestine	D	Epiglottis

Solution: (b) Pepsin of the gastric juice makes the first cut in a protein.

MCQ 14.1.14 The digestive secretions from different parts of GIT have the ability to kill microbe present in the food. Which of the following best describes this role? (SZABMU MDCAT 2025)

A	Antiseptics	B	Disinfectants
C	Chemotherapeutics	D	Immunosuppressant

Solution: (a) They kill the microbes on living tissue, which is what an antiseptic does.

MCQ 14.1.15 Which enzyme is secreted in the active form? (KMU MDCAT 2024)

A	Amylase	B	Lipase
C	Peptidase	D	Protease

Solution: (a) Salivary amylase is poured out ready to work; the protein digesting enzymes are secreted as inactive precursors.

MCQ 14.1.16 Which hormone stimulates the secretion of gastric juice? (KMU MDCAT 2024)

A	Cholecystokinin	B	Gastrin
C	Insulin	D	Secretin

Solution: (b) Gastrin from the stomach lining calls out the gastric juice.

MCQ 14.1.17 Which is true about the cells found in gastric glands lining the stomach wall? (KMU MDCAT 2024)

A	Chief cells secrete gastrin	B	Hormone cells secrete intrinsic factor
C	Mucus cells secrete mucin	D	Parietal cells secrete pepsinogen

Solution: (c) The mucus cells make mucin, which protects the lining from the acid.

MCQ 14.1.18 **Activation of all of the following enzymes need a regulatory molecule except: (NUMS MDCAT 2024)**

A	Pepsinogen	**B**	Trypsinogen
C	Erepsin	**D**	Chymotrypsinogen

Solution: (c) Erepsin is secreted ready to work; the other three are zymogens needing activation.

MCQ 14.1.19 **A person with a removed gall bladder experiences difficulty in fat digestion due to: (NUMS MDCAT 2024)**

A	Absence of Bile	**B**	Uncontrolled release of Bile
C	Reduced alkalinity of bile	**D**	Absence of bile pigments

Solution: (b) Without the gall bladder the bile trickles in continuously instead of being stored and released with a meal.

MCQ 14.1.20 **Digested food from intestine is carried to the liver by? (UHS MDCAT 2023)**

A	Hepatic artery	**B**	Hepatic vein
C	Hepatic portal vein	**D**	Hepatic portal artery

Solution: (c) The hepatic portal vein carries the absorbed food straight from the gut to the liver.

MCQ 14.1.21 **When food reaches stomach, the action of which of the following come to an end due to acidic PH? (UHS MDCAT 2023)**

A	Lipases	**B**	Amylase
C	Maltase	**D**	Hydrolases

Solution: (b) Salivary amylase works at a slightly alkaline pH and is destroyed by the acid of the stomach.

MCQ 14.1.22 **What is the contribution of hormone cholecystokinin? (SZABMU MDCAT 2023)**

A	Facilitates bile release from gall bladder	**B**	Mucus release from stomach
C	Production of bile from liver	**D**	Gastric juice release from stomach

Solution: (a) Cholecystokinin from the duodenum makes the gall bladder contract and empty its bile.

MCQ 14.1.23 **Which of the following is not a component of bile? (SZABMU MDCAT 2023)**

A	Digestive enzymes	**B**	Salts
C	Mucus	**D**	Lecithin

Solution: (a) Bile emulsifies fat but carries no enzyme of its own.

MCQ 14.1.24 **The first chemical digestion of proteins takes place in the: (SZABMU MDCAT 2023)**

A	Mouth	**B**	Esophagus
C	Stomach	**D**	Intestine

Solution: (c) Pepsin of the gastric juice makes the first cut in a protein.

MCQ 14.1.25 **Select the hormone which increases the activity of parietal and chief cells: (SZABMU MDCAT 2023)**

A	Cholecystokinin	**B**	Secretin
C	Gastrin	**D**	Acetylcholine

Solution: (c) Gastrin drives the parietal cells to make acid and the chief cells to make pepsinogen.

MCQ 14.1.26 **Enzyme trypsinogen is activated by: (SZABMU MDCAT 2023)**

A	HCL	**B**	Pepsin
C	Enterokinase	**D**	Erypsin

Solution: (c) Enterokinase of the intestinal juice converts trypsinogen into trypsin.

MCQ 14.1.27 **Emulsification of large fat globules is facilitated by: (SZABMU MDCAT 2023)**

A	Lipase	**B**	Bile salts
C	Trypsin	**D**	Chymotrypsin

Solution: (b) Bile salts break the large fat globules into a fine emulsion for the lipase to work on.

MCQ 14.1.28 **Pepsinogen is converted into its active form pepsin by: (NUMS MDCAT 2023)**

A	Proteolytic enzyme action	**B**	Dissolving in mucus
C	Hormonal action	**D**	Hydrochloric acid

Solution: (d) The hydrochloric acid of the gastric juice strips a length off pepsinogen and leaves active pepsin.

MCQ 14.1.29 **Intrinsic factor is secreted by: (NUMS MDCAT 2023)**

A	Pancreas	**B**	Liver
C	Stomach	**D**	Duodenum

Solution: (c) The parietal cells of the stomach make intrinsic factor along with the acid.

MCQ 14.1.30 **Digestion of which food component starts from oral cavity? (NUMS MDCAT 2023)**

A	Proteins	**B**	Fats
C	Carbohydrates	**D**	Vitamins

Solution: (c) Salivary amylase begins to break starch down in the mouth.

MCQ 14.1.31 **After the digestion & before absorption the product of the protein is: (UHS MDCAT 2023)**

A	Amino Acid and small polypeptide	**B**	Only Amino Acid
C	Only small polypeptide	**D**	Only ammonia

Solution: (a) Peptidases leave a mixture of amino acids and short peptides for the villi to absorb.

MCQ 14.1.32 **Which enzyme is different from others? (UHS MDCAT 2023)**

A	Pepsin	**B**	Trypsin
C	Chymotrypsin	**D**	Lactase

Solution: (d) Lactase splits a sugar; the other three are protein digesting enzymes.

MCQ 14.1.33 **Hunger contractions are of which type? (PMC MDCAT 2022)**

A	Antiperistalsis	**B**	Peristalsis
C	Voluntary	**D**	Involuntary

Solution: (b) The empty stomach contracts in waves of peristalsis, which is felt as hunger.

MCQ 14.1.34 **The salivary glands are present in: (PMC MDCAT 2022)**

A	Stomach	**B**	Pharynx
C	Buccal cavity	**D**	Pancreas

Solution: (c) The three pairs of salivary glands open into the mouth.

MCQ 14.1.35 **Incomplete or Imperfect digestion Is called: (PMC MDCAT 2022)**

A	anorexia	**B**	botulism
C	bulimia nervosa	**D**	Dyspepsia

Solution: (d) Dyspepsia is indigestion, food imperfectly broken down.

MCQ 14.1.36 **Which of the following enzymes is absent in pancreatic juice? (PMC MDCAT 2022)**

A	amylase	**B**	erepsin
C	lipase	**D**	trypsin

Solution: (b) Erepsin is made by the intestinal glands, not by the pancreas.

MCQ 14.1.37 **Concentration of bile Is the function of which body part? (PMC MDCAT 2022)**

A	Liver	**B**	Gall bladder
C	Pancreas	**D**	Stomach

Solution: (b) The gall bladder stores the bile and concentrates it between meals.

MCQ 14.1.38 **A condition characterized by bouts of over eating fattening food is called: (PMC MDCAT 2022)**

A	anorexia	**B**	botulism
C	bulimia nervosa	**D**	piles

Solution: (c) Bulimia nervosa is bouts of overeating, often followed by purging.

MCQ 14.1.39 **Which cells protect the stomach wall by producing mucus? (PMC MDCAT 2022)**

A	chief cells	**B**	mucus cells
C	zymogen cells	**D**	endocrine cells

Solution: (b) The mucus cells make the mucin that keeps the acid off the stomach lining.

MCQ 14.1.40 **Function of insulin: (PMC MDCAT 2022)**

A	Promoting hydrolysis of glycogen	**B**	Increasing the rate of fat breakdown
C	promoting conversion of glucose into protein	**D**	reduces blood glucose level

Solution: (d) Insulin drives glucose into the cells and stores it as glycogen, so the blood level falls.

MCQ 14.1.41 **Which one is NOT a function of the large intestine: (NUMS MDCAT 2022)**

A	Absorption of electrolytes	**B**	Absorption of water
C	Production of vitamins	**D**	Absorption of amino acids

Solution: (d) Amino acids are absorbed in the small intestine; the large intestine takes water, salts and the vitamins its bacteria make.

MCQ 14.1.42 **Which type of enzyme would be most active in your gut after eating the loaf of bread? (NUMS MDCAT 2022)**

A	Amylase	**B**	Erypsin
C	Lactase	**D**	Carboxypeptidase

Solution: (a) Bread is starch, and amylase is the enzyme that breaks starch down.

MCQ 14.1.43 **Enzymatic portion of the gastric juices secreted by which mucosal cells? (NUMS MDCAT 2022)**

A	Oxyntic cells	**B**	Chief cells
C	Mucus cells	**D**	Endocrine cells

Solution: (b) The chief cells of the gastric glands make pepsinogen.

MCQ 14.1.44 **The semi-solid mass in stomach is known as: (PMC Practice 2021)**

A	Bolus	**B**	Chyme
C	Serum	**D**	Food

Solution: (b) The semi-fluid mixture leaving the stomach is chyme.

MCQ 14.1.45 **Pancreatic zymogens are only activated when they reach the _____. (PMC Practice 2021)**

A	Stomach	**B**	Pancreas
C	Small intestine	**D**	Large intestine

Solution: (c) Enterokinase of the intestinal juice starts them off; in the pancreas they would digest the gland itself.

MCQ 14.1.46 **The term "Loss of appetite" refers to disease: (UHS MDCAT 2018)**

A	Botulism	**B**	Anorexia nervosa
C	Obesity	**D**	Bulemia nervosa

Solution: (b) Anorexia nervosa is the refusal of food and the loss of appetite that goes with it.

MCQ 14.1.47 **The first part of the large intestine is: (UHS MDCAT 2018)**

A	Colon	**B**	Appendix
C	Caecum	**D**	Rectum

Solution: (c) The caecum is the pouch at the beginning of the large intestine.

MCQ 14.1.48 **Number of salivary glands found in the human oral cavity. (UHS MDCAT 2018)**

A	4	**B**	3
C	6	**D**	2

Solution: (c) There are three pairs of salivary glands, six in all.

MCQ 14.1.49 **Salivary Amylase begins to digest Starch to shorter polysaccharides and then to: (UHS MDCAT 2018)**

A	Glucose	**B**	Maltose
C	Sucrose	**D**	Lactose

Solution: (b) Amylase breaks starch to dextrins and then to the disaccharide maltose.

MCQ 14.1.50 **In the oral cavity, the main function of sodium bicarbonate is: (UHS MDCAT 2017)**

A	To act as antiseptic	**B**	To stabilize the pH of food
C	To act as lubricant	**D**	To make a slimy food

Solution: (b) Sodium hydrogen carbonate in the saliva keeps the mouth near neutral.

MCQ 14.1.51 **Identify the cells which secretes HCl: (UHS MDCAT 2017)**

A	Parietal cells	**B**	Oxyntic cells
C	Zymogen cells	**D**	Both Parietal cells and Oxyntic cells

Solution: (d) The parietal, or oxyntic, cells of the gastric glands make the hydrochloric acid.

MCQ 14.1.52 **Name the structure from which appendix is formed: (UHS MDCAT 2017)**

A	Duodenum	**B**	Caecum
C	Kidney	**D**	Rectum

Solution: (b) The appendix is a blind tube growing from the caecum.

MCQ 14.1.53 **The site where the most absorption takes place: (UHS MDCAT 2017)**

A	Large intestine	**B**	Small intestine
C	Illium	**D**	Duodenum

Solution: (c) Most of the absorption happens in the ileum, over its villi.

MCQ 14.1.54 **_____ are the part of a gastric gland which produce hydrochloric acid. (UHS MDCAT 2016)**

A	Parietal Cells	**B**	Goblet Cells
C	Chief Cells	**D**	Zymogen Cells

Solution: (a) The parietal, or oxyntic, cells make the hydrochloric acid.

MCQ 14.1.55 **Digestive System consists of different layers, the innermost is known as: (UHS MDCAT 2016)**

A	Submucosa	**B**	Mucosa
C	Muscularis	**D**	Serosa

Solution: (b) The mucosa lines the lumen; the submucosa, muscularis and serosa lie outside it.

MCQ 14.1.56 **Protein components of food are digested by the enzymatic secretion of: (UHS MDCAT 2016)**

A	Goblet Cells	**B**	Parietal Cells
C	Zymogen Cells	**D**	Oxyntic Cells

Solution: (c) The zymogen, or chief, cells make pepsinogen.

MCQ 14.1.57 **Food enters from stomach into small intestine through: (UHS MDCAT 2016)**

A	Pyloric Sphincter	B	Cardiac Sphincter
C	Semilunar valve	D	Diaphragm

Solution: (a) The pyloric sphincter lets the chyme through into the duodenum a little at a time.

MCQ 14.1.58 **Digestion of _____ starts in oral cavity due to the action of enzyme present in saliva. (UHS MDCAT 2016)**

A	Starch	B	Cellulose
C	Fatty Acids	D	Polypeptides

Solution: (a) Salivary amylase begins the digestion of starch in the mouth.

MCQ 14.1.59 **The hormone which inhibits the secretion of pancreatic juice is: (UHS MDCAT 2015)**

A	Secretin	B	Gastrin
C	Thyroxine	D	Parathormone

Solution: (a) Secretin calls out the alkaline pancreatic juice but damps down the enzyme secretion of the gastric glands.

MCQ 14.1.60 **Trypsinogen is activated to trypsin by: (UHS MDCAT 2015)**

A	HCl	B	Enterokinase
C	Mucus	D	Gastrin

Solution: (b) Enterokinase of the intestinal juice converts trypsinogen into trypsin.

MCQ 14.1.61 **The emulsification of fats is the role of: (UHS MDCAT 2015)**

A	Saliva	B	Pancreatic juice
C	Gastrin	D	Bile www.PakLearningSpot.com UNIVERSITY OF HEALTH SCIENCES, LAHORE Entrance Test - 2015 PakLearningSpot.com

Solution: (d) Bile salts break the fat into a fine emulsion for the lipase.

Unit 15 Homeostasis

Topic 15.1 Homeostasis and the Kidney

Past MDCAT Questions

MCQ 15.1.1 **Kidneys perform their osmoregulatory role under the effect of Antidiuretic Hormone, which type of urine is produced in this situation? (UHS MDCAT 2025)**

A	Hypotonic urine with decreased volume	B	Hypotonic urine with increased volume
C	Hypertonic urine with decreased volume	D	Hypertonic urine with increased volume

Solution: (c) ADH makes the collecting ducts reabsorb more water, so a smaller volume of concentrated, hypertonic urine leaves.

MCQ 15.1.2 **The process of osmoregulation refers to: (UHS MDCAT 2025)**

A	The filtration of blood to remove metabolic waste	B	The regulation of solute and water movement between an organism and its environment
C	The creation of an osmotic gradient in the kidney medulla	D	The secretion of hormones that control blood plasma

Solution: (b) Osmoregulation is the control of the water and solute balance between the organism and its surroundings.

MCQ 15.1.3 **Which type of nephron is responsible for the development of osmotic gradients in the renal medulla? (KMU MDCAT 2025)**

A	Glomerular	B	Cortical
C	Juxtamedullary	D	Medullary

Solution: (c) Only the juxtamedullary nephrons have loops long enough to build the osmotic gradient of the medulla.

MCQ 15.1.4 **Which of the following describes how the distal convoluted tubule contributes to regulation of blood pH in the body? (KMU MDCAT 2025)**

A	Selective reabsorption of Glucose	B	Active secretion of hydrogen ions into the filtrate
C	Active secretion of sodium from the glomerular filtrate	D	Tubular reabsorption of potassium ions

Solution: (b) The distal tubule secretes hydrogen ions into the filtrate, which is how the blood is kept from turning acidic.

MCQ 15.1.5 **The sodium potassium pumps in the distal convoluted tubule are activated by: (KMU MDCAT 2025)**

A	Aldosterone	B	Antidiuretic hormone
C	Anti-natriuretic peptide	D	Renin

Solution: (a) Aldosterone from the adrenal cortex drives the sodium potassium pumps of the distal tubule.

MCQ 15.1.6 **If a person drinks excessive amount of water, how does the kidney respond to maintaining osmoregulation? (KMU MDCAT 2025)**

A	Increase ADH release and water reabsorption	B	Increase aldosterone release and reabsorb more sodium
C	Decrease renin secretion and retain more water	D	Decrease ADH release and increase water excretion

Solution: (d) Dilute blood suppresses ADH, the ducts stay impermeable, and the surplus water leaves as dilute urine.

MCQ 15.1.7 **The primary function of glomerular capillaries is: (KMU MDCAT 2025)**

A	Reabsorption of water and solutes from the renal tubules	B	Secretion of waste products from the blood into the tubules
C	Filtration of blood from glomerular filtrate	D	Supply of nutrients and oxygen to the kidney

Solution: (c) High pressure in the glomerulus forces water and small solutes out of the blood as the filtrate.

MCQ 15.1.8 **Hyperparathyroidism may lead to the formation of: (KMU MDCAT 2025)**

A	Calcium phosphate stones	B	Uric acid stones
C	Cystine stones	D	Struvite stones

Solution: (a) Too much parathyroid hormone frees calcium from the bones, and the excess settles as calcium phosphate stones.

MCQ 15.1.9 **Overconsumption of which of the following foods increases the risk of calcium oxalate stone? (SIBA MDCAT 2025)**

A	Leafy vegetables	B	Fruits contain Vitamin C*
C	Fruits contain high fiber	D	Whole grains

Solution: (a) Spinach and other leafy vegetables are rich in oxalate, which settles with calcium as a stone.

MCQ 15.1.10 **Which of the following substances pass through the glomerulus into Bowman's capsule? (SIBA MDCAT 2025)**

A	Glucose	**B**	Red blood cells
C	Platelets	**D**	Albumin

Solution: (a) Glucose is small enough to be filtered; cells and plasma proteins are held back.

MCQ 15.1.11 **The water content of human kidney is regulated by ADH. Which of the following gland is involved in its secretion process? (SIBA MDCAT 2025)**

A	Adrenal gland	**B**	Pituitary gland
C	Thyroid gland	**D**	Parathyroid gland

Solution: (b) Antidiuretic hormone is released from the posterior lobe of the pituitary.

MCQ 15.1.12 **Osmotic gradient of inner medulla of kidney is increased by: (SZABMU MDCAT 2025)**

A	Urea	**B**	Water
C	Phosphate	**D**	Potassium

Solution: (a) Urea diffusing out of the collecting duct is what makes the inner medulla so concentrated.

MCQ 15.1.13 **The hormone, when overproduced can lead to hypercalcemia and stone formation is: (SZABMU MDCAT 2025)**

A	Insulin	**B**	Thyroxine
C	Parathyroid hormone	**D**	Antidiuretic hormone

Solution: (c) Excess parathyroid hormone frees calcium from bone, and the surplus settles in the kidney as stones.

MCQ 15.1.14 **Additional capillaries present in the juxtamedullary nephrons to form a loop of vessels are: (SZABMU MDCAT 2025)**

A	Efferent arterioles	**B**	Peritubular capillaries
C	Vasa recta	**D**	Afferent arterioles

Solution: (c) The vasa recta are the straight capillaries that follow the long loops of the juxtamedullary nephrons.

MCQ 15.1.15 **How do the kidneys contribute to maintain normal blood calcium level? (SZABMU MDCAT 2025)**

A	By storing excess calcium	**B**	By reabsorbing calcium and activating vitamin D
C	By secreting calcium directly into the blood	**D**	By converting calcium into urea for excretion

Solution: (b) The kidney reabsorbs calcium from the filtrate and makes vitamin D active so the gut absorbs more.

MCQ 15.1.16 **Osmoreceptors that detect the osmotic pressure of blood are primarily located in the: (SZABMU MDCAT 2025)**

A	Cerebellum	**B**	Medulla oblongata
C	Hypothalamus	**D**	Cerebral cortex

Solution: (c) The osmoreceptors of the hypothalamus watch the osmotic pressure of the blood and call for ADH.

MCQ 15.1.17 **A desert mammal faces severe dehydration in a hot sunny day. Which internal condition would lead to secretion of ADH? (NUMS MDCAT 2024)**

A	High osmotic pressure of blood	**B**	High blood pressure
C	Low osmotic pressure of blood	**D**	Low solute potential of blood

Solution: (a) Losing water concentrates the blood, and the osmoreceptors answer that by calling for ADH.

MCQ 15.1.18 **Hormone secreted in bulk due to decreased water content of blood is: (NUMS MDCAT 2023)**

A	Anti-Diuretic Hormone (ADH)	**B**	Oxytocin
C	Glucagon	**D**	Thyroxin

Solution: (a) Concentrated blood is sensed by the hypothalamus, which calls for antidiuretic hormone.

MCQ 15.1.19 **The target cells of this hormone are present in kidney tubules: (PMC MDCAT 2022)**

A	Aldosterone	**B**	Corticosterone
C	Cortisol	**D**	Noradrenaline

Solution: (a) Aldosterone acts on the distal tubule of the nephron to reabsorb sodium.

MCQ 15.1.20 **The mechanism of regulation, generally between organism and Its environment, of solutes and the gain and the loss of water is called? (PMC MDCAT 2022)**

A	Hemostasis	**B**	Homeostasis
C	Osmoregulation	**D**	Thermoregulation

Solution: (c) Controlling the water and solute balance with the surroundings is osmoregulation.

MCQ 15.1.21 **The active uptake of sodium in the ascending limb or thick loop of Henle is promoted by the action of: (PMC MDCAT 2020)**

A	Aldosterone	**B**	Thyroxine
C	ADH	**D**	Cortisone

Solution: (a) Aldosterone drives the sodium pumps of the nephron.

MCQ 15.1.22 **The excretion of hypertonic urine in humans is associated best with the: (PMC MDCAT 2020)**

A	Glomerular capsule	**B**	Proximal convoluted tubule
C	Loop of Henle	**D**	Distal convoluted tubule

Solution: (c) The loop of Henle builds the salt gradient of the medulla that lets water be drawn from the collecting duct.

MCQ 15.1.23 **The capillaries of glomerulus rejoin to form an _____. (UHS MDCAT 2018)**

A	Efferent arteriole	**B**	Afferent arteriole
C	Peritubular capillaries	**D**	Collecting duct

Solution: (a) The glomerular capillaries gather again into the efferent arteriole, which is narrower than the afferent one.

MCQ 15.1.24 **When filtration is completed the waste products through distal tube of Nephrons empties to: (UHS MDCAT 2018)**

A	Efferent Arteriole	**B**	Collecting Tubules
C	Peritubular capillaries	**D**	Proximal tubules

Solution: (b) The distal tubule empties into the collecting duct, which carries the urine down through the medulla.

MCQ 15.1.25 **_____ hormone is released from the posterior lobe of the pituitary gland. (UHS MDCAT 2018)**

A	Adrenaline	**B**	Thyroid stimulating hormone
C	FSH	**D**	Antidiuretic hormone

Solution: (d) The posterior pituitary releases antidiuretic hormone and oxytocin.

MCQ 15.1.26 **The hormone which controls the uptake of Sodium ions in kidney and its maintenance in blood plasma is: (UHS MDCAT 2018)**

A	Somatotrophic Hormone	**B**	Aldosterone Hormone
C	Gonadotrophic Hormone	**D**	Thyroxine Hormone

Solution: (b) Aldosterone drives the sodium pumps of the distal tubule.

MCQ 15.1.27 **Keeping correct balance of ions and water in our body is called as: (UHS MDCAT 2018)**

A	Thermoregulation	**B**	Osmoregulation
C	Excretion	**D**	Selective reabsorption

Solution: (b) Keeping the water and solute balance right is osmoregulation.

MCQ 15.1.28 **Blood solute potential is controlled by the following hormone. (UHS MDCAT 2018)**

A	Estrogen	B	Epinephrine
C	Thyroxine	D	Vasopressin

Solution: (d) Vasopressin, that is antidiuretic hormone, sets how much water the kidney returns to the blood.

MCQ 15.1.29 **Blood leaves the Bowman's capsule by: (UHS MDCAT 2017)**

A	Afferent arterioles	B	Afferent capillaries
C	Efferent arterioles	D	Efferent capillaries

Solution: (c) The glomerular capillaries gather into the efferent arteriole.

MCQ 15.1.30 **The mechanism of regulation, generally between organisms and its environment, of (UHS MDCAT 2017)**

A	Homeostasis	B	Osmoregulation
C	Thermoregulation	D	Excretion

Solution: (b) Controlling the water and solute balance with the surroundings is osmoregulation.

MCQ 15.1.31 **End-stage renal failure is called: (UHS MDCAT 2017)**

A	Kidney failure stage	B	Hyperoxaluria
C	Uremia	D	Hypercalcemia

Solution: (c) Uraemia is the accumulation of urea and other wastes when the kidneys fail.

MCQ 15.1.32 **Which structure receives about 20% of total blood and has a weight less than 1% of the total body: (UHS MDCAT 2017)**

A	Heart	B	Lungs
C	Kidney	D	Liver

Solution: (c) The kidneys take about a fifth of the cardiac output though they weigh less than a hundredth of the body.

MCQ 15.1.33 **Bowman's capsule continues as extensively convoluted portion known as: (UHS MDCAT 2016)**

A	Peritubular capillaries	B	Proximal convoluted tubules
C	Efferent arterioles	D	Afferent arterioles

Solution: (b) The Bowman capsule leads into the proximal convoluted tubule.

MCQ 15.1.34 **A hormone released from posterior pituitary lobe acts to be actively transport water from filtrate is collecting tubules back to kidney is shown as: (UHS MDCAT 2016)**

A	Renin	B	Antidiuretic hormone
C	Angiotensin	D	Growth Factor

Solution: (b) Antidiuretic hormone makes the collecting duct permeable, so water returns to the blood.

MCQ 15.1.35 **Those nephrons which are present along the border of the cortex and medulla are called: (UHS MDCAT 2015)**

A	Juxtamedullary nephrons	B	Cortical nephrons
C	Internal nephrons	D	Outer nephrons

Solution: (a) The juxtamedullary nephrons sit at the border and send their long loops into the medulla.

MCQ 15.1.36 **When water is in short supply, increased water retention occurs through the: (UHS MDCAT 2015)**

A	Cortical nephrons	B	Proximal Convoluted Tubule
C	Juxtamedullary nephrons	D	The tissue of cortex

Solution: (c) Only their long loops can build the gradient that lets water be drawn back.

MCQ 15.1.37 **In nephrons, counter-current multiplier occurs at: (UHS MDCAT 2015)**

A	Loop of Henle	B	Collecting Duct
C	Bowman's Capsule	D	Glomerulus

Solution: (a) The two limbs of the loop of Henle work against each other to multiply the gradient.

MCQ 15.1.38 **Ascending loop of Henle does not allow outflow of: (UHS MDCAT 2015)**

A	Na+ ions	B	K ions
C	Cl— ions +	D	Water

Solution: (d) The ascending limb is impermeable to water; it pumps out salt instead.

MCQ 15.1.39 **A larger quantity of dilute urine is produced in diabetes insipidus. This disease is due to the deficiency of: (UHS MDCAT 2015)**

A	Antidiuretic Hormone	B	Aldosterone
C	Thyroxine	D	Cortisol

Solution: (a) Without antidiuretic hormone the collecting duct stays impermeable and a great deal of dilute urine is passed.

MCQ 15.1.40 **Water and sodium ions are reabsorbed in: (UHS MDCAT 2015)**

A	Urinary Bladder and Urethra	B	Ureter
C	Adrenal Cortex	D	Proximal Convoluted Tubule & Collecting Duct

Solution: (d) Most water and sodium return in the proximal tubule, and the rest under hormonal control in the collecting duct.

Topic 15.2 Thermoregulation

Past MDCAT Questions

MCQ 15.2.1 **A person in hot weather is unable to maintain body temperature. Which physiological process has failed? (UHS MDCAT 2025)**

A	Vasodilation & sweating	B	Vasoconstriction
C	Shivering	D	Renin secretion

Solution: (a) Cooling in the heat depends on widening the skin arterioles and on sweating.

MCQ 15.2.2 **In a heat stroke the hypothalamus will detect an increase in core body temperature, which of the following response is triggered (KMU MDCAT 2025)**

A	Vasoconstriction and shivering	B	Vasodilation and sweating
C	Increased metabolic rate	D	Release of thyroxin

Solution: (b) The hypothalamus answers overheating by widening the skin vessels and turning on the sweat glands.

MCQ 15.2.3 **Shivering thermogenesis involves: (SIBA MDCAT 2025)**

A	Voluntary muscle contraction	B	Involuntary muscle contraction.
C	Dehydration	D	Hormone secretion

Solution: (b) Shivering is a rapid involuntary contraction of skeletal muscle whose only product is heat.

MCQ 15.2.4 **The part of the brain which controls the body temperature in human beings is called: (NUMS MDCAT 2022)**

A	Thalamus	B	Hypothalamus
C	Pones	D	Cerebellum

Solution: (b) The hypothalamus holds the thermostat of the body.

MCQ 15.2.5 **In humans, the temperature regulation control center is located in: (PMC MDCAT 2020)**

A	Kidneys	B	Brain
C	Lungs	D	Liver

Solution: (b) The hypothalamus holds the thermostat of the body.

MCQ 15.2.6 **When the temperature of the surrounding environment rises, body responds by: (PMC MDCAT 2020)**

A	Vasoconstriction	B	Vasodilation
C	Shivering	D	Raising body hairs

Solution: (b) Widening the skin arterioles brings more blood to the surface, where the heat is lost.

MCQ 15.2.7 **Substances responsible for increasing the set point of the hypothalamus are called: (UHS MDCAT 2019)**

A	Androgens	B	Pathogens
C	Pepsin	D	Prions

Solution: (b) Pyrogens from the pathogens raise the setting of the hypothalamic thermostat, which is what a fever is.

MCQ 15.2.8 **Among the following animals, which ones are endotherms? (UHS MDCAT 2017)**

A	Birds	B	Amphibians
C	Fishes	D	Both A and C

Solution: (a) Birds and mammals make their own heat and hold their temperature steady.

MCQ 15.2.9 **Humans have homeostatic thermostat present in a specified portion of the brain that is: (UHS MDCAT 2016)**

A	Lateral ventricle	B	Thalamus
C	Spinal Cord	D	Hypothalamus

Solution: (d) The hypothalamus holds the thermostat of the body.

Topic 15.3 Excretion

Past MDCAT Questions

MCQ 15.3.1 **Which of the following organisms eliminate nitrogenous waste mainly in the form of uric acid? (UHS MDCAT 2025)**

A	Freshwater Fish	B	Amphibians
C	Birds	D	Mammals

Solution: (c) Birds and reptiles are uricotelic, which saves the water an egg cannot spare.

MCQ 15.3.2 **Which nitrogenous waste has the lowest solubility in water? (KMU MDCAT 2025)**

A	Urea	B	Ammonia
C	Uric acid	D	Nitrite

Solution: (c) Uric acid is almost insoluble, which is why it can be excreted as a paste with almost no water.

MCQ 15.3.3 **By nature, human excretory system is: (KMU MDCAT 2025)**

A	Ammonotelic	B	Uricotelic
C	Ureotelic	D	Aminotelic

Solution: (c) Humans convert their ammonia to urea in the liver, so they are ureotelic.

MCQ 15.3.4 **Which one of the following is the most common nitrogenous waste excreted in urine of a healthy human? (SIBA MDCAT 2025)**

A	Ammonia	B	Urea
C	Uric Acid	D	Creatinine

Solution: (b) Urea is the chief nitrogenous waste of human urine.

MCQ 15.3.5 **Which class of animals excrete ammonia as their primary nitrogenous waste? (SIBA MDCAT 2025)**

A	Uricotelic	B	Urotelic
C	Ammonotelic	D	Ureotelic

Solution: (c) Animals that excrete ammonia directly, chiefly aquatic ones, are ammonotelic.

MCQ 15.3.6 **Which one of the following organism is uricotolic with reference to excretion of nitrogenous compound? (SZABMU MDCAT 2025)**

A	Human	B	freshwater Fish
C	Snake	D	Frog

Solution: (c) Reptiles and birds excrete uric acid, which needs almost no water to void.

MCQ 15.3.7 **Ureotelism (removal of nitrogenous waste in the form of urea) is an adaptation to the: (SZABMU MDCAT 2025)**

A	cold weather	B	less availability of water
C	flooded environmental conditions	D	food shortage

Solution: (b) Urea is far less toxic than ammonia, so it can be concentrated and less water is spent on it.

MCQ 15.3.8 **Which of the following fish drink large amount of seawater and excrete concentrated urine resulting in maximum salt excretion and minimal water loss? (PMC MDCAT 2022)**

A	Hagfish	B	Freshwater fish
C	Bonyfish	D	Cartilaginous fishes

Solution: (c) A bony fish in the sea is losing water, so it drinks and voids the salt in a small volume of urine.

MCQ 15.3.9 **As an excretory organ, liver: (PMC MDCAT 2020)**

A	Detoxifies many chemical poisons	B	Breaks down ammonia for excretion by the kidneys
C	Produces urea and uric acids from the nitrogen of amino acids	D	All of the above

Solution: (d) The liver detoxifies, deaminates the amino acids and makes the urea the kidney then excretes.

MCQ 15.3.10 **The main nitrogenous excretory product of humans is: (UHS MDCAT 2019)**

A	Ammonia	B	Urea
C	Ammonium	D	Uric acid

Solution: (b) Humans convert their ammonia to urea in the liver.

MCQ 15.3.11 **The route of urine excretion from kidney to outside of body is: (UHS MDCAT 2019)**

A	Kidney -> ureter -> urinary bladder -> urethra	B	Urinary bladder -> kidney -> ureter -> urethra
C	Kidney -> urethra -> urinary bladder -> ureter	D	Kidney -> ureter -> urethra -> urinary bladder

Solution: (a) Urine passes from the kidney down the ureter to the bladder and out through the urethra.

MCQ 15.3.12 **Urea cycle is the detoxification of: (UHS MDCAT 2018)**

A	Creatinine	B	Amino acids
C	Carbon dioxide	D	Ammonia

Solution: (d) The liver turns the toxic ammonia of deamination into urea.

MCQ 15.3.13 **Highly toxic nitrogenous excretory product is: (UHS MDCAT 2016)**

A	CO2	B	Uric Acid
C	Urea	D	Ammonia

Solution: (d) Ammonia is very toxic, which is why it must be either diluted greatly or converted to urea.

MCQ 15.3.14 **The removal metabolic waste from the blood is called: (UHS MDCAT 2016)**

A	Thermoregulation	B	Osmoregulation
C	Kidney Failure	D	Excretion

Solution: (d) Removing the waste of metabolism from the blood is excretion.

Unit 16 Biotechnology

Topic 16.1 Biotechnology and Health Care

Past MDCAT Questions

MCQ 16.1.1 **In somatic cell hybridization, which two cells are fused to produce monoclonal antibodies? (KMU MDCAT 2025)**

A	T-cells and nerve cells	B	B-lymphocytes and spleen cells
C	T-cells and liver cells	D	B-lymphocytes and macrophages

Solution: (b) An antibody forming B lymphocyte is fused with a myeloma cell to give a hybridoma that divides without limit.

MCQ 16.1.2 **In molecular diagnostics, the primary function of DNA/RNA probes is to: (KMU MDCAT 2025)**

A	Replace malfunctioning genes in effected cells	B	Bind to specific DNA or RNA sequences for identification
C	Cut genetic material at precise locations	D	Stimulate immune responses against disease-causing organisms

Solution: (b) A probe is a labelled length of nucleic acid that pairs with the sequence being looked for.

MCQ 16.1.3 **A set of uniform proteins generated by genetically identical immune cells (a clone) is called: (KMU MDCAT 2025)**

A	Therapeutic proteins	B	Immunoglobulins
C	Monoclonal antibodies	D	Recombinant proteins

Solution: (c) Antibodies from one clone of cells are all identical, and are called monoclonal.

MCQ 16.1.4 **Which biotechnological product is used to replace an abnormal gene in a patient's cells? (KMU MDCAT 2025)**

A	Antibiotic	B	Vaccine
C	Vector	D	Interferon

Solution: (c) A vector, usually a modified virus, carries the healthy gene into the cells of the patient.

MCQ 16.1.5 **Which of the following bacteria is used for developing vaccine against tuberculosis? (NUMS MDCAT 2025)**

A	Mycobacterium tuberculosis	B	E. coli
C	Salmonella typhi	D	Mycobacterium bovis

Solution: (d) BCG is a weakened strain of Mycobacterium bovis, the cattle bacillus.

MCQ 16.1.6 **Which product is produced by genetically modified bacteria for patients with Diabetes mellitus? (SIBA MDCAT 2025)**

A	Insulin	B	Erythropoietin
C	Growth hormone	D	Vaccine

Solution: (a) The human insulin gene is put into a bacterium, which then makes the hormone in bulk.

MCQ 16.1.7 **Role of mRNA in COVID-19 vaccines like Pfizer and Moderna is to: (SIBA MDCAT 2025)**

A	Helps the immune system recognize the virus	B	Instructs cells to produce the viral spike protein
C	Triggers immediate antibody release from memory cells	D	Delivers enzymes that destroy the virus

Solution: (b) The messenger RNA of the vaccine tells the cell to build the spike protein, and the immune system learns it from there.

MCQ 16.1.8 **Monoclonal antibodies are useful in cancer diagnosis by: (SIBA MDCAT 2025)**

A	Replacing damaged tissue	B	Changing the genetic code of cancer cells
C	Killing healthy cells to reduce tumor spread	D	Detecting specific tumor markers in samples

Solution: (d) A labelled monoclonal antibody binds only its own tumour marker, so it shows where the marker is.

MCQ 16.1.9 **In biotechnology vaccines can be developed by cloning of: (SIBA MDCAT 2025)**

A	Gene for antigen of pathogen	B	Gene for receptor of the patient
C	Gene for antigen of patient	D	Gene for antibody of patient

Solution: (a) The gene for a surface antigen of the pathogen is cloned, and the antigen alone is used as the vaccine.

MCQ 16.1.10 **DNA/RNA probes are most commonly used as: (SZABMU MDCAT 2025)**

A	diagnostic tools of infectious diseases	B	carrier in gene cloning experiments
C	cementing material in somatic cell hybridization	D	carrier or vector in gene therapy

Solution: (a) A labelled probe pairs only with its own sequence, which is how a pathogen is identified.

MCQ 16.1.11 **A patient with a genetic disorder undergoes treatment where a normal gene is inserted into their cells. This is called (SZABMU MDCAT 2025)**

A	Gene therapy	B	Genetic testing
C	Protein engineering	D	DNA fingerprinting

Solution: (a) Putting a working copy of the gene into the cells of a patient is gene therapy.

MCQ 16.1.12 **_____ is used in the production of Humulin? (KMU MDCAT 2024)**

A	Bacteria	B	Fungi
C	Protozoa	D	Virus

Solution: (a) Humulin is human insulin made by a genetically engineered bacterium.

MCQ 16.1.13 **Probiotics in infants formula milk keep babies healthy by doing all of the following actions except: (NUMS MDCAT 2024)**

A	Produce important vitamins	B	Kill pathogenic bacteria
C	Prevent colonization of pathogens	D	Enhance immunity

Solution: (b) Probiotics crowd the pathogens out and feed the host, but they do not kill.

MCQ 16.1.14 Gel electrophoresis is a technique: (PMC MDCAT 2020)

A	Employed by forensic scientist to assist in the identification of the individuals by their respective type of DNA	B	Collect all the genes found in one complete set of chromosome
C	Is a technique to separate different sizeds fragment of charge bearing polymers (proteins, RNA or DNA)	D	Grows single cell or a group of cells in a glass ware on artificial medium under aseptic conditions

Solution: (c) Gel electrophoresis pulls charged fragments through a gel, and the small ones travel furthest.

MCQ 16.1.15 Which of the following is the components / tools of recombinant DNA technology? (PMC MDCAT 2020)

A	Gene of interest	B	Molecular scissors
C	Molecular glue and expression system	D	All of the above

Solution: (d) The gene, restriction enzymes to cut it, ligase to join it and a host to express it are all needed.

MCQ 16.1.16 The DNA that has been altered and which now contains length of nucleotides from two different organisms is called a: (PMC MDCAT 2020)

A	Plasmid	B	Combined DNA
C	Vector	D	Recombinant DNA

Solution: (d) DNA carrying lengths from two organisms is recombinant DNA.

MCQ 16.1.17 It is a method for rapid production of a very large number of copies of a particular fragment of DNA: (PMC MDCAT 2020)

A	Gel electrophoresis	B	Polymerase chain reaction
C	DNA extraction	D	Recombination

Solution: (b) The polymerase chain reaction doubles the chosen fragment at every cycle.

MCQ 16.1.18 Transgenic organisms: (PMC MDCAT 2020)

A	Have a foreign gene inserted into them	B	Have an important role in the large scale production of medicinal products
C	Are considered beneficial to humans	D	All of the above

Solution: (d) A transgenic organism carries a gene from another species, and such organisms make insulin and other medicines.

MCQ 16.1.19 The Plasmid pBR322 has antibiotic resistance genes for: (UHS MDCAT 2019)

A	Streptomycin	B	Ampicillin and Tetracycline
C	Tetracycline and mxycycline	D	Ampicillin

Solution: (b) pBR322 carries resistance to ampicillin and to tetracycline, which is how transformed cells are picked out.

MCQ 16.1.20 Genetic engineering has been successfully used for producing; (UHS MDCAT 2019)

A	Animals, with inferior traits.	B	Transgenic mice for testing safety of polio vaccine before use in humans
C	Animals, that have the same genetic constitution.	D	None of the above

Solution: (b) Transgenic mice carrying the human receptor are used to test the safety of the polio vaccine.

MCQ 16.1.21 Which enzyme is administered to the patients of Severe Combined Immunodeficiency Disease (SCID)? (UHS MDCAT 2019)

A	Adenosine Deaminase (ADA)	B	Pancreatic Enzyme
C	ß galactosidase	D	ß lactamase

Solution: (a) Adenosine deaminase is the enzyme missing in ADA-SCID, and it is given by injection or by gene therapy.

MCQ 16.1.22 Complementary DNA molecule is: (UHS MDCAT 2019)

A	DNA from mRNA	B	an artificial DNA
C	single stranded DNA	D	a small segment Of chromosomal DNA

Solution: (a) Complementary DNA is made from messenger RNA by reverse transcriptase, so it carries no introns.

MCQ 16.1.23 DNA polymerase enzyme for PCR is isolated from bacteria, Thermus aquaticus, because; (UHS MDCAT 2019)

A	It can work at high speed.	B	It can withstand high denaturation temperature.
C	It can withstand low denaturation temperature.	D	It can be used again and again.

Solution: (b) Taq polymerase comes from a hot spring bacterium and survives the 95°C of each cycle.

MCQ 16.1.24 DNA made by joining pieces from two or more different sources: (UHS MDCAT 2018)

A	Probes	B	Restriction endonuclease
C	Mutated DNA	D	Recombinant DNA

Solution: (d) DNA carrying lengths from two organisms is recombinant DNA.

MCQ 16.1.25 Deficiency of enzyme _____ causes combined immunodeficiency syndrome. (UHS MDCAT 2018)

A	Adenosine transcriptase	B	Adenosine transaminase
C	Adenosine polymerase	D	Adenosine deaminase

Solution: (d) Adenosine deaminase deficiency is the commonest cause of severe combined immunodeficiency.

MCQ 16.1.26 Chemical nature of primers used in the PCR process is _____. (UHS MDCAT 2018)

A	RNA	B	Protein
C	Carbohydrate	D	DNA

Solution: (d) A primer is a short single strand of DNA that the polymerase can extend.

MCQ 16.1.27 By PCR we mean: (UHS MDCAT 2018)

A	Polymerase chronic reaction	B	Polymerase chain reaction
C	Polymerase copy reaction	D	Polymerase cross reaction

Solution: (b) PCR stands for polymerase chain reaction.

MCQ 16.1.28 Enzyme used by the Bacteria to cut the DNA of the invading Virus for its protection is: (UHS MDCAT 2018)

A	Restriction Exonuclease	B	Restriction Ligase
C	Restriction Endonuclease	D	DNA polymerase

Solution: (c) A restriction endonuclease cuts the DNA at a specific sequence within the molecule.

MCQ 16.1.29 DNA polymerase is a temperature insensitive enzyme extracted from: (UHS MDCAT 2017)

A	Fishelsoni	B	Thermus aquaticus
C	E. Coli	D	Both Fishelsoni and Thermus aquaticus

Solution: (b) Taq polymerase comes from Thermus aquaticus, a hot spring bacterium.

MCQ 16.1.30 Gene can be made from mRNA using: (UHS MDCAT 2017)

A	PCR	B	PBr 103
C	Eco RI	D	Reverse transcriptase

Solution: (d) Reverse transcriptase copies messenger RNA into complementary DNA, which carries no introns.

MCQ 16.1.31 **DNA Polymerase synthesize DNA from _____: (UHS MDCAT 2017)**

A	RNA	**B**	Eco RI
C	Template RNA	**D**	Template DNA

Solution: (d) DNA polymerase copies a DNA template, adding to a primer.

MCQ 16.1.32 **Among the following, which one is commonly used as a restriction enzyme: (UHS MDCAT 2017)**

A	pBr 101	**B**	EcoRI
C	EcoR3	**D**	Both pBr 101 and EcoR3

Solution: (b) EcoRI is the restriction endonuclease from Escherichia coli.

MCQ 16.1.33 **Restriction endonucleases cleave the _____ of duplex DNA. (UHS MDCAT 2016)**

A	Nitrogenous base	**B**	Base sugar
C	Phosphodiester bond	**D**	Hydrogen bond

Solution: (c) A restriction enzyme cuts the sugar phosphate backbone at a specific sequence.

MCQ 16.1.34 **The enzyme which is responsible for the formation of bond between two double stranded DNA fragments is: (UHS MDCAT 2016)**

A	Endonuclease	**B**	Urease
C	Ligase	**D**	Helicase

Solution: (c) DNA ligase seals the backbone between two fragments.

MCQ 16.1.35 **The modified plasmid or phage DNA is called: (UHS MDCAT 2016)**

A	lone DNA	**B**	Recombinant DNA
C	cDNA	**D**	rDNA

Solution: (b) A plasmid carrying an inserted gene is recombinant DNA.

MCQ 16.1.36 **In cystic fibrosis, liposomes-microscopic vesicles are sued which are coated with: (UHS MDCAT 2015)**

A	Healthy Gene	**B**	Chromosome
C	Protein	**D**	Carbohydrate

Solution: (a) The liposome carries a healthy copy of the gene into the cells of the airway.

MCQ 16.1.37 **The DNA formed by the reverse transcription is called: (UHS MDCAT 2015)**

A	rDNA	**B**	dDNA
C	cDNA	**D**	DNA

Solution: (c) DNA made from RNA by reverse transcriptase is complementary DNA.

MCQ 16.1.38 **Bacterial cells take up recombinant plasmids when they are treated with: (UHS MDCAT 2015)**

A	CaCl2	**B**	NaCl
C	KCl	**D**	NaOH

Solution: (a) Calcium chloride makes the wall permeable so the plasmid can enter.

MCQ 16.1.39 **Which one of the following is made up of radioactively labelled nucleotides? (UHS MDCAT 2015)**

A	Phage DNA	**B**	Genomic Library
C	Recombinant DNA	**D**	Gene Probe

Solution: (d) A gene probe is a labelled length of nucleic acid that pairs with the sequence sought.

MCQ 16.1.40 **A technique in transgenic animals in which desired gene is inserted into the eggs of animal is called: (UHS MDCAT 2015)**

A	Embryonic Stem Cell mediated Transfer	**B**	Microinjection
C	Retro-virus mediated gene Transfer	**D**	Virus vectors

Solution: (b) Injecting the gene straight into the egg is microinjection.

MCQ 16.1.41 **Which one of the following edible products is widely pasteurized? (UHS MDCAT 2015)**

A	Soft drinks	**B**	Mango squash
C	Milk	**D**	Orange Juice

Solution: (c) Milk is pasteurized to kill the pathogens without spoiling its taste.

CHEMISTRY

Unit 1 Fundamental Concepts of Chemistry

Topic 1.1 Moles and Avogadro's Number

Past MDCAT Questions

MCQ 1.1.1 **The mass of one molecule of O_2 is: (MDCAT 2020)**

A	$6.02 \times 10^{23}/32$ g	**B**	$32/6.02 \times 10^{23}$ g
C	32 g	**D**	0.32 g

Solution: (b) One mole of O_2 weighs 32 g and holds 6.02×10^{23} molecules, so one molecule is the quotient of the two.

MCQ 1.1.2 **The number of moles of CO_2 which contain 8.0 g of oxygen is: (MDCAT 2020)**

A	1.0	**B**	4.50
C	0.50	**D**	0.25

Solution: (d) One mole of CO_2 carries 32 g of oxygen, so 8.0 g of oxygen belongs to a quarter of a mole.

MCQ 1.1.3 **One mole of any substance contains how many particles? (MDCAT 2020)**

A	6.02×10^{23}	**B**	6.02×10^{-23}
C	6.02×10^{32}	**D**	3.01×10^{23}

Solution: (a) That count is Avogadro's number.

MCQ 1.1.4 **What is the number of particles in 0.25 moles of CO_2? (MDCAT 2020)**

A	6.022×10^{23}	**B**	1.505×10^{23}
C	2.00×10^{23}	**D**	3.01×10^{23}

Solution: (b) $0.25 \times 6.022 \times 10^{23} = 1.505 \times 10^{23}$.

MCQ 1.1.5 **The number of moles of an element is directly proportional to the: (MDCAT 2024)**

A	mass of the element	**B**	empirical formula mass
C	molar mass of the element	**D**	formula mass

Solution: (a) $n = m/M$, and for a given element M is fixed, so the number of moles follows the mass.

MCQ 1.1.6 **NaOH + H2SO4 → Na2SO4 + H2O. When 40g of NaOH reacts with 49g of H2SO4, the number of water molecules produced are: (NUMS MDCAT 2025)**

A	6.02 × 1023	B	6.02 × 1024
C	1.2044 × 1023	D	1.204 × 1024

Solution: (a) One mole of the acid and two of the alkali would be needed; the half mole of acid present gives one mole of water.

MCQ 1.1.7 **The mass of hydrogen gas needed to produce 51 g ammonia: (SIBA MDCAT 2025)**

A	6g	B	9g
C	12g	D	15g

Solution: (b) Fifty-one grams is three moles of ammonia, which needs four and a half moles of hydrogen, that is 9 g.

MCQ 1.1.8 **Number of moles in an element is directly proportional to: (UHS MDCAT 2024)**

A	Mass of an element	B	Empirical formula mass
C	Molar mass of an element	D	Formula mass

Solution: (a) The number of moles is the mass divided by the fixed molar mass, so it rises with the mass.

MCQ 1.1.9 **The type and relative amount of each isotope in an element can be found by: (UHS MDCAT 2024)**

A	R spectroscopy	B	U. V spectroscopy
C	Mass Spectrometry	D	N.M.R

Solution: (c) A mass spectrometer separates the isotopes by mass and measures how much of each there is.

MCQ 1.1.10 **The atomic masses of element depend upon: (UHS MDCAT 2024)**

A	Atomic number	B	Number of electrons
C	Number of isopotes & their abundance	D	None of the above

Solution: (c) The atomic mass is the weighted mean over the isotopes, so it depends on which they are and how abundant.

MCQ 1.1.11 **No individual atom in the sample of 1 mole of Neon has a mass of 20.18 a.m.u. because it is: (UHS MDCAT 2024)**

A	Overall mass of an isobar	B	It is a fractional mass
C	It is molar mass of Ne	D	Average atomic mass of Ne

Solution: (d) No single atom weighs the average; 20.18 is the mean over the isotopes of neon.

MCQ 1.1.12 **What is the mass of 1 mole of calcium carbonate (CaCO3)? (KMU MDCAT 2024)**

A	50g	B	75g
C	100g	D	125g

Solution: (c) $40 + 12 + 48$ gives a molar mass of $100\,\mathrm{g\,mol^{-1}}$.

MCQ 1.1.13 **How many grams of CO2 can be produced by thermally decomposing 10 moles of ZnCO3(s)? (KMU MDCAT 2024)**

A	320	B	360
C	400	D	440

Solution: (d) Each mole of the carbonate gives a mole of carbon dioxide, so ten moles give 440 g.

MCQ 1.1.14 **How many moles of NaCl are produced from 16.5g of HCl, according to the neutralization reaction? HCl(aq) + NaOH(aq) -> NaCl(aq) + H2O(l) (KMU MDCAT 2024)**

A	0.252	B	0.452
C	0.652	D	0.852

Solution: (b) 16.5/36.5 is 0.452 mole of the acid, and each mole gives one of the salt.

MCQ 1.1.15 **What mass of aluminium oxide (Al2O3) is produced from 18.5g of Al metal, when it reacts completely with oxygen gas according to the following equation? 4Al(s) + 3O2(g) → 2Al2O3(s) (KMU MDCAT 2024)**

A	30.8g	B	32.6g
C	34.9g	D	36.5g

Solution: (c) 18.5/27 is 0.685 mole of aluminium, half of which is 0.343 mole of oxide, that is 34.9 g.

MCQ 1.1.16 **When 4 g of magnesium was heated in excess of oxygen. Calculate the theoretical yield of magnesium oxide (MgO). (KMU MDCAT 2024)**

A	3.7g	B	4.2g
C	5.4g	D	6.6g

Solution: (d) 4 g is 1/6 mole of magnesium, which gives 1/6 mole, about 6.6 g, of the oxide.

MCQ 1.1.17 **Select the greatest number of particles in the following: (NUMS MDCAT 2024)**

A	2g of Sodium (atomic mass = 23)	B	2g of Hydrogen gas (atomic mass of H = 1)
C	2g of Nitrogen gas (atomic mass of N = 14)	D	2g of Carbon dioxide gas (C=12, O=16)

Solution: (b) Two grams of hydrogen is a whole mole; the others are small fractions of one.

MCQ 1.1.18 **One a. m .u stands for (UHS MDCAT 2023)**

A	An atom of C - 12	B	1/12th of a carbon
C	1/12th of H	D	1 atom of all the elements

Solution: (b) One atomic mass unit is a twelfth of the mass of an atom of carbon-12.

MCQ 1.1.19 **A compound of sodium oxide has 74.2 % sodium and 25.8% of Oxygen. The empirical formula of the compound is? (UHS MDCAT 2023)**

A	NaO	B	NaO2
C	Na2O	D	Na2O2

Solution: (c) Dividing by the atomic masses gives 3.23 of sodium to 1.61 of oxygen, a ratio of two to one.

MCQ 1.1.20 **For the reaction given below: N2 + 3H2 ⇌ 2NH3 How many moles N2 are required for synthesis of 4 moles of NH3? (SZABMU MDCAT 2023)**

A	4 moles of N2	B	2 moles of N2
C	3 moles of N2	D	4.5 moles

Solution: (b) The equation gives two moles of ammonia for each mole of nitrogen.

MCQ 1.1.21 **Al reacts with O2 according to the following reaction: 4Al + 3O2 ⟶ 2Al2O3 27g of Al will react with how much of O2? (SZABMU MDCAT 2023)**

A	8 g	B	16 g
C	24 g	D	32 g

Solution: (c) 27 g is one mole of aluminium, which needs three quarters of a mole, 24 g, of oxygen.

MCQ 1.1.22 **One mole of a substance is the amount of that substance that has the same number of particles (atom, ions or molecules) as there are atoms in exactly: (SZABMU MDCAT 2023)**

A	1.008 g of hydrogen gas (H2)	B	16 g of oxygen gas (O2)
C	12 g of carbon-12 isotopes	D	12 g of magnesium

Solution: (c) The mole is defined by the number of atoms in exactly 12 g of carbon-12.

MCQ 1.1.23 **What is the mass of sulphur in 24.5 g of H2SO4? (NUMS MDCAT 2023)**

A	32 g	**B**	24 g
C	16 g	**D**	8 g

Solution: (d) 24.5 g is a quarter of a mole, and a quarter of 32 g of sulphur is 8 g.

MCQ 1.1.24 **From the equation (N2 + 3H2 → 2NH3), how many moles of NH3 are produced from 2.5 moles of N2? (NUMS MDCAT 2023)**

A	2.5 moles	**B**	2 moles
C	5 moles	**D**	7.5 moles

Solution: (c) Each mole of nitrogen gives two of ammonia, so 2.5 moles give 5.

MCQ 1.1.25 **The average weight of atoms of an element compared to the weight of one atom of _____ is called atomic weight. (UHS MDCAT 2023)**

A	Carbon	**B**	Helium
C	Hydrogen	**D**	Nitrogen

Solution: (a) Atomic weights are referred to carbon-12, taken as exactly twelve units.

MCQ 1.1.26 **Which element is used as standard to determine atomic mass of an element? (UHS MDCAT 2023)**

A	H	**B**	C
C	P	**D**	Cl

Solution: (b) Carbon-12 is the standard against which atomic masses are measured.

MCQ 1.1.27 **What mass is the mass of 2 dm3 of oxygen at S.T.P? (PMC MDCAT 2022)**

A	1.42 g	**B**	2.22 g
C	3.2 g	**D**	2.85 g

Solution: (d) 2/22.4 mole of oxygen at $32\,\mathrm{g\,mol^{-1}}$ weighs about 2.85 g.

MCQ 1.1.28 **What is the mass in grams of 1.69 moles of phosphoric acid? (PMC MDCAT 2022)**

A	148 g	**B**	138 g
C	157 g	**D**	166 g

Solution: (d) 1.69×98 gives about 166 g.

MCQ 1.1.29 **A compound of boron and hydrogen contains 18.9% hydrogen and 81.1% boron. The empirical formula of the compound is: (PMC MDCAT 2022)**

A	BeH2	**B**	Be2H
C	B4H	**D**	B2H5

Solution: (d) 81.1/10.8 to 18.9/1 is 7.5 to 18.9, that is 2 to 5.

MCQ 1.1.30 **What is the percentage of C in glucose (C6H1206)? (PMC MDCAT 2022)**

A	41.5	**B**	38
C	39.9	**D**	38.9

Solution: (c) Carbon is 72 of the 180 units of the molar mass, that is about 40%.

MCQ 1.1.31 **One mole of ethanol and one mole of ethane have an equal: (NUMS MDCAT 2022)**

A	Mass	**B**	Number of atoms
C	Number of electrons	**D**	Number of molecules

Solution: (d) A mole of anything holds Avogadro's number of molecules.

MCQ 1.1.32 **The 1' step involved in the determination of Empirical Formula of chemical compound is: (NUMS MDCAT 2022)**

A	Finding number of gram atoms of each element	**B**	Percentage composition of each element
C	Atomic ratio of each element	**D**	Multiplication of atomic ratio with whole number

Solution: (b) The analysis gives the percentage of each element, and everything else follows from that.

MCQ 1.1.33 **The number of moles of CO2 which contains 16 g of oxygen is: (NUMS MDCAT 2022)**

A	0.25	**B**	0.5
C	1	**D**	2

Solution: (b) Sixteen grams is one mole of oxygen atoms, and each molecule carries two, so there is half a mole.

MCQ 1.1.34 **Percentage composition of mass in CO2, is: (NUMS MDCAT 2022)**

A	30.45% Carbon & 69.54% Oxygen	**B**	24.22% Carbon & 75.78% Oxygen
C	27.37% Carbon & 72.72% Oxygen	**D**	41.68% Carbon & 58.12% Oxygen

Solution: (c) Carbon is 12 of the 44 units, that is 27.3%, and the oxygen is the rest.

MCQ 1.1.35 **The relative atomic mass of copper is? (PMC Practice 2021)**

A	63.345amu	**B**	63.455amu
C	63.55amu	**D**	63.456amu

Solution: (c) Copper has two isotopes, and the weighted mean of their masses is 63.55 amu.

MCQ 1.1.36 **18g of water contains ____ atoms of hydrogen (PMC Practice 2021)**

A	6.022 x 1023	**B**	3 x 6.022 x 1023
C	2 x 6.022 x 1023	**D**	4 x 6. 22 x 1023

Solution: (c) Eighteen grams is one mole of water, and each molecule carries two hydrogen atoms.

MCQ 1.1.37 **According to Avogadro's law, .899g of 1dm3 H2 and 1.4384g of 1dm3 02 have _____number of molecules. (PMC Practice 2021)**

A	Same	**B**	Different
C	H2 has more	**D**	02 has more

Solution: (a) Equal volumes of gases at the same temperature and pressure hold equal numbers of molecules.

MCQ 1.1.38 **Different kinds of atoms of the same element are called isotope having different _____but same _____ properties. (PMC Practice 2021)**

A	Physical, atomic	**B**	Physical, chemical
C	Chemical, physical	**D**	Chemical, atomic

Solution: (b) Isotopes differ in mass and so in physical properties, but their electron arrangement, and so their chemistry, is the same.

MCQ 1.1.39 **Calculate the mass in grams of 8.694 moles of Ag2CO3 (PMC Practice 2021)**

A	1417.53 g	**B**	2399.544 g
C	3456.78 g	**D**	1231.98 g

Solution: (b) 8.694×275.8 gives about 2399.5 g.

MCQ 1.1.40 **The empirical formula of Glucose C6H1206 is: (PMC MDCAT 2020)**

A	C6H1206	**B**	CHO
C	CH2O	**D**	CH202

Solution: (c) Dividing the subscripts by six leaves CH_2O.

MCQ 1.1.41 **In a vessel, 10 g N2, 10 g H2 and 10g O2 are present. Which one will have least number of atoms? (PMC MDCAT 2020)**

A H2	**B** N2
C O2	**D** Both H2 and N2

Solution: (c) Ten grams is 5 moles of hydrogen but only 0.31 of oxygen, so the oxygen has fewest atoms.

MCQ 1.1.42 **Which two elements are isotopes? (UHS MDCAT 2019)**

A 16X8 and 16Y8	**B** 14X8 and 15Y8
C 18X9 and 20Y10	**D** 12X6 and 12Y7

Solution: (b) Isotopes have the same proton number and different mass numbers.

MCQ 1.1.43 **Solution contains 85.5 g of sucrose (C12H22O11) in 250 cm3. What is its molarity? (UHS MDCAT 2019)**

A 1 M	**B** 0.5 M
C 0.25 M	**D** 2 M

Solution: (a) $85.5/342$ is 0.25 mole in $0.25\,\mathrm{dm}^3$, that is $1\,\mathrm{M}$.

MCQ 1.1.44 **The average atomic mass of Boron is 10.8. It has two isotopes of masses 10 and 11 respectively. What is the percentage of isotope with the average mass of 10? (UHS MDCAT 2019)**

A 20%	**B** 60%
C 80%	**D** 50%

Solution: (a) $10x + 11(1-x) = 10.8$ gives $x = 0.2$, that is 20%.

MCQ 1.1.45 **The number of moles of water in 1 kg ice are: (UHS MDCAT 2019)**

A 50 moles	**B** 100 moles
C 1000 moles	**D** 55.5 moles

Solution: (d) $1000/18$ is about 55.5 moles.

MCQ 1.1.46 **How many moles of Calcium Carbonate are present in 1.75 kg of Calcium Carbonate (Ar of Ca = 40, Ar of C = 12, Ar of O = 16) (UHS MDCAT 2019)**

A 1.75 mol	**B** 1750 mol
C 0.0175 mol	**D** 17.5 mol

Solution: (d) $1750/100$ is 17.5 moles.

MCQ 1.1.47 **During stoichiometric calculations, which of the following laws must be followed? (UHS MDCAT 2019)**

A Dalton's law	**B** Avogadro's law
C Law of conservation of mass	**D** Law of conservation of energy

Solution: (c) Matter is neither made nor destroyed, so the equation must balance.

MCQ 1.1.48 **The formula which shows the simplest whole number ratio for the atoms of different elements in a compound is: (UHS MDCAT 2018)**

A Ionic formula	**B** Structural formula
C Empirical formula	**D** Molecular formula

Solution: (c) The simplest whole number ratio of the atoms is the empirical formula.

MCQ 1.1.49 **While finding the relative atomic mass, which of the following standard is used to compare the atomic mass of chlorine (35.5 amu) (UHS MDCAT 2018)**

A Carbon - 13	**B** Neon - 20
C Carbon - 12	**D** Nucleon number

Solution: (c) Atomic masses are referred to carbon-12, taken as exactly twelve units.

MCQ 1.1.50 **3.0 mole of Calcium will contain _____ g of Calcium. (UHS MDCAT 2018)**

A 105 g	**B** 120 g
C 80 g	**D** 100 g

Solution: (b) 3.0×40 is $120\,\mathrm{g}$.

MCQ 1.1.51 **Determine the number of moles of O in 10.6g of Na2CO3: (UHS MDCAT 2017)**

A 0.4 moles	**B** 0.3 moles
C 0.2 moles	**D** None of the given options

Solution: (b) $10.6/106$ is 0.1 mole of the carbonate, and each carries three oxygens.

MCQ 1.1.52 **Choose the correct option regarding number or particles associated with one mole of a substance: (UHS MDCAT 2017)**

A 6.03 x 1023	**B** 6.01 x 10-19
C 6.02 x 10-23	**D** 6.02 x 1023

Solution: (d) A mole holds 6.02×10^{23} particles.

MCQ 1.1.53 **Calculate the grams of H2O formed when 8g of CH4 burns in excess of oxygen: (UHS MDCAT 2017)**

A 21 grams	**B** 19 grams
C 18 grams	**D** 15 grams

Solution: (c) $8\,\mathrm{g}$ is half a mole of methane, which gives one mole, $18\,\mathrm{g}$, of water.

MCQ 1.1.54 **A compound has an empirical formula CH2Cl and molecular formula mass as 99gmol-1, identify the compound: (UHS MDCAT 2017)**

A C2H4Cl	**B** C4H8Cl
C C2H4Cl2	**D** C2H3Cl3

Solution: (c) The empirical formula weighs 49.5, and $99/49.5$ is two, so the molecule is $\mathrm{C_2H_4Cl_2}$.

MCQ 1.1.55 **Among the following, which contains the same no. Of electrons & protons but different no. of neutrons: (UHS MDCAT 2017)**

A Isboars	**B** Isotopes
C Isotones	**D** None of the given options

Solution: (b) Isotopes of an element differ only in the number of neutrons.

MCQ 1.1.56 **What mass of NaOH is present in 0.5 mol of sodium hydroxide? (UHS MDCAT 2016)**

A 40 gm	**B** 2.5 gm
C 5 gm	**D** 20 gm

Solution: (d) 0.5×40 is $20\,\mathrm{g}$.

MCQ 1.1.57 **The number of moles of CO2 which contain 8.00 gm of oxygen is: (UHS MDCAT 2016)**

A 0.75	**B** 1.50
C 0.25	**D** 1.00

Solution: (c) $8.00\,\mathrm{g}$ is half a mole of oxygen atoms, and each molecule carries two.

MCQ 1.1.58 **The substance for the separation of isotopes is firstly converted into the (UHS MDCAT 2016)**

A Neutral state	**B** Free state
C Vapour state	**D** Charged state

Solution: (c) Isotopes are separated in a mass spectrometer, which works on the vapour.

MCQ 1.1.59 **Number of neutrons in 6630Zn (UHS MDCAT 2016)**

A 30	**B** 35
C 38	**D** 36

Solution: (d) $66 - 30$ leaves 36 neutrons.

MCQ 1.1.60 **10.0 grams of glucose are dissolved in water to make 100 cm3 of its solution, its molarity is: (UHS MDCAT 2015)**

A	0.55	B	0.1
C	10	D	1

Solution: (a) $10.0/180$ is 0.0555 mole in $0.1\,\mathrm{dm}^3$, that is about $0.55\,\mathrm{M}$.

MCQ 1.1.61 **Given solution contains 16.0 g of CH3OH, 92.0 g of C2H5OH and 36 g of water. Which statement about mole fraction of the components is true? (UHS MDCAT 2015)**

A	Mole fraction of CH3OH is highest among all	B	Mole fraction of C2H5OH and H2O is the same
C	Mole fraction of CH3OH and C2H5OH is same components	D	Mole fraction of H2O is the lowest among all

Solution: (b) The amounts are 0.5, 2 and 2 moles, so ethanol and water share the same mole fraction.

Topic 1.3 Yield

Past MDCAT Questions

MCQ 1.3.1 **30 grams of ethanol are mixed with excess acidified $\mathrm{K_2Cr_2O_7}$ and boiled under reflux. The organic product is collected by distillation and the yield is 75.0%. What is the mass of product produced? (MDCAT 2022)**

A	1.74 g	B	24.75 g
C	2.74 g	D	29 g

Solution: (d) $30/46 = 0.65$ mol of ethanol would give $0.65 \times 60 = 39$ g of ethanoic acid, and 75% of that is about 29 g.

MCQ 1.3.2 **Consider the given balanced chemical equation: 2H2 + O2 -> 2H2O If 4 g of H2 reacts with 32 g of O2 to produce 28 g of H2O, what is the percentage yield of the reaction? (Molar mass of H2 = 2 g/mol, O2 = 32 g/mol and H2O = 18 g/mol) (UHS MDCAT 2025)**

A	63.6%	B	77.8%
C	87.5%	D	92.5%

Solution: (b) Four grams of hydrogen would give $36\,\mathrm{g}$ of water, so the yield is $28/36$, or 77.8%.

MCQ 1.3.3 **A chemical reaction has a theoretical yield of 25 g, but only 20 g of product was obtained. What is the percentage yield of the reaction? (UHS MDCAT 2025)**

A	20%	B	25%
C	45%	D	80%

Solution: (d) The yield is the actual over the theoretical, $20/25$, which is 80%.

MCQ 1.3.4 **If % yield and actual yield is 80 and 20g respectively, what will be theoretical yield? (UHS MDCAT 2025)**

A	20g	B	25g
C	30g	D	40g

Solution: (b) The theoretical yield is the actual divided by the fraction, $20/0.8$, which is $25\,\mathrm{g}$.

MCQ 1.3.5 **Heating 24.8g of copper carbonate (CuCO3) in a crucible produced only 13.9g of copper oxide (CuO). What is the percentage yield of copper oxide? (KMU MDCAT 2024)**

A	81.79%	B	83.98%
C	86.87%	D	89.68%

Solution: (c) $24.8\,\mathrm{g}$ is 0.2 mole, which should give $16\,\mathrm{g}$ of the oxide, and $13.9/16$ is 86.87%.

MCQ 1.3.6 **Efficiency of chemical reaction can be checked by calculating (KMU MDCAT 2024)**

A	Actual yield	B	Theoretical yield
C	Percentage yield	D	Amount of the reactant unused

Solution: (c) The percentage yield compares what was got with what was possible, so it measures the efficiency.

MCQ 1.3.7 **Actual yield will reach the ideal (theoretical) value if the % yield of the reaction is, (KMU MDCAT 2024)**

A	10%	B	50%
C	90%	D	100%

Solution: (d) A hundred per cent yield is exactly the case where the actual yield equals the theoretical one.

MCQ 1.3.8 **30 grams of 2-propanol were mixed with excess acidified K2Cr2O7 and boiled under reflux for 20 minutes. The organic product was then collected by distillation. The yield of product was 75.0%. What is the mass of product produced? (UHS MDCAT 2023)**

A	1.74g	B	21.75g
C	2.74g	D	29.9 g

Solution: (b) Half a mole of the alcohol would give half a mole, $29\,\mathrm{g}$, of acetone, and three quarters of that is $21.75\,\mathrm{g}$.

MCQ 1.3.9 **The amount of product according to the balanced chemical equation is called as? (PMC MDCAT 2022)**

A	Theoretical yield	B	Actual amount
C	Limiting amount	D	Stoichiometric amount

Solution: (a) The amount the equation says is possible is the theoretical yield.

MCQ 1.3.10 **In a particular chemical reaction the actual yield was 70gm, while that of Its theoretical yield Is 100gm. The pecentage yield of the said reatlon is: (PMC MDCAT 2022)**

A	100%	B	70%
C	40%	D	20%

Solution: (b) $70/100$ is a yield of 70%.

MCQ 1.3.11 **Actual yield is always less than theoretical yield due to? (PMC Practice 2021)**

A	Operational losses	B	Reaction reversibility
C	Side reaction	D	All of these options are correct

Solution: (d) Some product is lost in handling, some reactions reverse and some go another way.

MCQ 1.3.12 **The efficiency of chemical reaction can be expressed as: (PMC MDCAT 2020)**

A	Theoretical yield	B	Actual yield
C	% yield	D	Maximum yield

Solution: (c) The percentage yield compares what was got with what was possible.

Topic 1.2 Limiting and Excess Reactants

Past MDCAT Questions

MCQ 1.2.1 **Consider the given reaction: N2 + 3H2 --> 2NH3 If 56 g of N2 reacts with 12 g of H2 and produces 51 g of NH3, what is the theoretical yield (TY) of NH3 and the percentage yield (PY) of the reaction? (Molar mass of N2 = 28 g/mol, H2 = 2 g/mol and NH3 = 17 g/mol) (SIBA MDCAT 2025)**

A	TY = 68 g and PY = 75%	**B**	TY = 34 g and PY = 67%
C	TY = 68 g and PY = 33%	**D**	TY = 34 g and PY = 75%

Solution: (a) Two moles of nitrogen and six of hydrogen are exactly the required ratio, so four moles, 68 g, are possible and 51/68 is 75%.

MCQ 1.2.2 **50.0 g Mg is burnt with 32g of oxygen to form MgO, amount of excess reagent left is? (SIBA MDCAT 2025)**

A	6g Mg	**B**	2g Mg
C	8g O2	**D**	16g O2

Solution: (b) One mole of oxygen needs two moles, 48 g, of magnesium, so 2 g of magnesium is left over.

MCQ 1.2.3 **Ca + S → CaS. If 2.0g of Calcium and 4.0g of Sulphur are available, amount of product formed: (NUMS MDCAT 2024)**

A	4.6g	**B**	1.6g
C	2.6g	**D**	3.6g

Solution: (d) 2.0 g is 0.05 mole of calcium, the limiting reactant, so 0.05×72, that is 3.6 g, of the sulphide is formed.

MCQ 1.2.4 **The limiting reactant in a particular chemical reaction is the one which: (PMC MDCAT 2022)**

A	Is consumed later in the reaction	**B**	Is present in excess in the reaction
C	Gives the least amount of product	**D**	Gives the largest amount of product

Solution: (c) The limiting reactant is used up first and so fixes how much product can be made.

MCQ 1.2.5 **The amount of reactant according to the balanced chemical equation is called as? (PMC MDCAT 2022)**

A	Excess amount	**B**	Actual amount
C	Limiting amount	**D**	Stoichiometric amount

Solution: (d) The amount the equation calls for is the stoichiometric amount.

MCQ 1.2.6 **The _____ reagent is the reactant that gets consumed first in a chemical reaction and therefore limits how much product can be formed. (PMC MDCAT 2022)**

A	excess	**B**	limiting
C	extent	**D**	none of the above

Solution: (b) The reactant used up first is the limiting reagent.

MCQ 1.2.7 **Which one of the following is calculated from balanced equation during the determination of limiting reactant? (PMC MDCAT 2022)**

A	Amount of reactants present	**B**	Amount of limiting reactant that produces·the product
C	Amount of product expected to form from each reactant	**D**	Amountof excess reactant

Solution: (c) Each reactant is converted to the product it could give, and the smaller answer settles which is limiting.

MCQ 1.2.8 **In the process of iron rusting, which of the following is the limiting reactant? (PMC MDCAT 2022)**

A	Iron	**B**	Oxygen
C	Air	**D**	Water

Solution: (a) Air supplies oxygen and water without limit, so it is the iron that runs out.

Topic 2.1 Discovery of the Proton

Past MDCAT Questions

MCQ 2.1.1 The lightest positive rays are obtained from: (MDCAT 2020)

A	hydrogen gas	B	helium
C	neon	D	air

Solution: (a) The positive ray is an ion of the gas in the tube, and the hydrogen ion is the lightest there is.

MCQ 2.1.2 Which gas in a discharge tube produces the lightest canal ray particles? (MDCAT 2022)

A	Ar	B	He
C	H_2	D	Ne

Solution: (c) The positive rays are ions of the gas, and the hydrogen ion, the proton, is the lightest of them.

MCQ 2.1.3 How much heavier is the H-atom as compared to electron? (NUMS MDCAT 2025)

A	1937	B	1737
C	1837	D	1637

Solution: (c) A hydrogen atom is about 1837 times as massive as an electron.

MCQ 2.1.4 Which gas in the discharge tube produces lightest canal ray particles? (UHS MDCAT 2023)

A	Ar	B	He
C	H2	D	Ne

Solution: (c) Canal rays are positive ions of the gas, and the hydrogen ion is the lightest of all.

MCQ 2.1.5 Mass of electron ___ times smaller than that of proton. (PMC MDCAT 2022)

A	1837	B	1839
C	1836	D	1834

Solution: (c) The proton is about 1836 times as massive as the electron.

MCQ 2.1.6 In the gaseous phase, when ionization takes place _____ are isolated and are free from all external influences: (PMC MDCAT 2022)

A	Atoms and molecule	B	Atom and cation
C	Atom and anion	D	Atom and ion

Solution: (b) Ionization energy is measured in the gas phase, where an isolated atom gives an isolated cation.

MCQ 2.1.7 Who named the positive rays produced by the hydrogen gas in discharge tube? (PMC MDCAT 2022)

A	Goldstein	B	Rutherford
C	Bohr	D	Chedwick

Solution: (b) Rutherford identified the positive ray of hydrogen as a new particle and named it the proton.

MCQ 2.1.8 In the discharge tube positive rays moves in which direction (PMC MDCAT 2022)

A	Towards anode	B	Towards cathode
C	Move randomly	D	Move towards vaccum in the tube

Solution: (b) Positive rays are cations, so they are drawn to the negative electrode.

MCQ 2.1.9 Proton number of 23Nall is: (NUMS MDCAT 2022)

A	23	B	11
C	12	D	34

Solution: (b) The subscript is the atomic number, so sodium has eleven protons.

MCQ 2.1.10 The mass of electron is: (NUMS MDCAT 2022)

A	1836 times more than mass of proton	B	1836 times less than mass of proton
C	1836 times more than mass of neutron	D	1836 times more than mass of hydrogen atom

Solution: (b) The proton is about 1836 times as massive as the electron.

MCQ 2.1.11 The e/m values for the positive rays depends on _____enclosed in a discharge tube. (PMC Practice 2021)

A	Nature of gas	B	Properties of gas
C	Composition of gas	D	All of these

Solution: (a) A positive ray is an ion of the gas in the tube, so its charge to mass ratio depends on which gas that is.

Topic 2.2 Planck's Quantum Theory

Past MDCAT Questions

MCQ 2.2.1 The amount of energy associated with a quantum of radiation is directly proportional to its: (MDCAT 2020)

A	photon	B	wavelength
C	frequency	D	velocity

Solution: (c) $E=h

MCQ 2.2.2 According to Planck's quantum theory, if the frequency of photon is doubled, the value of hf will be: (KMU MDCAT 2025)

A	Doubled	B	Increased 3 times
C	Increased 4 times	D	Unchanged

Solution: (a) The energy of a quantum is hf, which is proportional to the frequency.

MCQ 2.2.3 Highest energy for one quantum among radiation is: (SZABMU MDCAT 2025)

A	microwave	B	infrared
C	ultra violet	D	visible

Solution: (c) Energy is hf, and of these four the ultraviolet has the highest frequency.

MCQ 2.2.4 The amount of energy associated with quantum of radiation is directly proportional to: (NUMS MDCAT 2023)

A	Photon	B	Wavelength
C	Frequency	D	Velocity

Solution: (c) A quantum carries energy hf, proportional to the frequency.

MCQ 2.2.5 What is the value of Planck's constant {h)? (PMC MDCAT 2022)

A	6.62×10^-34Js	B	6.02×10^-34Js
C	6.62×10^-33Js	D	6.34×10^-34 Js

Solution: (a) Planck's constant is 6.62×10^{-34} J s.

MCQ 2.2.6 Which is the correct demonstration of de-Broglie equation? (PMC MDCAT 2022)

A	λ=mv/h	B	λ=h/mv
C	h=λ/mv	D	P=λ/h

Solution: (b) De Broglie put the wavelength of a particle at h/mv.

Topic 2.3 Quantum Numbers and Orbitals

Past MDCAT Questions

MCQ 2.3.1 **The maximum number of electrons that can be placed in one orbital is: (MDCAT 2020)**

A	l	**B**	2
C	3	**D**	4

Solution: (b) The Pauli exclusion principle allows two electrons of opposite spin in one orbital.

MCQ 2.3.2 **According to which scientist is the probability of finding an electron at a certain position possible? (MDCAT 2022)**

A	Bohr	**B**	de Broglie
C	Hund	**D**	Schrodinger

Solution: (d) The square of the wave function of the Schrodinger equation gives the probability of finding the electron in a region, which is what an orbital is.

MCQ 2.3.3 **Which set of quantum numbers is not allowed for an electron. (UHS MDCAT 2025)**

A	n=2, l=l, m=0, s=+l/2	**B**	n=3, l=0, m=0, s=-l/2
C	n=2, l=2, m=+l, s=+l/2	**D**	n=l, l=0, m=0, s=+l/2

Solution: (c) The azimuthal quantum number cannot reach the principal one, so $l = 2$ is impossible when $n = 2$.

MCQ 2.3.4 **Shape of orbital is determined by quantum number: (UHS MDCAT 2025)**

A	n	**B**	l
C	m	**D**	s

Solution: (b) The azimuthal quantum number l fixes the shape of the orbital; n fixes its size.

MCQ 2.3.5 **The number of electrons in a subshell can be calculated by the formula: (NUMS MDCAT 2025)**

A	2l + l	**B**	2l + 2
C	2(2 + l)	**D**	2(2l + l)

Solution: (d) A subshell holds $2(2l + 1)$ electrons, so two in s, six in p and ten in d.

MCQ 2.3.6 **Number of electron with l=2 in an atom having atomic number 23 is: (SZABMU MDCAT 2025)**

A	2	**B**	3
C	4	**D**	5

Solution: (b) Vanadium is $[\mathrm{Ar}]3d^3 4s^2$, and $l = 2$ means the d subshell, which holds three electrons.

MCQ 2.3.7 **Which of the following sub-shell does not exist? (KMU MDCAT 2024)**

A	lp	**B**	ls
C	5d	**D**	6f

Solution: (a) The first shell has $l = 0$ only, so there is no lp subshell.

MCQ 2.3.8 **The value of 'l' for 4p orbital is: (NUMS MDCAT 2024)**

A	0	**B**	l
C	2	**D**	3

Solution: (b) A p orbital has $l = 1$ whatever its shell.

MCQ 2.3.9 **Choose the correct quantum numbers: (NUMS MDCAT 2024)**

A	n=3, l=2, m=0, s=+l/2	**B**	n=-3, l=3, m=0, s=-l/2
C	n=4, l=3, m=4, s=+l/2	**D**	n=4, l=2, m=4, s=-l/2

Solution: (a) Only the first set obeys the rules: l below n, and m within $\pm l$.

MCQ 2.3.10 **Principle quantum number is represented by the symbol: (SZABMU MDCAT 2023)**

A	m	**B**	n
C	s	**D**	l

Solution: (b) The principal quantum number is n.

MCQ 2.3.11 **Shape of the sub shell is explained by which quantum number: (SZABMU MDCAT 2023)**

A	Principal quantum number	**B**	Azimuthal quantum number
C	Magnetic quantum number	**D**	Spin quantum number

Solution: (b) The azimuthal quantum number l fixes the shape of the subshell.

MCQ 2.3.12 **Maximum number of electrons which can be placed in one orbital is: (SZABMU MDCAT 2023)**

A	l	**B**	2
C	3	**D**	4

Solution: (b) No two electrons may share all four quantum numbers, so an orbital holds two of opposite spin.

MCQ 2.3.13 **If value of azimuthal quantum number is 2 then total values of magnetic quantum number will be: (NUMS MDCAT 2023)**

A	03	**B**	05
C	07	**D**	10

Solution: (b) With $l = 2$ the magnetic quantum number runs from -2 to $+2$, five values in all.

MCQ 2.3.14 **Which of the following quantum number is not obtained from Schrodinger Wave equation? (NUMS MDCAT 2023)**

A	Principal Quantum Number	**B**	Spin Quantum Number
C	Azimuthal Quantum Number	**D**	Magnetic Quantum Number

Solution: (b) The wave equation gives n, l and m; the spin quantum number was added to account for the doubling of lines.

MCQ 2.3.15 **Which of the following orbital is closer to the nucleus? (PMC MDCAT 2022)**

A	3d	**B**	2p
C	3p	**D**	3s

Solution: (b) The lower the principal quantum number the nearer the shell, and 2p is nearer than any of the third shell.

MCQ 2.3.16 **How many electrons are present in the orbital having n=l, l=0, m=0? (PMC MDCAT 2022)**

A	3	**B**	2
C	4	**D**	5

Solution: (b) Those numbers name the ls orbital, which holds two electrons of opposite spin.

MCQ 2.3.17 **Which subshells are present In M shell? (PMC MDCAT 2022)**

A	s	**B**	s, p
C	s, p, d	**D**	s, p, d, f

Solution: (c) The third shell has $l = 0, 1, 2$, that is s, p and d.

MCQ 2.3.18 **The maximum number of electrons which can be accommodated in all orbital for which I=3 is: (PMC MDCAT 2022)**

A	6	**B**	14
C	10	**D**	18

Solution: (b) With $l = 3$ there are seven orbitals, holding fourteen electrons.

MCQ 2.3.19 **The value of Azimuthal quantum number (I) depends upon: (PMC MDCAT 2022)**

A	n	**B**	m
C	s	**D**	p

Solution: (a) For a given n the azimuthal number runs from 0 to $n - 1$.

MCQ 2.3.20 **Maximum electrons that can be placed in p subshell are: (NUMS MDCAT 2022)**

A	2	**B**	6
C	10	**D**	14

Solution: (b) A p subshell has three orbitals, holding six electrons.

MCQ 2.3.21 **The shape of an orbital is determined by which quantum number? (NUMS MDCAT 2022)**

A	n	**B**	l
C	m	**D**	s

Solution: (b) The azimuthal quantum number l fixes the shape.

MCQ 2.3.22 **The shielding effect is also called? (PMC Practice 2021)**

A	Zee effect	**B**	Screening effect
C	Negative effect	**D**	Reducing effect

Solution: (b) The inner electrons screen the outer ones from the nucleus, which is why it is called screening.

MCQ 2.3.23 **The formula for calculating the number of electrons in subshells or sub-energy levels is: (PMC Practice 2021)**

A	2l+1	**B**	2(l+1)
C	2(2l+1)	**D**	2(2l-1)

Solution: (c) A subshell holds $2(2l+1)$ electrons.

MCQ 2.3.24 **Quantum number values for '2p' orbitals are: (PMC MDCAT 2020)**

A	n=2, l=1	**B**	n=1, l=2
C	n=1, l=0	**D**	n=2, l=0

Solution: (a) The 2p orbital has $n = 2$ and $l = 1$.

MCQ 2.3.25 **The relationship between quantum number n and l is: (PMC MDCAT 2020)**

A	n = l - 1	**B**	l = n - 2
C	l = n - 1	**D**	n = l - 2

Solution: (c) For a given n, l runs from zero up to $n-1$.

MCQ 2.3.26 **The maximum number of electrons in electronic configuration can be calculated by using formula: (UHS MDCAT 2016)**

A	2(2l + 1)	**B**	2n2 + 2
C	2n2	**D**	2n2 + l

Solution: (c) A shell holds $2n^2$ electrons.

Topic 2.4 Shapes of Orbitals

Past MDCAT Questions

MCQ 2.4.1 **The p orbital has: (MDCAT 2024)**

A	2 lobes	**B**	3 lobes
C	4 lobes	**D**	5 lobes

Solution: (a) A p orbital is dumb-bell shaped, with two lobes on either side of the nucleus.

MCQ 2.4.2 **The maximum probability of finding an electron is at a distance of: (SIBA MDCAT 2025)**

A	0.53 nm	**B**	0.35 nm
C	0.053 nm	**D**	0.0053 nm

Solution: (c) The most probable distance of the electron of a hydrogen atom is the Bohr radius, $0.053\,\text{nm}$.

MCQ 2.4.3 **Which atom has at least single electron in dumbell shape orbital? (SIBA MDCAT 2025)**

A	H	**B**	He
C	Li	**D**	B

Solution: (d) The p orbital is dumb-bell shaped, and boron is the first of these with an electron in one.

MCQ 2.4.4 **According to which scientist, the probability of finding an electron at a certain position is possible? (UHS MDCAT 2023)**

A	Bohr's	**B**	De-Broglie
C	Hund's	**D**	Schrodinger

Solution: (d) Schrodinger's wave equation gives the probability of finding the electron in a region of space.

MCQ 2.4.5 **Total number of directions of f-orbitals in space are: (NUMS MDCAT 2023)**

A	05	**B**	03
C	07	**D**	06

Solution: (c) There are seven f orbitals in a subshell.

MCQ 2.4.6 **Which principle contradicts the Bohr's model? (PMC MDCAT 2022)**

A	Planck quantum theory	**B**	Hunds rule
C	Pauli's exclusion principle	**D**	Heisenberg's uncertainty principle

Solution: (d) Bohr gave the electron a definite orbit and speed, which the uncertainty principle forbids.

MCQ 2.4.7 **What is the shape of s-orbital ? (PMC MDCAT 2022)**

A	Lobed	**B**	Spherical
C	Dumbbell	**D**	Sausage

Solution: (b) An s orbital is spherical about the nucleus.

MCQ 2.4.8 **How do the 'p' orbitals px, py, pz differ from each other? (PMC Practice 2021)**

A	Size	**B**	Shape
C	Orientation	**D**	Capacity

Solution: (c) The three p orbitals are alike in size and shape and differ only in the axis they lie along.

MCQ 2.4.9 **The shape of s-orbital is _____ and the shape of p-orbital is _____. (UHS MDCAT 2017)**

A	Spherical, dumb-bell	**B**	Dumb-bell, spherical
C	Spherical, double dumb-bell	**D**	Spherical, spherical

Solution: (a) An s orbital is spherical and a p orbital dumb-bell shaped.

Topic 2.6 Electronic Configuration

Past MDCAT Questions

MCQ 2.6.1 **Which of the following orbitals will be filled before $4p$? (MDCAT 2020)**

A	$4s$	**B**	$2p$
C	$3d$	**D**	$5s$

Solution: (c) By the $(n+l)$ rule the order runs $4s$, $3d$, $4p$, so $3d$ fills first of these.

MCQ 2.6.2 **Which element has the ground state electronic configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6$? (MDCAT 2022)**

A	Ar	**B**	O
C	Na	**D**	S

Solution: (a) Eighteen electrons filling up to $3p$ is argon.

MCQ 2.6.3 **When the $6d$ orbital is filled, the entering electron goes into: (MDCAT 2023)**

A	$7s$	**B**	$7p$
C	$8s$	**D**	$5f$

Solution: (b) By the $(n+l)$ rule the next lowest set after $6d$ is $7p$.

MCQ 2.6.4 **Which element has the ground state electronic configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6$? (MDCAT 2023)**

A	Cl	**B**	K
C	Ne	**D**	Ar

Solution: (d) Eighteen electrons in a closed shell arrangement is argon.

MCQ 2.6.5 **What is the proton number of the element that has four unpaired electrons in its ground state? (MDCAT 2023)**

A	24	**B**	25
C	22	**D**	26

Solution: (d) Iron, $[Ar]3d^6 4s^2$, has four unpaired 3d electrons.

MCQ 2.6.6 **Which of the following electronic configurations is correct for carbon? (MDCAT 2024)**

A	$1s^2 2s^2 2p^2$	**B**	$1s^2 2s^2 2p^4$
C	$1s^2 2s^2 2p^3$	**D**	$1s^2 2s^2 2p^1$

Solution: (a) Carbon has six electrons, which fill 1s and 2s and leave two in 2p.

MCQ 2.6.7 **Number of unpaired electrons present in the ground state of Fe3+ are (Atomic number of Fe=26). (UHS MDCAT 2025)**

A	Three	**B**	Four
C	Five	**D**	Six

Solution: (c) Iron(III) is $[Ar]3d^5$, and five d electrons stay unpaired.

MCQ 2.6.8 **Number of unpaired electrons In Boron in ground state is/are: (UHS MDCAT 2025)**

A	1	**B**	2
C	3	**D**	4

Solution: (a) Boron is $1s^2 2s^2 2p^1$, so the single p electron is the only unpaired one.

MCQ 2.6.9 **When 5d orbital is complete, the entering electron goes into: (NUMS MDCAT 2025)**

A	6s	**B**	6p
C	6d	**D**	6f

Solution: (b) By the $n+l$ rule the 6p subshell is filled after the 5d.

MCQ 2.6.10 **Which of the following is expected to be the most paramagnetic? (SIBA MDCAT 2025)**

A	H	**B**	Be
C	B	**D**	C

Solution: (d) Carbon is $1s^2 2s^2 2p^2$, with two unpaired p electrons, more than any of the others here.

MCQ 2.6.11 **Which of the following electronic configuration is correct for carbon? (UHS MDCAT 2024)**

A	ls22s2p3	**B**	ls22s2p4
C	ls22s2p2	**D**	ls22s2pl

Solution: (c) Carbon has six electrons, $1s^2 2s^2 2p^2$.

MCQ 2.6.12 **Which element has the electronic configuration of noble-gas notation [Kr], 5s2, 4d? (KMU MDCAT 2024)**

A	Mo	**B**	Se
C	Sr	**D**	Zr

Solution: (d) Zirconium is $[Kr]5s^2 4d^2$.

MCQ 2.6.13 **The element having the electronic configuration (Kr) 5s24d8 is: (NUMS MDCAT 2024)**

A	Sr	**B**	Ru
C	Pd	**D**	Zr

Solution: (c) Filling to $[Kr]5s^2 4d^8$ accounts for 46 electrons, which is palladium.

MCQ 2.6.14 **Which element has the ground state electronic configuration of ls2, 2s2, 2p6, 3s2, 3p6? (UHS MDCAT 2023)**

A	Ar	**B**	Cl
C	Na	**D**	S

Solution: (a) Eighteen electrons filled to $3p^6$ is argon.

MCQ 2.6.15 **What is the proton (atomic number) of an element that has four unpaired electrons in its ground state? (UHS MDCAT 2023)**

A	6	**B**	14
C	22	**D**	26

Solution: (d) Iron, $[Ar]3d^6 4s^2$, has four unpaired d electrons.

MCQ 2.6.16 **The electronic configuration for degenerated orbitals is explained by: (SZABMU MDCAT 2023)**

A	Aufbau Principle	**B**	n + l rule
C	Hund's rule	**D**	Pauli exclusion principle

Solution: (c) Hund's rule fills degenerate orbitals singly before any is doubled.

MCQ 2.6.17 **The electronic configuration for degenerate orbitals is explained by: (NUMS MDCAT 2023)**

A	Aufbau Principle	**B**	n + l rule
C	Hund's rule	**D**	Pauli exclusion principle

Solution: (c) Hund's rule fills degenerate orbitals singly before any is doubled.

MCQ 2.6.18 **When 6d orbital is filled, the entering electron goes into? (UHS MDCAT 2023)**

A	7f	**B**	7d
C	7p	**D**	7s

Solution: (c) By the $n+l$ rule the 7p subshell follows the 6d.

MCQ 2.6.19 **How many unpaired electrons are there in the Nitrogen atom? (PMC MDCAT 2022)**

A	3	**B**	4
C	5	**D**	6

Solution: (a) Nitrogen is $1s^2 2s^2 2p^3$, and by Hund's rule the three p electrons stay unpaired.

MCQ 2.6.20 **The valence shell electronic configuration of Ca is Ar[ ]: (PMC MDCAT 2022)**

A	ls2	**B**	2s2
C	3s2	**D**	4s2

Solution: (d) Calcium is $[Ar]4s^2$.

MCQ 2.6.21 **Which of the following atomic orbital has lowest energy? (PMC MDCAT 2022)**

A	ls	**B**	2p
C	3s	**D**	4p

Solution: (a) The ls orbital is nearest the nucleus and lowest in energy.

MCQ 2.6.22 **Atomic numbers of chromium (Cr) is 24. Correct electronic configuration of Cr is: (PMC MDCAT 2022)**

A	[Ar]3d54sl	**B**	[Ar]3d54s2
C	[Ar]3d04s0	**D**	[Ar]3d44s2

Solution: (a) A half filled d subshell is stable, so chromium is $[Ar]3d^5 4s^1$.

MCQ 2.6.23 **How many electrons does calcium have in the 3p orbital? (PMC MDCAT 2022)**

A	5	**B**	6
C	2	**D**	3

Solution: (b) Calcium is $[Ne]3s^2 3p^6 4s^2$, so its 3p subshell is full with six.

MCQ 2.6.24 **The atomic number of calcium is 20. The electronic structure of a calcium ion can be represented as: (PMC MDCAT 2022)**

A	2,8	**B**	2,8,4
C	2,8,8	**D**	2,8,8,2

Solution: (c) The calcium ion has lost its two 4s electrons, leaving the argon structure 2,8,8.

MCQ 2.6.25 **Apply n+l rule and calculate which of the following orbital has maximum energy? (NUMS MDCAT 2022)**

A	4s	**B**	2p
C	2d	**D**	3s

Solution: (a) The 4s orbital has the largest $n + l$ of these, so it lies highest.

MCQ 2.6.26 **Sodium-11 has the electronic configuration: (PMC Practice 2021)**

A	[He] 2sl	**B**	[Ne] 3sl
C	[Ne] 3s2	**D**	[He] 2s2

Solution: (b) Sodium is $[\mathrm{Ne}]3s^1$.

MCQ 2.6.27 **Which pair has I electron in it's 's' orbital? (PMC MDCAT 2020)**

A	Li & Fe	**B**	Na & Cr
C	K & Mn	**D**	H & He

Solution: (b) Sodium is $3s^1$ and chromium $4s^1$, each with a single s electron in its outer shell.

MCQ 2.6.28 **Which of the following is the electronic configuration of Cr? (UHS MDCAT 2019)**

A	[Ar] 3d5 4s2	**B**	[Ar] 3d5 4sl
C	[Ar] 3d4 4s2	**D**	[Ar] 3d6 4s0

Solution: (b) A half filled d subshell is stable, so chromium is $[\mathrm{Ar}]3d^5 4s^1$.

MCQ 2.6.29 **Which is the correct electronic configuration of Chromium (24Cr)? (UHS MDCAT 2018)**

A	ls2, 2s2, 3s2, 2p6, 3p6, 4s2, 3d6	**B**	ls2, 2s2, 2p6, 3s2, 3p6, 4s2, 3d4
C	lsl, 2s2, 2p6, 3s2, 3p6, 3d6	**D**	ls2, 2s2, 2p6, 3s2, 3p6, 4sl, 3d5

Solution: (d) A half filled d subshell is stable, so chromium is $[\mathrm{Ar}]4s^1 3d^5$.

MCQ 2.6.30 **Which element of 3d series of periodic table shows the electronic configuration of 3d8, 4s2? (UHS MDCAT 2016)**

A	Copper	**B**	Cobalt
C	Zinc	**D**	Ni

Solution: (d) $[\mathrm{Ar}]3d^8 4s^2$ accounts for 28 electrons, which is nickel.

Topic 2.5 Spectrum of Hydrogen

Past MDCAT Questions

MCQ 2.5.1 **The splitting of spectral lines in magnetic field is (KMU MDCAT 2024)**

A	Aufbau principle	**B**	Pauli exclusion principle
C	Stark effect	**D**	Zeeman effect

Solution: (d) Splitting of spectral lines in a magnetic field is the Zeeman effect; in an electric field it is the Stark effect.

MCQ 2.5.2 **An element or its compound is first _____ to get its _____ spectrum by a spectrometer. (PMC Practice 2021)**

A	Freezed, continuous	**B**	Freezed, line
C	Volatilized, line	**D**	Volatilized, continuous

Solution: (c) The sample is vaporized so that its free atoms give the line spectrum by which it is identified.

Unit 3 Gases

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Topic 3.1 Kinetic Molecular Theory

Past MDCAT Questions

MCQ 3.1.1 The process of heat flow between hotter and colder gases continues until all the molecules have equal: (MDCAT 2022)

A	average translational kinetic energy	B	average rotational kinetic energy
C	average translational potential energy	D	average vibrational kinetic energy

Solution: (a) Temperature measures the average translational kinetic energy, and heat flows until the two gases share it equally.

MCQ 3.1.2 The process of heat flow between hotter and colder bodies stops when their molecules have equal: (MDCAT 2023)

A	average translational kinetic energy	B	average rotational kinetic energy
C	average translational potential energy	D	average vibrational kinetic energy

Solution: (a) Temperature is a measure of the average translational kinetic energy, and heat flows until the two are equal.

MCQ 3.1.3 The intermolecular forces between the molecules of an ideal gas are: (MDCAT 2024)

A	strong	B	moderate
C	weak	D	absent

Solution: (d) The kinetic theory of an ideal gas assumes no attraction between the molecules at all.

MCQ 3.1.4 Which of the following is NOT a postulate of kinetic molecular theory of gases? (KMU MDCAT 2025)

A	Gas molecules undergo elastic collision	B	Gas molecules are in continuous random motion
C	Gas molecules do not exert pressure when molecules collide with wall of container	D	Gas molecules are far away from each other

Solution: (c) The theory says pressure is precisely the result of those collisions with the walls.

MCQ 3.1.5 Which of the following relationship is correct for kinetic energy of gases? (NUMS MDCAT 2025)

A	K.E = 2RT/3NA	B	K.E = 3RT/2NA
C	K.E = 2mNT/2R	D	K.E = 2NA/3RT

Solution: (b) The mean translational energy of one molecule is $\frac{3}{2}RT/N_A$.

MCQ 3.1.6 The fourth state of matter is: (NUMS MDCAT 2025)

A	Solid	B	Liquid
C	Gaseous liquid	D	Plasma

Solution: (d) A gas heated until its atoms ionize becomes plasma, the fourth state of matter.

MCQ 3.1.7 According to the Kinetic molecular theory, the kinetic energy of gas molecules increases when they are (SZABMU MDCAT 2025)

A	melted from solid to liquid state	B	mixed with other molecules at lower temperature
C	frozen into solids	D	condensed into liquids

Solution: (a) Melting raises the temperature at which the particles move, so their kinetic energy rises.

MCQ 3.1.8 Which statement applies to both ideal and real gases (SZABMU MDCAT 2025)

A	collision between molecules are elastic	B	molecules are in constant random motion
C	molecules attract each other	D	molecules have zero size

Solution: (b) Continuous random motion is common to both; only the ideal gas has point molecules that do not attract.

MCQ 3.1.9 The relationship between absolute temperature and velocities of gas molecules is given by: (NUMS MDCAT 2024)

A	Crms = sqrt(3RT/M)	B	PV = nRT
C	V = sqrt(2Ek/m)	D	PV = 1/3mNc2

Solution: (a) The root mean square speed is $\sqrt{3RT/M}$.

MCQ 3.1.10 The process of heat flow between hotter and colder gases remains continued until all the molecules have equal (UHS MDCAT 2023)

A	Average translational kinetic energy	B	Average rotational kinetic energy
C	Average translational potential energy	D	Average vibrational kinetic energy

Solution: (a) Temperature is a measure of the mean translational kinetic energy, so heat flows until those are equal.

MCQ 3.1.11 Air is a mixture of gases. The molecules of air do notsettle down due to: (SZABMU MDCAT 2023)

A	Different molar mass	B	Non polar nature of gases
C	Presence of dust particles in air	D	Elastic collision of gas molecules

Solution: (d) The molecules keep their energy through collisions, so they stay in ceaseless motion and never settle.

MCQ 3.1.12 Collision shown by gases involve the following: (SZABMU MDCAT 2023)

A	No energy change	B	No pressure change
C	Small energy change	D	Large energy change

Solution: (a) Gas collisions are perfectly elastic, so no kinetic energy is lost in them.

MCQ 3.1.13 The idea that molecules in gases are in constant movement is called: (NUMS MDCAT 2023)

A	Kinetic theory of gases	B	Crystal field theory
C	Molecular orbital theory	D	Transition state theory

Solution: (a) That is the kinetic molecular theory of gases.

MCQ 3.1.14 According to the kinetic molecular theory, collisions between the gas molecues: (PMC MDCAT 2022)

A	Are elastic	B	Are non-elastic
C	Increase energy	D	Decrease energy

Solution: (a) Collisions between gas molecules are perfectly elastic, so no kinetic energy is lost.

MCQ 3.1.15 Spreading of scent in the air is due to: (PMC MDCAT 2022)

A	Diffusion of gas molecules	B	Effusion of gas molecules
C	Volume of gas	D	Temperatue of gas

Solution: (a) The molecules of the scent move at random and spread through the air, which is diffusion.

MCQ 3.1.16 Gases can easily mix with each other to form a uniform mixture, this property Is called: (PMC MDCAT 2022)

A	Effusion	B	Homogenous Mixing
C	Diffusion	D	Heterogenous mixing

Solution: (c) The spontaneous intermingling of gases is diffusion.

MCQ 3.1.17 **Kinetic Energy is the sum of _____. (PMC Practice 2021)**

A	Rotational & Vibrational	B	Translational & Rotational
C	Rotational, Vibrational, and Translation	D	All of these are correct

Solution: (c) A molecule can move bodily, spin and vibrate, and all three carry kinetic energy.

MCQ 3.1.18 **All the collisions between the particles of gases are elastic in nature. What is meant by "Elastic Collisions"? (UHS MDCAT 2019)**

A	No change in the total kinetic energy	B	The velocity of the molecules changes
C	No change in potential energy during the collisions	D	No change in mass during the collisions

Solution: (a) An elastic collision is one in which the total kinetic energy is unchanged.

MCQ 3.1.19 **Gas is enclosed in a container of 20 cm3 with the moving piston. According to kinetic theory of gases, what will be the effect on freely moving molecules of the gas if temperature is increased from 20 C to 100 C? (UHS MDCAT 2018)**

A	Pressure will become one half	B	Volume will be increased
C	Temperature has no effect on freely moving molecules	D	Colliding capability of molecule will become lower

Solution: (b) The molecules move faster and strike the piston harder, so at constant pressure the gas expands.

Topic 3.2 Standard Temperature and Pressure

Past MDCAT Questions

MCQ 3.2.1 **Half of atmospheric pressure is: (MDCAT 2020)**

A	400 torr	B	50662 Pa
C	1013 Pa	D	6.5 pounds

Solution: (b) One atmosphere is 101325 Pa, so half of it is 50662 Pa.

MCQ 3.2.2 **Consider the equation H2 + O2 -> H2O, what volume of hydrogen gas is required to produce 1 mol of water at standard temperature & pressure? (UHS MDCAT 2025)**

A	11.2 dm3	B	22.4 dm3
C	10 dm3	D	58 dm3

Solution: (b) One mole of water needs one mole of hydrogen, and a mole of any gas fills $22.4\,\mathrm{dm}^3$ at STP.

MCQ 3.2.3 **Select the standard condition for temperature and pressure: (SIBA MDCAT 2025)**

A	1 atm and 0K	B	760 torr and 25°C
C	2 bar and 25°C	D	14.7 psi and 0°C

Solution: (d) Standard conditions are one atmosphere, that is $14.7\,\mathrm{psi}$, and $0^\circ\mathrm{C}$.

MCQ 3.2.4 **760 torr is equal to ____ Pascal (KMU MDCAT 2024)**

A	1	B	76
C	760	D	101325

Solution: (d) One atmosphere is $760\,\mathrm{torr}$, that is $101325\,\mathrm{Pa}$.

MCQ 3.2.5 **The SI unit for pressure is: (NUMS MDCAT 2023)**

A	mm of Hg	B	Pascal
C	Bar	D	Torr

Solution: (b) The SI unit of pressure is the pascal, a newton per square metre.

MCQ 3.2.6 **Standard temperatue in Fahrenheit (°F) is: (PMC MDCAT 2022)**

A	-273°F	B	0°F
C	32°F	D	114°F

Solution: (c) Standard temperature is $0^\circ\mathrm{C}$, that is $32^\circ\mathrm{F}$.

MCQ 3.2.7 **1 atm is equal to the following EXCEPT: (PMC MDCAT 2022)**

A	760 mm of Hg	B	76 cm of Hg
C	760 torr	D	1.47 psi

Solution: (d) One atmosphere is $14.7\,\mathrm{psi}$, not 1.47.

Topic 3.4 Charles's Law

Past MDCAT Questions

MCQ 3.4.1 **At constant pressure, at which temperature will the volume of a gas become twice its volume at $0^\circ\mathrm{C}$? (MDCAT 2020)**

A	$100^\circ C$	B	$200^\circ C$
C	$273^\circ C$	D	$373^\circ C$

Solution: (c) Volume goes as the absolute temperature, so it doubles when 273 K becomes 546 K, which is $273^\circ\mathrm{C}$.

MCQ 3.4.2 **A gas has volume 10dm3 at 10°C. At what temperature is volume reduced to half? (NUMS MDCAT 2024)**

A	283K	B	566K
C	142K	D	373K

Solution: (c) At constant pressure the volume follows the absolute temperature, so halving it halves $283\,\mathrm{K}$ to about $142\,\mathrm{K}$.

MCQ 3.4.3 **According to Charles law volume of gas reduces to zero at: (SZABMU MDCAT 2023)**

A	-12 0 C	B	0 0 C
C	-273.15 0 C	D	-210 0 C

Solution: (c) Extrapolating the volume line to zero gives $-273.15^\circ\mathrm{C}$.

MCQ 3.4.4 **The quantitative relationship between absolute temperature (T) and volume (V) of a fixed amount of a gas at constant pressure (P) can be best described by: (PMC MDCAT 2022)**

A	VT=K	B	V / P = T
C	V/T =K	D	P=KT

Solution: (c) At constant pressure the volume is proportional to the absolute temperature, so V/T is constant.

MCQ 3.4.5 **Liquid in the container has a temperature 70°C. What will be the temperature on the Kelvin scale? (UHS MDCAT 2018)**

A	350 K	B	343 K
C	300 K	D	283 K

Solution: (b) $70 + 273$ is $343\,\mathrm{K}$.

Topic 3.3 Boyle's Law

Past MDCAT Questions

MCQ 3.3.1 **The product of volume and pressure of fixed amount of a gas at constant temperature remains same for initial and final state of a gaseous system. This statement corresponds to: (PMC MDCAT 2022)**

A	Avogadro's Law	B	Dalton's law
C	Boyle's law	D	Graham's law

Solution: (c) That is Boyle's law.

Topic 3.5 Absolute Zero

Past MDCAT Questions

MCQ 3.5.1 A graph between volume and temperature gives a straight line which cuts the temperature axis at: (MDCAT 2020)

A	$273°C$	B	$-273°C$
C	$540°C$	D	$0°C$

Solution: (b) Extrapolated to zero volume the line meets the axis at absolute zero, $-273°C$.

MCQ 3.5.2 The starting point of the Kelvin scale is: (MDCAT 2020)

A	0 K	B	100 K
C	-210 K	D	-273.15 K

Solution: (a) The Kelvin scale begins at absolute zero, which is 0 K by definition.

MCQ 3.5.3 Which of the following is true about pressure for an ideal gas at -273°C? (UHS MDCAT 2025)

A	P=1atm	B	P=2atm
C	P=3atm	D	P=0 atm

Solution: (d) At absolute zero the molecular motion stops, so the gas would exert no pressure at all.

MCQ 3.5.4 Absolute zero temperature is equal to: (NUMS MDCAT 2025)

A	0°C	B	-173°C
C	-273°C	D	-373°C

Solution: (c) Absolute zero is $-273.15°C$, the temperature at which molecular motion would cease.

MCQ 3.5.5 The temperature at which volume of all the ideal gases becomes zero is: (PMC MDCAT 2022)

A	0 K	B	0°C
C	0°F	D	32°F

Solution: (a) Extrapolating the volume line of any gas to zero brings it to absolute zero.

Topic 3.6 Ideal Gas Equation

Past MDCAT Questions

MCQ 3.6.1 The expression $PV = nRT$ represents the: (MDCAT 2020)

A	Dalton's law	B	Avogadro's law
C	general gas equation	D	van der Waals equation

Solution: (c) It is the ideal or general gas equation, got by combining the laws of Boyle, Charles and Avogadro.

MCQ 3.6.2 The correct ideal gas equation is: (MDCAT 2024)

A	$qV = nRT$	B	$PV = nRT$
C	$PV = nRt$	D	$PV^2 = nRT$

Solution: (b) $PV = nRT$, with T the absolute temperature.

MCQ 3.6.3 When pressure is 1520 torr then density of oxygen gas will be: (SIBA MDCAT 2025)

A	64/RT	B	32/RT
C	16/RT	D	128/RT

Solution: (a) $1520\,\text{torr}$ is two atmospheres, and $d = PM/RT$ gives $2 \times 32/RT$.

MCQ 3.6.4 Which equation is used to calculate concentration for n mole of an ideal gas? (SIBA MDCAT 2025)

A	P/RT	B	PV/RT
C	CV/RT	D	PM/RT

Solution: (a) Dividing $PV = nRT$ by V gives the concentration n/V as P/RT.

MCQ 3.6.5 Keeping temperature constant, if pressure is increased, density of gas will (SZABMU MDCAT 2025)

A	Increases	B	decreases
C	gets doubled	D	remains same

Solution: (a) Density is PM/RT, so at fixed temperature it rises with the pressure.

MCQ 3.6.6 A gaseous mixture contains 9.6% NH3, 22.6% N2 and 67.8% H2 gases. If the total pressure is 50 atm, then the partial pressure of H2 is (UHS MDCAT 2023)

A	67.8 x100 / 50	B	50 x 100 / 100
C	67.8 x 50 / 100	D	67.8 + 50 / 100

Solution: (c) A partial pressure is the mole fraction times the total, that is $67.8 \times 50/100$.

MCQ 3.6.7 If both temperature and volume of gas are doubled, the pressure: (NUMS MDCAT 2023)

A	Cannot be predicted	B	Is reduced to 1/2
C	Remains unchanged	D	Is doubled

Solution: (c) $P = nRT/V$, and doubling both the temperature and the volume leaves the ratio unchanged.

MCQ 3.6.8 Which one of the following gases has the lowest density under room conditions? (UHS MDCAT 2023)

A	Neon	B	Nitrogen
C	Oxygen	D	Fluorine

Solution: (a) Density goes with molar mass at a given temperature and pressure, and neon has the smallest of these.

MCQ 3.6.9 Which of the following represents equation for ideal gas? (NUMS MDCAT 2022)

A	PV=nRT	B	PT=nRv
C	P=nRT	D	T=npv/R

Solution: (a) The ideal gas equation is $PV = nRT$.

MCQ 3.6.10 How should the condition be changed to prevent the value of a given gas from expanding when its mass is increased? (NUMS MDCAT 2022)

A	Temperature is lowered & pressure is increased	B	Temperature is increased & pressure is lowered
C	Temperature & pressure both are lowered	D	Temperature & pressure both are increased

Solution: (a) More moles would push the volume up, so the temperature must be lowered and the pressure raised to hold it.

MCQ 3.6.11 Which variable mentioned in ideal gas is assumed to be constant in other gas laws? (NUMS MDCAT 2022)

A	Volume	B	Temperature
C	Pressure	D	Number of moles

Solution: (d) Boyle's, Charles's and the pressure law all hold for a fixed mass of gas.

MCQ 3.6.12 How will the conditions be changed to prevent the volume of the given gas from expanding when its mass is increased? (PMC Practice 2021)

A	Temperature and pressure is increased	B	Temperature is lowered and pressure is decreased
C	Temperature and pressure is decreased	D	Temperature is lowered and pressure is increased

Solution: (d) More moles would push the volume up, so the temperature must be lowered and the pressure raised.

MCQ 3.6.13 **273 mL of a gas at STP was taken to 27oC and 600 mm pressure. The final volume of the gas would be: (PMC Practice 2021)**

A	273 mL	B	300 mL
C	380 mL	D	586 mL

Solution: (c) $273 \times (300/273) \times (760/600)$ gives about $380\,\text{mL}$.

MCQ 3.6.14 **According to the general gas equation, density of an ideal gas depends upon: (PMC MDCAT 2020)**

A	Pressure	B	Temperature
C	Molar Mass	D	All of these

Solution: (d) $d = PM/RT$ carries the pressure, the temperature and the molar mass together.

MCQ 3.6.15 **Which of the following is the correct equation to calculate relative molecular mass of a gas. (UHS MDCAT 2018)**

A	M = mPR / VT	B	M = PV / mRT
C	M = mPRT / V	D	M = mRT / PV

Solution: (d) From $PV = (m/M)RT$ it follows that $M = mRT/PV$.

Topic 3.7 The Gas Constant R

Past MDCAT Questions

MCQ 3.7.1 **If we want to raise the temperature of one mole of an ideal gas by one kelvin, how much energy do we have to provide? (MDCAT 2022)**

A	0.0821 joules	B	$8.314\,\text{dm}^3\,\text{atm}$
C	0.0821 kJ	D	$0.0821\,\text{dm}^3\,\text{atm}$

Solution: (d) That energy is the gas constant itself, $R = 8.314\,\text{J mol}^{-1}\text{K}^{-1} = 0.0821\,\text{dm}^3\,\text{atm mol}^{-1}\text{K}^{-1}$.

MCQ 3.7.2 **Value of R gas constant in J mol-1 K-1 is (UHS MDCAT 2025)**

A	8.314	B	62.4
C	0.821	D	62400

Solution: (a) In SI units the gas constant is $8.314\,\text{J mol}^{-1}\,\text{K}^{-1}$.

MCQ 3.7.3 **The value of R in atm.dm3.mol-1.K-1 is: (KMU MDCAT 2025)**

A	0.0821	B	0.821
C	62.4	D	8.314

Solution: (a) In these units the gas constant is $0.0821\,\text{atm}\,\text{dm}^3\,\text{mol}^{-1}\,\text{K}^{-1}$.

MCQ 3.7.4 **If we want to raise the temperature of one mole of an ideal gas by one kelvin, we have to provide how much amount of energy? (UHS MDCAT 2023)**

A	0.0821 joules	B	8.314 dm3·atm
C	0.0821 kJ	D	0.0821 dm3·atm

Solution: (d) That energy is the gas constant, $0.0821\,\text{dm}^3\,\text{atm}\,\text{mol}^{-1}\,\text{K}^{-1}$.

MCQ 3.7.5 **The value of general gas constant 'R' for a particular gas is independant of: (PMC MDCAT 2022)**

A	Pressure	B	Volume
C	Absolute temperature	D	Molar mass of the gas.

Solution: (d) R is the same for every gas, which is why it is called the universal gas constant.

MCQ 3.7.6 **Identify the value of R at STP: (UHS MDCAT 2017)**

A	8.324 atm dm-3 mol-1	B	0.0821 cal K-1 mol-1
C	0.0821 atm dm3 K-1 mol-1	D	8.314 cal K-1 mol-1

Solution: (c) In these units the gas constant is $0.0821\,\text{atm}\,\text{dm}^3\,\text{K}^{-1}\,\text{mol}^{-1}$.

Topic 3.8 Real and Ideal Gases

Past MDCAT Questions

MCQ 3.8.1 **Real gases show deviation from ideal behaviour at: (MDCAT 2024)**

A	low temperature and low pressure	B	high temperature and high pressure
C	low temperature and high pressure	D	high temperature and low pressure

Solution: (c) Cold, compressed molecules are close together and slow, so their own volume and their attractions both matter.

MCQ 3.8.2 **Real gases show more positive deviation as pressure increases because of (SZABMU MDCAT 2025)**

A	Ionic nature	B	repulsive forces
C	attractive forces	D	non polar nature

Solution: (b) Squeezed close, the molecules resist further compression, so the volume is larger than the ideal equation predicts.

MCQ 3.8.3 **Intermolecular forces between molecules of ideal gas are (UHS MDCAT 2024)**

A	Strong	B	Moderate
C	Weak	D	Absent

Solution: (d) An ideal gas is defined as one whose molecules neither attract nor repel each other.

MCQ 3.8.4 **The real gases show deviation from ideal behavior at: (UHS MDCAT 2024)**

A	Low temperature and low pressure	B	High temperature and high pressure
C	Low temperature and high pressure	D	High temperature and low pressure

Solution: (c) Cooling and compressing bring the molecules close and slow, so their attractions begin to tell.

MCQ 3.8.5 **Intermolecular forces between gas molecules are significant at: (PMC MDCAT 2022)**

A	High temperature and low pressure	B	Low temperature and high pressure
C	At standard temperature and pressure	D	At high temperature and high pressure

Solution: (b) Cooling and compressing bring the molecules close and slow, so their attractions begin to tell.

MCQ 3.8.6 **Which of the following postulate of kinetic molecular theory does NOT hold at high temperature and pressure? (PMC MDCAT 2022)**

A	Gases are considered to be composed of minute discrete particles called molecules.	B	The molecules move in straight line.
C	The pressure of gas is produced due to the collision of molecules with the wall of container.	D	The volume occupied by the gas molecules is negligible as compared to the the total volume of the gas.

Solution: (d) Squeezed close, the molecules take up a real fraction of the volume, and that is the assumption that fails.

MCQ 3.8.7 **Which one of the following is called as compressibility factor? (PMC MDCAT 2022)**

A	PV=nRT	B	PV/nRT
C	PV/RT=n	D	PV/T=Rn

Solution: (b) PV/nRT is the compressibility factor, one for an ideal gas and something else for a real one.

MCQ 3.8.8 **Gases behave ideally at: (PMC MDCAT 2022)**

A	under normal temperature and pressure conditions	B	at room temperature and pressure
C	at high temperature and low pressure	D	at high pressure and low temperature

Solution: (c) Hot and thin, the molecules are far apart and moving fast, so their attractions and their own volume hardly count.

MCQ 3.8.9 **The actual volume of gas molecules is considered negligible at following pressures: (PMC MDCAT 2020)**

A	2 atm	B	4 atm
C	6 atm	D	8 atm

Solution: (a) The lower the pressure the further apart the molecules, so their own volume counts for least at $2\,\text{atm}$.

Unit 4 Liquids

Topic 4.1 Properties of Liquids

Past MDCAT Questions

MCQ 4.1.1 **Which type of forces exist between iodine molecules? (MDCAT 2023)**

A	dipole-dipole forces	B	dipole-induced dipole forces
C	instantaneous dipole-induced dipole forces	D	hydrogen bonding

Solution: (c) Iodine is non-polar, so only London dispersion forces hold its molecules together.

MCQ 4.1.2 **Which of the following is responsible for the low boiling point of diethyl ether as compared to water? (NUMS MDCAT 2025)**

A	Weak intermolecular forces	B	High surface tension
C	Low vapour pressure	D	High vapour pressure

Solution: (a) Ether molecules attract each other only by weak dipole forces, while water is held by hydrogen bonds.

MCQ 4.1.3 **The weakest intermolecular force present in liquid is? (SZABMU MDCAT 2025)**

A	dipole dipole forces	B	induce dipole force
C	Instantaneous dipole induced dipole force	D	hydrogen bonding

Solution: (c) London forces between instantaneous dipoles are the weakest of the intermolecular attractions.

MCQ 4.1.4 **The maximum polarizability is exhibited in: (NUMS MDCAT 2024)**

A	C6H14	B	C3H6
C	C5H12	D	C2H6

Solution: (a) The largest, most loosely held electron cloud is the most easily distorted, and hexane is the biggest here.

MCQ 4.1.5 **In liquid, with the change in dipole-dipole forces, there is a change in some physical properties. Select the property which is not affected by the strength of dipole-dipole forces? (UHS MDCAT 2023)**

A	boiling point	B	heat of vaporization
C	heat of sublimation	D	moles

Solution: (d) The number of moles is fixed by how much substance there is, not by the forces between its molecules.

MCQ 4.1.6 **Which of the following has highest surface tension? (SZABMU MDCAT 2023)**

A	Benzene	B	Alcohols
C	Ether	D	Water

Solution: (d) Water is held by hydrogen bonds, which gives it much the greatest surface tension of these.

MCQ 4.1.7 **Which of the following has highest boiling point? (SZABMU MDCAT 2023)**

A	C4H10	B	C6H14
C	C10H22	D	C2H6

Solution: (c) The longest chain has the largest surface for its dispersion forces, so decane boils highest.

MCQ 4.1.8 **The boiling point of ether is less as compared to alcohols and phenols due to: (NUMS MDCAT 2023)**

A	Functional group	B	Intermolecular forces
C	Nature of alkyl groups	D	Isomerism

Solution: (b) An ether has no hydroxyl hydrogen, so it cannot hydrogen bond as an alcohol or a phenol does.

MCQ 4.1.9 **Which is not a property of liquid? (UHS MDCAT 2023)**

A	Osmotic pressure	B	Freezing point
C	Diffusion	D	Melting

Solution: (d) Melting is what a solid does; a liquid boils or freezes.

MCQ 4.1.10 **Specific heat of water is: (NUMS MDCAT 2022)**

A	4.18 J/g/°C	B	9.82 J/g/°C
C	6.04 J/g/°C	D	8.47 J/g/°C

Solution: (a) Water takes $4.18\,\text{J}$ to raise a gram by a degree.

MCQ 4.1.11 **Which of the following statement explains solubility of ionic substance in water? (NUMS MDCAT 2022)**

A	Water molar mass is 18.02	B	Water forms dative bonding
C	Water molecule is polar	D	Water has high density

Solution: (c) Water molecules are polar, so they pull the ions apart and surround them.

MCQ 4.1.12 **Instantaneous dipole is produced when _____. (PMC Practice 2021)**

A	Two polar molecules come closer	B	Two non-polar molecules comes closer
C	Polar and non-polar molecule comes closer	D	All of these options are correct

Solution: (b) The electron cloud of one non-polar molecule is momentarily lopsided and induces the same in its neighbour.

MCQ 4.1.13 **Water is considered as a universal solvent because of which properties? (PMC Practice 2021)**

A	Polar nature of water	B	H-bonding
C	Electronegativity difference	D	All of these options are correct

Solution: (d) Water is polar, hydrogen bonds and has a large electronegativity difference, so it dissolves ionic and polar substances alike.

MCQ 4.1.14 **Which of the following forces have no relation with valence electrons? (PMC Practice 2021)**

A	Ionic Bond	B	Chemical bond
C	Intermolecular forces	D	Intramolecular forces

Solution: (c) Intermolecular forces act between whole molecules; it is the valence electrons that make the bonds inside them.

MCQ 4.1.15 **CO2 and SO2 both are tri-atomic molecules but heat of vaporization of SO2 is greater than that of CO2 due to: (PMC MDCAT 2020)**

A	High electronegativity of S	B	Greater size of SO2
C	SO2 is polar and CO2 is non-polar	D	SO2 is more acidic than CO2

Solution: (c) Sulphur dioxide is bent and polar, so its molecules attract each other far more strongly.

MCQ 4.1.16 **London dispersion forces are the only forces present among the ____. (UHS MDCAT 2016)**

A	Molecules of H2O in liquid state	B	Molecules of HCl gas
C	Atoms of helium in gaseous state at high temperature	D	Molecules of solid chlorine

Solution: (d) Chlorine is non-polar, so only instantaneous dipoles hold its molecules in the solid.

Topic 4.2 Evaporation, Vapour Pressure and Boiling Point

Past MDCAT Questions

MCQ 4.2.1 **Vapour pressure is independent of which factor? (MDCAT 2020)**

A	temperature	B	intermolecular forces
C	density of the liquid	D	surface area of the liquid

Solution: (d) A wider surface evaporates more molecules but condenses just as many, so the equilibrium vapour pressure is unchanged.

MCQ 4.2.2 **Which of the following factors does not affect the vapour pressure of a liquid? (MDCAT 2022)**

A	amount of liquid	B	size of molecules
C	temperature of the liquid	D	intermolecular forces

Solution: (a) Vapour pressure is an intensive property; a larger volume of the same liquid at the same temperature has the same vapour pressure.

MCQ 4.2.3 **In order to boil water at 110°C, the external pressure should be: (MDCAT 2024)**

A	200-760 torr	B	760-1200 torr
C	665-670 torr	D	660-700 torr

Solution: (b) Above 100°C the vapour pressure of water is above one atmosphere, so the external pressure must be above 760 torr.

MCQ 4.2.4 **The boiling point of a liquid is the temperature at which: (MDCAT 2024)**

A	the surface tension is greater than the atmospheric pressure	B	the viscosity is less than the atmospheric pressure
C	the vapour pressure equals the atmospheric pressure	D	the viscosity equals the atmospheric pressure

Solution: (c) Bubbles can form in the bulk only once the vapour pressure has risen to the pressure above the liquid.

MCQ 4.2.5 **Which one of the following has higher vapour pressure? (UHS MDCAT 2025)**

A	acetone	B	acetaldehyde
C	isopentane	D	Benzene

Solution: (b) Acetaldehyde boils at about 20°C, the lowest of the four, so its vapour pressure is the highest.

MCQ 4.2.6 **Which factor does not affect the rate of evaporation? (NUMS MDCAT 2025)**

A	Amount of liquid	B	Surface area
C	Temperature	D	Inter-molecular forces

Solution: (a) Evaporation is a surface process, so its rate depends on the area, the temperature and the forces between molecules, but not on how much liquid there is.

MCQ 4.2.7 **Which of the following is least volatile? (SIBA MDCAT 2025)**

A	Glycerol	B	Water
C	Acetic acid	D	Diethyl ether

Solution: (a) Glycerol has three hydroxyl groups and so the strongest hydrogen bonding of the four.

MCQ 4.2.8 **In order to boil water at 110°C, external pressure should be (UHS MDCAT 2024)**

A	200 - 760 torr	B	760 - 1200 torr
C	665-670 torr	D	660-700 torr

Solution: (b) Water boils above 100°C only when the pressure on it is above one atmosphere.

MCQ 4.2.9 **Boiling point of a liquid is a temperature at which: (UHS MDCAT 2024)**

A	Surface tension is greater than the atmospheric pressure	B	Viscosity is less than the atmospheric pressure
C	Vapour pressure equals the atmospheric pressure	D	Viscosity equals the atmospheric pressure

Solution: (c) A liquid boils when its vapour pressure has risen to the pressure above it.

MCQ 4.2.10 **Molar heat of vaporization of water is (KMU MDCAT 2024)**

A	40.7 cal/mol	B	40.7 J/mol
C	40.7kcal/mol	D	40.7 kJ/mol

Solution: (d) It takes 40.7 kJ to turn a mole of water at 100°C into steam.

MCQ 4.2.11 **Distillation under very reduced pressure is ____ distillation (KMU MDCAT 2024)**

A	Destructive	B	Fractional
C	Steam	D	Vacuum

Solution: (d) Lowering the pressure lowers the boiling point, which is how heat sensitive liquids are distilled.

MCQ 4.2.12 **If external pressure is reduced to half, boiling point of ethanol will be: (NUMS MDCAT 2024)**

A	Greater than 78°C	B	Less than 78°C
C	Equal to 78°C	D	Reduced to half

Solution: (b) A liquid boils when its vapour pressure reaches the pressure above it, so less pressure means a lower boiling point.

MCQ 4.2.13 **Which of the following factor does not affect the magnitude of vapor pressure? (UHS MDCAT 2023)**

A	amount of liquid	B	size of molecule
C	temperature of liquid	D	intermolecular forces

Solution: (a) Vapour pressure is a property of the liquid at a given temperature, whatever quantity of it there is.

MCQ 4.2.14 **Vapor pressure is independent of which factor? (NUMS MDCAT 2023)**

A	Temperature	B	Intermolecular forces
C	Density of liquid	D	Surface area of liquid

Solution: (d) Vapour pressure is a property of the liquid at a given temperature, whatever area is exposed.

MCQ 4.2.15 **Which of the following molecules will show a higher rate of evaporation? (NUMS MDCAT 2022)**

A Acetone	B Ethanol
C Water	D Ethylene glycol

Solution: (a) Acetone has the weakest intermolecular forces of the four, so it evaporates fastest.

MCQ 4.2.16 **In which of the following will water evaporate earlier? (PMC Practice 2021)**

A Cup	B Saucepan
C Glass	D Small bowl

Solution: (b) Evaporation is a surface process, and the saucepan offers the widest surface.

MCQ 4.2.17 **While calculating vapor pressure of a liquid in manometer, the column of mercury facing the vapors of a liquid is _____ due to pressure on surface of liquid in flask. (PMC Practice 2021)**

A Compressed	B Depressed
C Rises	D Lowers

Solution: (b) The vapour presses on the mercury and pushes that column down.

MCQ 4.2.18 **In a pressure cooker, the boiling point of water is _____. (PMC Practice 2021)**

A Raised than the normal	B Lower than the normal
C Lower than the freezing point	D All of these options are correct

Solution: (a) The pressure inside is above atmospheric, so the water must be hotter before its vapour pressure matches it.

MCQ 4.2.19 **Vapor pressure is measured by calculating the difference in liquid pressure and? (PMC Practice 2021)**

A Mercury pressure	B Glass pressure
C Atmospheric pressure	D Container pressure

Solution: (c) The vapour pressure is the difference between the pressure with the liquid present and the atmospheric pressure.

MCQ 4.2.20 **Which of the following has the lowest vapour pressure at 20 degrees Centigrade? (PMC MDCAT 2020)**

A Diethyl ether	B Chloroform
C Carbon tetrachloride	D Water

Solution: (d) Water is hydrogen bonded, so far fewer of its molecules escape than of the others.

MCQ 4.2.21 **Freezing point will also be defined as that temperature at which its solid and liquid phases have the same: (UHS MDCAT 2016)**

A Concentration	B Ratio between the particles
C Vapour pressure	D Attraction between the phases

Solution: (c) At the freezing point the solid and the liquid are in equilibrium, so their vapour pressures are equal.

Topic 4.3 Hydrogen Bonding

Past MDCAT Questions

MCQ 4.3.1 **Which of the following does NOT have a tendency to form hydrogen bonding? (MDCAT 2024)**

A water	B ethyl alcohol
C carboxylic acid	D hydrocarbon

Solution: (d) Hydrogen bonding needs hydrogen bound to a small, strongly electronegative atom, and a hydrocarbon has none.

MCQ 4.3.2 **Hydrogen bonding does not exist in: (NUMS MDCAT 2025)**

A Proteins	B Alcohols
C Liq HF	D SiH4

Solution: (d) A hydrogen bond needs hydrogen bound to nitrogen, oxygen or fluorine; silicon is far too weakly electronegative.

MCQ 4.3.3 **Which one of the following DO NOT have tendency to form hydrogen bonding? (UHS MDCAT 2024)**

A Ammonia	B Ethyl alcohol
C Carboxylic acid	D Hydrocarbon

Solution: (d) A hydrocarbon has no hydrogen bound to nitrogen, oxygen or fluorine, so it cannot hydrogen bond.

MCQ 4.3.4 **When two ice cubes are pressed over each other, they unite to form one cube due to: (SZABMU MDCAT 2023)**

A Dipole dipole attraction	B Covalent attraction
C Van Der Waal's forces	D H - bonding

Solution: (d) The pressure melts a film of water, which freezes again as hydrogen bonds form across the join.

MCQ 4.3.5 **The strongest hydrogen bond is present in: (SZABMU MDCAT 2023)**

A H2S	B HF
C H2O	D NH3

Solution: (b) Fluorine is the most electronegative, so the hydrogen bond in hydrogen fluoride is the strongest.

MCQ 4.3.6 **When 2 ice cubes are pressed over each other they unite to form one cube due to: (NUMS MDCAT 2023)**

A Dipole dipole attraction	B Covalent attraction
C Van Der Waal's forces	D H-bonding

Solution: (d) The pressure melts a film of water, which freezes again as hydrogen bonds form across the join.

MCQ 4.3.7 **Which of the following substances has the largest intermolecular forces of attraction? (PMC MDCAT 2022)**

A H2O	B H2S
C H2Se	D H2Te

Solution: (a) Water alone hydrogen bonds; the others are held only by dipole and dispersion forces.

MCQ 4.3.8 **Which of the following substances exhibits hydrogen bonding? (UHS MDCAT 2019)**

A H2S	B SiH4
C NH3	D HI

Solution: (c) Only ammonia has hydrogen bound to nitrogen, oxygen or fluorine.

Topic 4.4 Anomalous Behaviour of Water

Past MDCAT Questions

MCQ 4.4.1 **Solid water is expanded how many times when compared with the same mass of liquid water? (MDCAT 2020)**

A 9	B 10
C 75	D 2

Solution: (a) The open hydrogen-bonded cage of ice takes about 9% more room, which is why ice floats and pipes burst.

MCQ 4.4.2 **Ice floats on the surface of water due to: (SZABMU MDCAT 2023)**

A Larger bond length	B Cubic structure of ice
C Weak intermolecular forces	D Empty spaces in the structure of ice

Solution: (d) Hydrogen bonds hold the molecules of ice in an open lattice with spaces in it, so ice is less dense than water.

MCQ 4.4.3 **What is the reason that ice at 0° occupies more volume than water: (UHS MDCAT 2017)**

A Empty spaces	B Ionic bond
C Intermolecular	D Debye forces

Solution: (a) Hydrogen bonds hold the molecules of ice in an open lattice with spaces in it.

Topic 5.1 Crystalline Solids

Past MDCAT Questions

MCQ 5.1.1 Some substances lack a definite heat of fusion. These substances are: (MDCAT 2020)

A	isomorphs	B	polymorphs
C	amorphous solids	D	crystalline solids

Solution: (c) Amorphous solids have no ordered lattice to break down at one temperature, so they soften over a range instead of melting sharply.

MCQ 5.1.2 Whenever crystalline solids are broken they do so along definite planes known as: (MDCAT 2024)

A	cleavage planes	B	refractory planes
C	sagittal planes	D	coronal planes

Solution: (a) The regular lattice parts most easily along particular planes, called cleavage planes.

MCQ 5.1.3 One of the following is NOT an example of an amorphous solid: (MDCAT 2024)

A	plastic	B	glass
C	glucose	D	rubber

Solution: (c) Glucose is crystalline, with a sharp melting point; the other three have no long-range order.

MCQ 5.1.4 Which one shows anisotropic behavior? (UHS MDCAT 2025)

A	Wood	B	Gemstone
C	Coke	D	Graphite

Solution: (d) Graphite conducts and cleaves along its layers but not across them, which is what anisotropy means.

MCQ 5.1.5 Pick the crystalline solids: (UHS MDCAT 2025)

A	Cement	B	Ceramics
C	Concrete	D	Copper

Solution: (b) Ceramics are crystalline; cement and concrete are amorphous mixtures.

MCQ 5.1.6 Which of the following is not a crystalline solid? (SZABMU MDCAT 2025)

A	KCl	B	Fe metal
C	Glass	D	rhombic S

Solution: (c) Glass is a supercooled liquid with no long range order, so it is amorphous.

MCQ 5.1.7 Whenever the crystalline solids are broken they do so along definite planes known as: (UHS MDCAT 2024)

A	Cleavage planes	B	Refractory planes
C	Sagittal planes	D	Coronal planes

Solution: (a) A crystal splits along its cleavage planes, where the lattice forces are weakest.

MCQ 5.1.8 One of the following is NOT an example of amorphous solids (UHS MDCAT 2024)

A	Plastic	B	Glass
C	Glucose	D	Rubber

Solution: (c) Glucose forms proper crystals; plastic, glass and rubber have no long range order.

MCQ 5.1.9 In graphite the carbon atoms are arranged in which of the following structure? (UHS MDCAT 2024)

A	Rhombic	B	Hexagonal
C	Tetragonal	D	Trigonal

Solution: (b) Graphite is built of flat sheets of carbon atoms in hexagonal rings.

MCQ 5.1.10 The example of metallic solid is (KMU MDCAT 2024)

A	B	B	C
C	Cu	D	Si

Solution: (c) Copper is a metal; boron, carbon and silicon here form covalent solids.

MCQ 5.1.11 When a crystalline substance conducts current in one direction but not through other directions of the crystal, this property is (KMU MDCAT 2024)

A	Allotropy	B	Anisotropy
C	Isomorphism	D	Polymorphism

Solution: (b) A property that differs with the direction taken through the crystal is anisotropy.

MCQ 5.1.12 Which of the following compound have any characteristic heat of fusion except? (NUMS MDCAT 2024)

A	NaCl	B	Aluminium oxide
C	Iron oxide	D	Silicates

Solution: (d) Silicates are amorphous, so they soften over a range instead of melting at a fixed point.

MCQ 5.1.13 Q.82 Which type of solid is called as atomic solid? (UHS MDCAT 2023)

A	Covalent solids	B	Ionic solids
C	Metallic solids	D	Molecular solids

Solution: (c) A metal crystal is built of atoms in a sea of electrons, so it is called an atomic solid.

MCQ 5.1.14 The molecules of iodine (I2) form the: (SZABMU MDCAT 2023)

A	Molecular crystals	B	Covalent crystals
C	Ionic crystals	D	Metallic crystals

Solution: (a) Iodine molecules are held in the lattice by weak dispersion forces, so the crystal is molecular.

MCQ 5.1.15 The type of bonding in Zinc is: (SZABMU MDCAT 2023)

A	Ionic	B	Covalent
C	Dative	D	Metallic

Solution: (d) Zinc is a metal, its atoms held by a sea of delocalized electrons.

MCQ 5.1.16 Thermal conductivity of metals is due to: (NUMS MDCAT 2023)

A	Layered structure of metals	B	Freely moving electrons
C	Loosely held metal atoms	D	Vibrational movement of metals

Solution: (b) The delocalized electrons carry the energy quickly through the metal.

MCQ 5.1.17 Which of the following substance is malleable and ductile? (NUMS MDCAT 2023)

A	Sodium chloride	B	Copper sulphate
C	Mercury	D	Aluminum

Solution: (d) A metal can be beaten into sheets and drawn into wire because its layers slide without breaking the bonding.

MCQ 5.1.18 In anisotropic crystals which property do not change with the change in direction of crystalline structure? (UHS MDCAT 2023)

A	Electrical conductance	B	Thermal conductance
C	Molar mass	D	Refractive index

Solution: (c) Anisotropy is about properties measured along a direction; the molar mass has no direction.

MCQ 5.1.19 **In metals, why electric conductivity decreases with the increase of temperature? (UHS MDCAT 2023)**

A	Because electron movement decrease with the increase of temperature	**B**	Because metal ions oscillations hinder electron movement
C	Because electron direction changes at high temperature	**D**	Because they pass heat current through collision of electrons

Solution: (b) Heating makes the ions vibrate more widely, and the electrons are scattered by them.

MCQ 5.1.20 **The solid which is hardest of all types is _____? (PMC MDCAT 2022)**

A	Covalent solids	**B**	Molecular solids
C	Ionic solids	**D**	Metallic solids

Solution: (a) A covalent network such as diamond is bonded right through, so it is the hardest kind of solid.

MCQ 5.1.21 **Which of the following properties of isomorphs is NOT true? (PMC MDCAT 2022)**

A	Isomorphs can make homogeneous mixtures together	**B**	Have different physical properties
C	Have same atoms	**D**	Have same ratio of atoms

Solution: (c) Isomorphs have the same crystal shape and the same ratio of atoms, but the atoms themselves differ.

MCQ 5.1.22 **Polymorphs have same (PMC MDCAT 2022)**

A	Chemical Properties	**B**	Melting points
C	Structures	**D**	boiling points

Solution: (a) Polymorphs are the same substance in different crystal forms, so their chemistry is the same.

MCQ 5.1.23 **The repetition of faces, angles and edges of a crystal, when it is rotated to 360 degree angle is called: (PMC MDCAT 2022)**

A	Habit of crystal	**B**	Isomorphism
C	Symmetry	**D**	Polymorphism

Solution: (c) The repetition of faces and edges on turning is the symmetry of the crystal.

MCQ 5.1.24 **Which of the following crystal has highest density? (PMC MDCAT 2022)**

A	Iodine	**B**	Graphite
C	Ice	**D**	Sodium Chloride

Solution: (a) Iodine is much the heaviest of these for its volume, so its crystal is the densest.

MCQ 5.1.25 **The properties which depends upon the direction are called: (PMC MDCAT 2022)**

A	Isotropic properties	**B**	Anisotropic properties
C	Additive properties	**D**	Colligative properties

Solution: (b) A property that differs with the direction taken through the crystal is anisotropic.

MCQ 5.1.26 **Which of the following solid has indefinite heat of fusion? (PMC MDCAT 2022)**

A	Crystalline solids	**B**	Pure solids
C	True solids	**D**	Amorphous solids

Solution: (d) An amorphous solid has no fixed melting point, so it has no definite heat of fusion.

MCQ 5.1.27 **The following are anisotropic properties except: (PMC MDCAT 2022)**

A	Refractive Index	**B**	Thermal conductivtiy
C	Electrical conductivity	**D**	Melting points

Solution: (d) A melting point is one number for the whole crystal, so it cannot vary with direction.

MCQ 5.1.28 **Malleability is a property of metals which means_____? (PMC MDCAT 2022)**

A	Drawn into wires	**B**	Converted into sheets
C	Drawn into wires and converted into sheets	**D**	Breakable

Solution: (b) Malleable means it can be beaten into sheets; ductile means it can be drawn into wire.

MCQ 5.1.29 **Which solids are also called as atomic solids? (PMC MDCAT 2022)**

A	Ionic solids	**B**	Covalent solids
C	Molecular solids	**D**	Metallic solids

Solution: (b) A covalent network such as diamond is one giant molecule of atoms, so it is called an atomic solid.

MCQ 5.1.30 **Who proposed valence bond theory for metals? (PMC MDCAT 2022)**

A	Loren	**B**	Drudge
C	L.Pauling	**D**	Maxwell

Solution: (c) Pauling put forward the valence bond account of metallic bonding.

MCQ 5.1.31 **Which of the following Is not true about Polymorphs? (PMC MDCAT 2022)**

A	Have same chemical properties	**B**	Interconvertible
C	Have same formula unlt	**D**	Have different formula unit

Solution: (d) Polymorphs are the same compound in different crystal forms, so their formula unit is the same.

MCQ 5.1.32 **A solid compounds exists is more than one crystalline form, this phenomenon is called (PMC MDCAT 2022)**

A	Allotropy	**B**	Isomorphism
C	Polymorphism	**D**	Isomerism

Solution: (c) One compound crystallizing in more than one form is polymorphism.

MCQ 5.1.33 **Which of the following solids shows the phenomenal of Isomorphism? (PMC MDCAT 2022)**

A	Molecular Solids	**B**	Covalent solids
C	Ionic solids	**D**	Metallic solids

Solution: (c) Ionic solids of similar formula and ion size crystallize in the same form, which is isomorphism.

MCQ 5.1.34 **Nature of diamond as solid is: (NUMS MDCAT 2022)**

A	Covalent	**B**	Ionic
C	Molecular	**D**	Metallic

Solution: (a) Diamond is a covalent network of carbon atoms bonded right through the crystal.

MCQ 5.1.35 **Which one of the following is as light as a feather and as strong as iron? (NUMS MDCAT 2022)**

A	Graphite	**B**	Graphene
C	Mercury	**D**	Diamond

Solution: (b) Graphene is a single sheet of graphite, almost weightless and stronger than steel.

MCQ 5.1.36 **The temperature at which one crystalline form changes to another is called ____ temperature. (PMC Practice 2021)**

A	Critical	**B**	Absolute
C	Transition	**D**	None of these options is correct

Solution: (c) The temperature at which one crystalline form changes into another is the transition temperature.

MCQ 5.1.37 **Graphite has a structural similarity with: (PMC Practice 2021)**

A	B_2H_6	**B**	B_4C
C	B	**D**	BN

Solution: (d) Boron nitride has the same layered hexagonal structure as graphite.

MCQ 5.1.38 **Allotropes are of same? (PMC Practice 2021)**

A	Compounds	**B**	Molecules
C	Ions	**D**	Elements

Solution: (d) Allotropes are different forms of the same element.

MCQ 5.1.39 **Which of the following substances has giant covalent structure? (PMC MDCAT 2020)**

A	Iodine crystal	**B**	Solid CO_2
C	Silica	**D**	White phosphorus

Solution: (c) Silica is bonded covalently right through the crystal.

MCQ 5.1.40 **Electrical conductivity of graphite is greater in one direction that in other due to (UHS MDCAT 2016)**

A	Isomorphism	**B**	Cleavage plane
C	Anisotropy	**D**	Symmetry

Solution: (c) Graphite conducts along its layers but not across them, which is anisotropy.

Topic 5.4 Crystal Lattice

Past MDCAT Questions

MCQ 5.4.1 **The smallest block which carries the whole information about a crystal structure is called the: (MDCAT 2022)**

A	cell	**B**	unit cell
C	crystal lattice	**D**	crystal unit

Solution: (b) Repeating the unit cell in three dimensions builds the whole lattice.

MCQ 5.4.2 **In graphite the carbon atoms are arranged in which of the following structures? (MDCAT 2024)**

A	rhombic	**B**	hexagonal
C	tetragonal	**D**	trigonal

Solution: (b) Each layer of graphite is a sheet of hexagons of sp^2 carbon atoms.

MCQ 5.4.3 **In a unit cell of a crystal lattice the angle β is between faces: (UHS MDCAT 2025)**

A	a and b	**B**	b and c
C	c and a	**D**	not specified

Solution: (c) By convention α lies between b and c, β between c and a, and γ between a and b.

MCQ 5.4.4 **The shape of the crystal lattice depends upon: (NUMS MDCAT 2025)**

A	Size of particles	**B**	Nature of particles
C	Arrangement of particles	**D**	Size of unit cell

Solution: (c) The lattice is defined by how the particles are ordered in space.

MCQ 5.4.5 **The smallest repeating pattern from which the lattice is built in a crystalline solid is called (SZABMU MDCAT 2025)**

A	Crystallite	**B**	Amorphous region
C	Unit cell	**D**	Crystal lattice

Solution: (c) The unit cell is the smallest block whose repetition builds the whole lattice.

MCQ 5.4.6 **Q.81 A small building block which belongs to whole information about crystal structure is called? (UHS MDCAT 2023)**

A	Cell	**B**	Unit Cell
C	Crystal lattice	**D**	Crystal unit

Solution: (b) The unit cell is the smallest block that carries the whole pattern of the crystal.

MCQ 5.4.7 **Which statement correctly describes the structure of sodium chloride crystal? (NUMS MDCAT 2023)**

A	Each sodium ion is surrounded by six chloride ions and each chloride ions surrounded by six sodium ions	**B**	The crystal is face centered cubic structure
C	Each sodium ion is surrounded by 3 chloride ions and each chloride ion surrounded by 3 sodium ions	**D**	Inter molecular forces are present between two oppositely charges ions

Solution: (a) Each ion in rock salt is at the centre of an octahedron of six of the other kind.

MCQ 5.4.8 **Co-ordination number of Na is: (NUMS MDCAT 2023)**

A	10	**B**	9
C	8	**D**	12

Solution: (c) Sodium is body centred cubic, so each atom has eight nearest neighbours.

MCQ 5.4.9 **Position of atoms in molecular crystals can be determined by: (PMC MDCAT 2022)**

A	X-rays analysis	**B**	Spectroscopic analysis
C	Spectrometric analysis	**D**	Combustlon analysis

Solution: (a) X-ray diffraction is what reveals the arrangement of the atoms in a crystal.

MCQ 5.4.10 **What shapes does diamond and NaCl unit cells possess? (PMC MDCAT 2022)**

A	NaCl monoclinic and diamond cubic	**B**	NaCl cubic and diamond rhombic
C	Both are cubic	**D**	Both are rectangular

Solution: (c) Both crystallize in the cubic system.

MCQ 5.4.11 **The array of points which shows the atoms ions or molecule arrangements in a crystal is called. (PMC MDCAT 2022)**

A	Crystal system	**B**	Crystal lattice
C	Crystal array	**D**	Crystallography

Solution: (b) The regular array of points representing the particles is the crystal lattice.

MCQ 5.4.12 **The smallest part of the crystal lattice has all the properties of the entire crystal, this is called: (PMC Practice 2021)**

A	Unit	**B**	Unit cell
C	Unit crystal	**D**	All of these options are correct

Solution: (b) The smallest block that carries the whole pattern of the crystal is the unit cell.

MCQ 5.4.13 **Lattice points are also called? (PMC Practice 2021)**

A	Space lattice	**B**	Crystal lattice
C	Lattice sites	**D**	Lattice location

Solution: (c) The points of the lattice at which the particles sit are the lattice sites.

MCQ 5.4.14 **In the NaCl crystal, chloride ions present at the face center are distributed in: (PMC Practice 2021)**

A	One Unit Cell	**B**	8 Unit Cells
C	4 Unit Cells	**D**	2 Unit Cells

Solution: (d) An ion on a face is shared between the two cells that meet at it.

Topic 5.2 Factors Affecting the Shape of Ionic Crystals

Past MDCAT Questions

MCQ 5.2.1 **Predict the shape of CsCl having radius ratio of 0.93: (NUMS MDCAT 2024)**

A	Tetrahedral	**B**	Octahedral
C	Body centered cubic	**D**	Hexagonal

Solution: (c) A radius ratio above 0.732 gives eight-fold coordination, the caesium chloride body centred structure.

Topic 5.5 Lattice Energy

Past MDCAT Questions

MCQ 5.5.1 **All of the following steps are used to calculate the lattice energy in the Born-Haber cycle EXCEPT: (MDCAT 2024)**

A	atomizing the metal	**B**	ionizing the metal
C	deionizing the metal	**D**	ionizing the non-metal

Solution: (c) The cycle atomizes and ionizes; there is no step that returns an ion to its atom.

MCQ 5.5.2 **The factor that affects the lattice energy is: (NUMS MDCAT 2025)**

A	Charge to size ratio	**B**	Shielding effect
C	Crystal structure	**D**	Atomic radius

Solution: (a) Lattice energy rises with the charge on the ions and falls with their size.

MCQ 5.5.3 **The ionic compound among the following with the highest lattice energy is: (SIBA MDCAT 2025)**

A	LiF	**B**	NaCl
C	KCl	**D**	CsI

Solution: (a) Lattice energy is greatest for the smallest ions, and lithium fluoride has the smallest pair here.

MCQ 5.5.4 **Which of the following compound has lower Lattice Energy? (SZABMU MDCAT 2025)**

A	LiCl	**B**	KCl
C	CaCl2	**D**	CaH2O

Solution: (b) Lattice energy falls as the ions get bigger, and the potassium ion is the largest of the singly charged ones here.

MCQ 5.5.5 **All of the following steps are used to calculate the lattice energy in Born-Haber cycle EXCEPT (UHS MDCAT 2024)**

A	Atomizing the metal	**B**	Ionizing the metal
C	Delonlize the metal	**D**	Ionlize non metal

Solution: (c) The Born-Haber cycle atomizes and ionizes the metal and adds electrons to the non-metal; nothing is de-ionized.

MCQ 5.5.6 **The heat of sublimation of potassium is 98kJ/mol, the heat of dissociation of bromine gas is 192.5 kJ/mol. The ionization energy of K is 414 kJ/mol. The electron affinity of Br is -334.7 kJ/mol and the heat of formation of KBr is -405.8 kJ/mol. Calculate the lattice energy of KBr. (KMU MDCAT 2024)**

A	-679.3	**B**	-669.5
C	679.3	**D**	669.5

Solution: (a) The cycle gives $-405.8 - (98 + 96.25 + 414 - 334.7)$, that is $-679.3\,\text{kJ mol}^{-1}$.

MCQ 5.5.7 **The greater Lattice energy is shown by: (NUMS MDCAT 2023)**

A	NaCl	**B**	NaBr
C	NaI	**D**	NaF

Solution: (d) Lattice energy is greatest for the smallest ions, and fluoride is the smallest halide.

MCQ 5.5.8 **Equation represents which energy change? Mg2+(g) + 02-(g) → MgO(s) (NUMS MDCAT 2023)**

A	Atomization	**B**	Neutralization
C	Lattice energy	**D**	Solution

Solution: (c) Gaseous ions coming together into one mole of the solid release the lattice energy.

MCQ 5.5.9 **Born Haber cycle is used to determine: (PMC MDCAT 2022)**

A	Enthalpy of lattice	**B**	Enthalpy of formation
C	Enthalpy of Neutralisation	**D**	Enthalpy of Solution

Solution: (a) The Born-Haber cycle gives the lattice energy, which cannot be measured directly.

MCQ 5.5.10 **What is the value of lattice energy when one mole of an ionic crystal is formed? (PMC MDCAT 2022)**

A	Positive value	**B**	Negative value
C	Zero value	**D**	Positive fraction value

Solution: (b) Energy is released when the gaseous ions come together, so the lattice energy is negative.

MCQ 5.5.11 **Lattice energy does not depend on the: (PMC MDCAT 2022)**

A	Nature of charge of the ion	**B**	Size of ions
C	Magnitude of charge on the ion	**D**	Room temperature

Solution: (d) Lattice energy turns on the charges and sizes of the ions; the temperature of the room does not enter.

MCQ 5.5.12 **The Lattice energy is also called as: (PMC MDCAT 2020)**

A	Energy of affinity	**B**	Bond energy
C	Crystal energy	**D**	Potential energy

Solution: (c) Lattice energy is also called crystal energy.

MCQ 5.5.13 **Born-Haber cycle is used to determine the lattice energies of: (PMC MDCAT 2020)**

A	Molecular solids	**B**	Metallic solids
C	Ionic solids	**D**	Covalent solids

Solution: (c) The Born-Haber cycle gives the lattice energy of an ionic crystal, which cannot be measured directly.

Topic 5.3 Ionic and Molecular Crystals Compared

Past MDCAT Questions

MCQ 5.3.1 **Most molecular crystals melt below: (NUMS MDCAT 2025)**

A	200°C	**B**	280°C
C	330°C	**D**	480°C

Solution: (a) Molecular crystals are held by weak intermolecular forces, so they melt low, mostly under 200°C.

Topic 6.1 Chemical Equilibrium

Past MDCAT Questions

MCQ 6.1.1 At equilibrium the concentrations of the reactants and the products become: (MDCAT 2020)

A	zero	B	equal
C	constant	D	infinite

Solution: (c) The two opposing rates are equal, so the concentrations stop changing, though they need not be equal to each other.

MCQ 6.1.2 Chemical equilibrium is: (MDCAT 2023)

A	the end of the reaction	B	the complete consumption of the reactants
C	the complete consumption of the products	D	a state at which there is no net concentration change

Solution: (d) Both reactions continue at equal rates, so the concentrations stop changing without the reaction stopping.

MCQ 6.1.3 If the equilibrium expression of a reversible reaction is [C]2/[A][B] The balanced chemical equation should be (SZABMU MDCAT 2025)

A	C=A+B	B	2C=A+B
C	A+B=C	D	A + B = 2C

Solution: (d) The powers in the expression are the coefficients, so two moles of C are formed from one of A and one of B.

MCQ 6.1.4 Forward reaction is the one that (KMU MDCAT 2024)

A	Is very slow at the beginning of the reaction	B	Reacts to form reactants
C	Speeds up gradually and at equilibrium its rate becomes constant	D	Takes place from left to right as given in chemical equation

Solution: (d) The forward reaction is the one written from left to right in the equation.

MCQ 6.1.5 The unit of Kc for the system PCl5 ⇌ PCl3 + Cl2 is (KMU MDCAT 2024)

A	dm^3/mol	B	mol/dm^3
C	mol/dm^6	D	mol^2/dm^6

Solution: (b) One concentration term is left over in the numerator, so the unit is moles per cubic decimetre.

MCQ 6.1.6 By which of the following factors equilibrim state is attained earlier? (SZABMU MDCAT 2023)

A	Temperature	B	Pressure
C	Concentration	D	Catalyst

Solution: (d) A catalyst speeds both directions equally, so equilibrium is reached sooner without being shifted.

MCQ 6.1.7 By which of the following factors equilibrium state is attained earlier? (NUMS MDCAT 2023)

A	Temperature	B	Pressure
C	Concentration	D	Catalyst

Solution: (d) A catalyst speeds both directions equally, so equilibrium comes sooner without moving.

MCQ 6.1.8 What is the ultimate fate of reversible reaction? (UHS MDCAT 2023)

A	Completion of reaction	B	Complete consumption of reactants
C	Complete consumption of products	D	A state when there is no net concentration change

Solution: (d) A reversible reaction ends in equilibrium, where the concentrations no longer change.

MCQ 6.1.9 [Product]/[Reactant] = 2.5 for a reaction at equilibrium, what does it mean? (PMC MDCAT 2022)

A	Products are more than reactants	B	Products are Less
C	reaction is at equilibrium	D	Reactants are more

Solution: (a) A ratio above one means the equilibrium lies on the side of the products.

MCQ 6.1.10 For a particular reversible reaction If [Products]/[Reactants]>Kc It means that: (PMC MDCAT 2022)

A	More products are needed to attain equillbrium	B	There are more reactants in the system
C	More Reactants are needed to attain equillbrium	D	The reaction will move forward to attain equilibrium

Solution: (c) The quotient is above the constant, so the reaction must run backwards to reach equilibrium.

MCQ 6.1.11 The equilibrium constant is always written as a ratio of: (PMC Practice 2021)

A	Reactants over products	B	Products over reactants
C	Product times Reactants	D	None of these

Solution: (b) The equilibrium constant puts the products over the reactants, each to the power of its coefficient.

MCQ 6.1.12 A very small value of Kc depicts: (PMC Practice 2021)

A	No Reaction	B	Backward Reaction
C	Little Forward Reaction	D	Complete Reaction

Solution: (c) A small constant means the equilibrium lies well over towards the reactants.

MCQ 6.1.13 If Kp and Kc have the same values then Δn will be: (PMC Practice 2021)

A	Maximum	B	Minimum
C	Zero	D	Negligible

Solution: (c) $K_p = K_c(RT)^{\Delta n}$, so the two are equal only when Δn is zero.

MCQ 6.1.14 For a gaseous phase reaction, when number of moles of reactants and products are equal: (PMC MDCAT 2020)

A	The values of Kp and Kc are different	B	The value of Kp is greater than Kc
C	The value of Kc is greater than Kp	D	The values of Kp and Kc are the same

Solution: (d) $K_p = K_c(RT)^{\Delta n}$, and with Δn zero the two are equal.

MCQ 6.1.15 Which of the following reaction has greater Kp than Kc? (PMC MDCAT 2020)

A	2NO + Cl2 2NOCl	B	2SO2 + O2 2SO3
C	2NOCl 2NO + Cl2	D	N2 + 3H2 2NH3

Solution: (c) $K_p = K_c(RT)^{\Delta n}$, and only that reaction goes from two molecules to three.

Topic 6.2 Le Chatelier's Principle

Past MDCAT Questions

MCQ 6.2.1 For a gaseous reaction, an increase in pressure will shift the equilibrium in the direction of: (MDCAT 2020)

A	decreased concentration	B	increased concentration
C	decreased volume	D	increased volume

Solution: (c) The system relieves the pressure by moving to the side with fewer gas molecules, which occupies less volume.

MCQ 6.2.2 **In the reaction $H_2 + CO_2 \rightleftharpoons H_2O + CO$, a decrease in the concentration of CO_2 will shift the equilibrium: (MDCAT 2020)**

A	towards the left	B	towards the right
C	nothing happens to the equilibrium	D	towards both directions

Solution: (a) Taking a reactant away makes the reverse reaction the faster of the two, so the equilibrium moves back to the left.

MCQ 6.2.3 **When the numbers of moles of reactants and products are equal in a reversible gaseous reaction, which parameter would not affect the equilibrium? (MDCAT 2020)**

A	temperature	B	pressure
C	concentration	D	catalyst

Solution: (b) With no change in the number of gas molecules there is no volume change for the pressure to act on.

MCQ 6.2.4 **One can estimate the direction in which an equilibrium will shift with the help of: (MDCAT 2022)**

A	Le Chatelier's principle	B	the law of mass action
C	Hess's law	D	the law of heat of formation

Solution: (a) The system responds so as to reduce the change imposed on it, which is Le Chatelier's principle.

MCQ 6.2.5 **One can estimate the direction in which an equilibrium will shift with the help of: (MDCAT 2023)**

A	Le Chatelier's principle	B	the law of mass action
C	Hess's law	D	the law of heat of formation

Solution: (a) Le Chatelier's principle says the system shifts so as to oppose the change imposed on it.

MCQ 6.2.6 **The principle which states that if a stress is applied to a system at equilibrium the system nullifies the effect of the stress as far as possible is: (MDCAT 2024)**

A	Haber's	B	Le Chatelier's
C	Boyle's	D	Charles'

Solution: (b) That is Le Chatelier's principle.

MCQ 6.2.7 **Consider the following reaction in equilibrium and tell which chemical, when added, will change the cloudy solution into a clear solution: $BiCl_3 + H_2O \rightleftharpoons BiOCl + 2HCl$ (MDCAT 2024)**

A	$BiCl_3$	B	H_2O
C	BiOCl	D	HCl

Solution: (d) Added HCl drives the equilibrium back to the left, so the insoluble BiOCl that clouded the solution dissolves.

MCQ 6.2.8 **If ΔH for a reaction is positive, then by decreasing temperature, the reaction will (KMU MDCAT 2025)**

A	Move forward	B	Move in reverse
C	Have no effect	D	Be both forward and reverse

Solution: (b) The forward reaction absorbs heat, so cooling shifts the equilibrium back the other way.

MCQ 6.2.9 **For which reaction, the value of Kc increases with increase in temperature? (SIBA MDCAT 2025)**

A	CH4 + O2 → CO2 + H2O	B	NaOH + HCl → NaCl + H2O
C	2SO2 + O2 → 2SO3	D	H2 + I2 → 2HI

Solution: (d) Only the formation of hydrogen iodide from its elements absorbs heat, and heating favours the endothermic direction.

MCQ 6.2.10 **In separate vessel of volume 2000 cm3 and 1500cm3, 6g of hydrogen and 28g of nitrogen are mixed in each vessel at 25°C, ammonia formed is? N2 + 3H2 ⇌ 2NH3 (SZABMU MDCAT 2025)**

A	More in 2 L vessel	B	More in 1500 cm^3 vessel
C	Equal in both vessel	D	Cannot be predicted

Solution: (b) The forward reaction goes from four molecules to two, so the smaller vessel, at higher pressure, gives more ammonia.

MCQ 6.2.11 **The principle that states that if a stress is applied to a system at equilibrium the system nullify the effect of stress as far as possible is: (UHS MDCAT 2024)**

A	Haber's	B	Le-Chatelier
C	Boyle's	D	Charles'

Solution: (b) That is Le Chatelier's principle.

MCQ 6.2.12 **Consider the following reaction in equilibrium and tell addition of which chemical will turn the cloudy solution into clear solution? BiCl3 + H2O <-> BiOCl + 2HCl (UHS MDCAT 2024)**

A	BiCl3	B	H2O
C	BiOCl	D	HCl

Solution: (d) Adding hydrochloric acid drives the equilibrium back and dissolves the white bismuth oxychloride.

MCQ 6.2.13 **In the production of SO3 from SO2 and Oxygen, the yield of SO3 is increased by (KMU MDCAT 2024)**

A	Adding a catalyst	B	Adding more SO2
C	Increasing temperature	D	Removing oxygen

Solution: (b) Adding more of a reactant drives the equilibrium towards the product.

MCQ 6.2.14 **Q.85 One can estimate the direction in which equilibrium will shift with the help of: (UHS MDCAT 2023)**

A	Le Chatelier's principle	B	Law of mass action
C	Mess's law	D	Law of heat of formation

Solution: (a) Le Chatelier's principle says which way an equilibrium moves when it is disturbed.

MCQ 6.2.15 **In reversible reaction, when product is removed, the equilibrium shift towards the: (UHS MDCAT 2023)**

A	Reactant side	B	Product side
C	Both side one by one	D	No effect

Solution: (b) Taking the product away drives the equilibrium forward to replace it.

Topic 6.3 Solubility Product

Past MDCAT Questions

MCQ 6.3.1 **Precipitation occurs if the ionic concentration is: (MDCAT 2022)**

A	greater than K_{sp}	B	less than K_{sp}
C	equal to K_{sp}	D	present in any amount

Solution: (a) The solution can hold only as much as K_{sp} allows, so anything above that comes out as solid.

MCQ 6.3.2 **The solubility of PbS at 25°C is 4.0 × 10-28. Then ionic concentration will be: (NUMS MDCAT 2024)**

A	4x10-14	B	2x10-14
C	1x10-14	D	3.0x10-10

Solution: (b) For a one to one salt $K_{sp} = s^2$, so $s = \sqrt{4.0 \times 10^{-28}}$, that is 2×10^{-14}.

MCQ 6.3.3 **Q.84 The precipitation occurs if the ionic concentration is: (UHS MDCAT 2023)**

A	Less than ksp	B	More than ksp
C	Equal to ksp	D	Present in any amount

Solution: (b) A solid comes down once the ionic product exceeds the solubility product.

MCQ 6.3.4 **Ksp (Solubility product) depends upon: (PMC MDCAT 2022)**

A	Pressure	B	Concentration
C	Temperature	D	Volume

Solution: (c) Like any equilibrium constant, the solubility product changes only with temperature.

MCQ 6.3.5 **Which term describes a solution in which dissolved solute is in equilibrium with undissolved solute? (NUMS MDCAT 2022)**

A	Dilute	B	Saturated
C	Unsaturated	D	Supersaturated

Solution: (b) A saturated solution is one in equilibrium with the undissolved solid.

MCQ 6.3.6 **The product of the concentrations of each ion in a saturated solution of a sparingly soluble salt at 298 K, raised to the power of their relative concentrations is: (UHS MDCAT 2018)**

A	Ksp	B	Ka
C	Kw	D	Kb

Solution: (a) That product is the solubility product, K_{sp}.

MCQ 6.3.7 **Ca(OH)2 is sparingly soluble having solubility constant value 6.5 x 10-6. What'll be its solubility: (UHS MDCAT 2017)**

A	2.75 x 10-2	B	2.75 x 102
C	1.17 x 10-2	D	3.63 x 103

Solution: (c) $K_{sp} = 4s^3$, so $s = \sqrt[3]{6.5 \times 10^{-6}/4}$, about 1.17×10^{-2}.

MCQ 6.3.8 **Value of Ksp for PbSO4 system at 25 °C is equal to: (UHS MDCAT 2016)**

A	1.6 x 10-5 mol2dm-6	B	1.6 x 10-6 mol2dm-6
C	1.6 x 10-8mol2dm-6	D	1.6 x 10-7 mol2dm-6

Solution: (c) The solubility product of lead sulphate at $25^\circ C$ is about 1.6×10^{-8}.

MCQ 6.3.9 **Which one of the following is the correct presentation for Ksp? AgCl Ag+ + Cl— [AgCl] (UHS MDCAT 2015)**

A	Ksp = [Ag +1	B	Ksp = [Ag+1] [Cl-1] +1 -1] [Cl] [AgCl]
C	Ksp = -1 [Ag] [Cl]	D	Ksp = [AgCl] ENGLISH

Solution: (b) The solubility product is the product of the ionic concentrations; the solid does not appear in it.

Topic 6.4 Common Ion Effect

Past MDCAT Questions

MCQ 6.4.1 **The decrease in solubility of a salt in a solution that already contains an ion common to that salt is known as: (MDCAT 2022)**

A	Le Chatelier's principle	B	solubility product
C	common ion effect	D	K_{sp}

Solution: (c) The added common ion shifts the dissolution equilibrium back towards the solid.

MCQ 6.4.2 **Q.83 The decrease in solubility of the salt in a solution that already contains an ion common to that salt is known as: (UHS MDCAT 2023)**

A	Le Chatelier's principle	B	Solubility Product
C	Common ion effect	D	Ksp

Solution: (c) Adding a common ion drives the dissolution equilibrium back, which is the common ion effect.

MCQ 6.4.3 **When Hydrogen Chloride gas passes through saturated brine, it increases the concentration of: (PMC MDCAT 2022)**

A	Sodium ion	B	Hydrogen ion
C	Calcium ion	D	Chloride ion

Solution: (d) The added chloride is the ion common to the salt, so it drives the sodium chloride out of solution.

MCQ 6.4.4 **Common Ion Effect finds its extensive application in: (PMC MDCAT 2022)**

A	quantitative analysis	B	Gas testing
C	material testing	D	Salt analysis

Solution: (d) The salts of a group are precipitated by adding a common ion, which is how they are separated.

MCQ 6.4.5 **What will happen to the KClO3 when KCl is added to its solution in water? (PMC MDCAT 2022)**

A	Its solubility increases	B	Its solubility decreases
C	Concentration of Cl- ion decreases	D	Concentration of ClO3- ion increases

Solution: (b) The potassium ion is common to both salts, so it drives the chlorate out of solution.

MCQ 6.4.6 **Suppression of ionization means: (PMC Practice 2021)**

A	Decreasing ionization	B	Increasing ionization
C	Maintaining ionization	D	None of these options is correct

Solution: (a) Adding a common ion pushes the ionization equilibrium back, which suppresses it.

MCQ 6.4.7 **Purification of table salt (NaCl) by passing HCl gas through its saturated aqueous solution is an example of: (PMC MDCAT 2020)**

A	Law of mass action	B	Hess's law
C	Common ion effect	D	Henry's law

Solution: (c) The added chloride is the ion common to the salt, so the sodium chloride is driven out of solution.

Topic 6.5 Buffer Solutions

Past MDCAT Questions

MCQ 6.5.1 **A buffer solution is not formed by: (MDCAT 2020)**

A	$NH_4OH + NH_4Cl$	B	$CH_3COOH + CH_3COONa$
C	$C_2H_5COOH + C_2H_5COONa$	D	$HCl + NaCl$

Solution: (d) A buffer needs a weak acid or base with its own salt; HCl is a strong acid, so this mixture has no reserve to soak up added acid or alkali.

MCQ 6.5.2 **Which of the following is basic buffer? (UHS MDCAT 2025)**

A	NH4OH/NH4Cl	B	NaOH/NaCl
C	NaOH/HCl	D	H2CO3/NaHCO3

Solution: (a) A basic buffer is a weak base with the salt of that base, here ammonium hydroxide with ammonium chloride.

MCQ 6.5.3 **What happens when H+ is added to ammonium hydroxide and ammonium chloride buffer? (UHS MDCAT 2025)**

A	more ammonium hydroxide is formed	B	reaction will move reverse
C	reaction will move forward	D	no effect on equilibrium

Solution: (b) The added protons are taken up by the ammonium hydroxide, driving the ionization back and holding the pH.

MCQ 6.5.4 **Select the buffer solution having highest pH: (NUMS MDCAT 2024)**

A	0.1M CH3COOH, 0.01M CH3COO-	B	0.1M CH3COOH, 0.05M CH3COO-
C	0.1M CH3COOH, 0.10M CH3COO-	D	0.1M CH3COOH, 0.15M CH3COO-

Solution: (d) The pH rises with the ratio of salt to acid, which is largest in the last mixture.

MCQ 6.5.5 **Which of the following is not the use of Buffer solution? (SZABMU MDCAT 2023)**

A	Used for the caliberation of pH meters	B	Used to preserve biologicalspecimen
C	Maintain the pH of the human blood	D	Predict the concentration of a substance

Solution: (d) A buffer holds a pH steady; it measures no concentration.

MCQ 6.5.6 **The reaction of a weak acid and its salt with a strong base produces: (PMC MDCAT 2022)**

A	Basic buffer	B	A buffer with pH <7
C	Neutral buffer	D	Amphoteric buffer

Solution: (b) A weak acid with its salt is an acidic buffer, holding a pH below seven.

MCQ 6.5.7 **The pH of a solution can be kept constant by: (PMC MDCAT 2022)**

A	saturated solution	B	super saturated solution
C	buffer solution	D	dilute solution

Solution: (c) A buffer resists a change of pH when a little acid or alkali is added.

MCQ 6.5.8 **Which of the following solutions will act as a buffer? (PMC MDCAT 2022)**

A	HN02 and NaN02	B	HCI and KCI
C	HN03 and NH4N03	D	NaOH and NaCl

Solution: (a) Nitrous acid with its sodium salt is a weak acid and its conjugate base, which is a buffer.

MCQ 6.5.9 **The pH of an acidic buffer depends upon the concentration of acid, concentration of salt and: (PMC MDCAT 2022)**

A	pKa of acid used in it	B	pH of acid used in it.
C	pKb of base used in it	D	pOH of base used in it.

Solution: (a) The Henderson equation gives the pH as the $\mathrm{p}K_a$ plus the log of the salt to acid ratio.

MCQ 6.5.10 **Addition of extra CH3COONa in acetate buffer soluton wlll: (PMC MDCAT 2022)**

A	Decrease pH	B	Have no effect on pH
C	Increase pH	D	First increases, then decreases

Solution: (c) More salt raises the ratio of acetate to acid, so the pH rises.

MCQ 6.5.11 **The addition of an acid or H+ Ions to acetic acid buffer will: (PMC MDCAT 2022)**

A	Increase the pH	B	Decrease the pH
C	Have no effect on the pH	D	Both A and B

Solution: (c) The acetate ions take up the added protons, so the pH scarcely moves.

MCQ 6.5.12 **The pH of human blood is: (NUMS MDCAT 2022)**

A	7.35 to 7.45	B	8.35 to 8.45
C	6.35 to 7.45	D	5.57 to 6.57

Solution: (a) Blood is held between pH 7.35 and 7.45 by its buffers.

MCQ 6.5.13 **The pH of 10-2 M aqueous solution of sodium hydroxide is: (UHS MDCAT 2019)**

A	14	B	10
C	12	D	13

Solution: (c) $10^{-2}\,\mathrm{M}$ alkali gives pOH 2, so the pH is 12.

MCQ 6.5.14 **The Ka values of HCI, CH3COOH, HF, and H2S04 are 107, 1.85 x 10-5, 6.7 x 10-5 and 102 respectively. The decreasing order of acidic strength is: (UHS MDCAT 2019)**

A	CH3COOH > HF > H2S04 > HCI	B	HCI > H2S04 > HF > CH3COOH
C	HCl > CH3COOH > HF > H2S04	D	HCl > HF > H2S04 > CH3COOH

Solution: (b) The larger the acid dissociation constant the stronger the acid.

MCQ 6.5.15 **According to Lowry – Bronsted Acid & Base Concept, H20 is: (UHS MDCAT 2018)**

A	An acid	B	A base
C	An amphoteric species	D	A salt

Solution: (c) Water can give a proton or take one, so it is amphoteric.

MCQ 6.5.16 **Human blood maintains its pH between (UHS MDCAT 2016)**

A	6.50 - 7.00	B	7.20 - 7.25
C	7.50 - 7.55	D	7.35 - 7.40

Solution: (d) Blood is buffered between about pH 7.35 and 7.45.

Topic 6.6 Haber's Process

Past MDCAT Questions

MCQ 6.6.1 **Identify the CORRECT conditions required for the maximum yield of ammonia by Haber's process: (MDCAT 2024)**

A	high pressure, low temperature and continual removal of ammonia	B	low pressure, low temperature and continual removal of ammonia
C	high pressure, high temperature and continual removal of ammonia	D	high pressure, low temperature and continual addition of ammonia

Solution: (a) The forward reaction is exothermic and goes with a fall in the number of moles, so pressure helps, heat hurts, and taking the ammonia out keeps pulling it forward.

MCQ 6.6.2 **According to Le Chatelier's principle, in Haber's process yield of ammonia can be increased by: (SZABMU MDCAT 2025)**

A	decreasing pressure and increasing temperature	B	increasing pressure and decreasing temperature
C	increasing volume and decreasing temperature	D	decreasing concentration of H2

Solution: (b) The forward reaction is exothermic and goes from four molecules to two, so high pressure and low temperature favour it.

MCQ 6.6.3 **Identify the CORRECT option required for the maximum yield of ammonia by Haber's process: (UHS MDCAT 2024)**

A	High pressure low temperature continual removal of ammonia	**B**	Low pressure low temperature continual removal of ammonia
C	High pressure high temperature continual removal of ammonia	**D**	High pressure low temperature continual addition of ammonia

Solution: (a) The forward reaction is exothermic and contracts in volume, and taking the ammonia away keeps pulling it forward.

MCQ 6.6.4 **Consider $N_2 + 3H_2(g) \rightleftharpoons 2NH_3(g)$ $\Delta H = -92.46 kJ/mol$ The optimum temperature (°C), to produce ammonia is (KMU MDCAT 2024)**

A	450	**B**	500
C	5000	**D**	Constant temperature

Solution: (a) About 450°C is the compromise between a good yield and a workable rate.

MCQ 6.6.5 **What conditions should be applied to minimize the leftover reactants in Ammonia synthesis? (NUMS MDCAT 2024)**

A	200atm, 500°C	**B**	400atm, 200°C
C	100atm, 400°C	**D**	200atm, 400°C

Solution: (d) High pressure drives the contraction forward, and 400°C is warm enough to reach equilibrium quickly.

MCQ 6.6.6 **For the chemical reaction: $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + Heat$ We can get maximize the yield of NH_3: (SZABMU MDCAT 2023)**

A	By increasing the temperature	**B**	By decreasing the pressure
C	By increasing the volume of the reaction vessel	**D**	By continuous withdrawal of ammonia after intervals

Solution: (d) Taking the ammonia away as it forms keeps drawing the equilibrium forward.

MCQ 6.6.7 **The high pressure of 200 atm in Haber's process is used for: (SZABMU MDCAT 2023)**

A	Better yield	**B**	Lower yield
C	Lower rate	**D**	Cost decrease

Solution: (a) The forward reaction contracts from four molecules to two, so pressure favours it.

MCQ 6.6.8 **Nitrogen and Hydrogen present in equilibrium mixture in Haber Process remain in (PMC MDCAT 2022)**

A	Solid state	**B**	Liquid state
C	Gaseous state	**D**	Mixture of solid and gas

Solution: (c) The synthesis is run at about 450°C, well above the boiling point of all three gases.

MCQ 6.6.9 **The equation $N_2(g) + 3H_2(g) \leftrightharpoons 2NH_3(g)$ represents: (PMC MDCAT 2020)**

A	Contact process	**B**	Haber's process
C	Solvay process	**D**	Avogadro's Law

Solution: (b) That is the Haber process for ammonia.

MCQ 6.6.10 **In contact process, to which substance adequate quantities of water is added to convert it to sulphuric acid? (UHS MDCAT 2019)**

A	$H_2S_2O_7$	**B**	HSO_4^-
C	SO_3	**D**	S

Solution: (a) Sulphur trioxide is absorbed in sulphuric acid to give oleum, and water is then added to that.

MCQ 6.6.11 **The catalyst used for the manufacture of H_2SO_4 by contact process is: (UHS MDCAT 2018)**

A	SO_3	**B**	V_2O_5
C	Fe_2O_3	**D**	Pt/Pd

Solution: (b) Vanadium(V) oxide catalyses the oxidation of sulphur dioxide in the contact process.

MCQ 6.6.12 **In contact process, optimum temperature lies between _____: (UHS MDCAT 2017)**

A	200-300°C	**B**	300-400°C
C	400-500°C	**D**	300-500°C

Solution: (c) The contact process is run at about 400 to 500°C, a compromise between yield and rate.

MCQ 6.6.13 **Among the following, which compound is a catalyst in contact process: (UHS MDCAT 2017)**

A	V_2O_5	**B**	H_2SO_4
C	NH_4Cl	**D**	NaOH

Solution: (a) Vanadium(V) oxide catalyses the oxidation of sulphur dioxide.

Topic 7.1 Chemical Kinetics

Past MDCAT Questions

MCQ 7.1.1 The rate of a reaction: (MDCAT 2020)

A	increases as the reaction proceeds	B	decreases as the reaction proceeds
C	remains the same	D	may decrease or increase

Solution: (b) The reactants are being used up, so their concentrations and with them the rate fall as the reaction goes on.

MCQ 7.1.2 The rate of reaction between two specific time intervals is called the: (MDCAT 2023)

A	instantaneous rate of reaction	B	rate of reaction
C	average rate of reaction	D	specific rate of reaction

Solution: (c) A change measured over an interval rather than at an instant is the average rate.

MCQ 7.1.3 Identify the correct formula to calculate the rate of a reaction: (MDCAT 2024)

A	change in concentration of substance ÷ time taken for the change	B	time taken for the change ÷ change in concentration of substance
C	time taken for the change ÷ change in concentration ×100	D	time taken for the change × change in concentration

Solution: (a) Rate is the change in concentration per unit time.

MCQ 7.1.4 Amount of energy needed to weaken the existing bonds to an extent that can be broken through collision is called: (UHS MDCAT 2025)

A	Bond energy	B	Activation energy
C	Average energy	D	Enthalpy

Solution: (b) Activation energy is the least energy a colliding pair must carry for the reaction to proceed.

MCQ 7.1.5 2A + B -> 3C + D which of the following does not express the reaction rate? (UHS MDCAT 2025)

A	-d[B]/dt	B	d[D]/dt
C	-1/2 d[A]/dt	D	-1/3 d[C]/dt

Solution: (d) C is formed, not consumed, so its rate term takes a plus sign.

MCQ 7.1.6 Final equation for the representation of rate of reaction in term of concentration is called (UHS MDCAT 2025)

A	Rate law	B	Rate constant
C	Reaction rate	D	Reaction order

Solution: (a) The rate law is the equation giving the rate in terms of the concentrations of the reactants.

MCQ 7.1.7 The formation of activated complex in a reaction is: (SIBA MDCAT 2025)

A	Exothermic process	B	Endothermic process
C	Either endo or exo	D	Always energy released

Solution: (b) Energy must be put in to reach the activated complex, so forming it absorbs heat.

MCQ 7.1.8 At start of reaction: (SIBA MDCAT 2025)

A	Average rate is high	B	Instantaneous rate is high
C	Both rates are same	D	Both rates are slow

Solution: (b) At the start the concentration of reactant is greatest, so the instantaneous rate is at its highest.

MCQ 7.1.9 Reaction having high activation energy are: (SZABMU MDCAT 2025)

A	spontaneous	B	fast
C	slow	D	always exothermic

Solution: (c) The higher the barrier, the fewer the collisions that carry enough energy, so the slower the reaction.

MCQ 7.1.10 The rate of reaction (SZABMU MDCAT 2025)

A	Increases as the reaction proceeds	B	Decreases as the reaction proceeds
C	Remains the same as the reaction proceeds	D	May decrease or increase as the reaction proceeds

Solution: (d) It usually falls as the reactants are used up, but an autocatalytic reaction speeds up instead.

MCQ 7.1.11 Identify the correct formula to calculate rate of reaction: (UHS MDCAT 2024)

A	Change in concentration of substance ÷ Time taken for the change	B	Time taken for the change ÷ Change in concentration of substance
C	Time taken for the change ÷ Change in concentration of substance x 100	D	Time taken for the change x Change in concentration of substance

Solution: (a) Rate is the change in concentration divided by the time it took.

MCQ 7.1.12 What is incorrect about activated complex? (SZABMU MDCAT 2023)

A	It is a high energy specie	B	It is a stable specie
C	It is an unstable specie	D	Potentia energy is maximum at activated complex stage

Solution: (b) The activated complex sits at the top of the energy barrier and is therefore unstable.

MCQ 7.1.13 The minimum amount of energy required by the colliding particles for effective collisions is called: (NUMS MDCAT 2023)

A	Activation energy	B	Lattice energy
C	Bond energy	D	Hydration energy

Solution: (a) That least energy is the activation energy.

MCQ 7.1.14 How will be the rate of reaction, if the slope of the curve is greater near the start of the reaction? (UHS MDCAT 2023)

A	Constant	B	Equilibrium
C	Greater	D	Lesser

Solution: (c) The slope of the concentration time curve is the rate, so a steep slope means a fast reaction.

MCQ 7.1.15 The rate of reaction between two specific time intervals is called? (UHS MDCAT 2023)

A	Instantaneous rate of reaction	B	Rate of reaction
C	Average rate of reaction	D	Initial rate

Solution: (c) A rate measured over an interval rather than at an instant is the average rate.

MCQ 7.1.16 Activation energy for forward and backward reaction is always: (PMC MDCAT 2022)

A	Same	B	Different
C	Reciprocal of each other	D	Higher for forward reaction

Solution: (b) The two barriers differ by the enthalpy of the reaction.

MCQ 7.1.17 **At ordinary temperature, only few molecules possess energy equal to (PMC MDCAT 2022)**

A	Kinetic energy	B	Potential Energy
C	Activation energy	D	Ionization Energy

Solution: (c) Only the small fraction of molecules at the top of the energy distribution can react.

MCQ 7.1.18 **Drawing a graph between concentration change with time gives a: (PMC Practice 2021)**

A	Straight line	B	Parabola
C	Curve	D	Scattered graph

Solution: (c) The rate falls as the reactant is used up, so the plot bends.

MCQ 7.1.19 **The study of rates of chemical reactions and the factors that affect the rates of chemical reactions is known as: (PMC MDCAT 2020)**

A	Thermodynamics	B	Stoichiometry
C	Electrochemistry	D	Chemical Kinetics

Solution: (d) That study is chemical kinetics.

MCQ 7.1.20 **What is the measure of activation energy in an endothermic reaction? (UHS MDCAT 2019)**

A	The energy of activation of backward reaction is less than that of forward reaction	B	The energy of activation of backward reaction is more that that of forward reaction.
C	The energy of activation of forward reaction is less than that of backward reaction.	D	The energy of activation of forward - backward reaction is same.

Solution: (a) The products lie above the reactants, so the barrier is lower seen from the product side.

MCQ 7.1.21 **If the energy of activation of a chemical reaction is very low, the rate of that chemical reaction is observed to be very high because? (UHS MDCAT 2019)**

A	Concentration of the reactants becomes irrelevant	B	Reaction proceeds without any transition state
C	Number of efficient or fruitful collisions increase	D	Molecules of the reactants move slowly

Solution: (c) A low barrier means a large fraction of collisions carry enough energy to succeed.

Topic 7.2 Factors Affecting the Rate of Reaction

Past MDCAT Questions

MCQ 7.2.1 **In a reversible reaction, a catalyst lowers the activation energy of the: (MDCAT 2020)**

A	forward reaction	B	reverse reaction
C	forward as well as the reverse reaction	D	forward reaction but raises that of the reverse reaction

Solution: (c) The catalyst offers a lower path between the same two states, so both directions are speeded up equally and the equilibrium is unmoved.

MCQ 7.2.2 **A catalyst which is in the same phase as the reactants is known as: (MDCAT 2022)**

A	a heterogeneous catalyst	B	a homogeneous catalyst
C	a slow catalyst	D	a fast catalyst

Solution: (b) One phase throughout is what homogeneous means.

MCQ 7.2.3 **The rate of a chemical reaction changes with: (KMU MDCAT 2025)**

A	Concentration of reactant molecules	B	Concentration of product molecules
C	Concentration of both reactant and product	D	Rate constant

Solution: (a) The rate law is written in the concentrations of the reactants alone.

MCQ 7.2.4 **Orientation of molecule is more important in following cases except: (SZABMU MDCAT 2025)**

A	High Pressure	B	complex molecules
C	poly atomic molecules	D	low pressure

Solution: (d) At low pressure the molecules are far apart and collisions are rare, so how they are turned matters least.

MCQ 7.2.5 **Formation of hydrogen gas can be increased by reacting which Zn sample with IM HCl? (NUMS MDCAT 2024)**

A	1g Zn Rod	B	1g Zn Pellets
C	1g Zn Ribbon	D	1g Zn Powder

Solution: (d) The powder offers by far the greatest surface for the acid to attack.

MCQ 7.2.6 **Q.87 The catalysis in which the catalyst and the reactants are in the same phase is known? (UHS MDCAT 2023)**

A	Heterogeneous catalyst	B	Homogeneous catalyst
C	Slow	D	Fast

Solution: (b) A catalyst in the same phase as the reactants is a homogeneous catalyst.

MCQ 7.2.7 **When temperature of reacting gases is raised by 10 K, the reaction rate will increase to: (NUMS MDCAT 2023)**

A	Double	B	Three times
C	Four times	D	Five times

Solution: (a) As a rough rule the rate doubles for every ten kelvin rise.

MCQ 7.2.8 **Number of molecules possessing Ea (Activation Energy) can be increased by (PMC MDCAT 2022)**

A	Adding a catalyst	B	increasing the volume
C	increasing temperature	D	increasing temperature of Moles of Reactants

Solution: (c) Heating spreads the energies upwards, so a far larger fraction of molecules clears the barrier.

MCQ 7.2.9 **The slowest reaction among these is (PMC MDCAT 2022)**

A	Neutralization	B	Double Decomposition Reactions
C	Ionic Reactions	D	Hydrogenation Reaction

Solution: (d) Hydrogenation needs bonds broken and a catalyst; ionic reactions need only a meeting of ions.

MCQ 7.2.10 **Rate of any reaction depends upon: (NUMS MDCAT 2022)**

A	Temperature	B	Concentration
C	Pressure	D	Rate constant

Solution: (a) Raising the temperature speeds almost every reaction, and steeply.

MCQ 7.2.11 **What is "NOT TRUE" about rate of a reaction? (NUMS MDCAT 2022)**

A	Concentration of reactants does not affect the rate of a reaction	B	Surface area of reactants affects rate of reaction
C	Concentration affects rate of reaction	D	Catalyst affects rate of a reaction

Solution: (a) Concentration does affect the rate; that is what the rate law says.

MCQ 7.2.12 **Role of a catalyst in a chemical reaction is to: (UHS MDCAT 2018)**

A	Decreases yield of a reaction	B	Decreases rate of a reaction
C	Increase yield of product	D	Increase rate of a reaction

Solution: (d) A catalyst offers a path of lower activation energy; it does not change the yield.

Past MDCAT Questions

MCQ 7.3.1 Consider the hypothetical equation $aA + bB \rightarrow cC + dD$. Which of the following represents the correct rate equation? (MDCAT 2024)

A	Rate $= k[A][B]$	B	Rate $= k[A]^a[B]^b$
C	Rate $= k[A]^a$	D	Rate $= k[B]^b$

Solution: (b) For an elementary step the order in each reactant is its coefficient, so the rate law carries both concentrations raised to those powers.

MCQ 7.3.2 If a reaction rate does not change with concentration, then it is: (MDCAT 2024)

A	third order	B	second order
C	first order	D	zero order

Solution: (d) A rate independent of concentration is $\text{rate} = k[A]^0$, which is zero order.

MCQ 7.3.3 A reaction is first order with respect to A and third order with respect to B, the rate equation is: (NUMS MDCAT 2025)

A	Rate = K[A][B]2	B	Rate = K[A]2[B]
C	Rate = K[A][B]3	D	Rate = K[A]

Solution: (c) The rate law carries each concentration to the power of its own order.

MCQ 7.3.4 For a reaction A → Product, if concentration of A is doubled, product increases 4 times. The order of reaction will be: (NUMS MDCAT 2025)

A	Zero	B	Ist
C	2nd	D	3rd

Solution: (c) The rate goes up by 2^2 when the concentration doubles, so the order is two.

MCQ 7.3.5 The order of chemical reaction is defined as: (SZABMU MDCAT 2025)

A	The number of reactants involved in balanced equation	B	The number of products formed in balanced equation
C	The power to which the concentration of a reactant is raised in the rate equation	D	The rate constant of the reaction

Solution: (c) The order in a reactant is the power to which its concentration is raised in the rate equation.

MCQ 7.3.6 A reaction is first order with respect to A and second order with respect to B, the rate equation is (KMU MDCAT 2024)

A	Rate = k [A]	B	Rate = k [A][B]
C	Rate = k [A]²[B]	D	Rate = k [A][B]²

Solution: (d) Each concentration is raised to the power of its own order.

MCQ 7.3.7 6CO2 + 6H2O → sunlight → C6H12O6 + 6O2. Predict the order of reaction: (NUMS MDCAT 2024)

A	2nd	B	Ist
C	Zero	D	3rd

Solution: (c) A photochemical reaction goes at a rate set by the light, not by the concentrations, so it is zero order.

MCQ 7.3.8 Which mechanism is consistent with rate law Rate = K[NO]2[H2]? (NUMS MDCAT 2024)

A	2NO + H2 → N2 + H2O2 (slow), H2O2 + H2 → 2H2O (fast)	B	NO + H2O → N2 + H2O2 (slow), H2O2 + H2 → 2H2O (fast)
C	2NO + 2H2 → N2O + H2 (slow), H2O + H2 → H2O2 (fast)	D	NO + NO → N2 + O2 (slow), O2 + H2 → H2O (fast)

Solution: (a) The rate law follows the slow step, and only the first scheme has two molecules of nitric oxide and one of hydrogen in it.

MCQ 7.3.9 Q.86 What is the overall order of this rate equation? Rate =k[H3][NO2]2 (UHS MDCAT 2023)

A	1	B	2
C	3	D	4

Solution: (c) The overall order is the sum of the powers, $1 + 2$, that is three.

MCQ 7.3.10 If a reaction is first order with respectd to a reactant then the rate will be_____if the concentration of reactant is doubled: (SZABMU MDCAT 2023)

A	Doubled	B	Halved
C	One fourth	D	Quadrupled

Solution: (a) First order means the rate is proportional to that concentration.

MCQ 7.3.11 When nitric oxide reacts with ozone, the order of reaction will be: (NUMS MDCAT 2023)

A	2nd	B	3rd
C	Ist	D	Zero

Solution: (a) The reaction is first order in each reactant, so second order overall.

MCQ 7.3.12 The number of reactant molecules whose concentrations affect the rate of reaction is called: (PMC MDCAT 2022)

A	Rate law	B	Molecularity
C	Order of reaction	D	Rate constant

Solution: (b) The number of molecules taking part in the rate determining step is the molecularity.

MCQ 7.3.13 The reaction in which rate depends only on one reactant concentrations, although more than one reactants are present in the reaction mixture is known as _____ (PMC MDCAT 2022)

A	Ist order reaction	B	2nd order reaction
C	Pseudo first order reaction	D	Third order reaction

Solution: (c) With one reactant in great excess its concentration hardly changes, so the reaction behaves as first order.

MCQ 7.3.14 The rate law of a particular reaction is Rate = k[NO][O3]. The order of this reaction with respect to ozone is: (PMC MDCAT 2022)

A	Ist	B	2nd
C	3rd	D	Zero

Solution: (a) Ozone appears to the first power, so the order in it is one.

MCQ 7.3.15 The order of reaction for which half-life is inversely proportional to the concentration of reaction is? (PMC Practice 2021)

A	Second Order	B	Zero Order
C	First Order	D	Third Order

Solution: (a) For a second order reaction $t_{1/2} = 1/k[A]_0$.

MCQ 7.3.16 **For which of the following order of the reaction, rate of reaction is inversely proportional to the concentration reaction? (PMC MDCAT 2020)**

A	Ist order reaction	B	2nd order reaction
C	Negative order of reaction	D	Zero order of reaction

Solution: (c) A rate falling as the concentration rises means the order in that reactant is negative.

MCQ 7.3.17 **If concentration time graph of a reactant indicates a constant half life, then the order reaction with respect to that reactant is: (UHS MDCAT 2018)**

A	Zero order	B	Half order
C	Second order	D	First order

Solution: (d) Only for a first order reaction is the half life independent of the concentration.

MCQ 7.3.18 **Rate of first order reaction depends on: (UHS MDCAT 2017)**

A	Concentration of one reactant	B	Concentration of two reactants
C	Concentration of three reactants	D	Independent of the initial concentration

Solution: (a) A first order reaction has its rate proportional to a single concentration.

Topic 7.4 Rate Constant

Past MDCAT Questions

MCQ 7.4.1 **The effect of temperature on the rate of a reaction is given by: (MDCAT 2020)**

A	Henderson's equation	B	the general gas equation
C	the Arrhenius equation	D	the van der Waals equation

Solution: (c) $k = Ae^{-E_a/RT}$ is the Arrhenius equation.

MCQ 7.4.2 **Which of the following is the CORRECT Arrhenius equation? (MDCAT 2024)**

A	$k = Ae^{-E_a/QT}$	B	$k = Ae^{-E_a/RT}$
C	$k = Ae^{-E_a/ST}$	D	$k = Ae^{-E_a/uT}$

Solution: (b) $k = Ae^{-E_a/RT}$, with R the gas constant and E_a the activation energy.

MCQ 7.4.3 **The specific rate constant (k) of a reaction is related to the concentration of reactants: (KMU MDCAT 2025)**

A	Directly	B	Inversely
C	Exponentially	D	Independently

Solution: (d) The rate constant depends on temperature and on the catalyst, never on how much reactant is present.

MCQ 7.4.4 **K is called specific rate constant because it is: (SIBA MDCAT 2025)**

A	Rate per unit concentration	B	Temperature independent
C	Depends on concentration	D	Unitless

Solution: (a) It is the rate when every reactant is at unit concentration, that is the rate per unit concentration.

MCQ 7.4.5 **For a first order reaction A → B, the rate constant is 0.0458 s^{-1}. Calculate rate of the reaction if the concentration of reactant is 0.35mol dm^{-3}. (KMU MDCAT 2024)**

A	0.012 mol dm^{-3} s^{-1}	B	0.014 mol dm^{-3} s^{-1}
C	0.016 mol dm^{-3} s^{-1}	D	0.018 mol dm^{-3} s^{-1}

Solution: (c) Rate is $k[A] = 0.0458 \times 0.35$, which is $0.016\,\mathrm{mol\,dm^{-3}\,s^{-1}}$.

MCQ 7.4.6 **The unit of rate constants is the same as the rate of reaction in which of the following order of reaction? (SZABMU MDCAT 2023)**

A	Zero	B	First
C	Second	D	Third

Solution: (a) For a zero order reaction the rate equals k, so the two have the same unit.

MCQ 7.4.7 **Arrhenius equation is an equation of: (PMC MDCAT 2022)**

A	Curve	B	Parabola
C	Straight line	D	Hyperbola

Solution: (c) Taking logarithms turns it into $\ln k = \ln A - E_a/RT$, a straight line against $1/T$.

MCQ 7.4.8 **What Is the unit of slope obtained from Arrhenius equation? (PMC MDCAT 2022)**

A	K	B	J/mol K
C	mol/K	D	K-

Solution: (a) The slope is $-E_a/R$, and joules per mole over joules per mole per kelvin leaves kelvin.

MCQ 7.4.9 **Rate constant is denoted by? (PMC Practice 2021)**

A	K	B	Kr
C	Kv	D	Ks

Solution: (a) The rate constant is written k.

MCQ 7.4.10 **The unit of the rate constant is the same as that of the rate of reaction in: (PMC MDCAT 2020)**

A	Zero order reaction	B	First order reaction
C	Second order reaction	D	Third order reaction

Solution: (a) For a zero order reaction the rate equals k.

MCQ 7.4.11 **Unit of K in first order Reaction is: (UHS MDCAT 2017)**

A	s-1	B	moles dm-3 s-1
C	moles dm-3	D	mol-1 dm3'

Solution: (a) For a first order reaction the rate constant has the unit of reciprocal seconds.

MCQ 7.4.12 **The rate constant 'k' is 0.693 min-1. The half-life for the 1st order reaction will be: (UHS MDCAT 2016)**

A	1 min	B	2 min
C	0.693 min	D	4 min

Solution: (a) $t_{1/2} = 0.693/k = 0.693/0.693$, that is one minute.

Topic 8.2 Exothermic and Endothermic Reactions

Past MDCAT Questions

MCQ 8.2.1 In an exothermic reaction, the heat content of the: (MDCAT 2024)

A	reactants and products is equal	B	reactants is more than that of the products
C	products is more than that of the reactants	D	reactants and products does not change

Solution: (b) Heat is given out, so the products hold less energy than the reactants and ΔH is negative.

MCQ 8.2.2 Majority of reactions taking place at ordinary temperatures with -ΔH are (UHS MDCAT 2025)

A	Endothermic	B	Exothermic
C	Thermally unstable	D	Reversible

Solution: (b) A negative enthalpy change means heat leaves the system, which is what exothermic means.

MCQ 8.2.3 Select the exothermic reaction among the following: (NUMS MDCAT 2025)

A	Thermal composition of P2O5	B	Formation of atmospheric nitric oxide
C	Burning of methane	D	Sublimation of dry ice

Solution: (c) Burning methane gives out heat, so its enthalpy change is negative.

MCQ 8.2.4 In endothermic reaction, the heat content of the (UHS MDCAT 2024)

A	Reactants and products is equal	B	Reactants is more than that of products
C	Products is more than that of reactants	D	Reactants & Products will not change

Solution: (c) An endothermic reaction takes heat in, so the products hold more energy than the reactants.

MCQ 8.2.5 In the air, N2 and O2 occur naturally but they do not react to form oxides of nitrogen because: (PMC MDCAT 2022)

A	Oxides of nitrogen are unstable	B	Catalyst is required for the reaction
C	The reaction is endothermic	D	N2 and O2 do not react with each other

Solution: (c) Nitrogen and oxygen combine only at the temperature of a spark or an engine, because the reaction absorbs heat.

MCQ 8.2.6 Enthalpy change of combustion is exothermic because: (NUMS MDCAT 2022)

A	Energy released in bond breaking is greater	B	Energy released in bond making is greater
C	Energy absorbed in bond breaking is greater	D	Energy absorbed in bond making is greater

Solution: (b) More energy comes out in forming the new bonds than goes in breaking the old ones.

MCQ 8.2.7 Energy for the endothermic reaction is given a ____ value? (PMC Practice 2021)

A	Positive	B	Negative
C	Zero	D	Neither positive nor negative

Solution: (a) An endothermic reaction takes heat in, so its enthalpy change is positive.

MCQ 8.2.8 Reaction of water with quicklime results in the rise in the temperature of the system. Using the concept of an energy change, indicates the nature of the reaction? (UHS MDCAT 2018)

A	Endothermic Reaction	B	Non-Spontaneous Reaction
C	Third Order Reaction	D	Exothermic Reaction

Solution: (d) Heat is given out, so the reaction is exothermic.

Topic 8.1 Thermodynamics

Past MDCAT Questions

MCQ 8.1.1 Select the spontaneous reaction from the following: (NUMS MDCAT 2025)

A	Reaction of nitrogen and oxygen	B	Emission of α-particles from polonium
C	Thermal decomposition of marble	D	Burning of paper

Solution: (b) Alpha emission needs no help from outside; the other three must be driven or lit.

Topic 8.3 Terms Used in Thermochemistry

Past MDCAT Questions

MCQ 8.3.1 Which of the following terms is a state function? (MDCAT 2022)

A	freezing	B	decomposition
C	sublimation	D	enthalpy

Solution: (d) Enthalpy depends only on the state of the system, not on the path by which it got there.

MCQ 8.3.2 Which of the following is NOT a state function? (SIBA MDCAT 2025)

A	Enthalpy	B	Work
C	Internal energy	D	Pressure

Solution: (b) Work depends on the path taken, so it is not fixed by the state of the system.

MCQ 8.3.3 Q.89 Which of the following term is state function? (UHS MDCAT 2023)

A	freezing	B	decomposition
C	sublimation	D	enthalpy

Solution: (d) Enthalpy depends only on the state of the system, not on how it got there.

MCQ 8.3.4 One calorie is equal to: (SZABMU MDCAT 2023)

A	4.18 KJ	B	4.18 J
C	0.418 KJ mole-1	D	0.418 KJ

Solution: (b) One calorie is 4.18 J.

MCQ 8.3.5 What is the reason of energy changes in chemical reactions? (UHS MDCAT 2023)

A	Bond formation	B	Bond breakage
C	Bond formation and breakage	D	Ionic bonds

Solution: (c) Breaking bonds absorbs energy and forming them releases it; the difference is the heat of reaction.

MCQ 8.3.6 What is the unit of heat capacity? (UHS MDCAT 2023)

A	JK-1	B	kJmol-1
C	kJ/K	D	kJ.mol

Solution: (a) Heat capacity is heat per unit rise in temperature, so its unit is the joule per kelvin.

MCQ 8.3.7 **One Calorie is equivalent to: (NUMS MDCAT 2022)**

A	4.184 J	**B**	4.184 kJ
C	0.4184 J	**D**	0.4184 kJ

Solution: (a) One calorie is $4.184\,\mathrm{J}$.

MCQ 8.3.8 **If water is present in a cup placed on a table, what will be the system in this case? (PMC Practice 2021)**

A	Water	**B**	Water in the cup
C	Whole table	**D**	All of these options are correct

Solution: (a) The system is the part under study, here the water; the cup and the table are its surroundings.

MCQ 8.3.9 **Enthalpy is measured at _____: (UHS MDCAT 2017)**

A	300 K and 2 atm	**B**	300 K and latm
C	298 K and I atm	**D**	295 K and I atm

Solution: (c) Standard enthalpies are quoted at $298\,\mathrm{K}$ and one atmosphere.

MCQ 8.3.10 **Determine the value of Enthalpy of formation of NH4Cl (UHS MDCAT 2017)**

A	- 788 kJmol-I	**B**	-314.55 kJmol-I
C	-692 kJmol-I	**D**	None of the given options

Solution: (b) The formation of ammonium chloride from its elements releases about $315\,\mathrm{kJ\,mol^{-1}}$.

Topic 8.6 Hess's Law

Past MDCAT Questions

MCQ 8.6.1 **The Born-Haber cycle is used to determine the lattice energy of ionic compounds. It is an application of: (MDCAT 2022)**

A	Henry's law	**B**	Le Chatelier's principle
C	Hess's law	**D**	the common ion effect

Solution: (c) The cycle adds the enthalpies of a set of steps to reach the same final state, which is Hess's law.

MCQ 8.6.2 **The heat of formation of CO and CO2 are -26.4 Kcal and -94.0 Kcal respectively. The heat of combustion of carbon monoxide according to Hess's Law will be: (SIBA MDCAT 2025)**

A	+26.4Kcal	**B**	-67.6Kcal
C	+94.0Kcal	**D**	-120.4Kcal

Solution: (b) Burning carbon monoxide is the formation of carbon dioxide less the formation of the monoxide, $-94.0 - (-26.4)$, or $-67.6\,\mathrm{kcal}$.

MCQ 8.6.3 **ΔH can be measured indirectly by applying (KMU MDCAT 2024)**

A	Avogadro's law	**B**	Faraday's law
C	Gas's law	**D**	Hess's law

Solution: (d) Hess's law lets an enthalpy change be got from any convenient route between the same two states.

MCQ 8.6.4 **DeltaH° for sublimation of one mole of iodine: H2(g) + I2(g) → 2HI(g) DH = 51.8kJ/mol H2(g) + I2(s) → 2HI(g) DH = -10.5kJ/mol (NUMS MDCAT 2024)**

A	41.3 kJ/mol	**B**	62.3 kJ/mol
C	53.5 kJ/mol	**D**	36.5 kJ/mol

Solution: (b) Subtracting the second equation from the first leaves the sublimation, $51.8 - (-10.5)$, that is $62.3\,\mathrm{kJ\,mol^{-1}}$.

MCQ 8.6.5 **Q.88 Born-Haber cycle is used to determine the Lattice energy of ionic compounds. It is the application of (UHS MDCAT 2023)**

A	Henry's law	**B**	Le - Chatleir's Principle
C	Hess's law	**D**	Common ion effect

Solution: (c) The cycle adds enthalpies round a closed path, which is Hess's law.

MCQ 8.6.6 **Which of the following law Is an application of first law of thermodynamics? (PMC MDCAT 2022)**

A	Hess's law	**B**	Dalton's law
C	Moseley's Law	**D**	Avogadro's law

Solution: (a) Hess's law follows from the conservation of energy applied to enthalpy.

MCQ 8.6.7 **Standard enthalpy of combustion of graphite at 25 oC is -393.5I kJ mol-I and that of diamond is -395.4I kJ mol-I. The enthalpy change for graphite is: (UHS MDCAT 2015)**

A	- I.9I	**B**	+2.I
C	-2.I	**D**	+I.9I

Solution: (d) Subtracting the two combustion enthalpies leaves $+1.91\,\mathrm{kJ\,mol^{-1}}$ for graphite turning to diamond.

Topic 8.7 Enthalpy of Reaction

Past MDCAT Questions

MCQ 8.7.1 **The enthalpy change when one mole of water is formed by the reaction of an acid with an alkali under standard conditions is known as the: (MDCAT 2024)**

A	enthalpy of formation	**B**	enthalpy of reaction
C	enthalpy of combustion	**D**	enthalpy of neutralization

Solution: (d) Acid plus alkali making one mole of water is the enthalpy of neutralization.

MCQ 8.7.2 **For endothermic reaction, enthalpy change is: (SZABMU MDCAT 2025)**

A	ΔHreactant>ΔHproduct	**B**	ΔHreactant<ΔHproduct
C	ΔHreactant=ΔHproduct	**D**	ΔHreactant=ΔHproduct=0

Solution: (b) An endothermic reaction takes heat in, so the products hold more enthalpy than the reactants.

MCQ 8.7.3 **The enthalpy change whenI Mole of water is formed by the reaction of acid with an alkali under standard conditions is known as: (UHS MDCAT 2024)**

A	Enthalpy of formation	**B**	Enthalpy of reaction
C	Enthalpy of combustion	**D**	Enthalpy of neutralization

Solution: (d) That is the enthalpy of neutralization.

MCQ 8.7.4 **One slice of bread with a tablespoon of peanut butter on it contains 20g carbohydrate, I0g protein, and 9g fat. Calculate total energy consumed in this intake. (KMU MDCAT 2024)**

A	I58kcal	**B**	I73kcal
C	20Ikcal	**D**	2I8kcal

Solution: (c) Carbohydrate and protein give $4\,\mathrm{kcal}$ a gram and fat 9, so $80 + 40 + 81$ is $201\,\mathrm{kcal}$.

MCQ 8.7.5 **Identify standard enthalpy of formation for the following reaction: (NUMS MDCAT 2024)**

A	H2(g) + I/2 O2(g) → H2O(l)	**B**	CO(g) + I/2 O2(g) → CO2(g)
C	2Al(s) + Fe2O3(s) → Al2O3(s) + 2Fe(s)	**D**	S(s) + 3/2 O2(g) → SO3(g)

Solution: (a) Only the first makes one mole of a compound from its elements in their standard states.

MCQ 8.7.6 **The thermal energy at constan pressure is called: (SZABMU MDCAT 2023)**

A	Enthalpy	**B**	Internal energy
C	Heat capacity	**D**	Work done

Solution: (a) Heat exchanged at constant pressure is the enthalpy change.

MCQ 8.7.7 **The correct value for the enthalpy of formation of CO is: (PMC MDCAT 2022)**

A	-110kJ/mol	**B**	-210kJ/mol
C	+110kJ/mol	**D**	+210kJ/mol

Solution: (a) Carbon monoxide is formed from its elements with the release of about $110\,\mathrm{kJ\,mol^{-1}}$.

MCQ 8.7.8 **Formation of carbon dioxide hinders in calculating the heat of formation of: (PMC Practice 2021)**

A	CCl4	**B**	O3
C	CO	**D**	C

Solution: (c) Burning carbon always gives some dioxide as well, so the formation of the monoxide cannot be measured directly.

MCQ 8.7.9 **Which of these have a positive value of enthalpy? (PMC Practice 2021)**

A	Combustion	**B**	Neutralization
C	Atomization	**D**	All of these options are correct

Solution: (c) Atomizing a substance means breaking every bond in it, which always takes energy.

MCQ 8.7.10 **Which of the following is always an exothermic process? (PMC Practice 2021)**

A	Enthalpy of atomization	**B**	Enthalpy of fusion
C	Enthalpy of neutralization	**D**	Enthalpy of sublimation

Solution: (c) Neutralization of an acid by an alkali always gives out heat.

MCQ 8.7.11 **The thermal energy at constant pressure is called: (PMC MDCAT 2020)**

A	Enthalpy	**B**	Internal Energy
C	Heat capacity	**D**	Work done

Solution: (a) Heat exchanged at constant pressure is the enthalpy change.

MCQ 8.7.12 **Which of the equations shows "twice" the enthalpy change of neutralization as the following equation (UHS MDCAT 2019)**

A	MgCO3 + 2HCl -> MgCl2 + CO2 + H2O	**B**	KOH + HCl -> KCl + H2P
C	NH4Cl + NaOH -> NaCl + H2O + NH3	**D**	H2SO4 + Mg(OH)2 -> MgSO4 + 2H2O

Solution: (d) A diprotic acid with a dibasic alkali makes two moles of water, so twice the heat is given out.

MCQ 8.7.13 **Which one of the following enthalpy changes is always exothermic? (UHS MDCAT 2018)**

A	Enthalpy of combustion	**B**	Enthalpy of formation
C	Enthalpy of atomization	**D**	Enthalpy of solution

Solution: (a) Burning always gives out heat.

Topic 8.4 Internal Energy

Past MDCAT Questions

MCQ 8.4.1 **If 100 KJ of heat is absorbed by the system and 40 KJ of work is done on the system what is the change of Internal energy? (UHS MDCAT 2025)**

A	-60 KJ	**B**	+60 KJ
C	-140 KJ	**D**	+140 KJ

Solution: (d) Heat absorbed and work done on the system both add, so the internal energy rises by $140\,\mathrm{kJ}$.

MCQ 8.4.2 **An increase in the internal energy of a chemical system can lead to all EXCEPT: (KMU MDCAT 2025)**

A	An increase in temperature due to rise in kinetic energy of molecules	**B**	A phase change such as melting or evaporation
C	A chemical reaction if energy supplied is sufficient to break bonds	**D**	An increase in temperature due to drop in kinetic energy of molecules

Solution: (d) Internal energy rises with the kinetic energy of the molecules, so a drop in that energy cannot raise the temperature.

MCQ 8.4.3 **When 1 mole of ice melts at 0°C and constant pressure of 1 atmosphere, 6025 J of heat is absorbed by the system. The molar volume of ice and water are 0.020 and 0.018 dm³, respectively. Calculate ΔE. (1dm³.atm=101.33J) (KMU MDCAT 2024)**

A	6010.20J	**B**	6015.20J
C	6020.20J	**D**	6025.20J

Solution: (d) The volume falls slightly on melting, so the surroundings do a little work and ΔE is a shade above the heat absorbed.

Topic 8.5 Laws of Thermodynamics

Past MDCAT Questions

MCQ 8.5.1 **Calculate the work done when 1 mole of an ideal gas expands from 15 dm³ to 20 dm³ against a constant external pressure of 2 atmospheres. (KMU MDCAT 2024)**

A	-10 atm.dm³	**B**	-5 atm.dm³
C	5 atm.dm³	**D**	10 atm.dm³

Solution: (a) $w = -P\Delta V = -2 \times 5$, which is $-10\,\mathrm{atm\,dm^3}$; the sign says the gas did the work.

MCQ 8.5.2 **Expansion takes place when gas evolves during reaction between carbohydrates and dilute HCl. Predict energy change and work done: (NUMS MDCAT 2024)**

A	w is positive, q is negative	**B**	w is negative, q is positive
C	q is positive, no work done	**D**	w is positive, q is positive

Solution: (b) The gas pushes back the surroundings, so the system does work and the sign of w is negative while heat is absorbed.

MCQ 8.5.3 **The correct equation for the first law of thermodynamics is: (SZABMU MDCAT 2023)**

A	ΔE = q + w	**B**	ΔE = w - q
C	ΔE = Δq - pΔv	**D**	ΔE = Δq + pΔv

Solution: (a) The first law is $\Delta E = q + w$: heat put in and work done on the system.

MCQ 8.5.4 **Which one of the following is the correct demonstration of first law of thermodynamics? (PMC MDCAT 2022)**

A	△H= qw	**B**	△E=q - P△V
C	△H=q+w	**D**	△E = q+w

Solution: (d) The first law is $\Delta E = q + w$.

MCQ 8.5.5 **With different number of moles of reactants and products, the volume of system? (PMC Practice 2021)**

A	Remains unchanged	**B**	Changes
C	Decrease	**D**	Increase

Solution: (b) A change in the number of gas molecules changes the volume, and the system then does or absorbs work.

MCQ 8.5.6 **Heat exchanged between the system and surrounding at constant volume is shown by the relation? (PMC Practice 2021)**

A	$\Delta H = qv + w$	B	$\Delta E = (q)v$
C	$\Delta H = (q)v$	D	$\Delta E = (q)v + PV$

Solution: (b) At constant volume no work is done, so the heat exchanged is the change in internal energy.

MCQ 8.5.7 **At constant volume the heat supplied is equal to: (PMC Practice 2021)**

A	Work done	B	Internal energy change
C	Enthalpy	D	Entropy

Solution: (b) With no work done, the first law leaves the heat supplied equal to the rise in internal energy.

MCQ 8.5.8 **Which of the following condition is constant in Bomb calorimeter? (PMC Practice 2021)**

A	Pressure	B	Volume
C	Temperature	D	All of these

Solution: (b) A bomb calorimeter is a sealed steel vessel, so the volume cannot change.

Unit 9 Electrochemistry

Topic 9.1 Redox Reactions

Past MDCAT Questions

MCQ 9.1.1 **An electrochemical cell is based upon which reaction? (MDCAT 2022)**

A	acid-base reaction	B	redox reaction
C	nuclear reaction	D	neutralization reaction

Solution: (b) The cell works by separating the oxidation and the reduction, so the electrons travel through the external circuit.

MCQ 9.1.2 **Which of the following situations most clearly demonstrates a key characteristic of a Redox reaction? (UHS MDCAT 2025)**

A	Water boiling to steam	B	Hydrogen gas reacting with chlorine to form hydrogen chloride gas
C	Sodium chloride dissolving in water	D	Ethanol evaporating at room temperature

Solution: (b) Hydrogen loses electrons to chlorine; the other three changes are physical.

MCQ 9.1.3 **Placing a rod of iron metal in a solution of CuSO4: (NUMS MDCAT 2024)**

A	Cu will be deposited	B	Fe is precipitated out
C	Cu and Fe both dissolve	D	No reaction taken place

Solution: (a) Iron is above copper in the reactivity series, so it displaces copper from the solution.

MCQ 9.1.4 **Q.90 An electrochemical cell is based upon which reaction? (UHS MDCAT 2023)**

A	Acid-base reaction	B	Redox reaction
C	Nuclear reaction	D	Neutralization reaction

Solution: (b) An electrochemical cell draws its emf from a redox reaction split between two electrodes.

MCQ 9.1.5 **The branch of science which deals with the conversion of electrical energy to chemical energy and vice versa is called: (SZABMU MDCAT 2023)**

A	Electrochemistry	B	Thermochemistry
C	Stereochemistry	D	Biochemistry

Solution: (a) That is electrochemistry.

MCQ 9.1.6 **Fe is precipitated out when Mg strip is dipped in (PMC MDCAT 2022)**

A	FeSO4 solution	B	CuSO4 Solution
C	MgSO4 Solution	D	H2SO4 solution

Solution: (a) Magnesium is above iron in the reactivity series, so it displaces iron from the solution.

MCQ 9.1.7 **Which of the following substances is the strongest reducing agent? (PMC MDCAT 2022)**

A	Cl2	B	Cl-
C	Br2	D	Br-

Solution: (d) A reducing agent gives up electrons, and the bromide ion parts with one most readily here.

MCQ 9.1.8 **A galvanic cell is setup (PMC MDCAT 2022)**

A	When a less reactive metal contacts a more reactive metal via an electrolyte	B	When two reactive metals contact via an electrolyte
C	When two reactive metals are placed in any solutiin	D	When two metals come In direct contact

Solution: (a) A galvanic cell needs two metals of different reactivity joined through an electrolyte.

MCQ 9.1.9 **Keeping in mind the electrode potential, which one of the following reactions is feasible? (UHS MDCAT 2015)**

A	Zn+2 + Cu Cu+2 + Zn	B	Zn + MgSO4
C	Fe + CuSO4 ZnSO4 + Mg FeSO4 + Cu	D	Cd + MgSO4 CdSO4 + Mg

Solution: (c) Iron stands above copper in the series, so it displaces copper from the sulphate.

Topic 9.2 Oxidation and Reduction

Past MDCAT Questions

MCQ 9.2.1 **In which of the following does oxygen show a fractional oxidation number? (MDCAT 2022)**

A	OF_2	B	Na_2O_2
C	KO_2	D	Cl_2O_7

Solution: (c) In the superoxide KO_2 the two oxygens share a single negative charge, so each is $-\frac{1}{2}$.

MCQ 9.2.2 **Which statement describes the conversion of magnesium atoms to magnesium ions for ionic bond formation with chlorine? (MDCAT 2022)**

A	the change is reduction, because there has been a gain of electrons	B	the change is oxidation, because there has been a loss of electrons
C	the change is reduction, because there has been a loss of electrons	D	the change is oxidation, because there has been a gain of electrons

Solution: (b) Mg loses two electrons to become Mg^{2+}, and loss of electrons is oxidation.

MCQ 9.2.3 **The oxidation number of a free element is: (MDCAT 2023)**

A	zero	**B**	$+1$
C	-1	**D**	equal to its group number

Solution: (a) An uncombined atom has shared its electrons with nothing, so its oxidation number is zero.

MCQ 9.2.4 **The oxidation number of Mn in $KMnO_4$ is: (MDCAT 2024)**

A	$+2$	**B**	$+1$
C	-7	**D**	$+7$

Solution: (d) $+1$ for K and -2 for each of four oxygens leaves $+7$ for manganese.

MCQ 9.2.5 **Which of the following best identifies the redox reaction: (UHS MDCAT 2025)**

A	transfer of proton	**B**	transfer of electron
C	absorption of light	**D**	exchange of ions

Solution: (b) Oxidation is loss of electrons and reduction is gain, so a redox reaction is an electron transfer.

MCQ 9.2.6 **In an electrolytic cell when the current passes through a solution, the anode is: (KMU MDCAT 2025)**

A	a positive electrode where oxidation occurs	**B**	a negative electrode where oxidation occurs
C	a negative electrode where reduction occurs	**D**	a positive electrode where reduction occurs

Solution: (a) Oxidation always happens at the anode, and in an electrolytic cell the anode is the positive electrode.

MCQ 9.2.7 **The oxidation number of Cl in HClO2 is: (NUMS MDCAT 2025)**

A	+1	**B**	+3
C	+5	**D**	+7

Solution: (b) Hydrogen is $+1$ and each oxygen -2, so chlorine must be $+3$ for the molecule to be neutral.

MCQ 9.2.8 **In the given reaction CH3OH -> HCOOH, oxidation state of carbon changes from: (SZABMU MDCAT 2025)**

A	-2 to 0	**B**	-2 to +2
C	-3 to +2	**D**	0 to +2

Solution: (b) Carbon is -2 in methanol and $+2$ in formic acid, so it loses four electrons.

MCQ 9.2.9 **Which species contain an element with an oxidation number of +4? (SZABMU MDCAT 2025)**

A	CrO2-4	**B**	MnO2-
C	H2SO4	**D**	Na2CO3

Solution: (d) Each oxygen is -2 and each sodium $+1$, so the carbon of the carbonate is $+4$.

MCQ 9.2.10 **Oxidation number of 'Mn' in KMnO4 is (UHS MDCAT 2024)**

A	0	**B**	+1
C	-7	**D**	+7

Solution: (d) Potassium is $+1$ and the four oxygens are -8, so manganese must be $+7$.

MCQ 9.2.11 **Which of the following is NOT a correct feature of electrolytic cells? (UHS MDCAT 2024)**

A	Reduction occurs at cathode	**B**	Oxidation occurs at anode
C	Alternating current source is connected to electrodes	**D**	Electrochemical reaction takes place

Solution: (c) An electrolytic cell is driven by direct current; alternating current would reverse the electrodes every half cycle.

MCQ 9.2.12 **Q.91 In which of the following, oxygen shows fractional oxidation number? (UHS MDCAT 2023)**

A	OF2	**B**	Na2O2
C	KO2	**D**	Cl2O7

Solution: (c) In the superoxide ion the charge is shared between two oxygens, so each is at $-\frac{1}{2}$.

MCQ 9.2.13 **Q.94 Which statement describes the conversion of magnesium atoms to magnesium ions for ionic bond formation with chlorine? (UHS MDCAT 2023)**

A	The change is reduction, because there has been a gain of electrons	**B**	The change is oxidation, because there has been a loss of electrons
C	The change is reduction, because there has been a loss of electrons	**D**	The change is oxidation, because there has been a gain of electrons

Solution: (b) Magnesium gives up two electrons, and loss of electrons is oxidation.

MCQ 9.2.14 **Oxidation number of an element in free state is: (SZABMU MDCAT 2023)**

A	Negative	**B**	Positive
C	Zero	**D**	±1

Solution: (c) An uncombined element has an oxidation number of zero.

MCQ 9.2.15 **During electrolysis, reduction always occurs at the: (NUMS MDCAT 2023)**

A	Anode	**B**	Cathode
C	SHE	**D**	Salt bridge

Solution: (b) Reduction is gain of electrons, and the electrons enter the cell at the cathode.

MCQ 9.2.16 **Oxidation number of free magnesium is? (UHS MDCAT 2023)**

A	0	**B**	+1
C	+2	**D**	+3

Solution: (a) An uncombined element has an oxidation number of zero.

MCQ 9.2.17 **Oxidation state of Cr in K2Cr2O7 is: (PMC MDCAT 2022)**

A	+3	**B**	+4
C	+5	**D**	+6

Solution: (d) Two potassium at $+1$ and seven oxygen at -2 leave $+12$ for two chromium atoms, so each is $+6$.

MCQ 9.2.18 **In the electrolysis of fused salt, where do the cations move? (PMC MDCAT 2022)**

A	Move towards anode and discharge on it	**B**	Move towards cathode and discharge on it
C	Move towards cathod, gain electron and dissolve in solution	**D**	Both a and b

Solution: (b) Cations are attracted to the cathode, where they take electrons and are discharged.

MCQ 9.2.19 **Electrons flow from _____ (PMC MDCAT 2022)**

A	Anode to cathode	**B**	Cathode to anode
C	Don't flow	**D**	In either directions

Solution: (a) Electrons leave the electrode where oxidation happens, the anode, and travel to the cathode.

MCQ 9.2.20 **During electrolysis, reduction always occurs at: (NUMS MDCAT 2022)**

A	Anode	**B**	Cathode
C	SHE	**D**	Salt bridge

Solution: (b) Reduction is gain of electrons, and the electrons enter at the cathode.

MCQ 9.2.21 **Current in electrolysis is carried through? (PMC Practice 2021)**

A	Free electrons	B	Positive Ions
C	Negative Ions	D	Both B and C

Solution: (d) In the electrolyte the current is carried by the ions, positive one way and negative the other.

MCQ 9.2.22 **During oxidation process, oxidation number of an element: (PMC MDCAT 2020)**

A	Decreases	B	Increases
C	Remains constant	D	Both decreases and increases

Solution: (b) Oxidation is loss of electrons, which raises the oxidation number.

MCQ 9.2.23 **The oxidation state of "S' in the (S2O3)-2 is: (PMC MDCAT 2020)**

A	+4	B	+6
C	-2	D	+2

Solution: (d) Three oxygens at -2 and a charge of -2 leave $+4$ for two sulphur atoms, that is $+2$ each.

MCQ 9.2.24 **The common oxidation number of halogens is: (PMC MDCAT 2020)**

A	-1	B	+1
C	-2	D	0

Solution: (a) A halogen needs one electron to complete its octet, so it is usually -1.

MCQ 9.2.25 **Oxidation number of particular element can be directly or indirectly inferred from its: (UHS MDCAT 2019)**

A	Group number	B	Atomic size
C	Atomic mass	D	Physical state

Solution: (a) The group number gives the number of outer electrons, and so the usual oxidation state.

MCQ 9.2.26 **For the purification, impure copper is made the: (UHS MDCAT 2017)**

A	Cathode	B	Anode
C	Solution	D	Both Cathode and Anode

Solution: (b) The impure copper is the anode and dissolves; the pure metal is deposited on the cathode.

Topic 9.3 Balancing Redox Equations

Past MDCAT Questions

MCQ 9.3.1 **Which step is irrelevant with respect to balancing redox equations by the oxidation number method? (MDCAT 2024)**

A	split the reaction into two half reactions	B	assign oxidation numbers to all the atoms involved in the equation
C	identify the element undergoing a change in oxidation number	D	equalize the number of electrons lost and gained

Solution: (a) Splitting into half reactions belongs to the ion-electron method, not to the oxidation number method.

MCQ 9.3.2 **Which step is irrelevant with respect to balancing of redox equations by oxidation number method? (UHS MDCAT 2024)**

A	Split the reaction into two half reactions	B	Assign oxidation number to all the atoms involved in the equation
C	Identify the element undergoing a change in oxidation number	D	Equalize the number of electrons lost and gained

Solution: (a) Splitting into half reactions belongs to the ion electron method, not to the oxidation number method.

MCQ 9.3.3 **In the ion-electron method of balancing equations, how oxygen is balanced? (PMC MDCAT 2022)**

A	O is balanced by adding O2	B	O is balanced by adding H2O
C	O is balanced by adding OH	D	All the ways are used

Solution: (b) Oxygen is balanced by adding water to the side short of it, and hydrogen then by adding protons.

Topic 9.4 Standard Hydrogen Electrode

Past MDCAT Questions

MCQ 9.4.1 **The stronger the oxidizing agent, the greater is its: (MDCAT 2020)**

A	oxidation potential	B	reduction potential
C	redox potential	D	emf

Solution: (b) An oxidizing agent is itself reduced, so the more readily it takes electrons the higher its standard reduction potential.

MCQ 9.4.2 **When SHE is connected with Cu electrode using salt bridge and external wire: (SIBA MDCAT 2025)**

A	Cu reduces	B	Cu+2 reduces
C	H+ reduces	D	H2 reduces

Solution: (b) Copper stands above hydrogen in the electrochemical series, so the copper ions take the electrons and the copper electrode is the cathode.

MCQ 9.4.3 **In a standard hydrogen electrode, the platinum electrode: (SZABMU MDCAT 2025)**

A	Reacts with hydrogen	B	Provide a surface for oxidation and reduction.
C	Acts as a salt bridge.	D	Provide voltage to the circuit.

Solution: (b) The platinum is inert; it only carries the electrons and offers a surface for the hydrogen.

MCQ 9.4.4 **Which one of the following is a strong electrolyte in solution? (KMU MDCAT 2024)**

A	Acetic acid	B	Ammonium hydroxide
C	Carbonic acid	D	Potassium iodide

Solution: (d) Potassium iodide is an ionic salt fully dissociated in water; the other three are weak acids or a weak base.

MCQ 9.4.5 **The electrode potential of the standard hydrogen electrode is chosen as (KMU MDCAT 2024)**

A	-1 V	B	0 V
C	1 V	D	2 V

Solution: (b) The standard hydrogen electrode is the zero against which every other electrode potential is measured.

MCQ 9.4.6 **Zn rod acts as cathode when coupled with magnesium electrode because reduction potential of: (NUMS MDCAT 2024)**

A	Zn > Mg	B	Zn < Mg
C	Zn = Mg	D	Zn = 0

Solution: (a) The electrode with the higher reduction potential is reduced, and that is the cathode.

MCQ 9.4.7 **Which statement correctly describes the term Standard Electrode Potential? (SZABMU MDCAT 2023)**

A	It is the electrode potential determined at room temperature and pressure	B	It is the electrode potential determined under standard conditions using StandardHydrogen Electrode as the other electrode
C	It is the electrode potential of an element and its solution compared to a standard value	D	It is the potential which is measured when two half cells are connected together

Solution: (b) It is measured under standard conditions against the standard hydrogen electrode.

MCQ 9.4.8 **Cu ion takes up 2 electrons to give an electrode potential value of: (PMC MDCAT 2022)**

A	+0.76 v	**B**	-0.32 v
C	+0.34 v	**D**	-0.34 v

Solution: (c) The standard electrode potential of the copper half cell is $+0.34\,\mathrm{V}$.

MCQ 9.4.9 **What is the advantage of using a platinaum foil in the standard hydrogen electrode formation? (PMC MDCAT 2022)**

A	It acts as catalyst	**B**	It does not support the electrode
C	It provides a large surface area	**D**	It decreases the time duration for measurement

Solution: (a) Platinized platinum catalyses the change between hydrogen gas and its ions at the surface.

MCQ 9.4.10 **The element has highest reduction potential in electrochemical series Is; (PMC MDCAT 2022)**

A	Zinc	**B**	Fluorine
C	Oxygen	**D**	Lithium

Solution: (b) Fluorine is the strongest oxidizing agent, so it stands at the top of the series.

MCQ 9.4.11 **Cu, Au and Ag are least reactive, because they have _____ ? (PMC MDCAT 2022)**

A	Negative reduction potential	**B**	Negative oxidation potential
C	Positive reduction potential	**D**	Negative electrode potential

Solution: (c) A positive reduction potential means the metal holds its electrons and is not readily oxidized.

MCQ 9.4.12 **Potential of Standard Hydrogen Electrode (SHE) is arbitrarily taken as: (NUMS MDCAT 2022)**

A	10	**B**	+1
C	-1	**D**	Zero

Solution: (d) The hydrogen electrode is taken as zero and everything else is measured against it.

MCQ 9.4.13 **Electrode Potential is developed when a metal is dipped into: (PMC Practice 2021)**

A	An acid	**B**	A base
C	In its own ions	**D**	Water

Solution: (c) A metal in a solution of its own ions sets up the equilibrium whose potential is measured.

MCQ 9.4.14 **The standard electrode potential of hydrogen is arbitrarily taken at 298 K is _____ (UHS MDCAT 2018)**

A	0.00 volt	**B**	0.10 volt
C	10.0 volt	**D**	1.00 volt

Solution: (a) The standard hydrogen electrode is taken as zero.

MCQ 9.4.15 **The potential difference of an electrochemical cell is measured by: (UHS MDCAT 2018)**

A	Ammeter	**B**	Voltmeter
C	Galvanometer	**D**	Calorimeter

Solution: (b) A high resistance voltmeter reads the emf without drawing appreciable current.

MCQ 9.4.16 **During space flights, astronauts obtain water from _____: (UHS MDCAT 2017)**

A	Nickel cadmium cells	**B**	Fuel cells
C	Lead accumulator	**D**	Alkaline battery

Solution: (b) The hydrogen oxygen fuel cell gives electricity and leaves water, which the crew can drink.

Unit 10 Chemical Bonding

Topic 10.1 VSEPR Theory

Past MDCAT Questions

MCQ 10.1.1 **Which of the following is NOT a feature of the Valence Shell Electron Pair Repulsion theory? (MDCAT 2024)**

A	it determines the shape of a molecule	**B**	pairs of electrons repel each other
C	it helps in understanding the interaction of medicinal drug molecules	**D**	only lone pairs participate in determining the geometry of molecules

Solution: (d) Bond pairs count as well as lone pairs; it is the whole set of electron pairs that fixes the shape.

MCQ 10.1.2 **Which of the following is NOT a feature of Valence Shell Electron Pair Repulsion theory? (UHS MDCAT 2024)**

A	It determines the shape of molecule	**B**	Pairs of electrons repel each other
C	It helps in understanding interaction of medicinal drug molecules	**D**	Only lone pairs participate in determining geometry of molecules

Solution: (d) VSEPR counts lone pairs and bond pairs alike; the lone pairs merely repel more strongly.

MCQ 10.1.3 **Total number of electron pairs present in the valence shell of central atom in water are (KMU MDCAT 2024)**

A	2	**B**	3
C	4	**D**	5

Solution: (c) Oxygen in water has two bond pairs and two lone pairs, four pairs in all.

MCQ 10.1.4 **Valance shell electron pair repulsion theory explains: (NUMS MDCAT 2023)**

A	Bond Energy	**B**	Bond Length
C	Shapes and Bond Energy	**D**	Shapes

Solution: (d) VSEPR predicts the shape of a molecule from the repulsion of its electron pairs.

MCQ 10.1.5 **Which of the following does not have a complete octet? (PMC MDCAT 2022)**

A	O2-	**B**	N5+
C	Ca2+	**D**	K+

Solution: (b) Nitrogen stripped of five electrons is left with only two, so it has no octet.

Topic 10.3 Hybridization

Past MDCAT Questions

MCQ 10.3.1 **In which of the following functional groups is the carbon atom sp hybridized? (MDCAT 2022)**

A	$-CHO$	**B**	$-COOH$
C	$-CN$	**D**	$-COOR$

Solution: (c) The carbon of the nitrile group holds a triple bond, so it is sp hybridized and linear.

MCQ 10.3.2 **Correct arrangement of orbital according to size of hybridized orbitals? (UHS MDCAT 2025)**

A	sp>sp2>sp3	**B**	sp3> sp> sp2
C	sp2>sp>sp3	**D**	sp3>sp2>sp

Solution: (d) More s character pulls the orbital in, so the sp orbital is the smallest and sp3 the largest.

MCQ 10.3.3 **In ethene molecule, each carbon atom has three hybridized sp2 orbitals which are: (KMU MDCAT 2025)**

A	Coplanar	**B**	Tetrahedral
C	Linear	**D**	Pyramidal

Solution: (a) Three sp2 orbitals lie in one plane at 120° to each other.

MCQ 10.3.4 **In which of the following molecules does the central atom use sp2 hybridization? (KMU MDCAT 2025)**

A	PH3	**B**	NH3
C	BH3	**D**	SbH3

Solution: (c) Boron in BH_3 has three bond pairs and no lone pair, so it is sp2 and trigonal planar.

MCQ 10.3.5 **The unhybridized p orbital in sp2 hybridization is (KMU MDCAT 2024)**

A	In the same plane	**B**	Out of the plane
C	Parallel to sp2 orbitals	**D**	Perpendicular to sp2 orbitals

Solution: (d) The three sp2 orbitals lie in a plane and the leftover p orbital stands at right angles to it.

MCQ 10.3.6 **Carbon atoms in ethane are hybridized: (SZABMU MDCAT 2023)**

A	Sp3	**B**	Sp2
C	Sp	**D**	Sp3d

Solution: (a) Each carbon of ethane has four sigma bonds, so it is sp3.

MCQ 10.3.7 **In alkanes, each Carbon has hybridization: (SZABMU MDCAT 2023)**

A	Sp3	**B**	Sp
C	Sp2	**D**	dsp

Solution: (a) Every carbon of an alkane makes four sigma bonds, so all are sp3.

MCQ 10.3.8 **Which of the following has sp3 hybridization? (NUMS MDCAT 2023)**

A	BF3	**B**	C2H4
C	BeCl2	**D**	CH4

Solution: (d) Carbon in methane has four sigma bonds and no lone pair, so it is sp3.

MCQ 10.3.9 **How many hybrdized orbitals are formed by intermixing of 4 atomic orbitals? (PMC MDCAT 2022)**

A	2	**B**	4
C	8	**D**	6

Solution: (b) Hybridization gives back as many orbitals as it mixes, so four atomic orbitals give four hybrids.

MCQ 10.3.10 **In the structure of diamond, each carbon atom is ____ hybridized? (PMC MDCAT 2022)**

A	sp3	**B**	sp2
C	sp	**D**	dsp2

Solution: (a) Each carbon in diamond is bonded tetrahedrally to four others, so it is sp3.

MCQ 10.3.11 **Sp3 hybridization is also called as: (PMC MDCAT 2022)**

A	Sigma	**B**	Pi bond
C	Coordinate covalent	**D**	Hydrogen bond

Solution: (a) All four sp3 orbitals overlap head-on, so every bond they make is a sigma bond.

MCQ 10.3.12 **Type of hybridization of carbon in Ethene (H2C=CH2) is: (NUMS MDCAT 2022)**

A	Sp3	**B**	sp2
C	Sp	**D**	dsp2

Solution: (b) Each carbon of ethene makes three sigma bonds and one pi bond, so it is sp2.

MCQ 10.3.13 **Which of the following hybrid orbitals has maximum "s" character? (PMC MDCAT 2020)**

A	Sp3 hybrid orbital	**B**	Sp2 hybrid orbital
C	Sp hybrid orbital	**D**	Dsp2 hybrid orbital

Solution: (c) An sp orbital is half s character, more than sp2 or sp3.

MCQ 10.3.14 Which one of the following molecules has sp3 hybridization? (UHS MDCAT 2019)

A	CH4	B	C2H4
C	CO2	D	C2H2

Solution: (a) Carbon in methane has four sigma bonds and no lone pair.

Topic 10.2 Sigma and Pi Bonds

Past MDCAT Questions

MCQ 10.2.1 In propene pi-bond is formed by sideway overlap of: (UHS MDCAT 2025)

A	s-orbitals	B	p-orbitals
C	sp2 hybrid orbitals	D	sp3 hybrid orbitals

Solution: (b) A pi bond is the sideways overlap of two unhybridized p orbitals.

MCQ 10.2.2 The theories which explain the formation of sigma and pi bond are EXCEPT: (UHS MDCAT 2025)

A	MOT	B	VBT
C	VSEPR	D	CFT

Solution: (c) VSEPR predicts shape from electron pair repulsion; it says nothing about how a bond is formed.

MCQ 10.2.3 Bond order is equal to: (NUMS MDCAT 2025)

A	Difference between number of bonding electrons and antibonding electrons	B	The sum of number of bonding electrons and antibonding electrons
C	Half of the difference between number of bonding electrons and antibonding electrons	D	Quarter of the difference between number of bonding electrons and antibonding electrons

Solution: (c) Bond order is half the difference between the bonding and the antibonding electrons.

MCQ 10.2.4 How many sigma and pi bonds are present in maleic anhydride? (SZABMU MDCAT 2025)

A	5 sigma 3 pi	B	6 sigma 3 pi
C	7 sigma 2 pi	D	9 sigma 3 pi

Solution: (d) Maleic anhydride has nine sigma bonds and three pi bonds, two of them in the carbonyl groups.

MCQ 10.2.5 Which of the following has a coordinate bond? (UHS MDCAT 2024)

A	NaCl	B	CaO
C	NH3BF3	D	H2O

Solution: (c) Nitrogen gives both electrons of the bond to the empty orbital of boron.

MCQ 10.2.6 Q.96 Why dimer of Aluminum chloride is formed (UHS MDCAT 2023)

A	Aluminum is electron rich	B	Aluminum is having lone pair of electron
C	Aluminum donates lone pair to form bridge	D	Aluminum forms coordinate bonds with chlorine to complete its octet

Solution: (d) Aluminium is two electrons short of an octet, so a chlorine of the other molecule donates a pair as a bridge.

MCQ 10.2.7 The pi bonds surrounding the sigma bonds in an ethyne molecule are in the shape of: (PMC MDCAT 2022)

A	Linear	B	Cylindrical
C	Trigonal Planar	D	Tetrahedral

Solution: (b) The two pi bonds of ethyne at right angles make a cylinder of charge round the axis.

MCQ 10.2.8 Pi (π) bond between two atoms is (PMC MDCAT 2022)

A	Formed by axial overlapping of atomic orbitals, and is stronger than sigma bond.	B	Formed by parallel overlapping of atomic orbitals, and is stronger than sigma bond.
C	Formed by axial overlapping of atomic orbitals, and is weaker than sigma bond.	D	Formed by parallel overlapping of atomic orbitals, and is weaker than sigma bond.

Solution: (d) A pi bond is the sideways overlap of two p orbitals, and that overlap is poorer than the head-on one of a sigma bond.

MCQ 10.2.9 Which of the following orbitals has lower energy? (PMC MDCAT 2022)

A	Anti-bonding molecular orbital	B	Anti-bonding atomic orbitals
C	Bonding half-filled orbitals	D	Bonding molecular orbital

Solution: (d) The bonding molecular orbital lies below the atomic orbitals it was made from.

MCQ 10.2.10 Which of the following molecules has the largest number of shared pairs of electrons? (UHS MDCAT 2018)

A	C2H4	B	N2
C	CO2	D	NH3

Solution: (a) Ethene has four carbon hydrogen bonds and a double bond between the carbons, six shared pairs in all.

MCQ 10.2.11 How many pi bond(s) are there in ethene? (UHS MDCAT 2017)

A	None	B	One
C	Two	D	Three

Solution: (b) The double bond of ethene is one sigma and one pi bond.

MCQ 10.2.12 Pi-bond is formed by sideways overlap of _____? (UHS MDCAT 2017)

A	s-orbitals	B	p-orbitals
C	d-orbitals	D	None of the given options

Solution: (b) A pi bond is the sideways overlap of two p orbitals.

Topic 10.4 Applications of VSEPR Theory

Past MDCAT Questions

MCQ 10.4.1 An AB_4 type molecule with no lone pairs has which shape? (MDCAT 2022)

A	trigonal	B	regular tetrahedron
C	regular octahedron	D	regular pyramid

Solution: (b) Four bond pairs and nothing else repel to the corners of a tetrahedron, 109.5° apart.

MCQ 10.4.2 Molecules having one lone pair and three bond pairs have geometrical shape (UHS MDCAT 2025)

A	Bent or angular	B	Trigonal
C	Trigonal pyramidal	D	Trigonal planer

Solution: (c) Four electron pairs are arranged tetrahedrally, and with one of them a lone pair the shape of the molecule is trigonal pyramidal.

MCQ 10.4.3 Which one of the following is a planar molecule? (KMU MDCAT 2025)

A	NH3	B	H2O
C	BF3	D	CH4

Solution: (c) Three bond pairs and no lone pair on boron give a flat trigonal planar molecule.

MCQ 10.4.4 **Which of the following molecules have similar molecular shape? (SIBA MDCAT 2025)**

A	NH_3 & $AlCl_3$	**B**	BCl_3 & NH_3
C	$AlCl_3$ & PCl_3	**D**	H_2O & $SnCl_2$

Solution: (d) Both have two bond pairs and lone pairs on the central atom, so both are bent.

MCQ 10.4.5 **All of following have two bond pairs and show linear geometry except: (SIBA MDCAT 2025)**

A	$SnCl_2$	**B**	CS_2
C	HCN	**D**	CO_2

Solution: (a) Tin in tin(II) chloride keeps a lone pair, which bends the molecule.

MCQ 10.4.6 **Q.95 AB4 Type with no Lone Pairs geometry enables to form which shape of molecule? (UHS MDCAT 2023)**

A	Trigonal	**B**	Regular tetrahedron
C	Regular octahedron	**D**	Regular pyramidal

Solution: (b) Four bond pairs and no lone pair repel into a regular tetrahedron.

MCQ 10.4.7 **Select among the following that has trigonal pyramidal geometry: (PMC MDCAT 2022)**

A	NH_3	**B**	BF_3
C	$AlCl_3$	**D**	SO_3

Solution: (a) Ammonia has three bond pairs and one lone pair, so its shape is trigonal pyramidal.

MCQ 10.4.8 **If a molecule contains 4 electron pairs, The shape of molecule will be: (PMC Practice 2021)**

A	Tetrahedral	**B**	Trigonal
C	Linear	**D**	None of these

Solution: (a) Four electron pairs repel into a tetrahedron.

MCQ 10.4.9 **Which of the following set constitutes of all the molecules and ions of non-planar geometry? (UHS MDCAT 2019)**

A	PH_4^+, NH_3, SO_3, Benzene	**B**	CH_4, NH_4^+, MnO_4^-, NF_3
C	Ethene, H_2O, $BeCl_2$, H_2S	**D**	SO_2, C_2H_4, BF_3, NO_3^-

Solution: (b) Methane, the ammonium ion, the permanganate ion and nitrogen trifluoride are all three dimensional.

MCQ 10.4.10 **Which option shows all the molecules with bond angle 109.5 degrees. (UHS MDCAT 2018)**

A	CH_4, NH_4^+, PH_3	**B**	$SiCl_4$, H_2O, $BeCl_2$
C	$SiCl_4$, NH_4^+, CH_4	**D**	CH_4, CCl_4, NH_3

Solution: (c) All three have four bond pairs and no lone pair, so all are regular tetrahedra.

MCQ 10.4.11 **What is the exact value of angle in BF3: (UHS MDCAT 2017)**

A	90°	**B**	119.5°
C	104.5°	**D**	120°

Solution: (d) Three bond pairs and no lone pair give a trigonal planar molecule with 120° angles.

Topic 10.7 Bond Energy

Past MDCAT Questions

MCQ 10.7.1 **Which of the following halogen molecules has the maximum bond energy? (MDCAT 2020)**

A	F_2	**B**	Cl_2
C	Br_2	**D**	I_2

Solution: (b) Chlorine is the strongest of the halogen bonds; in F_2 the two small atoms' lone pairs repel and weaken it.

MCQ 10.7.2 **What is the reason for energy changes in chemical reactions? (MDCAT 2023)**

A	ionic bonds	**B**	bond breakage only
C	bond formation and breakage	**D**	hydrogen bonding

Solution: (c) Breaking bonds absorbs energy and forming them releases it, and the balance of the two is the enthalpy change.

MCQ 10.7.3 **The bond energy of hydrogen in the H_2 molecule is: (MDCAT 2023)**

A	$242\ \text{kJ mol}^{-1}$	**B**	$431\ \text{kJ mol}^{-1}$
C	$436\ \text{kJ mol}^{-1}$	**D**	$346\ \text{kJ mol}^{-1}$

Solution: (c) It takes $436\ \text{kJ mol}^{-1}$ to break the H-H bond.

MCQ 10.7.4 **Which of the following has highest bond energy? (KMU MDCAT 2025)**

A	HCl	**B**	HI
C	HF	**D**	HBr

Solution: (c) The bond is shortest and strongest to the smallest halogen, so it is highest in hydrogen fluoride.

MCQ 10.7.5 **Correct order of bond energy will be: (SIBA MDCAT 2025)**

A	HCl>HBr>HI	**B**	HBr>HCl>HI
C	HI>HCl>HBr	**D**	HCl>HI>HBr

Solution: (a) The bond shortens as the halogen gets smaller, so it is strongest in hydrogen chloride of these three.

MCQ 10.7.6 **Predict the highest bond energy of the following single bond: (NUMS MDCAT 2024)**

A	C-H	**B**	C-N
C	C-O	**D**	C-C

Solution: (a) The bond to the small hydrogen atom is the shortest and strongest of the four.

MCQ 10.7.7 **Identify the following compound having shortest bond length: (NUMS MDCAT 2024)**

A	Methyl amine	**B**	Formamide
C	Formic acid	**D**	Ethanol

Solution: (c) The carbon oxygen double bond of the carboxyl group is the shortest bond among these.

MCQ 10.7.8 **The factor which is not affecting bond length is: (NUMS MDCAT 2023)**

A	Pressure of multiple bonds	**B**	Nature of hybridization present
C	Difference in electronegativity between the two bonded atoms	**D**	Ionization energies of the two bonded atoms

Solution: (d) Bond length turns on the size of the atoms, the bond order and the hybridization, not on ionization energy.

MCQ 10.7.9 **The bond energy of hydrogen in H2 molecule is: (UHS MDCAT 2023)**

A	242 KJ/mol	**B**	431 KJ/mol
C	436 KJ/mol	**D**	346 KJ/mol

Solution: (c) The bond in hydrogen takes $436\ \text{kJ mol}^{-1}$ to break.

MCQ 10.7.10 **If bond energy of C-CI is 346 kJ/mol. The bond enegy of C-Br should be: (PMC MDCAT 2022)**

A	290 kJ/mol	**B**	390 kJ/mol
C	490 kJ/mol	**D**	590 KJ/mol

Solution: (a) Bromine is the larger atom, so its bond to carbon is longer and weaker.

MCQ 10.7.11 **The amount of energy required to beak one mole of a particular type of bond is equal to its: (PMC MDCAT 2022)**

A	Activation energy	**B**	Ionization energy
C	Bond Energy	**D**	Potential energy

Solution: (c) That energy is the bond energy.

MCQ 10.7.12 **Which of these has a bond length of _____ 174 pm? (PMC MDCAT 2022)**

A	C-C	B	Cl-Cl
C	Cl-H	D	C-Cl

Solution: (d) The carbon chlorine bond is about 174 pm, the sum of the two covalent radii.

MCQ 10.7.13 **When repulsive forces tend to push the atoms apart and the potential energy of the system is_____ (PMC MDCAT 2022)**

A	No Effect	B	Decrease
C	Increase	D	Change in alternation

Solution: (c) Pushed closer than the bond length, the atoms repel and the energy of the system climbs steeply.

MCQ 10.7.14 **When two atoms are bonded to form a stable compound, the attractive forces will _____ repulsive forces and the potential energy of the system will be _____. (PMC Practice 2021)**

A	Recessive, higher	B	Dominate, minimum
C	Dominate, maximum	D	Recessive, lower

Solution: (b) A bond forms where the attraction wins and the energy of the pair is at its lowest.

MCQ 10.7.15 **The average bond energy of C-Br is (UHS MDCAT 2016)**

A	228 kJmol-1	B	200 kJmol-1
C	250 kJmol-1	D	290 kJmol-1

Solution: (d) The carbon bromine bond energy is about $290\,\mathrm{kJ\,mol^{-1}}$.

Topic 10.5 Dipole Moment

Past MDCAT Questions

MCQ 10.5.1 **Which of the following molecule has non-polar covalent bond? (NUMS MDCAT 2025)**

A	Methyl chloride	B	Methanol
C	Carbon dioxide	D	Tetrachloromethane

Solution: (c) Carbon dioxide is linear, so its two bond dipoles are equal and opposite and the molecule has no net dipole.

MCQ 10.5.2 **Which one of the following molecules has a zero-dipole moment? (KMU MDCAT 2024)**

A	BF3	B	NF3
C	NH3	D	H2O

Solution: (a) Boron trifluoride is trigonal planar, so its three bond dipoles cancel exactly.

MCQ 10.5.3 **Which type of bond is present between C and O in methanol? (PMC MDCAT 2022)**

A	Dative bond	B	Polar bond
C	Non-Polar bond	D	Ionic bond

Solution: (b) Oxygen is much the more electronegative, so the shared pair is drawn towards it.

MCQ 10.5.4 **Which of the following molecule is covalent in nature? (NUMS MDCAT 2022)**

A	NaCl	B	MgCl2
C	AlCl3	D	KCl

Solution: (c) Aluminium has a small, highly charged ion that polarizes the chloride, so the bond is largely covalent.

MCQ 10.5.5 **Which of the following molecule is polar? (NUMS MDCAT 2022)**

A	CCl4	B	AlCl3
C	CO2	D	HCl

Solution: (d) Hydrogen chloride is a single polar bond with nothing to cancel it; the other three are symmetrical.

MCQ 10.5.6 **The difference in the E.N values of the bonded atoms b/w two atoms is an index to of covalent bond: (PMC Practice 2021)**

A	Polar nature	B	Non-polar nature
C	Strength	D	Nature

Solution: (a) The greater the difference in electronegativity, the more polar the bond.

MCQ 10.5.7 **The molecules of _____ have dipole-dipole interaction. (PMC Practice 2021)**

A	Methane	B	Neon
C	Ammonia	D	Ethane-ethyl alcohol

Solution: (c) Ammonia is polar; methane and ethane are not, and neon is a single atom.

MCQ 10.5.8 **Non-polar covalent bond is formed between: (PMC Practice 2021)**

A	Homonuclear diatomic molecules	B	Heteronuclear diatomic molecules
C	Similar atoms	D	Dissimilar atoms

Solution: (a) Two like atoms pull equally on the shared pair, so the bond has no polarity.

Topic 10.6 Applications of Dipole Moment

Past MDCAT Questions

MCQ 10.6.1 **Value of electronegativity of atoms A and B are 1.20 and 4.0 respectively, the percent ionic character will be: (SIBA MDCAT 2025)**

A	43%	B	50%
C	55%	D	73%

Solution: (d) An electronegativity difference of 2.8 puts the bond at about 73% ionic character.

Topic II.1 Periodic Properties and Their Trends

Past MDCAT Questions

MCQ II.1.1 Which of the following has the highest atomic radius in its period? (MDCAT 2023)

A	alkaline earth metals	B	alkali metals
C	chalcogens	D	halogens

Solution: (b) The radius falls across a period, so the group I element at the start of each period is the largest.

MCQ II.1.2 Why does fluorine have less electron affinity as compared to bromine? (MDCAT 2023)

A	its electronegativity	B	its small size and dense electronic cloud
C	seven electrons in its outermost shell	D	its higher ionization energy

Solution: (b) The incoming electron is crowded into a very small 2p shell, and the repulsion there offsets the attraction of the nucleus.

MCQ II.1.3 Which of the following has the smallest atomic radius? (MDCAT 2024)

A	Mg	B	S
C	P	D	Na

Solution: (b) Across a period the nuclear charge rises and the radius falls, and sulphur is the furthest right of the four.

MCQ II.1.4 Which of the following is not basic in nature? (MDCAT 2024)

A	aluminium oxide	B	potassium oxide
C	magnesium oxide	D	sodium oxide

Solution: (a) Aluminium oxide is amphoteric, reacting with acids and with alkalis alike.

MCQ II.1.5 The element with smallest value of ionization energy is (UHS MDCAT 2025)

A	Li	B	Al
C	Ca	D	Ba

Solution: (d) Ionization energy falls down a group, and barium is the lowest of the four.

MCQ II.1.6 The most electronegative element in periodic table is: (KMU MDCAT 2025)

A	F	B	Cl
C	N	D	O

Solution: (a) Fluorine is the most electronegative of all the elements.

MCQ II.1.7 Predict the element with lowest ionization energy: (NUMS MDCAT 2025)

A	Mg	B	Ar
C	Si	D	P

Solution: (a) Ionization energy rises across a period, and magnesium lies furthest to the left of the four.

MCQ II.1.8 Select the group II element which has the highest atomic radius? (NUMS MDCAT 2025)

A	Be	B	Ca
C	Ba	D	Sr

Solution: (c) The atomic radius grows down the group, and barium is the lowest of the four.

MCQ II.1.9 Which of the following element has least boiling point? (NUMS MDCAT 2025)

A	Li	B	Na
C	K	D	Cs

Solution: (d) Metallic bonding weakens down group I, so caesium boils lowest.

MCQ II.1.10 If ionization energy of an element is greater then: (SIBA MDCAT 2025)

A	More is it's reducing power	B	More is it's electropositivity
C	Less is it's metallic character	D	More is it's atomic radius

Solution: (c) A high ionization energy means the atom holds its electrons tightly, so it is not metallic.

MCQ II.1.11 Which of the following has smallest atomic radius (UHS MDCAT 2024)

A	Mg	B	S
C	P	D	Na

Solution: (b) Atomic radius shrinks across a period, and sulphur lies furthest right of the four.

MCQ II.1.12 The difference of lithium from the other alkall metals is mainly because of: (UHS MDCAT 2024)

A	Large radius and low charge density	B	Small radius and low charge density
C	Large radius and high charge density	D	Small radius and high charge density

Solution: (d) The lithium ion is very small and its charge is concentrated, so it polarizes and behaves unlike its group.

MCQ II.1.13 Which of the following is not Basic in nature (UHS MDCAT 2024)

A	Aluminum oxide	B	Magnesium oxide
C	Potassium oxide	D	Sodium oxide

Solution: (a) Aluminium oxide is amphoteric; the other three are the basic oxides of group I and II metals.

MCQ II.1.14 Third period element that initially reacts rapidly with oxygen to form a protective oxide coating that prevents further reactions is (KMU MDCAT 2024)

A	Al	B	Ar
C	Na	D	Si

Solution: (a) Aluminium takes an oxide film at once, and the film then seals the metal beneath it.

MCQ II.1.15 In CH3Cl, bond length of C-Cl is 176.7pm and covalent radius of Cl is 99.4pm. Covalent radius of carbon is: (NUMS MDCAT 2024)

A	66.3 pm	B	276.1 pm
C	175.4 pm	D	77.3 pm

Solution: (d) The bond length is the sum of the two radii, so $176.7 - 99.4$ leaves $77.3\,\text{pm}$.

MCQ II.1.16 Correct order of decreasing electron affinities of group VII is: (NUMS MDCAT 2024)

A	F > Cl > Br > I	B	Cl > F > Br > I
C	F < Cl < Br < I	D	Cl < F < Br < I

Solution: (b) Fluorine is so small that the incoming electron is crowded, so chlorine has the greater electron affinity.

MCQ II.1.17 Q.92 Which of the following element has smaller size? (UHS MDCAT 2023)

A	Na	B	K
C	Al	D	Li

Solution: (c) Aluminium is furthest to the right in its period of the four, so its atom is the smallest.

MCQ II.1.18 Q.93 Among LiCl, BeCl2, NaCl, CsCl, the compounds with the greatest and the least ionic character respectively are: (UHS MDCAT 2023)

A	LiCl and CsCl	B	NaCl and LiCl
C	CsCl and NaCl	D	CsCl and BeCl2

Solution: (d) Ionic character grows with the size of the cation and falls with its charge, so caesium chloride is most ionic and beryllium chloride least.

MCQ 11.1.19 Which of the following has greatest difference of electronegativity? (SZABMU MDCAT 2023)

A	HF	**B**	HCl
C	HBr	**D**	HI

Solution: (a) Fluorine is the most electronegative element, so its bond to hydrogen is the most polar.

MCQ 11.1.20 Ionization energy decreases down the group because: (SZABMU MDCAT 2023)

A	Shielding remains constant	**B**	Atomic radius remains constant
C	Proton number increases	**D**	Atomic radius increases

Solution: (d) The outer electron is further from the nucleus and better screened, so it is easier to remove.

MCQ 11.1.21 Which of the following property decreases in Group 2 as we go down the group? (SZABMU MDCAT 2023)

A	Shielding	**B**	Atomic radius
C	Proton number	**D**	Ionization energy

Solution: (d) The atom grows and its outer electron is easier to pull off, so ionization energy falls.

MCQ 11.1.22 The reason of highest electronegativity value of Fluorine is: (NUMS MDCAT 2023)

A	Complete outermost shell	**B**	Ability to form negative ion
C	Existence as diatomic molecule	**D**	Smaller size and higher nuclear charge in the respective period

Solution: (d) Fluorine is the smallest atom of its period with a high nuclear charge, so it pulls hardest on a shared pair.

MCQ 11.1.23 More the ionization potential, the less will be the ability to form: (PMC MDCAT 2022)

A	Cations	**B**	Anions
C	Radicals	**D**	Free radicals

Solution: (a) A high ionization energy means the atom holds its electrons tightly and will not readily give one up.

MCQ 11.1.24 Which statement about the Group VIA elements is false? (PMC MDCAT 2022)

A	All have an outer electronic configuration of ns2np4	**B**	The electronegativity of Group VIA elements decreases as one goes down the group
C	Most are found in sulfide deposits	**D**	Oxygen has the highest boiling point and melting point

Solution: (d) Melting and boiling points rise down the group, so oxygen has the lowest, not the highest.

MCQ 11.1.25 The covalent radius of H2 is: (PMC MDCAT 2022)

A	37.7 pm	**B**	37.7 nm
C	37.7 mm	**D**	37.7μm

Solution: (a) Half the bond length in the hydrogen molecule is about 37.7 pm.

MCQ 11.1.26 Shielding effect in 3rd period of periodic table: (PMC MDCAT 2022)

A	Increases from left to right.	**B**	Decreases from left to right.
C	May increase or decrease	**D**	Remain unchanged

Solution: (d) The inner shells do not change across a period, so the screening they give stays the same.

MCQ 11.1.27 In alkali metals the highest shielding effect is exhibited by: (PMC MDCAT 2022)

A	Li	**B**	Na
C	K	**D**	Rb

Solution: (d) Screening grows with the number of inner shells, and rubidium has the most of these four.

MCQ 11.1.28 Which of the following has highest atomic size? (PMC MDCAT 2022)

A	Be	**B**	Mg
C	Ca	**D**	Ba

Solution: (d) Atomic radius grows down the group, and barium is the lowest of the four.

MCQ 11.1.29 Using the periodic table, indicate which one of the following elements is the most metallic? (PMC MDCAT 2022)

A	Rb	**B**	K
C	Ca	**D**	Fe

Solution: (a) Metallic character grows down a group and falls across a period, and rubidium is lowest and furthest left.

MCQ 11.1.30 Covalant radius is defined as half of the single bonded length between _____ atoms covalently bonded in a molecule. (PMC MDCAT 2022)

A	Two Different	**B**	Two Simultaneous
C	Any Two	**D**	Two Similar

Solution: (c) Covalent radius is half the distance between the nuclei of two like atoms singly bonded.

MCQ 11.1.31 Among alkali metals which of the following property is high for Li? (PMC MDCAT 2022)

A	Hydration energy	**B**	Ionic radius
C	Electropositivity	**D**	Atomic size

Solution: (a) The lithium ion is the smallest, so water molecules pack tightly round it and much energy is released.

MCQ 11.1.32 Electron affinity decreases down the group because: (NUMS MDCAT 2022)

A	Proton number increases	**B**	Atomic radius increases
C	Shielding decrease	**D**	Rate constant

Solution: (b) The bigger the atom, the further the added electron is from the nucleus.

MCQ 11.1.33 Which ion will have a maximum value of the heat of hydration? (PMC Practice 2021)

A	Al+3	**B**	Cs+
C	Ba+	**D**	Mg+2

Solution: (a) Hydration energy rises with the charge and falls with the size, and the aluminium ion is small and triply charged.

MCQ 11.1.34 The ionization energy increases from left to right in a period due to increase in? (PMC Practice 2021)

A	Nuclear charge	**B**	Number of electrons
C	Atomic number	**D**	All of these

Solution: (a) The nuclear charge grows across a period while the shell stays the same, so the electrons are held more tightly.

MCQ 11.1.35 By increasing which of the following factor polarizability increases? (PMC Practice 2021)

A	Atomic radius	**B**	Ionization energy
C	Ionic radius	**D**	Hydration energy

Solution: (a) A larger atom holds its outer electrons loosely, so its cloud is the more easily distorted.

MCQ 11.1.36 Covalent character of hydrides decrease _____? (PMC Practice 2021)

A	Down the Group	**B**	Along period
C	Along d- block	**D**	All of these

Solution: (a) The bond grows more ionic as the element gets larger and less electronegative.

MCQ 11.1.37 Boiling point of hydrides of the 4th period is larger than _____. (PMC Practice 2021)

A	5th period	**B**	3rd period
C	6th period	**D**	7th period

Solution: (b) The molecules are larger and their dispersion forces stronger, so the hydrides boil higher.

MCQ II.1.38 **The increase in size of an anion is due to the increase in repulsion of: (PMC Practice 2021)**

A	Electron-proton	**B**	Electron-electron
C	Electron-nucleus	**D**	Proton-nucleus

Solution: (b) An anion has more electrons than protons, so they repel each other more and the cloud spreads.

MCQ II.1.39 **The unit of electronegativity is? (PMC Practice 2021)**

A	Joule	**B**	Kilojoules
C	Watt	**D**	No unit

Solution: (d) Electronegativity is a relative number on an arbitrary scale, so it has no unit.

MCQ II.1.40 **Which of the following has the highest value of electronegativity? (PMC MDCAT 2020)**

A	I	**B**	Br
C	Cl	**D**	F

Solution: (d) Fluorine is the most electronegative element.

MCQ II.1.41 **Densities of alkali metals are low due to: (PMC MDCAT 2020)**

A	Weak intermolecular forces	**B**	Large atomic volume
C	Smaller size	**D**	Nsl configuration

Solution: (b) The atoms are large and loosely packed, so a given mass takes up a great deal of room.

MCQ II.1.42 **The first ionization energy is maximum for: (PMC MDCAT 2020)**

A	Na	**B**	Mg
C	Al	**D**	K

Solution: (b) Magnesium has a filled 3s subshell, which makes its first electron harder to remove than aluminium's.

MCQ II.1.43 **In the second period of elements, although oxygen lies next to nitrogen yet its ionization first energy is lower than that of nitrogen because? (UHS MDCAT 2019)**

A	Oxygen is paramagnetic in character	**B**	Nuclear charger of oxygen is greater than nitrogen
C	Oxygen has higher electron affinity	**D**	In oxygen, there exists repulsion between pair of electrons present in the same orbital of valence shell.

Solution: (d) Nitrogen has a half filled p subshell; in oxygen one orbital holds a pair, and their repulsion makes that electron easier to remove.

MCQ II.1.44 **Ionization energy decreases down the group, from top to bottom, due to: (UHS MDCAT 2019)**

A	Increase in atomic mass	**B**	Increase in shielding effect of the intervening electrons
C	Increase in proton number	**D**	Decrease in atomic size

Solution: (b) More inner shells screen the outer electron better, so it is easier to remove.

MCQ II.1.45 **Electron affinity of the atom is the energy released when: (UHS MDCAT 2018)**

A	Covalent bond of molecule is broken	**B**	Electron is added to gaseous atom
C	Electron is removed from gaseous atom	**D**	Covalent bond is formed between the atoms

Solution: (b) Electron affinity is the energy given out when an electron is added to a gaseous atom.

MCQ II.1.46 **In Period 2 and Period 3 maximum melting point shown by elements: (UHS MDCAT 2018)**

A	Nitrogen and Phosphorus	**B**	Neon and Argon
C	Lithium and Sodium	**D**	Carbon and Silicon

Solution: (d) Carbon and silicon are covalent networks bonded right through, so they melt highest in their periods.

MCQ II.1.47 **Ionic radius decreases along the period due to: (UHS MDCAT 2017)**

A	Addition of a new shell	**B**	Increase in nuclear charge
C	High Ionization Energy	**D**	Decrease in nuclear charge

Solution: (b) The nuclear charge grows across a period while the shell stays the same, so the ions shrink.

MCQ II.1.48 **The ionic radius of fluoride ion is: (UHS MDCAT 2016)**

A	72 pm	**B**	95 pm
C	136 pm	**D**	157 pm

Solution: (c) The fluoride ion is much larger than the atom, about 136 pm.

Topic II.2 s-, p-, d- and f-Block Elements

Past MDCAT Questions

MCQ II.2.1 **The electronic configurations of some elements are given below. Recognize the element that belongs to group IIIA. (MDCAT 2023)**

A	$1s^2\,2s^2\,2p^1$	**B**	$1s^2\,2s^2\,2p^4$
C	$1s^2\,2s^2\,2p^5$	**D**	$1s^2\,2s^2\,2p^2$

Solution: (a) Three electrons in the valence shell put the element in group IIIA; this is boron.

MCQ II.2.2 **Q.97 Which group of the periodic table contain non-metals, metalloids and metals. (UHS MDCAT 2023)**

A	I B	**B**	VII A
C	IV A	**D**	VI A

Solution: (c) Group IV runs from carbon, a non-metal, through silicon and germanium to tin and lead, which are metals.

MCQ II.2.3 **Which of the following is semiconductor? (SZABMU MDCAT 2023)**

A	Al	**B**	Si
C	P	**D**	Mg

Solution: (b) Silicon lies on the metalloid boundary of group IV and is the classic semiconductor.

MCQ II.2.4 **Select the metal which is extracted from bauxite? (UHS MDCAT 2023)**

A	Al	**B**	Ca
C	Mg	**D**	Cu

Solution: (a) Bauxite is hydrated aluminium oxide, from which aluminium is won by electrolysis.

MCQ II.2.5 **Galvanised Iron sheets have a coating of _____. (PMC MDCAT 2022)**

A	Tin	**B**	Silver
C	Zinc	**D**	Chromium

Solution: (c) Galvanizing is coating iron with zinc, which corrodes in its place.

MCQ II.2.6 **The name of a common ore from which aluminium can be extracted is called? (PMC MDCAT 2022)**

A	Charcoal	**B**	Haematite
C	Bauxite	**D**	Cryolite

Solution: (c) Bauxite is the hydrated oxide from which aluminium is extracted.

MCQ II.2.7 **Which of the following products is formed by the reaction of aluminium with nitrogen? (PMC MDCAT 2022)**

A	AlN3	**B**	AlN
C	Al2N2	**D**	Al3N2

Solution: (b) Aluminium burns in nitrogen to the nitride, AlN.

MCQ 11.2.8 **Which of the following metal occurs in free state _____ ? (PMC MDCAT 2022)**

A	Gold	B	Iron
C	Mercury	D	Copper

Solution: (a) Gold is so unreactive that it is found as the metal itself.

MCQ 11.2.9 **The Halide of aluminum is ___ ? (PMC MDCAT 2022)**

A	Electron deficient	B	Lewis acid
C	High melting point	D	High boiling point

Solution: (b) Aluminium has only six electrons round it in the halide, so it accepts a pair and acts as a Lewis acid.

MCQ 11.2.10 **Fused Bauxite is electrolyzed to get: (PMC Practice 2021)**

A	Sodium	B	Magnesium
C	Aluminum	D	Iron

Solution: (c) Aluminium is won by electrolysing its oxide dissolved in molten cryolite.

MCQ 11.2.11 **The alkali metals group lies in the _____. (PMC Practice 2021)**

A	d-block	B	s-block
C	f-block	D	p-block

Solution: (b) The alkali metals have their outermost electron in an s orbital.

MCQ 11.2.12 **Modern periodic table is arranged in ascending order of? (UHS MDCAT 2019)**

A	Nucleon number	B	Atomic mass
C	Proton number	D	Mass number

Solution: (c) The modern table is arranged by atomic, that is proton, number.

MCQ 11.2.13 **Which of the following element is not present in halogens? (UHS MDCAT 2019)**

A	I	B	Cl
C	Fe	D	F

Solution: (c) Iron is a transition metal; the halogens are group VII.

MCQ 11.2.14 **Halogens are being used as fire extinguishers, mild antiseptic CFCs and many other organic chemicals. Which of the following halogen is used to kill the bacteria in drinking water. (UHS MDCAT 2018)**

A	Bromine	B	Fluorine
C	Chlorine	D	Iodine

Solution: (c) Chlorine is used to disinfect drinking water.

MCQ 11.2.15 **To avoid the oxidation of filaments which element is used in electric bulbs: (UHS MDCAT 2017)**

A	Krypton	B	Argon
C	Helium	D	Neon

Solution: (b) Argon is cheap, plentiful and inert, so it protects the hot filament.

Topic 11.3 Reactions of Group I Elements

Past MDCAT Questions

MCQ 11.3.1 **The alkali metals react with chlorine gas to form white metal chloride salts. The metal chloride salt formed is: (MDCAT 2023)**

A	insoluble in water	B	soluble in water to give a neutral solution
C	soluble in water to give an acidic solution	D	soluble in water to give an alkaline solution

Solution: (b) Both ions come from a strong base and a strong acid, so neither hydrolyses and the solution is neutral.

MCQ 11.3.2 **The difference of lithium from the other alkali metals is mainly because of its: (MDCAT 2024)**

A	large radius and low charge density	B	small radius and low charge density
C	large radius and high charge density	D	small radius and high charge density

Solution: (d) The small Li^+ ion concentrates its charge, which is why lithium resembles magnesium more than it resembles sodium.

MCQ 11.3.3 **Which of the following alkali metal forms only normal oxide with O2? (KMU MDCAT 2024)**

A	K	B	Li
C	Na	D	Rb

Solution: (b) Lithium alone gives the simple oxide; sodium gives a peroxide and the rest give superoxides.

MCQ 11.3.4 **Which of the following alkali metal can form normal oxides as well as peroxides? (SZABMU MDCAT 2023)**

A	Na	B	K
C	Li	D	Cs

Solution: (a) Sodium gives both the oxide and the peroxide; lithium gives only the oxide.

MCQ 11.3.5 **All alkali metals react with chlorine gas to form white metal chlorides salt. The metal chlorides salt formed is: (UHS MDCAT 2023)**

A	Insoluble	B	Soluble in water to give neutral solution of ph 7
C	Soluble in water to give acidic solution of ph 1	D	Soluble in water to give alkaline solution of ph 14

Solution: (b) An alkali metal chloride is the salt of a strong acid and a strong base, so its solution is neutral.

MCQ 11.3.6 **NaCl can be purified by passing gaseous _____. (PMC MDCAT 2022)**

A	Sulfuric acid	B	Chlorine
C	Ammonia	D	Hydrogen Chloride

Solution: (d) Hydrogen chloride raises the chloride concentration and salts the sodium chloride out.

MCQ 11.3.7 **Which of the following metal is highly reactive? (PMC MDCAT 2022)**

A	Li	B	Zn
C	Ag	D	Au

Solution: (a) Lithium is an alkali metal and by far the most reactive of these four.

MCQ 11.3.8 **Upon burning in air, normal oxide is formed by: (PMC MDCAT 2022)**

A	Li	B	Na
C	K	D	Rb

Solution: (a) Lithium alone gives the simple oxide; the heavier alkali metals give peroxides and superoxides.

MCQ 11.3.9 **Alkali metal oxides dissolve In water to give: (PMC MDCAT 2022)**

A	Alkaline solution	B	Neutral solution
C	Acidic solution	D	Buffer solution

Solution: (a) The oxide takes up water to give the hydroxide, which is a strong alkali.

MCQ 11.3.10 **Which of the following property increases down the group in alkali metals? (NUMS MDCAT 2022)**

A	Ionization energy	B	Reactivity
C	Electron affinity	D	Electronegativity

Solution: (b) The outer electron is easier to lose down the group, so the metal grows more reactive.

MCQ 11.3.11 Which of the following family is linked with plant ashes? (PMC Practice 2021)

A	Nitrogen family	B	Alkali metals
C	Rare earth metals	D	Oxygen family

Solution: (b) Alkali means plant ash, and it is the potassium and sodium salts of the ash that gave the group its name.

MCQ 11.3.12 Potassium, Rubidium, Cesium react with oxygen to form which types of oxides? (PMC MDCAT 2020)

A	Peroxide	B	Superoxide
C	Suboxide	D	Normal oxide

Solution: (b) The larger alkali metals burn to superoxides; sodium gives a peroxide and lithium the simple oxide.

MCQ 11.3.13 2NaOH(aq) + Cl2(g) → NaCl + NaClO + H2O proceed at: (UHS MDCAT 2016)

A	500 °C	B	200 °C
C	-10 °C	D	15 °C

Solution: (d) Cold dilute alkali gives the chloride and the hypochlorite; hot concentrated alkali would give the chlorate.

Topic 11.4 Reactions of Group II Elements

Past MDCAT Questions

MCQ 11.4.1 Which of the following sulphates is insoluble in water? (MDCAT 2022)

A	$BeSO_4$	B	$BaSO_4$
C	$MgSO_4$	D	$CaSO_4$

Solution: (b) Solubility of the group II sulphates falls down the group, and barium sulphate is insoluble.

MCQ 11.4.2 Which one of these oxides is amphoteric in nature? (MDCAT 2023)

A	lithium oxide	B	beryllium oxide
C	calcium oxide	D	potassium oxide

Solution: (b) Beryllium oxide reacts both with acids and with alkalis; the other three are basic.

MCQ 11.4.3 The solubility of the sulphates of the alkaline earth metals generally: (MDCAT 2024)

A	increases down the group	B	decreases down the group
C	increases then decreases down the group	D	does not change down the group

Solution: (b) The lattice energy falls more slowly than the hydration energy down the group, so the sulphates become less soluble.

MCQ 11.4.4 Which of the following best explains the reaction between Beryllium (Be) and Oxygen (O)? (KMU MDCAT 2025)

A	Be burns vigorously with oxygen forming a layer of BeO, which accelerates the oxidation of remaining metal	B	Be reacts with oxygen forming a layer of BeO, which protects the metal from further oxidation
C	Be reacts slowly with oxygen to form a volatile oxide BeO, which evaporates quickly	D	Be is the only alkaline earth metal that doesn't react with oxygen

Solution: (b) The oxide film that forms on beryllium sticks to the metal and seals it from further attack.

MCQ 11.4.5 The solubility of sulphates of alkaline metals generally (UHS MDCAT 2024)

A	Increase down the group	B	Decrease down the group
C	Increase then decrease down the group	D	Doesn't change down the group

Solution: (b) The lattice energy falls more slowly than the hydration energy down group II, so the sulphates get less soluble.

MCQ 11.4.6 When a metal carbonate is heated at 100°C, which will readily decompose? (NUMS MDCAT 2024)

A	BaCO3	B	MgCO3
C	BeCO3	D	SrCO3

Solution: (c) Thermal stability of the carbonates rises down the group, so the beryllium salt goes first.

MCQ 11.4.7 Q.98 Which of the following sulfate compound is insoluble in water ? (UHS MDCAT 2023)

A	BeSO4	B	BaSO4
C	MgSO4	D	CaSO4

Solution: (b) Solubility of the group II sulphates falls down the group, and barium sulphate is insoluble.

MCQ 11.4.8 Which one of them is amphoteric in nature? (UHS MDCAT 2023)

A	Lithium oxide	B	Beryllium oxide
C	Calcium oxide	D	Potassium oxide

Solution: (b) Beryllium oxide dissolves in both acid and alkali, so it is amphoteric.

MCQ 11.4.9 All alkaline earth metals react with nitrogen to give: (PMC MDCAT 2022)

A	Nitrates	B	Nitrides
C	Nitriles	D	Amides

Solution: (b) Heated in nitrogen, the group II metals form nitrides of formula M_3N_2.

MCQ 11.4.10 When magnesium nitride (Mg3 N2) reacts with with water the reaction mixture becomes: (PMC MDCAT 2022)

A	Acidic	B	Basic
C	Neutral	D	Amphoteric

Solution: (b) The nitride hydrolyses to magnesium hydroxide and ammonia, both of them alkaline.

MCQ 11.4.11 Which of the following does not react with water even at red hot temperature. (PMC MDCAT 2022)

A	BeO	B	MgO
C	CaO	D	BaO

Solution: (a) Beryllium oxide is covalent and inert; the oxides below it in the group give hydroxides with water.

MCQ 11.4.12 Which one of the following is more soluble in water? (PMC MDCAT 2022)

A	Be(OH)2	B	Ca(OH)2
C	Mg(OH)2	D	Ba(OH)2

Solution: (d) Solubility of the group II hydroxides rises down the group, so barium hydroxide is the most soluble.

MCQ 11.4.13 Among alkaline earth metals the one which shows the least chemical reactivity Is: (PMC MDCAT 2022)

A	Be	B	Ca
C	Mg	D	Ba

Solution: (a) Beryllium is the smallest of the group and its compounds are largely covalent, so it reacts least readily.

MCQ 11.4.14 The solubility of alkaline earth metal: (NUMS MDCAT 2022)

A	Decreases down the group	B	Increases down the group
C	Remains constant throughout the group	D	First increases then decreases down the group

Solution: (b) The hydroxides grow more soluble down group II as the lattice energy falls faster than the hydration energy.

MCQ 11.4.15 Magnesium reacts with nitrogen to form: (PMC MDCAT 2020)

A	Mg2N2	B	Mg3N2
C	MgN2	D	MgN

Solution: (b) Magnesium burns in nitrogen to Mg_3N_2.

MCQ 11.4.16 **Down the group acid-base behaviour of metallic oxides of group 2 elements changes to: (UHS MDCAT 2018)**

A	More basic	B	No change
C	Less basic	D	More acidic

Solution: (a) The oxides grow more basic down the group as the metals grow more electropositive.

MCQ 11.4.17 **Melting points of group II-A elements are higher than those of group I-A because: (UHS MDCAT 2016)**

A	Atoms of II-A elements have smaller size	B	II-A elements are more reactive
C	Atoms of II-A elements provide two binding electrons	D	I-A elements have smaller atomic radius

Solution: (c) Each group II atom contributes two electrons to the metallic bond instead of one.

Topic 11.5 Reactions of Group IV Elements

Past MDCAT Questions

MCQ 11.5.1 **Which group of the periodic table contains non-metals, metalloids and metals? (MDCAT 2022)**

A	IB	B	VIIA
C	IVA	D	IIA

Solution: (c) Group IVA runs from carbon, a non-metal, through silicon and germanium, metalloids, to tin and lead, metals.

MCQ 11.5.2 **Which of the following has anti-knocking properties? (PMC MDCAT 2022)**

A	(CH3CH2)4Sn	B	(CH3CH2)4Pb
C	(CH3CH2)4Ge	D	(CH3CH2)4Si

Solution: (b) Tetraethyl lead was added to petrol to stop it knocking.

MCQ 11.5.3 **Which of the following compounds is sold as fertilizer? (PMC Practice 2021)**

A	CaSiO3	B	Na2SiO3
C	Ca3(PO4)2	D	MnSiO3

Solution: (c) Calcium phosphate is the rock from which phosphate fertilizers are made.

Unit 12 Transition Elements

Topic 12.1 Electronic Structure of d-Block Elements

Past MDCAT Questions

MCQ 12.1.1 **In which pair does one element have all unpaired d orbitals while the other has all paired d orbitals? (MDCAT 2022)**

A	Cu and Zn	B	Cr and Fe
C	Cr and Zn	D	Mn and Co

Solution: (c) Chromium is $3d^5$, with every d orbital singly filled, and zinc is $3d^{10}$, with every one of them full.

MCQ 12.1.2 **Which of the following electronic configurations is correct for $_{24}\mathrm{Cr}$? (MDCAT 2023)**

A	$[\mathrm{Ar}]3d^5 4s^1$	B	$[\mathrm{Ar}]3d^4 4s^2$
C	$[\mathrm{Ar}]3d^6 4s^0$	D	$[\mathrm{Ar}]3d^3 4s^2$

Solution: (a) One electron moves from $4s$ to $3d$ to give the more stable half-filled d set.

MCQ 12.1.3 **Which of the following transition metals shows a $3d^5$ configuration in its $+2$ oxidation state? (MDCAT 2023)**

A	Cu^{2+}	B	Fe^{2+}
C	Mn^{2+}	D	Zn^{2+}

Solution: (c) Manganese is $[\mathrm{Ar}]3d^5 4s^2$, so losing the two $4s$ electrons leaves $3d^5$.

MCQ 12.1.4 **The electronic configuration of chromium (proton number 24) is: (MDCAT 2024)**

A	$[\mathrm{Ar}]3d^4 4s^2$	B	$[\mathrm{Ar}]3d^5 4s^1$
C	$[\mathrm{Ar}]3d^5 4s^2$	D	$[\mathrm{Ar}]3d^6 4s^0$

Solution: (b) A half-filled $3d$ set with one $4s$ electron is the more stable arrangement.

MCQ 12.1.5 **Which of the following is NOT a property of transition elements? (MDCAT 2024)**

A	high melting points	B	good conductors of electricity
C	hard metals	D	their ions and compounds are colourless

Solution: (d) Transition metal ions are typically coloured, because of d-d electron transitions.

MCQ 12.1.6 **Which one of the following is a coinage metal (UHS MDCAT 2025)**

A	Pd	B	Cu
C	Cd	D	Hg

Solution: (b) Copper, silver and gold are the coinage metals.

MCQ 12.1.7 **Which of the following is NOT an Alloy (UHS MDCAT 2024)**

A	Steel	B	Brass
C	Bronze	D	Graphite

Solution: (d) Graphite is an element, not a mixture of metals.

MCQ 12.1.8 **Electronic configuration of chromium (Proton number 24) is: (UHS MDCAT 2024)**

A	[Ar] 3d4 4s2	B	[Ar] 3d5 4s2
C	[Ar] 3d5 4sl	D	[Ar] 3d6 4s2

Solution: (c) A half filled d subshell is stable, so chromium is $[\mathrm{Ar}]3d^5 4s^1$.

MCQ 12.1.9 **Cu2+ salt solution is blue in colour due to transition of electrons from (KMU MDCAT 2024)**

A	d to d orbital	B	p to d orbital
C	p to p orbital	D	s to p orbital

Solution: (a) The d subshell is split by the ligands, and an electron moving between the split levels absorbs visible light.

MCQ 12.1.10 **Potassium ferrocyanide is which type of salt? (KMU MDCAT 2024)**

A	Complex	B	Double
C	Mixed	D	Normal

Solution: (a) It gives no simple iron ions in solution, because the iron is held in the complex ferrocyanide ion.

MCQ 12.1.11 **Q.99 Which of the following complex show a tetrahedral geometry? (UHS MDCAT 2023)**

A	[Fe(CO)5]	B	[Cu(CN)4]-2
C	[Au(Cl)4]-	D	[Pt(NH3)4]+2

Solution: (b) Four ligands round a copper(I) centre with no d-orbital preference give a tetrahedron.

MCQ 12.1.12 **In which pair one has all Unpaired d orbitals while other have all paired d orbitals ? (UHS MDCAT 2023)**

A	Cu and Zn	**B**	Cr and Fe
C	Cr and Zn	**D**	Mn and Co

Solution: (c) Chromium is $3d^5$, all five unpaired; zinc is $3d^{10}$, all paired.

MCQ 12.1.13 **The transition element which doesn't show variable valency: (SZABMU MDCAT 2023)**

A	Cu	**B**	Sc
C	Zn	**D**	Cr

Solution: (c) Zinc has a full d subshell, so it can only give up its two 4s electrons.

MCQ 12.1.14 **The binding energy of transition metals increases upto group: (SZABMU MDCAT 2023)**

A	II B	**B**	IV B
C	III B	**D**	VI B

Solution: (d) More unpaired d electrons mean stronger metallic bonding, and that peaks around group VI B.

MCQ 12.1.15 **Which of the following transition metal show 3d5 configuration in its +2-oxidation state? (UHS MDCAT 2023)**

A	Cu+2	**B**	Fe+2
C	Mn+2	**D**	Zn+2

Solution: (c) Manganese(II) has lost its two 4s electrons, leaving a half filled $3d^5$ subshell.

MCQ 12.1.16 **Coinage metals belong to which group of the periodic table? (PMC MDCAT 2022)**

A	IB	**B**	2B
C	3B	**D**	3A

Solution: (a) Copper, silver and gold make up group IB.

MCQ 12.1.17 **An element that forms interstitial compounds is _____. (PMC MDCAT 2022)**

A	C	**B**	F
C	Cs	**D**	Rb

Solution: (a) Small atoms such as carbon fit into the holes of a metal lattice to give interstitial compounds.

MCQ 12.1.18 **Which element shows maximum oxidation state? (PMC MDCAT 2022)**

A	Cu	**B**	Zn
C	Cr	**D**	Mn

Solution: (d) Manganese can use all seven of its outer electrons, so it reaches +7.

MCQ 12.1.19 **The transition element which shows fixed 2+ oxidation state in its compound is: (PMC MDCAT 2022)**

A	Zn	**B**	Fe
C	Cu	**D**	Mn

Solution: (a) Zinc has a full d subshell, so it can only lose its two 4s electrons.

MCQ 12.1.20 **The color of Zn2+ compounds is: (PMC MDCAT 2022)**

A	Yellow	**B**	Black
C	Blue	**D**	Colorless

Solution: (d) Zinc has no partly filled d subshell, so there are no d-d transitions and its salts are white.

MCQ 12.1.21 **How many unpaired electrons are there in Co2+ ion? (PMC MDCAT 2022)**

A	2	**B**	3
C	4	**D**	7

Solution: (b) Cobalt(II) is $3d^7$, which leaves three electrons unpaired.

MCQ 12.1.22 **Transition elements form which bond with ligands? (PMC MDCAT 2022)**

A	Covalent	**B**	Ionic
C	Metallic	**D**	Coordinate Covalent

Solution: (d) The ligand donates both electrons of the bond to the empty d orbital of the metal.

MCQ 12.1.23 **Melting and boiling point of transition elements is higher due to? (PMC Practice 2021)**

A	Higher binding energy	**B**	Strong metallic bonding
C	Hardness	**D**	All of these

Solution: (b) Unpaired d electrons take part in the bonding as well as the s electrons, so the metallic bond is strong.

MCQ 12.1.24 **D block elements are also called as ____ ? (PMC Practice 2021)**

A	Rare earth elements	**B**	Outer transition elements
C	Inner transition elements	**D**	Typical transition elements

Solution: (b) The d block are the outer transition elements; the f block are the inner ones.

MCQ 12.1.25 **F-block elements are called? (PMC Practice 2021)**

A	Inner transition	**B**	Outer transition
C	Both	**D**	None

Solution: (a) The f block are the inner transition elements.

MCQ 12.1.26 **[Fe (CN)6]4- is called as ______. (PMC Practice 2021)**

A	Complex compound	**B**	Transition element ion
C	Anion	**D**	Complex anion

Solution: (d) It is a complex ion carrying a net negative charge, that is a complex anion.

MCQ 12.1.27 **The transition element which does not show variable valency is: (PMC MDCAT 2020)**

A	Cu	**B**	Sc
C	Zn	**D**	Cr

Solution: (c) Zinc has a full d subshell, so it can only give up its two 4s electrons.

MCQ 12.1.28 **In 3rd series of transition elements, paramagnetic behaviour is maximum for Mn +2 and : (PMC MDCAT 2020)**

A	Cr3+	**B**	Ti3+
C	V3+	**D**	Zn2+

Solution: (a) Chromium(III) and manganese(II) both have half filled or nearly half filled d subshells with the most unpaired electrons.

MCQ 12.1.29 **Copper is a typical transition metal. Its atomic number is 29. In which oxidation state does it have a partially filled orbital in d-subshell? (UHS MDCAT 2019)**

A	Cu	**B**	Cu+
C	Cu-	**D**	Cu2+

Solution: (d) Copper(I) is $3d^{10}$ and full; copper(II) is $3d^9$, which is partly filled.

MCQ 12.1.30 **The shape of [Co(NH3)6]3+ complex is: (UHS MDCAT 2018)**

A	Linear	**B**	Square planar
C	Tetrahedral	**D**	Octahedral

Solution: (d) Six ligands round a central ion take the corners of an octahedron.

MCQ 12.1.31 **Ligands having two lone pair of electrons for donation to the central transition metal ion are known as: (UHS MDCAT 2018)**

A	Polydentate ligands	**B**	Monodentate ligand
C	Bidentate ligands	**D**	Hexadentate ligands

Solution: (c) A ligand with two donor atoms is bidentate.

MCQ 12.1.32 **How many ligands does K4[Fe(CN)6] contains: (UHS MDCAT 2017)**

A	4	B	7
C	6	D	5

Solution: (c) Six cyanide ions surround the iron, so there are six ligands.

MCQ 12.1.33 **Identify the element that has maximum oxidation states: (UHS MDCAT 2017)**

A	Zinc	B	Chromium
C	Vanadium	D	Manganese

Solution: (d) Manganese can use all seven of its outer electrons, reaching $+7$.

MCQ 12.1.34 **The anomalous electronic configuration shown by chromium and copper among 3-d series of elements is due to: (UHS MDCAT 2016)**

A	Colour of ions of these metals	B	Variable oxidation states of metals
C	Stability associated with this configuration	D	Complex formation tendency of metals

Solution: (c) A half filled or filled d subshell is unusually stable, so an s electron moves across.

Unit 13 Fundamental Principles of Organic Chemistry

Topic 13.1 Classification of Organic Compounds

Past MDCAT Questions

MCQ 13.1.1 **What is the molecular formula of the pyridine molecule? (MDCAT 2023)**

A	C_6H_5N	B	C_5H_5N
C	C_4H_4N	D	C_6H_6N

Solution: (b) Pyridine is benzene with one CH replaced by N, so it is C_5H_5N.

MCQ 13.1.2 **Homocyclic organic compounds are subdivided into two types, namely: (MDCAT 2024)**

A	alicyclic and aromatic	B	alkenes and alkynes
C	aromatic and non-aromatic	D	saturated and unsaturated

Solution: (a) Rings of carbon only are either alicyclic, like cyclohexane, or aromatic, like benzene.

MCQ 13.1.3 **Pyridine belongs to which class of organic compounds? (KMU MDCAT 2024)**

A	Alicyclic	B	Heterocyclic
C	Homocyclic	D	Hydrocarbon

Solution: (b) Pyridine has a nitrogen atom in its ring, so it is heterocyclic.

MCQ 13.1.4 **Which of the following elements cannot be detected directly in a given organic compound? (KMU MDCAT 2024)**

A	Chlorine	B	Nitrogen
C	Oxygen	D	Phosphorous

Solution: (c) Oxygen has no test of its own; its presence is worked out from the difference in the analysis.

MCQ 13.1.5 **Homo-cyclic organic compounds are sub divided into two groups namely: (SZABMU MDCAT 2023)**

A	Alicyclic and Aromatic	B	Open chain and branched chain
C	Aromatic and non-aromatic	D	Anti-aromatic

Solution: (a) A homocyclic ring of carbon alone is either alicyclic or aromatic.

MCQ 13.1.6 **Generic formula of cycloalkane is: (NUMS MDCAT 2023)**

A	CnH2n+2	B	CnH2n
C	CnH2n-1	D	CnCH2n-2

Solution: (b) A ring costs two hydrogens, so a cycloalkane is Double subscripts: use braces to clarify .

MCQ 13.1.7 **What is the molecular formula of pyridine molecule? (UHS MDCAT 2023)**

A	C6H5N	B	C5H5N
C	C5H5NH	D	C6H6N

Solution: (b) Pyridine is benzene with one carbon replaced by nitrogen, so its formula is C_5H_5N.

MCQ 13.1.8 **Which of the following is not an IUPAC name of the compound? (PMC MDCAT 2022)**

A	Methanoic acid	B	Ethanoic acid
C	Propanoic acid	D	Propionic acid

Solution: (d) Propionic acid is the trivial name; the systematic one is propanoic acid.

MCQ 13.1.9 **Which one of the following is not a common name? (PMC MDCAT 2022)**

A	Butanoic acid	B	Formic acid
C	Propionic acid	D	Acetic acid

Solution: (a) Butanoic acid is the systematic name; the others are the older trivial names.

MCQ 13.1.10 **Organic compounds in which tetravalency of carbon atom is satisfied are called as ____ ? (PMC Practice 2021)**

A	Saturated	B	Unsaturated
C	Alkenes	D	Alkynes

Solution: (a) A compound with only single bonds has every valency of carbon used on a different atom, so it is saturated.

MCQ 13.1.11 **Friedrich prepared UREA from: (PMC Practice 2021)**

A	Amino acids	B	Ammonium carbonate
C	Ammonium cyanate	D	Xanthin

Solution: (c) Wohler made urea by heating ammonium cyanate, the first organic compound made from an inorganic one.

MCQ 13.1.12 **Which of the following is not a derivative of benzene? (PMC Practice 2021)**

A	Pyrrole	**B**	Furan
C	Thiophene	**D**	All

Solution: (d) Pyrrole, furan and thiophene are five membered heterocycles, not derivatives of benzene at all.

MCQ 13.1.13 **When are the prefixes ortho, para, and para used? (PMC Practice 2021)**

A	In alkynes to identify the position of the triple bond	**B**	In arenes to identify the position of the first substitution
C	In arenes to identify the position of the second substitution	**D**	In all hydrocarbons to identify the position of the functional group

Solution: (c) Ortho, meta and para say where the second substituent stands relative to the first.

MCQ 13.1.14 **Select the organic compound which belongs to Arene family: (PMC MDCAT 2020)**

A	CH2 = CH2	**B**	CH3 - O - CH3
C	CH3 - NH2	**D**	C6H6

Solution: (d) Benzene is the parent of the arenes.

MCQ 13.1.15 **IUPAC name of C6H5 - CH2 - CH2 - NH2 is: (PMC MDCAT 2020)**

A	2-phenyl ethenamine	**B**	2-phenyl ethanamine
C	2-phenyl ethylamine	**D**	3-phenyl ethanamine

Solution: (b) The chain is ethane with an amino group on carbon 1 and a phenyl group on carbon 2.

MCQ 13.1.16 **Cyclobutane structure is categorized under: (UHS MDCAT 2017)**

A	Aromatic compounds	**B**	Alicyclic compounds
C	Aliphatic compounds	**D**	Heterocyclic compounds

Solution: (b) Cyclobutane is a saturated carbon ring with no aromatic character, so it is alicyclic.

Topic 13.2 Functional Groups

Past MDCAT Questions

MCQ 13.2.1 **The compounds containing the $\mathrm{R-SH}$ functional group are known as: (MDCAT 2022)**

A	alcohols	**B**	thio-alcohols
C	thio-ethers	**D**	nitriles

Solution: (b) Sulphur in the place of the oxygen of an alcohol gives a thio-alcohol, or thiol.

MCQ 13.2.2 **CnH2nO is the general formula of: (UHS MDCAT 2024)**

A	Ether	**B**	Carboxylic acid
C	Ketones	**D**	Carbolic acid

Solution: (c) A ketone of formula Double subscripts: use braces to clarify carries one carbonyl group inside the chain.

MCQ 13.2.3 **Name of ketone functional group is (KMU MDCAT 2024)**

A	Amino	**B**	Carbonyl
C	Carboxyl	**D**	Formyl

Solution: (b) The group in a ketone is the carbonyl group.

MCQ 13.2.4 **In which of the following functional groups, the carbon atom is sp hybridized? (UHS MDCAT 2023)**

A	-CHO	**B**	-COOH
C	-CN	**D**	-COOR

Solution: (c) The carbon of a nitrile is triply bonded to nitrogen, so it is sp hybridized.

MCQ 13.2.5 **The compounds containing R-SH functional group are known as: (UHS MDCAT 2023)**

A	Alcohols	**B**	Thio-alcohols
C	Thio-ether	**D**	Nitrile

Solution: (b) Replacing the oxygen of an alcohol with sulphur gives a thio-alcohol, or thiol.

MCQ 13.2.6 **Which of the functional group are present in ethyl acetate? (UHS MDCAT 2023)**

A	Aldehyde group	**B**	Carboxyl group
C	Ester group	**D**	Ether group

Solution: (c) Ethyl acetate is the ester of acetic acid and ethanol.

MCQ 13.2.7 **Which of the following is an oxonium ion? (PMC MDCAT 2022)**

A	NH4+	**B**	PH4+
C	RSH2+	**D**	H3O+

Solution: (d) The hydronium ion is an oxonium ion, oxygen with three bonds and a positive charge.

Topic 13.3 Isomerism

Past MDCAT Questions

MCQ 13.3.1 **What are vinyl alcohol and acetaldehyde? (MDCAT 2023)**

A	position isomers	**B**	chain isomers
C	metamers	**D**	tautomers

Solution: (d) They differ by the place of a hydrogen and a double bond and interconvert, which makes them tautomers.

MCQ 13.3.2 **1-Butene and 2-butene show which type of isomerism? (MDCAT 2024)**

A	functional group	**B**	position
C	metamerism	**D**	chain

Solution: (b) The chain and the functional group are the same in both; only the position of the double bond differs.

MCQ 13.3.3 **Which type of isomerism is displayed by compounds having the same structural formula but a different position of atoms on the two sides of a carbon-carbon double bond? (MDCAT 2024)**

A	chain	**B**	metamerism
C	geometric	**D**	tautomerism

Solution: (c) Restricted rotation about the double bond gives the cis and trans forms, which is geometric isomerism.

MCQ 13.3.4 **2-pentanone and 3-pentanone are examples of: (NUMS MDCAT 2025)**

A	Metamers	**B**	Functional group isomers
C	Tautomerism	**D**	Position isomers

Solution: (d) The two differ only in where the carbonyl group sits along the same chain.

MCQ 13.3.5 **Which compound will not show geometrical isomerism: (SIBA MDCAT 2025)**

A	But-2-ene	**B**	1,2-dimethylcyclopropane
C	Pent-1-ene	**D**	1,3-dimethylcyclopentane

Solution: (c) Pent-1-ene has two hydrogens on its terminal carbon, so the two arrangements are the same.

MCQ 13.3.6 **Which one is not a type of stereoisomerism? (SIBA MDCAT 2025)**

A	Confirmational isomerism	**B**	Optical isomerism
C	Geometrical isomerism	**D**	Metamerism

Solution: (d) Metamerism is a kind of structural isomerism, not of stereoisomerism.

MCQ 13.3.7 **Which type of isomerism is displayed by compounds having same structural formula but different position of atoms on both sides of carbon bond? (UHS MDCAT 2024)**

A	Chain	B	Metamerism
C	Geometric	D	Tautomerism

Solution: (c) Groups fixed on either side of a double bond give the cis and trans, or geometric, isomers.

MCQ 13.3.8 **Select the alkene showing geometrical isomerism: (NUMS MDCAT 2024)**

A	3-methyl-1-butene	B	Methyl cyclopentane
C	2,3-dimethyl-2-butene	D	3-methyl-2-pentene

Solution: (d) Each carbon of its double bond carries two different groups, which is what geometrical isomerism needs.

MCQ 13.3.9 **The type of isomerism arising due to shifting of proton fron one atom to another in the same molecule is: (SZABMU MDCAT 2023)**

A	Chain isomerism	B	Metamerism
C	Tautomerism	D	Postion isomerism

Solution: (c) A proton shifting within the molecule between two forms in equilibrium is tautomerism.

MCQ 13.3.10 **The covalent compounds exhibit: (PMC MDCAT 2022)**

A	Fast reactions	B	Non-directional nature
C	Non-rigid structures	D	Isomerism

Solution: (d) A covalent bond points in a definite direction, so the same atoms can be arranged in more than one way.

MCQ 13.3.11 **Geometric isomerism is exhibited by: (NUMS MDCAT 2022)**

A	Alcohol	B	Ethers
C	Alkynes	D	Alkenes

Solution: (d) A double bond cannot rotate, so the groups on either side are fixed as cis or trans.

MCQ 13.3.12 **How many chain isomers of Pentane is possible? (PMC Practice 2021)**

A	Two	B	Four
C	Three	D	Five

Solution: (c) Pentane, 2-methylbutane and 2,2-dimethylpropane are the three.

MCQ 13.3.13 **How many isomers of mono-substituted benzene are possible? (PMC Practice 2021)**

A	Two	B	One
C	Three	D	None of these options is correct

Solution: (b) All six positions of benzene are alike, so one substituent can be put in only one way.

MCQ 13.3.14 **The type of isomerism existing in a compound of molecular formula C2H6O is: (PMC MDCAT 2020)**

A	Functional group	B	Position
C	Chain	D	Metamerism

Solution: (a) Ethanol and dimethyl ether share the formula but carry different functional groups.

MCQ 13.3.15 **Which of the following molecule shows cis-trans isomers? (UHS MDCAT 2019)**

A	C2H4	B	C2H2Cl4
C	C2H2Br2	D	C2HCl3

Solution: (c) 1,2-dibromoethene has one substituent on each carbon of the double bond, so cis and trans differ.

MCQ 13.3.16 **Butane molecules can have a maximum number of isomers. (UHS MDCAT 2018)**

A	5	B	3
C	4	D	2

Solution: (d) Butane and 2-methylpropane are the only two.

MCQ 13.3.17 **Name the compound, which shows geometric isomerism: (UHS MDCAT 2017)**

A	1-bromo-2chloropropene	B	2-pentene
C	2,3-dimethyl propene	D	Both "1-bromo-2 chloropropene" & "2-pentene"

Solution: (d) Each carbon of the double bond in both carries two different groups.

MCQ 13.3.18 **Which one of the following pairs can be cis-trans isomer to each other? (UHS MDCAT 2016)**

A	CHCl=CCl2 and CH2=CH	B	CHCl=CH2 and CH2=CHCl
C	CH3CH=CHCH3 and H3CCH=CHCH3	D	CH3CH3 and CH2=CH

Solution: (c) But-2-ene has a methyl and a hydrogen on each carbon of the double bond, so cis and trans differ.

Unit 14 Chemistry of Hydrocarbons

Topic 14.2 Free Radical Mechanism

Past MDCAT Questions

MCQ 14.2.1 **Consider the chlorination of methane. The attack of a chlorine free radical on methane to form a methyl free radical occurs in the: (MDCAT 2022)**

A	initiation step	B	propagation step
C	termination step	D	last step

Solution: (b) One radical is consumed and another is produced, which is what keeps the chain going.

MCQ 14.2.2 **What is general requirement for free radical substitution reaction of ethane and halogen? (UHS MDCAT 2025)**

A	low pressure	B	low temperature
C	high pressure	D	heat and UV light

Solution: (d) Halogenation of an alkane needs heat or ultraviolet light to split the halogen into free radicals.

MCQ 14.2.3 **Consider the chlorination of methane to methyl chloride, the attack of chlorine free radical on methane, occurs in which phase? (KMU MDCAT 2025)**

A	Before initiation	B	Initiation
C	Propagation	D	Termination

Solution: (c) A chlorine radical attacking methane is a propagation step: a radical is used and another is made.

MCQ 14.2.4 **The homolytic fission of C-H bond in an alkane result in (KMU MDCAT 2024)**

A	Alkyl free radical	B	Carbanion
C	Carbocation	D	Methylpropane

Solution: (a) Homolysis gives each atom one electron of the pair, leaving an alkyl free radical.

MCQ 14.2.5 **The carbon atom carrying positive charge and attached to three other atoms or groups is called (KMU MDCAT 2024)**

A	Carbanion	B	Carbene
C	Carbocation	D	Oxonium

Solution: (c) A positively charged carbon with three attachments is a carbocation.

MCQ 14.2.6 **Consider the chlorination of methane, the attack of chlorine free radical on methane form methyl free radical occurs in ? (UHS MDCAT 2023)**

A	Initiation step	B	Propagation step
C	Termination step	D	Last step

Solution: (b) A radical is used and another is made, which is the mark of a propagation step.

MCQ 14.2.7 **Halogenation of alkane in sunlight is an example of: (PMC MDCAT 2022)**

A	Addition reaction	B	Elimination reaction
C	Substitution reaction	D	Rearrangment reaction

Solution: (c) A hydrogen of the alkane is replaced by a halogen, which is substitution.

MCQ 14.2.8 **The termination step of the Halogenation of alkanes in the presence of sunlight involves the formation of: (PMC MDCAT 2022)**

A	Free radicals	B	Cations
C	Anions	D	Molecules

Solution: (d) Two radicals meeting join into a molecule, and the chain ends there.

MCQ 14.2.9 **Free radical reactions take place in the presence of _____? (PMC Practice 2021)**

A	Heat	B	Sunlight
C	Catalyst	D	Oxygen

Solution: (b) Ultraviolet light splits the halogen into radicals and the chain begins.

MCQ 14.2.10 **The species which are produced by heterolytic bond breaking and can act as electron pair donors are known as: (UHS MDCAT 2018)**

A	Nucleophiles	B	Cations
C	Free radicals	D	Anions

Solution: (a) A species with a lone pair to give is a nucleophile.

MCQ 14.2.11 **Reaction mechanism of alkanes with halogens is known as; (UHS MDCAT 2018)**

A	Propagation	B	Free radical substitution
C	Addition	D	Elimination

Solution: (b) Halogenation of an alkane goes by free radicals, and a hydrogen is substituted.

MCQ 14.2.12 **Chlorination and Bromination mostly uses: (UHS MDCAT 2017)**

A	Radio waves	B	Visible light
C	Infrared radiations	D	U.V. light

Solution: (d) Ultraviolet light splits the halogen molecule into radicals and the chain begins.

MCQ 14.2.13 **Among the following, which one is a nucleophile; (UHS MDCAT 2017)**

A	$H+$	B	$OH-$
C	$Ca2+$	D	None of the given options

Solution: (b) The hydroxide ion has a lone pair to give, so it is a nucleophile.

MCQ 14.2.14 **. Which one of the following is NOT a nucleophile: (UHS MDCAT 2016)**

A	$NH2^-$	B	$H2O$
C	$BF3$	D	$CH3^-$

Solution: (c) Boron trifluoride has an empty orbital and accepts a pair, so it is an electrophile.

Topic 14.5 Structure and Reactivity of Alkenes

Past MDCAT Questions

MCQ 14.5.1 **The addition reaction of 2-butene with HBr produces: (MDCAT 2023)**

A	1-bromobutane	B	2-bromobutane
C	3-bromobutane	D	2,3-dibromobutane

Solution: (b) Either carbon of the double bond is equivalent here, so the bromine ends up on carbon 2.

MCQ 14.5.2 **The addition of water to propene in the presence of sulfuric acid produces: (KMU MDCAT 2025)**

A	Propane	B	Propan-2-ol
C	Butanol	D	Ethanol

Solution: (b) The proton adds to give the more stable secondary carbocation, so the hydroxyl ends on the middle carbon.

MCQ 14.5.3 **Addition of HBr to isobutylene mainly gives (KMU MDCAT 2024)**

A	isobutyl bromide	B	n-butyl bromide
C	sec-butyl bromide	D	tert-butyl bromide

Solution: (d) By Markovnikov's rule the bromine goes to the more substituted carbon, giving the tertiary halide.

MCQ 14.5.4 **Identify the alkene which gives only one type of aldehyde upon ozonolysis: (NUMS MDCAT 2024)**

A	1-pentene	B	2-methyl propene
C	2-butene	D	2,3-dimethyl-2-butene

Solution: (c) But-2-ene is symmetrical, so both halves give the same aldehyde, acetaldehyde.

MCQ 14.5.5 **Major product of the following reaction is: $CH2=CH-CH2-CH3 + HBr$ -> (PMC MDCAT 2022)**

A	$CH2(Br)-CH2-CH2-CH3$	B	$CH3-CH(Br)-CH2-CH3$
C	$CH2=CH-CH(Br)-CH3$	D	$CH2=CH-CH2-CH2(Br)$

Solution: (b) By Markovnikov's rule the bromine adds to the carbon already carrying more substituents.

MCQ 14.5.6 **Which of the following method is used to prepare Ethylene glycol from ethene? (PMC Practice 2021)**

A	Dehydration	B	Hydroxylation
C	Hydration	D	Luca's test

Solution: (b) Cold alkaline permanganate adds two hydroxyl groups across the double bond.

MCQ 14.5.7 **Alkenes undergo: (UHS MDCAT 2019)**

A	Electrophilic Addition	B	Electrophilic substitution
C	Nucleophilic substitution	D	Nucleophilic addition

Solution: (a) The pi electrons of the double bond attract an electrophile, which then adds across it.

MCQ 14.5.8 **Bromination of alkene is shown in the following reaction. This reaction is used for: (UHS MDCAT 2018)**

A	Detection of ketones	B	Detection of double bond
C	Identification of Primary and Secondary alcohols	D	Detection of Aldehydes

Solution: (b) Bromine water is decolourized by an alkene, which is the test for a double bond.

MCQ 14.5.9 **What do you call the process when sodium periodate is reacted to 1,2-diols? (UHS MDCAT 2017)**

A	Protonation	B	Epoxidification
C	Oxidative cleavage	D	Esterification

Solution: (c) Periodate splits the bond between the two hydroxyl-bearing carbons, which is oxidative cleavage.

Topic 14.7 Molecular Orbital Treatment of Benzene

Past MDCAT Questions

MCQ 14.7.1 The three alternate double bonds in benzene are called: (MDCAT 2022)

A	delocalized bonds	B	coordinate covalent bonds
C	fixed bonds	D	ionic bonds

Solution: (a) The six p electrons spread over all six carbons, so the bonds are delocalized rather than three fixed double bonds.

MCQ 14.7.2 The ratio of sigma to pi electrons in benzene is: (MDCAT 2022)

A	2 : 3	B	5 : 1
C	4 : 1	D	1 : 4

Solution: (c) Benzene has twelve sigma bonds, so 24 sigma electrons, against 6 pi electrons.

MCQ 14.7.3 Ratio of sigma bonds and pi bonds present in benzene are: (SIBA MDCAT 2025)

A	4:1	B	1:4
C	2:3	D	6:1

Solution: (a) Benzene has twelve sigma bonds and three pi bonds, a ratio of four to one.

MCQ 14.7.4 What is the structure of benzene? (PMC MDCAT 2022)

A	Regular, flat planar hexagon	B	Regular, 3D hexagon
C	Regular, flat planar octagon	D	Regular, planar pentagon

Solution: (a) Benzene is a flat regular hexagon with all six bonds of the same length.

MCQ 14.7.5 The C-C bond length in benzene is: (PMC MDCAT 2022)

A	1.39 Angstrom	B	1.20 Angstrom
C	1.34 Angstrom	D	1.54 Angstrom

Solution: (a) Every carbon carbon bond in benzene is $1.39 \backslash \mathrm{AA}$, between a single and a double bond.

MCQ 14.7.6 The unhybridized p orbitals of benzene are present in the form of _____. (PMC Practice 2021)

A	Between the C-C bonds of benzene	B	Above and below the carbon bonds
C	In the form of a cloud above and below the benzene ring	D	None of these options is correct

Solution: (c) The six unhybridized p orbitals overlap sideways into a ring of delocalized charge above and below the plane.

Topic 14.10 Chemical Reactions of Benzene

Past MDCAT Questions

MCQ 14.10.1 Alkylbenzene is formed when benzene is treated with an alkyl halide in the presence of anhydrous aluminium chloride. Identify the type of reaction. (MDCAT 2022)

A	halogenation	B	Friedel-Crafts acylation
C	Friedel-Crafts alkylation	D	sulphonation

Solution: (c) An alkyl group substitutes for a ring hydrogen with the Lewis acid as catalyst.

MCQ 14.10.2 Alkylbenzene is formed when benzene is treated with an alkyl halide in the presence of anhydrous aluminium chloride. Identify the type of reaction. (MDCAT 2023)

A	halogenation	B	Friedel-Crafts acylation
C	Friedel-Crafts alkylation	D	sulphonation

Solution: (c) The Lewis acid makes a carbocation from the halide, which substitutes into the ring: Friedel-Crafts alkylation.

MCQ 14.10.3 In Friedel-Crafts acylation an acyl group is introduced into the benzene ring in the presence of the catalyst: (MDCAT 2024)

A	$AlCl_3$	B	H_2SO_4
C	sunlight	D	V_2O_5

Solution: (a) Anhydrous aluminium chloride is the Lewis acid that generates the acylium electrophile.

MCQ 14.10.4 Chlorination of benzene in the presence of Iron (III) chloride involves mechanism of: (UHS MDCAT 2025)

A	Electrophilic addition	B	Electrophilic Substitution
C	Free radical Substitution	D	Free radical halogenation

Solution: (b) Iron(III) chloride polarizes the chlorine into an electrophile, which then substitutes into the ring.

MCQ 14.10.5 Which of the following is an electrophile in sulphonation? (NUMS MDCAT 2025)

A	SO3H	B	SO3
C	SO2	D	SO3+

Solution: (b) Sulphur trioxide is itself electron poor at sulphur, so it attacks the ring without needing a catalyst.

MCQ 14.10.6 Which reagent and condition are used to bring about the reaction shown? Toluene --> p-chloro toluene (SIBA MDCAT 2025)

A	Cl2 in the dark	B	Cl2 in the presence of AlCl3
C	Cl2 in the presence of UV light	D	Concentrated HCl heated under reflux

Solution: (b) Aluminium chloride polarizes the chlorine into an electrophile for ring substitution; light would attack the side chain instead.

MCQ 14.10.7 In Friedel Craft acylation an acyl group is introduced in benzene ring in the presence of catalyst: (UHS MDCAT 2024)

A	AlCl3	B	H2SO4
C	Sunlight	D	V2O5

Solution: (a) Anhydrous aluminium chloride generates the acylium ion that attacks the ring.

MCQ 14.10.8 Alkylbenzene is formed when benzene is treated with an alkyl halide in the presence of anhydrous aluminum chloride. Identify the type of reaction. (UHS MDCAT 2023)

A	Halogenation	B	Friedel-Crafts acylation reaction
C	Friedel-Crafts alkylation reaction	D	Sulphonation

Solution: (c) An alkyl group is put on the ring with an alkyl halide and aluminium chloride, which is Friedel-Crafts alkylation.

MCQ 14.10.9 Acetophenone can be formed by which of the following reaction of benzene? (NUMS MDCAT 2023)

A	Alkylation	B	Acylation
C	Halogenation	D	Nitration

Solution: (b) Friedel-Crafts acylation with acetyl chloride puts the acetyl group on the ring.

MCQ 14.10.10 A new C-C bond formation is possible with: (PMC MDCAT 2022)

A	Clemmensen reaction	B	Nitration reaction
C	Friedel craft reaction	D	Saturation reaction

Solution: (c) Friedel-Crafts alkylation and acylation both make a new bond from the ring carbon to carbon.

MCQ 14.10.11 Which of the following process gives Benzenesulfonic acid from benzene? (PMC MDCAT 2022)

A	Ozonolysis	B	Sulphonation
C	Nitration	D	Halogenation

Solution: (b) Fuming sulphuric acid substitutes a sulphonic acid group into the ring.

MCQ 14.10.12 What is the Catalyst in Friedel-Crafts Alkylation? (PMC MDCAT 2022)

A	AlCl3	B	Al2S3
C	AlH3	D	Al2O3

Solution: (a) Anhydrous aluminium chloride generates the carbocation that attacks the ring.

MCQ 14.10.13 Electrophile in sulphonation of benzene is: (PMC MDCAT 2020)

A	HSO4-	B	H2SO4
C	SO3	D	HSO3

Solution: (c) Sulphur trioxide is electron poor at sulphur and attacks the ring directly.

MCQ 14.10.14 Acetophenone can be formed by which of the following reaction for benzene? (PMC MDCAT 2020)

A	Alkylation	B	Acylation
C	Halogenation	D	Nitration

Solution: (b) Friedel-Crafts acylation with acetyl chloride gives acetophenone.

MCQ 14.10.15 Which of the following acts as an electrophile in the electrophilic substitution of benzene with bromine? (UHS MDCAT 2018)

A	Br+	B	FeCl4+
C	Fe2+	D	Fe3+

Solution: (a) The catalyst polarizes the bromine molecule into Br^+, which attacks the ring.

MCQ 14.10.16 For halogenation of benzene, which reagent is used: (UHS MDCAT 2017)

A	H2SO4	B	AlCl3
C	HNO3	D	HCl

Solution: (b) Anhydrous aluminium chloride polarizes the halogen into an electrophile.

Topic 14.11 Effect of Substituents

Past MDCAT Questions

MCQ 14.11.1 Which of the following is an example of a substituent group which releases electrons to the benzene ring? (MDCAT 2024)

A	$-CN$	B	$-NR_3^+$
C	$-NH_2$	D	$-NO_2$

Solution: (c) The lone pair on nitrogen is donated into the ring, which is why $-NH_2$ activates it.

MCQ 14.11.2 Which of the following is an example of substituent group which release electrons to benzene ring : (UHS MDCAT 2024)

A	-CN	B	-NR3+
C	-NH2	D	-NO2

Solution: (c) The lone pair of the amino group is fed into the ring; nitro and cyano groups pull electrons out.

MCQ 14.11.3 The most readily sulphonated compound is: (NUMS MDCAT 2024)

A	Benzene	B	Chlorobenzene
C	Nitrobenzene	D	Toluene

Solution: (d) The methyl group feeds electrons into the ring and so activates it towards the electrophile.

MCQ 14.11.4 Which of the following undergoes sulfonation the fastest? (PMC MDCAT 2022)

A	Benzene	B	Chlorobenzene
C	Nitrobenzene	D	Toluene

Solution: (d) The methyl group feeds electrons into the ring and so speeds up attack by the electrophile.

MCQ 14.11.5 How do meta directing groups affect the electrophilic substitution of benzene ring? (PMC Practice 2021)

A	Increase electron density at the ortho and para positions	B	Decrease electron density at the ortho and para positions
C	Make benzene less reactive	D	Both Options B and C are correct

Solution: (d) A meta director pulls electrons out of the ring, chiefly from the ortho and para positions, so the ring is deactivated.

MCQ 14.11.6 When CH3 is attached to the benzene ring, it makes the ring a: (PMC MDCAT 2020)

A	Good electrophile	B	Good nucleophile
C	Resonance hybrid	D	Extraordinary stable

Solution: (b) The methyl group feeds electrons into the ring, so the ring becomes richer in electrons and attacks electrophiles.

MCQ 14.11.7 Which derivative of benzene shows maximum reactivity in electrophilic substitution reactions? (UHS MDCAT 2019)

A	Benzoic acid	B	Methyl benzene
C	Benzaldehyde	D	Nitrobenzene

Solution: (b) The methyl group feeds electrons into the ring; the other three groups pull them out.

MCQ 14.11.8 Among the following, which one has an electron withdrawing effect: (UHS MDCAT 2017)

A	-NH2	B	-N(CH3)2
C	-CHO	D	-I

Solution: (c) The carbonyl group pulls electrons out of the ring; the amino and alkyl groups push them in.

Topic 14.13 Preparation of Alkynes

Past MDCAT Questions

MCQ 14.13.1 Identify the method which is used to prepare alkynes. (MDCAT 2023)

A	dehalogenation of vicinal dihalides in the presence of methanol	B	dehydration of alcohols in the presence of Al_2O_3 at 340-450°C
C	dehydrohalogenation of vicinal dihalides in the presence of a strong base	D	electrolysis of carboxylic acid salts

Solution: (c) A strong base removes two molecules of hydrogen halide from the vicinal dihalide and leaves a triple bond.

MCQ 14.13.2 Conversion of dihaloalkane into alkyne does not involve (UHS MDCAT 2025)

A	Addition	B	Elimination
C	Base	D	Heat

Solution: (a) A dihaloalkane loses two molecules of hydrogen halide to a strong base on heating, so the step is elimination, not addition.

MCQ 14.13.3 Which of the following reagent is commonly used to prepare alkyne form vicinal dihalide? (SZABMU MDCAT 2025)

A	H2 and catalyst	B	KOH/NaNH2
C	KMnO4	D	LiAlH4

Solution: (b) Two molecules of hydrogen halide are eliminated by alcoholic potash and then sodamide.

Topic 14.6 Preparation of Alkanes

Past MDCAT Questions

MCQ 14.6.1 The cracking method used to obtain better quality gasoline is: (NUMS MDCAT 2023)

A	Thermal	B	Catalytic
C	Steam	D	Radiations

Solution: (b) Catalytic cracking gives branched and aromatic products, which have the higher octane number.

MCQ 14.6.2 Conversion of straight chain hydrocarbons into branched chain is called as _____. (PMC MDCAT 2022)

A	Reforming	B	Cracking
C	Isomerization	D	Decomposition

Solution: (a) Reforming rearranges straight chains into branched and cyclic ones of higher octane number.

MCQ 14.6.3 Which of the following fraction of petroleum has the lowest boiling point at STP. (PMC MDCAT 2022)

A	Kerosene oil	B	Lubricating oil
C	Gasoline	D	Heavy Oil

Solution: (c) The lighter the fraction the lower it boils, and gasoline is the lightest of these.

MCQ 14.6.4 Fuels with higher octane number can be produced by_ _ ? (PMC MDCAT 2022)

A	Cracking	B	Reforming
C	Decomposition	D	Isomerisation

Solution: (a) Reforming turns straight chains into branched and aromatic ones, which resist knocking.

MCQ 14.6.5 The breaking of large molecules by heating at high temperature and pressure is called: (PMC MDCAT 2022)

A	Reforming	B	Steam cracking
C	Catalytic cracking	D	Thermal cracking

Solution: (d) Breaking the chains by heat alone is thermal cracking.

MCQ 14.6.6 Which of the following fractions of petroleum has the lowest boiling point at STP? (PMC MDCAT 2022)

A	Kerosene Oil	B	Lubricating Oil
C	Gasoline	D	Natural Gas

Solution: (d) Natural gas is the lightest fraction of all and boils lowest.

MCQ 14.6.7 Which type of bonds are broken during cracking? (PMC Practice 2021)

A	C- C	B	C-H
C	Both C-C and C-H	D	C-O

Solution: (a) Cracking breaks the chain, that is a carbon carbon bond.

MCQ 14.6.8 What are the products of destructive distillation of coal? (PMC Practice 2021)

A	Coal tar	B	Coke
C	Coal gas	D	All of above

Solution: (d) Heating coal out of contact with air gives coke, coal tar and coal gas.

MCQ 14.6.9 Octane number of n-heptane is _____. (PMC Practice 2021)

A	0	B	100
C	40	D	98

Solution: (a) The octane scale is set by taking n-heptane as zero and iso-octane as a hundred.

MCQ 14.6.10 What should be the temperature and pressure respectively for catalytic cracking: (UHS MDCAT 2017)

A	500°C, 2 atm	B	900°C, 2 atm
C	500°C, 4 atm	D	900°C, 4 atm

Solution: (a) Catalytic cracking is done at about 500°C and a low pressure.

MCQ 14.6.11 Which one of the following reactions shows combustion of a saturated hydrocarbon? (UHS MDCAT 2016)

A	$C2H4 + 3O2 \rightarrow 2CO2 + 2H2O$	B	$CH4 + 2O2 \rightarrow CO2 + 2H2O$
C	$CH4 + ½\ O2 \rightarrow CH3OH$ (Conditions:Cu, 400°C, 200 atm)	D	$C2H2 + 5/2\ O2 \rightarrow 2CO2 + H2O$

Solution: (b) Methane is the saturated one, and it burns to carbon dioxide and water.

Topic 14.14 Acidity of Alkynes

Past MDCAT Questions

MCQ 14.14.1 Which of the following compounds is more acidic? (MDCAT 2022)

A	alkane	B	alkene
C	alkyne	D	cycloalkane

Solution: (c) The sp carbon of a terminal alkyne holds its electrons closest, so its hydrogen comes off most readily.

MCQ 14.14.2 Which of the following reagents can be used to distinguish between 1-pentyne and 2-pentyne? (MDCAT 2023)

A	$AgNO_3 + NH_4OH$	B	dilute alkaline $KMnO_4$
C	Br_2/CCl_4	D	$K_2Cr_2O_7 + H_2SO_4$

Solution: (a) Only the terminal alkyne has an acidic hydrogen, so only 1-pentyne gives a silver acetylide precipitate.

MCQ 14.14.3 Terminal alkynes show acidic character due to: (UHS MDCAT 2025)

A	Terminal carbon atoms are sp hybridized.	B	Terminal carbon atoms are sp2 hybridized.
C	Terminal carbon atoms are sp3 hybridized.	D	Terminal carbon atoms show hydrogen bonding.

Solution: (a) The sp hybridized carbon holds its electrons close, so the terminal hydrogen leaves as a proton.

MCQ 14.14.4 Which among the following will react with ammonical cuprous chloride: (SZABMU MDCAT 2025)

A	1-butene	B	1-butyne
C	2-butene	D	2-butyne

Solution: (b) A terminal alkyne is acidic enough to give a red copper acetylide; but-2-yne has no terminal hydrogen.

MCQ 14.14.5 Which of the following compound is more acidic? (UHS MDCAT 2023)

A	Alkane	B	Alkene
C	Alkyne	D	Cycloalkane

Solution: (c) The sp carbon of a terminal alkyne holds its electrons closely, so its hydrogen leaves most readily.

MCQ 14.14.6 White precipitate is formed when _ _ _ _ is passed through ammoniacal solution of silver nitrate. (PMC MDCAT 2022)

A	Methylene	B	Ethylene
C	Acetylene	D	Vinylene

Solution: (c) A terminal alkyne is acidic enough to give a white silver acetylide.

MCQ 14.14.7 **What is the color of silver acetylide, AgC=CAg? (PMC Practice 2021)**

A	Red	B	White
C	Brown	D	Pinkish

Solution: (b) Silver acetylide comes down as a white precipitate.

Topic 14.15 Reactions of Alkynes

Past MDCAT Questions

MCQ 14.15.1 **Propanone can be prepared from propyne by: (MDCAT 2023)**

A	passing a mixture of propyne and steam over a catalyst of magnesium at $420^{\circ}C$	B	passing a mixture of propyne and ethanol over a catalyst of zinc chromate
C	boiling propyne with water in the presence of $HgSO_4$ and H_2SO_4	D	treating propyne with iodine and NaOH

Solution: (c) Acid-catalysed hydration of the triple bond follows Markovnikov's rule and gives the ketone.

MCQ 14.15.2 **Acetylene reacts with hydrogen bromide to form: (NUMS MDCAT 2025)**

A	2,2-Dibromoethane	B	1,1-Dibromoethane
C	1,2-Dibromoethane	D	1,1,2,2-Tetrabromoethane

Solution: (b) Both molecules of hydrogen bromide add by Markovnikov's rule to the same carbon.

Topic 14.8 Resonance and Resonance Energy

Past MDCAT Questions

MCQ 14.8.1 **Three alternate single and double bonds in benzene are called? (UHS MDCAT 2023)**

A	Conjugate bonds	B	Coordinate covalent bonds
C	Fixed bonds	D	Ionic bonds

Solution: (a) Alternating single and double bonds make a conjugated system, and the electrons of it are delocalized.

MCQ 14.8.2 **Benzene is more stable than hypothetical 1,3,5-cyclohexatriene by: (PMC MDCAT 2022)**

A	150.5 kJ/mol	B	150.5J/mol
C	150.5 kJ/molecule	D	150.5 J/molecule

Solution: (a) The resonance energy of benzene is about $150\,\mathrm{kJ\,mol^{-1}}$.

Topic 14.16 Substitution versus Addition

Past MDCAT Questions

MCQ 14.16.1 **Under suitable conditions, alkanes cannot undergo which of the following reactions? (MDCAT 2023)**

A	substitution	B	combustion
C	hydrogenation	D	addition

Solution: (d) An alkane is already saturated, so it has no place to add anything; it reacts by substitution.

MCQ 14.16.2 **Generally the decreasing order of reactivity is: (NUMS MDCAT 2025)**

A	Alkane > Alkynes > Alkene	B	Alkene < Alkynes < Alkanes
C	Alkene > Alkynes > Alkanes	D	Alkynes < Alkanes < Alkene

Solution: (c) The loose pi electrons of an alkene are the most available, and the saturated alkane has none.

MCQ 14.16.3 **The correct order of reactivity of hydrocarbons is: (SZABMU MDCAT 2023)**

A	Alkanes > Alkynes > Alkenes	B	Alkenes > Alkanes > Alkynes
C	Alkynes > Alkenes > Alkanes	D	Alkenes > Alkynes > Alkanes

Solution: (d) The loose pi electrons of an alkene are the most available, and the saturated alkane has none.

MCQ 14.16.4 **Under suitable conditions alkanes cannot undergo _____ reactions? (UHS MDCAT 2023)**

A	Substitution	B	Combustion
C	Hydrogenation	D	Addition

Solution: (d) An alkane is saturated, so nothing can add to it; it can only substitute or burn.

Topic 14.9 Reactivity of Benzene

Past MDCAT Questions

MCQ 14.9.1 **Which one of the following is not a characteristic of benzene? (UHS MDCAT 2025)**

A	Aromaticity	B	Stability
C	to follow Huckle rule	D	High reactivity

Solution: (d) Delocalization makes benzene unusually stable, so it substitutes rather than reacting readily.

MCQ 14.9.2 **Addition of three molecules of chlorine into benzene prove that benzene has (SZABMU MDCAT 2025)**

A	double bonds	B	non polar
C	planar	D	non planer

Solution: (a) Three molecules of chlorine add to it, which is what three double bonds would take.

MCQ 14.9.3 **Which of the following is not oxidized by any oxidizing agent? (SZABMU MDCAT 2023)**

A	Benzene	B	Toulene
C	Ethylbenzene	D	Xylene

Solution: (a) Benzene resists oxidation; the side chain of an alkylbenzene is oxidized instead.

MCQ 14.9.4 **Benzene is less reactive than its corresponding alkene due to: (PMC MDCAT 2022)**

A	More unsaturation	B	More saturation
C	Less electronegativlty difference between C and H atom	D	Delocalization of π electrons

Solution: (d) The pi electrons are spread over the whole ring, so they are not available as an alkene's are.

MCQ 14.9.5 **Which of the following is not an aromatic compound? (PMC Practice 2021)**

A	Anthracene	B	Naphthalene
C	Phenol	D	None of these options is correct

Solution: (d) Anthracene, naphthalene and phenol are all aromatic, so none is the exception.

Topic 14.12 IUPAC Nomenclature of Alkynes

Past MDCAT Questions

MCQ 14.12.1 **The IUPAC name of Vinyl acetylene is: (SIBA MDCAT 2025)**

A	But-1-en-3-yne	B	But-3-en-1-yne
C	Pent-3-en-1-yne	D	Pent-2-en-4-yne

Solution: (a) The chain of four carbons carries the double bond at position 1 and the triple bond at position 3.

Topic 15.1 Nomenclature of Alkyl Halides

Past MDCAT Questions

MCQ 15.1.1 Neopentyl chloride belongs to which class of alkyl halides? (MDCAT 2022)

A	primary alkyl halides	B	secondary alkyl halides
C	tertiary alkyl halides	D	quaternary alkyl halides

Solution: (a) The carbon carrying the chlorine is attached to only one other carbon, so the halide is primary even though the molecule is branched.

MCQ 15.1.2 IUPAC name of (CH3)3 CCH2 Br is (UHS MDCAT 2025)

A	1-bromopentane	B	1-bromo-2,2,2-trimethylethane
C	1-bromo-2,2-dimethylpropane	D	2-bromopentane

Solution: (c) The longest chain is propane, with two methyl groups on carbon 2 and the bromine on carbon 1.

MCQ 15.1.3 IUPAC name of chloroform is: (SZABMU MDCAT 2025)

A	methylchloride	B	methyltrichloride
C	trichloromethane	D	chloromethane

Solution: (c) Chloroform is methane with three of its hydrogens replaced, that is trichloromethane.

MCQ 15.1.4 Freon is commonly known as ? (UHS MDCAT 2023)

A	Refrigerant	B	A solvent
C	Insecticides	D	A fire extinguisher

Solution: (a) The freons are chlorofluorocarbons, used as refrigerants for their low boiling points and inertness.

MCQ 15.1.5 Alkyl halides are also known as Halogen derivatives of: (SZABMU MDCAT 2023)

A	Alkanes	B	Alkenes
C	Alkynes	D	Alcohols

Solution: (a) An alkyl halide is an alkane with a halogen in place of a hydrogen.

MCQ 15.1.6 2-chlorobutane belongs to: (PMC MDCAT 2022)

A	Primary Alkyl Halides	B	Secondary Alkyl Halides
C	Tertiary Alkyl Halides	D	Quarternary Alkyl Halides

Solution: (b) The chlorine is on carbon 2, which carries two other carbons, so the halide is secondary.

MCQ 15.1.7 The correct name of CH2Cl2 is: (PMC MDCAT 2022)

A	Methyl chloride	B	Methylene chloride
C	Chloroform	D	Carbonyl chloride

Solution: (b) Dichloromethane is commonly called methylene chloride.

MCQ 15.1.8 Halothane is a halo derivative of: (UHS MDCAT 2018)

A	Methane	B	Ethane
C	Methanol	D	Ethanol

Solution: (b) Halothane is 2-bromo-2-chloro-1,1,1-trifluoroethane.

MCQ 15.1.9 Chloroform is used as the following except: (UHS MDCAT 2017)

A	Precursor of making Teflon	B	Precursor of making refrigerants
C	Anesthetic	D	Embalming chemicals

Solution: (d) Chloroform is a solvent, an anaesthetic and a precursor of refrigerants; formalin is what preserves tissue.

Topic 15.2 Structure and Reactivity of Alkyl Halides

Past MDCAT Questions

MCQ 15.2.1 Identify the correct ascending order of reactivity of alkyl halides: (MDCAT 2024)

A	Cl, Br, I, F	B	F, Cl, Br, I
C	Br, I, F, Cl	D	I, F, Cl, Br

Solution: (b) The weaker the carbon-halogen bond the better the leaving group, and that bond weakens from fluorine to iodine.

MCQ 15.2.2 The order of reactivity of following R-X for SN reaction is: (SIBA MDCAT 2025)

A	RF>RCl>RBr>RI	B	RBr>RF>RCl>RI
C	RCl>RF>RBr>RI	D	RI>RBr>RCl>RF

Solution: (d) The weakest carbon halogen bond breaks most readily, and that is the bond to iodine.

MCQ 15.2.3 Reactivity of order of halogen acid is: (SZABMU MDCAT 2023)

A	HF > HCl > HBr > HI	B	HBr > HCl > HI
C	HCl > HBr > HI > HF	D	HI > HBr > HCl > HF

Solution: (d) The weakest bond breaks first, and the bond to hydrogen is weakest in hydrogen iodide.

MCQ 15.2.4 Grignard reagent is formed when alkyl halide reacts in the presence of halogen with: (SZABMU MDCAT 2023)

A	Calcium	B	Potassium
C	Sodium	D	Magnesium

Solution: (d) Magnesium in dry ether inserts itself into the carbon halogen bond to give the Grignard reagent.

MCQ 15.2.5 In SNI reactions the correct order of reactivity of alkyl halide is? (UHS MDCAT 2023)

A	Primary>secondary>tertiary	B	Tertiary>secondary>primary
C	Secondary>primary>tertiary	D	Primary>tertiary >secondary

Solution: (b) The first step makes a carbocation, and that is most stable for the tertiary halide.

MCQ 15.2.6 Which one of the following is a strong nucleophile? (PMC MDCAT 2022)

A	Cl-	B	Br-
C	OH-	D	HSO4-

Solution: (c) The hydroxide ion carries a full negative charge on a small atom, so it is the strongest nucleophile here.

MCQ 15.2.7 Which of the following is a poor 'leaving' group in nucleophilic substitution reactions? (PMC Practice 2021)

A	Cl-	B	Br-
C	I-	D	OH-

Solution: (d) The hydroxide ion is a strong base and holds on to its electrons, so it leaves reluctantly.

MCQ 15.2.8 Which of the following alkyl halides is most reactive towards the Mg atom? (PMC Practice 2021)

A	Alkyl bromide	B	Alkyl fluoride
C	Alkyl chloride	D	Alkyl iodide

Solution: (d) The carbon iodine bond is the weakest, so the iodide reacts most readily with magnesium.

MCQ 15.2.9 **R-X on reaction with alcohols form: (PMC MDCAT 2020)**

A	R-OH	**B**	ROR
C	R-X-OH	**D**	RH

Solution: (b) The alkoxide displaces the halide and an ether is left, which is Williamson's synthesis.

MCQ 15.2.10 **Which of the following acts as a nucleophile in the reaction of alkyl halide with alcoholic / aqueous ammonia? (UHS MDCAT 2018)**

A	H+	**B**	NH3
C	NO2+	**D**	Br-

Solution: (b) The lone pair of the nitrogen of ammonia attacks the carbon and displaces the halide.

Topic 15.3 Substitution versus Elimination

Past MDCAT Questions

MCQ 15.3.1 **In S_N1 reactions the correct order of reactivity of alkyl halides is: (MDCAT 2023)**

A	primary > secondary > tertiary	**B**	tertiary > secondary > primary
C	secondary > tertiary > primary	**D**	tertiary > primary > secondary

Solution: (b) The step that decides the rate is the formation of the carbocation, and a tertiary carbocation is the most stable.

MCQ 15.3.2 **Identify the correct statement related to substitution and elimination of alkyl halides: (MDCAT 2024)**

A	strong bases cause substitution in preference to elimination	**B**	the role of leaving groups in elimination is similar to that in substitution
C	substitution is favoured more than elimination by decreasing solvent polarity	**D**	a decrease in temperature will favour elimination more than substitution

Solution: (b) Both reactions need the halide to leave, so a better leaving group speeds up either one; strong bases and higher temperatures favour elimination.

MCQ 15.3.3 **Alkyl halides involving C-X bond breakage and C-Nu bond formation simultaneously would follow which one of the following mechanisms? (MDCAT 2024)**

A	S_N1	**B**	S_N2
C	E1	**D**	E2

Solution: (b) In S_N2 the nucleophile attacks as the halide leaves, in one step through a single transition state.

MCQ 15.3.4 **Racemic mixture formed in SN1 reaction is due to presence of empty: (NUMS MDCAT 2025)**

A	s-orbital	**B**	p-orbital
C	sp3-orbital	**D**	sp2-orbital

Solution: (b) The carbocation of the first step is flat, so the nucleophile can come in from either face.

MCQ 15.3.5 **Reaction of 2-Bromobutane with alcoholic KOH yields: (SZABMU MDCAT 2025)**

A	2-Butanol	**B**	2-Butene
C	2-Butyne	**D**	1-Butanol

Solution: (b) Alcoholic potash favours elimination, so hydrogen bromide is lost and the alkene is left.

MCQ 15.3.6 **Dehydrohalogenation of alkylhalide is carried out in presence of (KMU MDCAT 2024)**

A	Alcoholic KOH	**B**	Aqueous KOH
C	Conc. H2SO4	**D**	Zn dust

Solution: (a) Alcoholic potash favours elimination; aqueous potash would substitute and give the alcohol.

MCQ 15.3.7 **When 2-bromopropane reacts with Sodium ethoxide, the major product is/are? (UHS MDCAT 2023)**

A	Propane	**B**	Propene
C	Ethyl isopropyl ether	**D**	All are formed

Solution: (b) Ethoxide is a strong base, so elimination wins over substitution and propene is left.

MCQ 15.3.8 **Which alkyl halide gives SN2 reactions? (PMC Practice 2021)**

A	Secondary	**B**	Primary
C	Tertiary	**D**	All of these

Solution: (b) A primary halide is least crowded, so the nucleophile can reach the carbon from behind.

MCQ 15.3.9 **During the course of an SNI reaction, the intermediate species formed is: (PMC Practice 2021)**

A	A carbocation	**B**	A free radical
C	A carbanion	**D**	An intermediate complex

Solution: (a) The halide leaves first and a carbocation is left behind.

MCQ 15.3.10 **Which of the following compete with each other? (PMC Practice 2021)**

A	E1, E2	**B**	E1, S2
C	E2, SI	**D**	E2, S2

Solution: (d) Both need a nucleophile attacking the same molecule, so elimination and substitution compete.

MCQ 15.3.11 **What is the value of molecularity and order of SNI reactions? (PMC Practice 2021)**

A	2, 1	**B**	1, 1
C	0, 1	**D**	0, 2

Solution: (b) The slow step involves the halide alone, so it is unimolecular and first order.

MCQ 15.3.12 **SNI reaction is a? (PMC Practice 2021)**

A	Multi-step reaction	**B**	Two-step reactions
C	Concerted reaction	**D**	Three-step reaction

Solution: (b) The halide leaves in the first step and the nucleophile adds in the second.

MCQ 15.3.13 **Alkyl halides involving -C-X bond breakage and -C-Nu bond formation simultaneously would follow the mechanism: (PMC MDCAT 2020)**

A	SNI	**B**	SN2
C	EI	**D**	E2

Solution: (b) In an SN2 reaction the nucleophile comes in as the halide goes out, in one step.

MCQ 15.3.14 **Which product is obtained by the hydrolysis of 1-chlorobutane with the aqueous sodium hydroxide? (UHS MDCAT 2019)**

A	1-butanal	**B**	1-butanol
C	1-butene	**D**	Butanone

Solution: (b) Aqueous alkali substitutes hydroxide for the halogen and gives the alcohol.

MCQ 15.3.15 **Which compound is obtained by the elimination of bromopropane? (UHS MDCAT 2018)**

A	Propene	**B**	Ether
C	Aldehyde	**D**	Ester

Solution: (a) Losing hydrogen bromide from bromopropane leaves propene.

MCQ 15.3.16 **In elimination reactions, _____ is used: (UHS MDCAT 2017)**

A	Acidic K2Cr2O7	**B**	CuCl
C	Acidic NaOH	**D**	Alcoholic KOH

Solution: (d) Alcoholic potash favours elimination and leaves the alkene.

MCQ 15.3.17 **Among the alkyl halides, which always follows SN2 mechanism: (UHS MDCAT 2017)**

A	Primary alkyl halides	B	Secondary alkyl halides
C	Tertiary alkyl halides	D	Both Secondary & Tertiary alkyl halides

Solution: (a) A primary halide is least crowded, so the nucleophile can reach the carbon from behind.

MCQ 15.3.18 **Which of the following is an intermediate compound in SNI: (UHS MDCAT 2017)**

A	Ethoxide ion	B	Alkyl halide
C	Alkene	D	Carbocation

Solution: (d) The halide leaves first and a carbocation is left behind.

Unit 16 Alcohols and Phenols

Topic 16.1 Nomenclature, Structure and Reactivity of Alcohols

Past MDCAT Questions

MCQ 16.1.1 **What is the common name of 1,2,3-propanetriol? (MDCAT 2022)**

A	butyl alcohol	B	glycol
C	glycerol	D	propyl alcohol

Solution: (c) Three hydroxyl groups on a propane chain make glycerol.

MCQ 16.1.2 **Ethanol gives which of the following products in the presence of H_2SO_4 at $140^\circ C$? (MDCAT 2023)**

A	ether	B	alkene
C	ethyl acetate	D	aldehyde

Solution: (a) At $140^\circ C$ two molecules of alcohol condense to diethyl ether; at $180^\circ C$ the product is ethene instead.

MCQ 16.1.3 **The complete oxidation of a primary alcohol gives which of the following? (MDCAT 2023)**

A	aldehyde	B	alkene
C	carboxylic acid	D	ketone

Solution: (c) The aldehyde is only the halfway stage; oxidation carried to completion gives the acid.

MCQ 16.1.4 **Which of the following alcohols can give the iodoform reaction? (MDCAT 2024)**

A	methanol	B	1-butanol
C	1-propanol	D	ethanol

Solution: (d) The test needs a $CH_3CH(OH)-$ group, and of these only ethanol has one.

MCQ 16.1.5 **Which of the following alcohols will give oily layer upon heating? (NUMS MDCAT 2025)**

A	3-Methyl-2-butanol	B	2-Methyl-2-butanol
C	2-Butanol	D	Ethyl alcohol

Solution: (b) A tertiary alcohol reacts at once in the Lucas test, and the halide separates as an oily layer.

MCQ 16.1.6 **The order of reactivity of alcohol with respect to cleavage of C–O bond: (NUMS MDCAT 2025)**

A	Tertiary > Secondary > Primary	B	Primary > Tertiary > Secondary
C	Secondary > Tertiary > Primary	D	Tertiary < Secondary < Primary

Solution: (a) The tertiary carbocation is the most stable, so the carbon oxygen bond breaks most readily there.

MCQ 16.1.7 **Rate of dehydration of alcohol is: (SIBA MDCAT 2025)**

A	3°>2°>1°	B	1°>3°>2°
C	2°>3°>1°	D	3°>1°>2°

Solution: (a) Dehydration goes through a carbocation, and the tertiary one is the most stable.

MCQ 16.1.8 **Which of the following alcohol can give Iodoform reaction? (UHS MDCAT 2024)**

A	Methanol	B	1-Butanol
C	1-Propanol	D	Ethanol

Solution: (d) Only an alcohol with a $CH_3CH(OH)$ group gives iodoform, and ethanol is the one here.

MCQ 16.1.9 **Which of the following has the highest boiling point? (KMU MDCAT 2024)**

A	ethyl alcohol	B	isopropyl alcohol
C	n-propyl alcohol	D	tert-butyl alcohol

Solution: (c) The straight chain has the largest surface for its dispersion forces, so n-propyl alcohol boils highest.

MCQ 16.1.10 **The reaction of an alcohol with sodium produces (KMU MDCAT 2024)**

A	Aldehyde	B	Alkoxide
C	Ethane	D	Ethene

Solution: (b) Sodium displaces the hydrogen of the hydroxyl group and leaves the sodium alkoxide.

MCQ 16.1.11 **Oxidation of secondary alcohol gives (KMU MDCAT 2024)**

A	Carboxylic acid	B	Ether
C	Ketone	D	Phenol

Solution: (c) A secondary alcohol has one hydrogen on the carbinol carbon, so oxidation stops at the ketone.

MCQ 16.1.12 **The increasing order of reactivity of alcohols towards nucleophile is: (NUMS MDCAT 2024)**

A	2-methyl-2-pentanol < 3-methyl-2-pentanol < 2-methyl-1-pentanol	B	2-methyl-1-pentanol > 3-methyl-2-pentanol > 2-methyl-2-pentanol
C	2-methyl-2-pentanol > 3-methyl-2-pentanol > 2-methyl-1-pentanol	D	2-methyl-2-pentanol < 2-methyl-1-pentanol < 3-methyl-2-pentanol

Solution: (a) Attack by a nucleophile is easiest where the carbon is least crowded, that is at the primary alcohol.

MCQ 16.1.13 **The most reactive alcohol towards Lucas reagent is: (NUMS MDCAT 2024)**

A	2-butanol	B	2-methyl-1-butanol
C	2-methyl-2-butanol	D	2,2-dimethyl-1-butanol

Solution: (c) Lucas reagent works fastest on a tertiary alcohol, and only the third is tertiary.

MCQ 16.1.14 **The order of reactivity of alcohol when C-O bond breaks is: (NUMS MDCAT 2023)**

A	Tertiary alcohol > secondary alcohol > Primary alcohol	B	Secondary alcohol > primary alcohol > tertiary alcohol
C	Primary alcohol > secondary alcohol > tertiary alcohol	D	Tertiary alcohol > primary alcohol > secondary alcohol

Solution: (a) The carbocation left when the bond breaks is most stable for the tertiary alcohol.

MCQ 16.1.15 **Complete oxidation of alcohol gives which of the following? (UHS MDCAT 2023)**

A	Aldehyde	B	Alkane
C	Carboxylic acid	D	Ketone

Solution: (c) A primary alcohol is oxidized first to the aldehyde and then on to the acid.

MCQ 16.1.16 **How are carboxylic acids formed from alcohol? (PMC Practice 2021)**

A	Hydrolysis	B	Reduction
C	Oxidation	D	Protonation

Solution: (c) A primary alcohol is oxidized first to the aldehyde and then on to the acid.

MCQ 16.1.17 **Which one of them is used as an automobile antifreeze? (PMC Practice 2021)**

A	Ethanol	B	Ethene
C	Ethylene glycol	D	Propene

Solution: (c) Ethylene glycol lowers the freezing point of the water in a radiator.

MCQ 16.1.18 **In the Lucas test, tertiary alcohols form an oily layer of alkyl halide _____. (PMC Practice 2021)**

A	On heating	B	Immediately
C	After 5-10 minutes	D	After 20 minutes

Solution: (b) A tertiary alcohol reacts at once, and the halide separates as an oily layer.

MCQ 16.1.19 **Which of the following reactions is used for the production of alcohols on industrial scale? (UHS MDCAT 2019)**

A	Hydrogenation of alkenes	B	Hydration of alkenes
C	Hydrohalogenation of alkenes	D	Hydroxylation of alkenes

Solution: (b) Ethene and steam over phosphoric acid give ethanol, which is how most industrial alcohol is made.

MCQ 16.1.20 **Treatment of ethene with cold sulphuric acid, followed by reaction with boiling water, yields: (UHS MDCAT 2019)**

A	Ethane	B	Ethanal
C	Ethanol	D	Ethyne

Solution: (c) The ethyl hydrogen sulphate formed in the cold hydrolyses on boiling to ethanol.

MCQ 16.1.21 **Why is it necessary to distill aldehyde formed from oxidation of primary alcohol through acidified potassium dichromate (VI) solution or acidified sodium dichromate (VI) solution? (UHS MDCAT 2018)**

A	Aldehyde formed may be oxidized further to carboxylic acid concerned	B	Aldehyde formed is unstable and decompose back to original precursor i.e. primary alcohol
C	Aldehyde may be oxidised further to a ketone	D	Aldehyde formed may react with primary alcohol, the original reactant.

Solution: (a) The aldehyde boils below the alcohol, so distilling it off as it forms keeps it from being oxidized further.

MCQ 16.1.22 **Select one which is alcohol. (UHS MDCAT 2018)**

A	CH3- CH2- Br	B	CH3- O - CH3
C	CH3COOH	D	CH3- CH2- OH

Solution: (d) Ethanol carries the hydroxyl group on a saturated carbon, so it is an alcohol.

MCQ 16.1.23 **Alcohol in which carbon atom bonded to OH group is further attached with three alkyl group is: (UHS MDCAT 2018)**

A	Tertiary alcohol	B	Primary alcohol
C	Aromatic alcohol	D	Secondary alcohol

Solution: (a) A carbinol carbon carrying three alkyl groups makes a tertiary alcohol.

MCQ 16.1.24 **Which one of the following compounds is known as tertiary alcohol? (UHS MDCAT 2018)**

A	1 - Propanol	B	2- methyl - 2- propanol
C	2- methyl - 1- propanol	D	2 - propanol

Solution: (b) 2-methylpropan-2-ol carries three methyl groups on the carbinol carbon.

MCQ 16.1.25 **Reaction of alcohol with hydrogen chloride yields: (UHS MDCAT 2017)**

A	Alkyl Halide	B	Carboxylic acid
C	Aldehyde	D	Ester

Solution: (a) Hydrogen chloride replaces the hydroxyl group and leaves the alkyl chloride.

MCQ 16.1.26 **Dehydration of methyl alcohol with concentrated sulphuric acid gives: (UHS MDCAT 2017)**

A	CH3CHO	B	C2H4
C	HCHO	D	None of these

Solution: (d) Methanol has only one carbon, so it cannot give an alkene or a symmetrical ether by simple dehydration.

MCQ 16.1.27 **Which one of the following is NOT able to denature the ethanol? (UHS MDCAT 2015)**

A	Methanol	B	Lactic acid
C	Pyridine	D	Acetone

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Solution: (b) Denaturing means adding something poisonous or foul; lactic acid is neither.

MCQ 16.1.28 **How will you distinguish between methanol and ethanol? (UHS MDCAT 2015)**

A	By Lucas test	B	By silver mirror test
C	By oxidation	D	By Iodoform test

Solution: (d) Ethanol has the $CH_3CH(OH)$ grouping and gives iodoform; methanol does not.

MCQ 16.1.29 **To produce absolute alcohol (100%) from rectified spirit (95.6% alcohol), the remaining 4.4% water must be removed by a drying agent such as (UHS MDCAT 2015)**

A	Calcium oxide	B	Calcium chloride
C	Calcium carbonate	D	Carbon monoxide

Solution: (a) Quicklime takes up the last of the water and leaves absolute alcohol.

Topic 16.2 Nomenclature, Structure and Reactivity of Phenols

Past MDCAT Questions

MCQ 16.2.1 **If phenol is treated with 3 moles of concentrated HNO_3 in the presence of H_2SO_4, what will be the product? (MDCAT 2023)**

A	o-nitrophenol	B	p-nitrophenol
C	o-nitrophenol and p-nitrophenol	D	picric acid

Solution: (d) Three nitro groups enter the activated ring at positions 2, 4 and 6, giving 2,4,6-trinitrophenol, which is picric acid.

MCQ 16.2.2 **In a molecule of phenol, the carbon atom which is attached to -OH group is: (KMU MDCAT 2025)**

A	sp hybridized	B	sp2 hybridized
C	sp3 hybridized	D	unhybridized

Solution: (b) That carbon is part of the aromatic ring, so it is sp2 hybridized.

MCQ 16.2.3 **Common name of 1,3 benzene diol is: (SZABMU MDCAT 2025)**

A	Pyrogallol	B	Cresol
C	Resorcinol	D	Catechol

Solution: (c) Benzene-1,3-diol is resorcinol; the 1,2 isomer is catechol.

MCQ 16.2.4 **Phenols are very reactive towards: (SZABMU MDCAT 2023)**

A	Oxidizing agent	B	Reducing agent
C	Dehydrating agent	D	Hygroscopic agent

Solution: (a) The ring is electron rich, so phenol is oxidized easily, to quinone.

MCQ 16.2.5 **If phenol is treated with 3 moles of conc. HNO3 in the presence of H2SO4 what will be the product? (UHS MDCAT 2023)**

A	o-nitro phenol	B	p-nitro phenol
C	o-nitro phenol and p-nitro phenol	D	picric acid

Solution: (d) Three nitro groups go on to the ring and the product is 2,4,6-trinitrophenol, picric acid.

MCQ 16.2.6 **Benzene can be formed from phenol in which of the following reactions? (NUMS MDCAT 2022)**

A	Reduction with hydrogen in the presence of Ni	B	Reduction with zinc
C	Reduction with alkali	D	Reduction with acids

Solution: (b) Distilling phenol with zinc dust takes the oxygen away and leaves benzene.

MCQ 16.2.7 **Phenol has following characteristics and physical properties: (NUMS MDCAT 2022)**

A	colorless crystalline solid	B	colorless crystalline deliquescent solid
C	Colorless amorphous solid	D	Colorless amorphous deliquescent solid

Solution: (b) Phenol is a colourless crystalline solid that takes up water from the air and turns pink on standing.

MCQ 16.2.8 **Phenol reacts with calcium carbonate and evolve _____? (PMC Practice 2021)**

A	H2 gas	B	CO2 gas
C	O2	D	None of these

Solution: (d) Phenol is a weaker acid than carbonic acid, so it cannot displace carbon dioxide from a carbonate.

MCQ 16.2.9 **Phenol is more acidic than alcohols because of the following reason: (PMC MDCAT 2020)**

A	Delocalization of negative charge in OH group	B	Delocation of positive charge on the carbon atom in ring
C	Delocalization of negative charge in the ring	D	Delocalization of positive charge in the OH group

Solution: (c) The ring spreads the negative charge of the phenoxide ion, which an alkoxide cannot do.

MCQ 16.2.10 **Phenol is known as: (PMC MDCAT 2020)**

A	Carpolic acid	B	Carbonylic acid
C	Carbolic acid	D	Carbolylic acid

Solution: (c) Phenol is known as carbolic acid.

MCQ 16.2.11 **Which of the following compounds is solid at room temperature? (UHS MDCAT 2018)**

A	Ethanol	B	Butane
C	Methanol	D	Phenol

Solution: (d) Phenol melts at about 41°C, so it is a solid at room temperature.

MCQ 16.2.12 **At 25°C with phenol 2-4-Dinitrophenol is formed by the reaction of: (UHS MDCAT 2017)**

A	(HNO3 +H2SO4) with benzene	B	(HNO3 +H2SO4) with phenol
C	NaOH with Benzene sulphonic acid	D	Sodium phenotype with HCl

Solution: (b) Phenol is nitrated far more readily than benzene, giving the 2,4-dinitro compound in the cold.

MCQ 16.2.13 **Sodium phenoxide on treating with hydrochloric acids yields: (UHS MDCAT 2017)**

A	Benzene	B	Benzoic acid
C	Phenol	D	Benzaldehyde

Solution: (c) The stronger acid displaces the weaker phenol from its salt.

MCQ 16.2.14 **The acidity of Phenol is due to its _____: (UHS MDCAT 2017)**

A	Nature of Benzene	B	Double bond in benzene ring
C	Nature of phenoxide	D	Hyoxal group

Solution: (c) The ring delocalizes the charge of the phenoxide ion, so the proton is readily lost.

MCQ 16.2.15 **Which one of the following was used as one of the earliest antiseptic and disinfectant? (UHS MDCAT 2015)**

A	Phenol	B	Ether
C	Ethanol	D	Methanol

Solution: (a) Phenol was Lister's antiseptic, the first used in surgery.

Topic 16.3 Alcohols and Phenols Compared

Past MDCAT Questions

MCQ 16.3.1 **Which of the following is correct regarding phenol? (MDCAT 2024)**

A	phenol and water are equally acidic	B	phenol is less acidic than carboxylic acid
C	phenol is less acidic than water	D	phenol is less acidic than ethanol

Solution: (b) Phenol is more acidic than water and ethanol because its anion is stabilized by the ring, but weaker than a carboxylic acid.

MCQ 16.3.2 **Which of the following best explains why phenol reacts with aqueous NaOH, but alcohols do not? (UHS MDCAT 2025)**

A	Phenol has a lower boiling point than alcohol.	B	Alcohols contain a strong O-H bond that cannot be broken by weak bases.
C	Phenol form hydrogen bonding that facilitates ionization.	D	Phenol is weakly acidic due to resonance stabilization of phenoxide ion.

Solution: (d) The ring delocalizes the charge of the phenoxide ion, so phenol is acidic enough to give a salt with sodium hydroxide.

MCQ 16.3.3 **Phenol differs from ethanol because it: (SIBA MDCAT 2025)**

A	Forms stronger hydrogen bonds to its aromatic ring	**B**	Is more acidic because of resonance stabilized conjugate base
C	Readily undergoes nucleophilic substitution at the -OH group	**D**	Is completely insoluble in water due to its benzene ring

Solution: (b) The ring spreads the negative charge of the phenoxide ion, which ethanol cannot do, so phenol is the stronger acid.

MCQ 16.3.4 **Both alcohols and phenols contain: (SZABMU MDCAT 2023)**

A	- OH group	**B**	- COOH group
C	- CH2 group	**D**	- CHO group

Solution: (a) Both carry the hydroxyl group; in a phenol it is attached to a benzene ring.

MCQ 16.3.5 **Which of the following reactions differentiates alcohol from phenol? (NUMS MDCAT 2023)**

A	Lucas test	**B**	Halogenations
C	Nitration	**D**	Iodoform test

Solution: (a) Lucas reagent reacts with alcohols; phenol does not give a halide at all.

MCQ 16.3.6 **Which of the following reactions are given by alcohol and phenol both? (PMC MDCAT 2022)**

A	Esterification	**B**	Nitrosation
C	Amide formation	**D**	Lucas Reaction

Solution: (a) Both the alcohol and the phenol give esters with an acid chloride or anhydride.

MCQ 16.3.7 **Lucas test is used for the identification of: (NUMS MDCAT 2022)**

A	Alkyl halides	**B**	Alcohols
C	Alkene	**D**	Carboxylic acids

Solution: (b) Lucas reagent tells primary, secondary and tertiary alcohols apart by how fast each turns cloudy.

Unit 17 Aldehydes and Ketones

Topic 17.1 Nomenclature and Structure of Aldehydes and Ketones

Past MDCAT Questions

MCQ 17.1.1 **Which of the following is the correct name of $CH_3CH_2CH_2COCH_2CHO$? (MDCAT 2022)**

A	3-oxohexanal	**B**	3-onehexanal
C	3-oxohexanone	**D**	hexanedial

Solution: (a) The aldehyde takes the suffix and is carbon 1, so the ketone at carbon 3 is named as an oxo prefix.

MCQ 17.1.2 Double subscripts: use braces to clarify **is the general formula of: (MDCAT 2024)**

A	ethers	**B**	carboxylic acids
C	ketones	**D**	carbolic acid

Solution: (c) Aldehydes and ketones share this formula; of the options only the ketones fit.

MCQ 17.1.3 **Formalin is a mixture of: (NUMS MDCAT 2025)**

A	40% HCHO, 8% CH3OH, 52% H2O	**B**	40% CH3CHO, 8% CH3OH, 50% H2O
C	40% CH3CHO, 8% C2H5OH, 50% H2O	**D**	45% HCHO, 8% C2H5OH, 50% H2O

Solution: (a) Formalin is the 40% aqueous solution of formaldehyde, with a little methanol to stop it polymerizing.

MCQ 17.1.4 **Q.115 Which of the following is the correct name of CH3CH2CH2COCH2CHO? (UHS MDCAT 2023)**

A	3-oxo hexanal	**B**	3-one hexanal
C	3-oxo hexanol	**D**	3- keto hexanol

Solution: (a) The aldehyde is the senior group, so the chain is hexanal with the ketone named as a 3-oxo substituent.

MCQ 17.1.5 **Q.119 If carboxylic acid and ketone groups C=O are present in a chain then final name will be given as (UHS MDCAT 2023)**

A	oxo, oic acid	**B**	one, oic acid
C	Both 1 and 2	**D**	None of these

Solution: (a) The acid takes the suffix and the ketone is named as an oxo substituent.

MCQ 17.1.6 **What is the ILIPAC name of diisopropyi ketone? (UHS MDCAT 2023)**

A	1,3-Dilsopropylpropan-2-one	**B**	2,4-Dimethylpentan-3-one
C	2,4-Dimethylpentan-2-one	**D**	1,3-Dimethylpropan-2-one

Solution: (b) The longest chain is pentane with the carbonyl at C3 and a methyl on C2 and C4.

MCQ 17.1.7 **Aldehyde common names are derived from carboxylic acid names with the same number of: (PMC MDCAT 2022)**

A	Hydrogen atoms	**B**	Carbon atoms
C	Oxygen atoms	**D**	Carbon and hydrogen atoms

Solution: (b) Formaldehyde is named from formic acid, acetaldehyde from acetic acid, and so on.

MCQ 17.1.8 **The carbonyl compound which is attached with at least one H atom at one side is called as? (PMC Practice 2021)**

A	Ketones	**B**	Aldehydes
C	Ethers	**D**	Alkyl halides

Solution: (b) An aldehyde has at least one hydrogen on the carbonyl carbon; a ketone has two alkyl groups.

Topic 17.4 Reactions of Aldehydes and Ketones

Past MDCAT Questions

MCQ 17.4.1 **Which of the following is also called the silver mirror test? (MDCAT 2022)**

A	Benedict's solution test	**B**	Fehling's solution test
C	iodoform test	**D**	Tollen's reagent test

Solution: (d) The aldehyde reduces the silver ion of Tollen's reagent to metallic silver, which plates the tube.

MCQ 17.4.2 **The blue colour of Fehling's solution is changed to red when warmed with an aldehyde due to the formation of: (MDCAT 2024)**

A	NO_2	**B**	Cu_2O
C	Ag_2O	**D**	SO_2

Solution: (b) The aldehyde reduces copper(II) to a red precipitate of copper(I) oxide.

MCQ 17.4.3 **The reaction of HCN with formaldehyde is a: (MDCAT 2024)**

A	nucleophilic addition reaction	**B**	nucleophilic substitution reaction
C	electrophilic addition reaction	**D**	electrophilic substitution reaction

Solution: (a) The cyanide ion adds to the carbon of the polar carbonyl group, giving a cyanohydrin.

MCQ 17.4.4 **Acetaldehyde undergoes oxidation to produce acetic acid, In this reaction oxidizing agent used is: (UHS MDCAT 2025)**

A	HI	**B**	LiAlH4
C	K2Cr2O7	**D**	NaBH4

Solution: (c) Acidified potassium dichromate oxidizes the aldehyde to the acid; the hydrides are reducing agents.

MCQ 17.4.5 **Methanol is produced by reduction of (UHS MDCAT 2025)**

A	Formaldehyde	**B**	Acetaldehyde
C	Propanal	**D**	Propanone

Solution: (a) Reducing the simplest aldehyde, formaldehyde, gives the simplest alcohol, methanol.

MCQ 17.4.6 **Polymerization of HCHO and CH3CHO occurs in the presence of: (NUMS MDCAT 2025)**

A	Conc. H2SO4	**B**	Dil. H2SO4
C	Conc. H2CO3	**D**	Dil. H2CO3

Solution: (a) Concentrated sulphuric acid polymerizes formaldehyde and acetaldehyde to trioxane and paraldehyde.

MCQ 17.4.7 **During Clemmenson reduction of aldehyde and ketone, carbonyl group into alkane group is carried out with: (SIBA MDCAT 2025)**

A	H2 and Pd	**B**	LiAlH4
C	Zn/Hg conc.HCl	**D**	NH2-NH2/KOH

Solution: (c) Clemmensen reduction uses zinc amalgam with concentrated hydrochloric acid to take the carbonyl down to a methylene group.

MCQ 17.4.8 **The blue color of Fehling solution is changed to red when warmed with an aldehyde due to formation of which of the following? (UHS MDCAT 2024)**

A	NO2	**B**	Cu2O
C	AgO	**D**	SO2

Solution: (b) The aldehyde reduces the copper(II) of Fehling's solution to a red precipitate of copper(I) oxide.

MCQ 17.4.9 **Reaction of HCN with formaldehyde is a: (UHS MDCAT 2024)**

A	Nucleophilic addition reaction	**B**	Nucleophilic substitution reaction
C	Electrophilic addition reaction	**D**	Electrophilic substitution reaction

Solution: (a) The cyanide ion attacks the electron poor carbonyl carbon, so the step is nucleophilic addition.

MCQ 17.4.10 **Compound A + I2 + Na2CO3 → Compound B + RCOONa + NaI + H2O. Identify compound B: (NUMS MDCAT 2024)**

A	Acetone	**B**	Acetic acid
C	Acetamide	**D**	Acetic anhydride

Solution: (a) A methyl ketone gives iodoform with iodine and alkali, and the ketone here is acetone.

MCQ 17.4.11 **When Phenol reacts with formaldehyde, which of the following product is produced? (UHS MDCAT 2023)**

A	Adduct	**B**	Hydronium ion
C	Oxonium ion	**D**	Phenoxide ion

Solution: (a) The ring attacks the carbonyl carbon and an addition product, the adduct, is formed first.

MCQ 17.4.12 **Which of the following is also called silver mirror test? (UHS MDCAT 2023)**

A	Benedict's solution test	**B**	Fehling's solution test
C	Iodoform test	**D**	Tollen's reagent test

Solution: (d) Tollens' reagent leaves a mirror of silver on the wall of the tube.

MCQ 17.4.13 **Catalytic reduction of Aldehyde & Ketone forms: (SZABMU MDCAT 2023)**

A	Alcohol	**B**	Carboxylic acid
C	Alkane	**D**	Aldehyde

Solution: (a) Hydrogen over a metal catalyst takes the carbonyl group down to an alcohol.

MCQ 17.4.14 **When Aldehyde reacts with 50% NaOH, this reaction is called as: (SZABMU MDCAT 2023)**

A	2, 4 - DNPH reaction	**B**	Aldol condensation reaction
C	Clemmensen reaction	**D**	Cannizarros's reaction

Solution: (d) An aldehyde with no alpha hydrogen disproportionates in strong alkali, which is the Cannizzaro reaction.

MCQ 17.4.15 **The appearance of a silver mirror in Toliens test indicates the presence of which of the following? (UHS MDCAT 2023)**

A	A ketone	**B**	An aldehyde
C	An acid	**D**	An alcohol

Solution: (b) Only an aldehyde reduces Tollens' reagent and leaves the silver mirror.

MCQ 17.4.16 **AcetaIs are: (PMC MDCAT 2022)**

A	Diethers	**B**	Aldehydes
C	Carboxylic acid	**D**	Ketones

Solution: (a) An acetal has two alkoxy groups on the same carbon, so it is a diether.

MCQ 17.4.17 **When two moles of acetone are treated with a base, the product is? (PMC MDCAT 2022)**

A	3-hydroxy-2-methyl pentanone	**B**	4-hydroxy-4 methyl-2-pentanone
C	3-hydroxy butanone	**D**	3-hydroxyl pentanal

Solution: (b) Base catalysed aldol condensation of two acetone molecules gives diacetone alcohol.

MCQ 17.4.18 **Formaldehyde reacts with which one of the following to give primary alcohols (PMC MDCAT 2022)**

A	Fehling's reagent	**B**	Benedict's reagent
C	Grignard's reagant	**D**	Millon's reagant

Solution: (c) A Grignard reagent adds to formaldehyde and the product hydrolyses to a primary alcohol.

MCQ 17.4.19 **Aldol products upon heating undergoes: (PMC MDCAT 2022)**

A	Decomposition	**B**	Dehydration
C	Rearrangement	**D**	Substitution

Solution: (b) The aldol loses water on heating and leaves an unsaturated carbonyl compound.

MCQ 17.4.20 **Iodoform test is used to check the presence of: (PMC MDCAT 2022)**

A	Amines	**B**	Carbonyl compounds
C	Carboxylic acid	**D**	Alkyl halides

Solution: (b) The iodoform test picks out a methyl ketone or an alcohol that oxidizes to one.

MCQ 17.4.21 **The carbanion attacks the molecule of another carbonyl compound to form: (PMC MDCAT 2022)**

A	an alkoxide group	**B**	aldol
C	a carbanion	**D**	a carbonium ion

Solution: (b) The carbanion adds to the carbonyl carbon of another molecule and the product is an aldol.

MCQ 17.4.22 **Fehling's solution is: (PMC MDCAT 2022)**

A	Alkaline-cupric citrate complex ion	**B**	Ammonical AgNO3
C	Alkaline cupric tartarate complex ion	**D**	Sodium nitroprusside solution

Solution: (c) Fehling's solution is copper(II) held in alkaline solution by tartrate.

MCQ 17.4.23 **The identification test for Ketone is: (NUMS MDCAT 2022)**

A	Benedict's Solution Test	**B**	Tehling's Solution Test
C	Sodium Nitro Prusside Test	**D**	Town's Test

Solution: (c) Sodium nitroprusside gives a red colour with a ketone but not with an aldehyde.

MCQ 17.4.24 **Which of the following compounds give a positive silver mirror test? (PMC Practice 2021)**

A	Butanal	**B**	Methanal
C	Ethanal	**D**	All of these options are correct

Solution: (d) All three are aldehydes, and every aldehyde reduces Tollens' reagent.

MCQ 17.4.25 **Which of the following reagent is used to separate and purify carbonyl and non carbonyl compounds? (PMC MDCAT 2020)**

A	HCN	**B**	BrMgCH3
C	NaHSO3	**D**	H2O

Solution: (c) Sodium bisulphite gives a crystalline addition product with aldehydes and methyl ketones, which is then hydrolysed back.

MCQ 17.4.26 **Identification tests for functional groups of organic compounds are associated with specific observations. Tollen's reagent is an ammoniacal silver nitrate solution, which is used for the identification of a functional group X with an observation O. Identify X and O. (UHS MDCAT 2019)**

A	X = Aldehyde O = Silver mirror	**B**	X = Ketone, O = grey precipitate
C	X = Ketone, O = Silver mirror	**D**	X = Aldehyde O = Red precipitate

Solution: (a) Only an aldehyde reduces Tollens' reagent, leaving a mirror of silver.

MCQ 17.4.27 **Ketones can be made by oxidation of: (UHS MDCAT 2019)**

A	Aldehydes	**B**	Primary Alcohols
C	Secondary Alcohols	**D**	Tertiary Alcohols

Solution: (c) A secondary alcohol has one hydrogen on the carbinol carbon, so oxidation stops at the ketone.

MCQ 17.4.28 **Which type of reaction takes place when a carbonyl compound is treated with a mixture of NaCN and an acid? (UHS MDCAT 2019)**

A	Electrophilic addition reaction	**B**	Substitution reaction
C	Nucleophilic addition reaction	**D**	Displacement reaction

Solution: (c) The cyanide ion attacks the electron poor carbonyl carbon, so the step is nucleophilic addition.

MCQ 17.4.29 **Which of the following will give a positive test with Tollen's reagent? (UHS MDCAT 2019)**

A	Tertiary alcohols	**B**	Carboxylic acids
C	Aldehydes	**D**	Ketones

Solution: (c) Only an aldehyde reduces Tollens' reagent.

MCQ 17.4.30 **Which of the following compounds will give a secondary alcohol after reaction with NaBH4? (UHS MDCAT 2019)**

A	CH3COCH3	**B**	CH3COOCH3
C	CH3CH2CHO	**D**	CH3CH2COOH

Solution: (a) Sodium borohydride reduces a ketone to a secondary alcohol.

MCQ 17.4.31 **Which one of the following reagents is used to distinguish between aldehydes and ketones? (UHS MDCAT 2018)**

A	Alkaline Iodine	**B**	Tollen's Reagent
C	Bromine	**D**	2, 4 DNPH

Solution: (b) Tollens' reagent leaves a silver mirror with an aldehyde and nothing with a ketone.

MCQ 17.4.32 **Which compound will be produced by the oxidation of ethanal by acidified K2Cr2O7 ? (UHS MDCAT 2018)**

A	Ethene	**B**	Ethanol
C	Ethanoic acid	**D**	Ethanone

Solution: (c) Acidified dichromate oxidizes the aldehyde on to the acid.

MCQ 17.4.33 **Which mechanism of reactions is shown by carbonyl compounds? (UHS MDCAT 2018)**

A	Electrophilic addition	**B**	Electrophilic substitution
C	Free radical substitution	**D**	Nucleophilic addition

Solution: (d) The carbonyl carbon is electron poor, so a nucleophile adds to it.

MCQ 17.4.34 **To distinguish aldehyde from ketone which solution is used: (UHS MDCAT 2017)**

A	Alkaline solution	**B**	Fehling's solution
C	A solution containing K2Cr2O7	**D**	A solution containing acid only

Solution: (b) Fehling's solution gives a red precipitate with an aldehyde and nothing with a ketone.

MCQ 17.4.35 **Which reagent is responsible for the conversion of ketone to secondary alcohol: (UHS MDCAT 2017)**

A	NaAlH4	**B**	NaBH4
C	Al	**D**	Red Phosphorus

Solution: (b) Sodium borohydride reduces a ketone to a secondary alcohol.

MCQ 17.4.36 **Both aldehyde and ketones give _____: (UHS MDCAT 2017)**

A	Tollen's test	**B**	2,4-DNPH test
C	Benedict's solution test	**D**	Sodium nitroprusside test

Solution: (b) 2,4-dinitrophenylhydrazine gives an orange precipitate with any carbonyl compound.

MCQ 17.4.37 **Which one of the following is an appropriate indication of positive iodoform test? (UHS MDCAT 2016)**

A	Formation of H2O	**B**	Release of H2 gas
C	Brick red precipitate	**D**	Yellow crystal

Solution: (d) Iodoform comes down as yellow crystals with the smell of antiseptic.

Topic 17.3 Reactivity of Aldehydes and Ketones

Past MDCAT Questions

MCQ 17.3.1 Which carbonyl carbon is more electrophilic: (SIBA MDCAT 2025)

A	HCOOH	B	HCHO
C	CH3COCH3	D	CH3COOH

Solution: (b) Formaldehyde has no alkyl group to push electrons towards the carbonyl carbon, so that carbon is the most electron poor.

MCQ 17.3.2 Which aldehyde is more reactive towards nucleophilic addition? (KMU MDCAT 2024)

A	Acetaldehyde	B	Butyraldehyde
C	Formaldehyde	D	Propionaldehyde

Solution: (c) Formaldehyde has no alkyl group feeding electrons to the carbonyl carbon, so it is the most open to attack.

MCQ 17.3.3 Acetone is less reactive than acetaldehyde due to: (PMC MDCAT 2022)

A	More Stearic hindrance offered by its methyl groups.	B	Electron withdrawing nature of its methyl groups.
C	Its Carbonyl carbon is sp2 hybridized.	D	Oxygen of carbonyl group is more electronegative than carbon atom.

Solution: (a) Two methyl groups crowd the carbonyl carbon and push electrons towards it, so it is less open to attack.

MCQ 17.3.4 Both aldehydes and ketones are planer to the neighborhoods of carbonyl (C=O) group. Which one of the following bonds is distorted towards the oxygen atoms? (UHS MDCAT 2015)

A	π-bond of C and O	B	Sigma bond of C and H
C	Sigma bond of C and O	D	Sigma bond of C and C

Solution: (a) Oxygen is the more electronegative, so the loose pi electrons of the double bond are drawn towards it.

Unit 18 Carboxylic Acids

Topic 18.1 Nomenclature, Structure and Preparation of Carboxylic Acids

Past MDCAT Questions

MCQ 18.1.1 The hydrolysis of nitriles produces: (MDCAT 2020)

A	carboxylic acids	B	aldehydes
C	ketones	D	esters

Solution: (a) $\mathrm{RCN} + 2\mathrm{H_2O} \rightarrow \mathrm{RCOOH} + \mathrm{NH_3}$, which is one of the standard preparations of an acid.

MCQ 18.1.2 When carboxylic acids and dicarboxylic acids have similar molecular weights, how do their melting points compare? (MDCAT 2022)

A	carboxylic acids have greater melting points	B	dicarboxylic acids have greater melting points
C	both acids have similar melting points	D	there is no consistent pattern

Solution: (b) Two carboxyl groups make more hydrogen bonds and pack better, so more heat is needed to break the crystal up.

MCQ 18.1.3 If both carboxylic acid and ketone $\mathrm{C{=}O}$ groups are present in a chain, then the final name will be given as: (MDCAT 2022)

A	oxo...oic acid	B	one...oic acid
C	al...oic acid	D	none of these

Solution: (a) The acid outranks the ketone, so the acid takes the suffix and the ketone becomes an oxo prefix.

MCQ 18.1.4 If both a carboxylic acid group and a ketone group are present in a chain, then the final name will be given as: (MDCAT 2023)

A	oxo...oic acid	B	one...oic acid
C	al...oic acid	D	none of these

Solution: (a) The acid takes the suffix, so the ketone is named as an oxo prefix.

MCQ 18.1.5 The common name of 2-hydroxypropanoic acid is: (MDCAT 2024)

A	tartaric acid	B	lactic acid
C	phthalic acid	D	formic acid

Solution: (b) That is lactic acid, the acid of sour milk and of tired muscle.

MCQ 18.1.6 The boiling point of carboxylic acids are relatively high due to: (NUMS MDCAT 2025)

A	Increased molecular mass	B	Intermolecular carbon bonding
C	Intermolecular oxygen bonding	D	Intermolecular hydrogen bonding

Solution: (d) Two molecules of the acid hydrogen bond into a dimer, so a great deal of heat is needed to separate them.

MCQ 18.1.7 Common name of 2-hydroxy propanoic acid is: (UHS MDCAT 2024)

A	Tartaric acid	B	Lactic acid
C	Phthalic acid	D	Formic acid

Solution: (b) 2-hydroxypropanoic acid is lactic acid, the acid of sour milk.

MCQ 18.1.8 Acetic acid can be prepared by the hydrolysis of (KMU MDCAT 2024)

A	Ethanal	B	Ethanol
C	Methanoic acid	D	Methyl cyanide

Solution: (d) Hydrolysis of methyl cyanide gives acetic acid and ammonia.

MCQ 18.1.9 Select the carboxylic acid with highest melting point: (NUMS MDCAT 2024)

A	Ethanoic acid	B	Propanoic acid
C	Butanoic acid	D	Pentanoic acid

Solution: (a) Ethanoic acid packs into the tightest crystal of the four, so it melts highest.

MCQ 18.1.10 Hydrolysis of Nitriles produces: (NUMS MDCAT 2023)

A	Carboxylic acid	B	Aldehydes
C	Ketones	D	Esters

Solution: (a) A nitrile hydrolyses to the carboxylic acid with one more carbon than the alkyl group.

MCQ 18.1.11 Carboxylic acids are obtained from fats and oils by: (PMC MDCAT 2022)

A	Oxidation	B	Reduction
C	Decarboxylalion	D	Hydrolysis

Solution: (d) Fats and oils are esters, and hydrolysing them gives glycerol and the fatty acids.

MCQ 18.1.12 Which one of the following carboxylic acid has an unpleasant smell? (PMC MDCAT 2022)

A	Propionic acid	B	Formic acid
C	Butyric acid	D	Acetic acld

Solution: (c) Butyric acid is what gives rancid butter its smell.

MCQ 18.1.13 **Acetic acid was first isolated from: (PMC MDCAT 2022)**

A	Ants	B	Butter
C	Milk	D	Vinegar

Solution: (d) Acetic acid was first got from vinegar, which is where its name comes from.

MCQ 18.1.14 **The aliphatic monocarboxylic acids is obtained from (PMC MDCAT 2022)**

A	fats and oils	B	proteins and oils
C	fats and proteins	D	fats only

Solution: (a) Hydrolysing a fat or an oil gives glycerol and the straight chain fatty acids.

MCQ 18.1.15 **Carboxylic acids are water soluble because they: (NUMS MDCAT 2022)**

A	Are more reactive	B	Have hydrogen bonding
C	Have low melting point	D	Have high density

Solution: (b) The carboxyl group hydrogen bonds to water, so the lower members dissolve freely.

MCQ 18.1.16 **Which of the following is most soluble in water? (PMC Practice 2021)**

A	Ethanoic acid	B	Pentanoic acid
C	Hexanoic acid	D	Butanoic acid

Solution: (a) The shorter the chain the more the carboxyl group tells, so the smallest acid is the most soluble.

MCQ 18.1.17 **Which of the following is an example of aromatic carboxylic acid? (PMC Practice 2021)**

A	Ethanoic acid	B	Butanoic acid
C	Adipic acid	D	Phthalic acid

Solution: (d) Phthalic acid carries its two carboxyl groups on a benzene ring.

MCQ 18.1.18 **In the case of HOCH2CH2CH2COOH, from where is numbering started? (PMC Practice 2021)**

A	OH group is given number 1 position	B	Carboxylic acid is given number 1 position
C	COOH is given number 3 position	D	COOH is given number 4 position

Solution: (b) The carboxyl carbon is always carbon one.

MCQ 18.1.19 **Acetic acid is soluble in? (PMC Practice 2021)**

A	Water, Alcohol, Ether	B	HCl, HBr, HI
C	Bromine water	D	All of these options are correct

Solution: (a) The carboxyl group hydrogen bonds to water and the alkyl group dissolves in the organic solvents.

MCQ 18.1.20 **Nitriles (RCN), on hydrolysis, in the presence of a mineral acid yield: (UHS MDCAT 2019)**

A	Ethers	B	Carboxylic acids
C	Aldehydes	D	Alcohols

Solution: (b) A nitrile hydrolyses to the carboxylic acid and ammonia.

MCQ 18.1.21 **The dilute solution of _____ is called vinegar. (UHS MDCAT 2018)**

A	Formic acid	B	Oxalic acid
C	Benzoic acid	D	Acetic acid

Solution: (d) Vinegar is dilute acetic, that is ethanoic, acid.

MCQ 18.1.22 **Final product of hydrolysis of nitrile yield: (UHS MDCAT 2017)**

A	Ketone	B	Ketone
C	Alcohol	D	Carboxylic acid

Solution: (d) A nitrile hydrolyses to the carboxylic acid.

Topic 18.2 Reactivity of Carboxylic Acids

Past MDCAT Questions

MCQ 18.2.1 **Which among the following has the least pH? (MDCAT 2022)**

A	CH_3CH_2COOH	B	CH_2ClCH_2COOH
C	$CH_3CHClCOOH$	D	$CH_3CH_2CH_2COOH$

Solution: (c) The chlorine on the carbon next to the carboxyl group pulls electrons away most strongly, so this acid is the strongest and its pH the lowest.

MCQ 18.2.2 **Acetic acid is a weaker acid than sulphuric acid because of which of the following reasons? (MDCAT 2023)**

A	it decomposes on increasing temperature	B	it has less degree of ionisation
C	it has a $-COOH$ group	D	it has a greater inductive effect

Solution: (b) Only a small fraction of its molecules ionize in water, so the concentration of H^+ it gives is far lower.

MCQ 18.2.3 **Carboxylic acid reacts with metal carbonate. The colorless gas evolved is: (NUMS MDCAT 2025)**

A	H2	B	O2
C	CO2	D	CO

Solution: (c) A carboxylic acid displaces carbon dioxide from a carbonate, as any acid does.

MCQ 18.2.4 **Compound X + Na2CO3 → Compound Y + CO2 + H2O. The compound X is: (NUMS MDCAT 2024)**

A	CH2=CH-CH2-CH3	B	CH3CH2CHO
C	CH3C(O)OCH3	D	CH3CH2COOH

Solution: (d) Only a carboxylic acid is strong enough to displace carbon dioxide from a carbonate.

MCQ 18.2.5 **Which among the following have least pH? (UHS MDCAT 2023)**

A	CH3CH2COOH	B	CH2ClCH2COOH
C	CH3CHCl2 COOH	D	CH3CH2CH2COOH

Solution: (c) Two chlorines pull the hardest on the carboxyl group, so that acid is the strongest and its pH the lowest.

MCQ 18.2.6 **Select the correct order of relative acidic strength of phenol, alcohol, water, and carboxylic acid: (SZABMU MDCAT 2023)**

A	Carboxylic acid > water > phenol > alcohol	B	Carboxylic acid > phenol > water > alcohol
C	Carboxylic acid > alcohol > phenol > water	D	Carboxylic acid > water > alcohol > phenol

Solution: (b) The carboxylate ion is best stabilized, then the phenoxide, and an alkoxide least of all.

MCQ 18.2.7 **Acetic acid is weak acid than sulphuric acid because of which of the following reasons? (UHS MDCAT 2023)**

A	It decomposes on increasing temperature	B	It has less degree of ionisation
C	It has -COOH group	D	It has more inductive effect

Solution: (b) Acetic acid is only slightly ionized in water, while sulphuric acid is ionized almost completely.

MCQ 18.2.8 **Which of the following gas is produced during the reaction of carbonates and bicarbonates with carboxylic acid (PMC MDCAT 2022)**

A	CO2	B	H2
C	N2	D	Ar

Solution: (a) A carboxylic acid displaces carbon dioxide from a carbonate or a hydrogen carbonate.

MCQ 18.2.9 **Salts of carboxylic acids can be converted into corresponding carboxylic acid by treating with: (PMC MDCAT 2022)**

A	Water	**B**	Base
C	Acid anhydrides	**D**	Acid

Solution: (d) A stronger acid displaces the weaker carboxylic acid from its salt.

MCQ 18.2.10 **Carboxylic acids do not give the characteristics reaction of >C=O group because of: (PMC Practice 2021)**

A	Polar nature	**B**	Resonance
C	Symmetrical structure	**D**	Attached alkyl group

Solution: (b) The lone pair of the hydroxyl oxygen is fed into the carbonyl group, so that group is no longer a plain C=O.

MCQ 18.2.11 **Which of the following carboxylic acids is used in medicine as a local irritant? (PMC Practice 2021)**

A	Formic acid	**B**	Acetic acid
C	Benzoic acid	**D**	Amino acid

Solution: (b) Dilute acetic acid is used as a counter-irritant on the skin.

MCQ 18.2.12 **The exact reactivity order for carboxylic acid derivatives is: (PMC MDCAT 2020)**

A	Anhydride > Acylchloride > ester	**B**	Ester > Anhydride > Acylchloride
C	Amide > Acylchloride > ester	**D**	Acylchloride > Anhydride > ester

Solution: (d) The better the leaving group, the more reactive the derivative, and chloride leaves most readily.

MCQ 18.2.13 **Which of the following is the strongest acid? (PMC MDCAT 2020)**

A	Propanoic acid	**B**	Fluoroethanoic acid
C	Trichloroethanoic acid	**D**	Nitroethanoic acid

Solution: (c) Three chlorine atoms pull hardest on the carboxyl group, so its proton is the most readily lost.

MCQ 18.2.14 **Which one will act as a strong acid? (UHS MDCAT 2018)**

A	Chloroethanoic acid	**B**	Ethanoic acid
C	Trichloroethanoic acid	**D**	Dichloroethanoic acid

Solution: (c) Three chlorine atoms pull hardest on the carboxyl group, so that acid is the strongest.

Topic 18.3 Conversion of Carboxylic Acids

Past MDCAT Questions

MCQ 18.3.1 **Acetic anhydride is a product of acetic acid as a result of which reaction? (MDCAT 2020)**

A	dehydration	**B**	reduction
C	oxidation	**D**	esterification

Solution: (a) Two molecules of the acid lose one molecule of water between them.

MCQ 18.3.2 **Acetic acid is mixed with thionyl chloride. Which product is obtained? (MDCAT 2023)**

A	$CH_3COCl + SO_2 + HCl$	**B**	$CH_3Cl + CH_3COCl$
C	$CH_3COOH + SO_2$	**D**	$CH_3CHO + HCl$

Solution: (a) Thionyl chloride replaces the $-OH$ of the acid by chlorine, and the by-products are gases.

MCQ 18.3.3 **When carboxylic acids are heated with an alcohol in the presence of sulphuric acid, one of the following is formed: (MDCAT 2024)**

A	amides	**B**	acyl chlorides
C	esters	**D**	acid anhydrides

Solution: (c) That is esterification, with the sulphuric acid as catalyst and water as the other product.

MCQ 18.3.4 **Fischer ESTERIFICATION Is which type of reaction: (UHS MDCAT 2025)**

A	Condensation	**B**	Substitution
C	Elimination	**D**	Dehydrogenation

Solution: (a) An acid and an alcohol join with the loss of water, which makes esterification a condensation.

MCQ 18.3.5 **Carboxylic acid reacts with ammonia to form ammonium salts which on heating produces: (UHS MDCAT 2025)**

A	Carbonates	**B**	Alkane
C	Ester	**D**	Amide

Solution: (d) The ammonium salt loses water on strong heating and leaves the amide.

MCQ 18.3.6 **Which of the following compound will react with 2,2-dimethyl propanoic acid to produce ester? (NUMS MDCAT 2025)**

A	Ethanoic acid	**B**	Propane
C	Ethanol	**D**	Propanone

Solution: (c) An ester is an acid plus an alcohol, so ethanol is the reagent that gives one.

MCQ 18.3.7 **Formic acid reacts with ethanol in presence of acid catalyst produces: (SIBA MDCAT 2025)**

A	Ester	**B**	Ether
C	Acid anhydride	**D**	Phenol

Solution: (a) An acid and an alcohol with an acid catalyst give an ester and water.

MCQ 18.3.8 **Reduction of carboxylic acid by using lithium aluminiumhydride produce (SZABMU MDCAT 2025)**

A	Alcohol	**B**	acid halide
C	ester	**D**	alkane

Solution: (a) Lithium aluminium hydride reduces the carboxyl group all the way to a primary alcohol.

MCQ 18.3.9 **When carboxylic acid are heated with alcohol in the presence of sulphuric acid one of the following is formed (UHS MDCAT 2024)**

A	Amides	**B**	Acyl chloride
C	Esters	**D**	Acid Anhydride

Solution: (c) An acid and an alcohol with a little sulphuric acid give an ester and water.

MCQ 18.3.10 **Carboxylic acid reacts with Alcohol to form: (SZABMU MDCAT 2023)**

A	Ester	**B**	Aldehyde
C	Ketone	**D**	Alkyl Halide

Solution: (a) An acid and an alcohol give an ester and water.

MCQ 18.3.11 **Which of the following reacts with Carboxylic Acid to form Ester? (NUMS MDCAT 2023)**

A	Aldehyde	**B**	Alkyl Halide
C	Ketones	**D**	Alcohol

Solution: (d) An acid and an alcohol give an ester and water.

MCQ 18.3.12 **Mr. Khan mix acetic acid with thionyl chloride. Which product is obtained? (UHS MDCAT 2023)**

A	$CH_3COCl + SO_2 + HCl$	B	$CH_3Cl + CH_3COCl$
C	$CH_3COOCH_3 + SO_2$	D	$CH_3Cl + SO_2 + HCl$

Solution: (a) Thionyl chloride replaces the hydroxyl group with chlorine and leaves gaseous by-products.

MCQ 18.3.13 **The flavour of amyl butyrate is: (PMC MDCAT 2022)**

A	Mango	B	Raspberry
C	Apricot	D	Orange

Solution: (c) Amyl butyrate smells of apricots; the esters are what give fruits their scent.

MCQ 18.3.14 **Complete the following reaction: $CH_3COOC_2H_5 + H_2O$ --> (PMC MDCAT 2022)**

A	Both HOC_2H_5 and CH_3CO_2H	B	Both $HOCH_3$ and CH_3CO_3H
C	HOC_3H_6 Only	D	CH_3CO_2H Only

Solution: (a) Hydrolysing the ester gives back the alcohol and the acid.

MCQ 18.3.15 **Hydrolysis of acyl chloride results in the formation of: (PMC MDCAT 2020)**

A	Acid anhydride	B	Carboxylic acid
C	Amides	D	Esters

Solution: (b) Water attacks the acyl chloride and leaves the carboxylic acid and hydrogen chloride.

MCQ 18.3.16 **Carboxylic acids can be reduced to corresponding alcohols. Which of the following reagent can be used for this purpose? (UHS MDCAT 2019)**

A	$KMnO_4$	B	$LiAlH_4$
C	$K_2Cr_2O_4$	D	H_2SO_4

Solution: (b) Lithium aluminium hydride reduces the carboxyl group all the way to a primary alcohol.

MCQ 18.3.17 **Which of the following reagent is required for preparation of acyl chloride (CH_3COCl) from ethanoic aicd? (UHS MDCAT 2019)**

A	PCl_5	B	$POCl_3$
C	CH_3Cl	D	HCl

Solution: (a) Phosphorus pentachloride replaces the hydroxyl group of the acid with chlorine.

MCQ 18.3.18 **Which balanced chemical equation show the formation of ethanoyl chloride using thionyl chloride? (UHS MDCAT 2019)**

A	$HCOOH + SOCl_2 \rightarrow HCOCl + SO_2 + HCl$	B	$CH_3CH_2COOH + 2SOCl \rightarrow CH_3CH_2COCl + SO_2 + HCl$
C	$CH_3CH_2COOH + 2SOCl \rightarrow CH_3CH_2COCl + SO_3 + HCl$	D	$CH_3COOH + SOCl_2 \rightarrow CH_3COCl + SO_2 + HCl$

Solution: (d) Ethanoic acid with thionyl chloride gives ethanoyl chloride, sulphur dioxide and hydrogen chloride.

MCQ 18.3.19 **Which product is formed by the reaction of carboxylic acid with alcohol? (UHS MDCAT 2018)**

A	Alkane	B	Ether
C	Aldehyde	D	Ester

Solution: (d) An acid and an alcohol give an ester and water.

MCQ 18.3.20 **Which one of the following compounds act as a catalyst when alcohols react with carboxylic acids. (UHS MDCAT 2018)**

A	Pt	B	Conc. HNO_3
C	Ni	D	Conc. H_2SO_4

Solution: (d) Concentrated sulphuric acid catalyses the esterification and takes up the water.

MCQ 18.3.21 **Catalytic oxidation of alkanes results in the formation of _____: (UHS MDCAT 2017)**

A	Carboxylic acid	B	Aldehyde
C	Ketone	D	Alcohol

Solution: (d) Controlled catalytic oxidation stops at the alcohol.

MCQ 18.3.22 **During esterification, the bond from alcohol that breaks in between: (UHS MDCAT 2017)**

A	Carbon and oxygen	B	Oxygen and hydrogen
C	Carbon and carbon	D	None of the given options

Solution: (b) Isotopic labelling shows the alcohol loses its hydrogen and keeps its oxygen in the ester.

MCQ 18.3.23 **Which one of the following reaction of carboxylic acid is reversible? (UHS MDCAT 2016)**

A	Esterification	B	Salt formation
C	Reaction with PCl_5	D	Reaction with $SOCl_2$

Solution: (a) Esterification is an equilibrium, which is why the water is removed to drive it forward.

Unit 19 Macromolecules

Topic 19.1 Classification of Proteins

Past MDCAT Questions

MCQ 19.1.1 **Which one of the following is not an amino acid? (MDCAT 2024)**

A	lactic acid	B	glutamic acid
C	glycine	D	lysine

Solution: (a) Lactic acid carries a hydroxyl group where an amino acid carries an amino group.

MCQ 19.1.2 **The most abundant protein in animal kingdom forming 25-35% of body proteins is/are: (NUMS MDCAT 2025)**

A	Derived proteins	B	Simple proteins
C	Compound proteins	D	Conjugated proteins

Solution: (b) Simple proteins yield only amino acids on hydrolysis, and they are the commonest kind in animals.

MCQ 19.1.3 **Which one of the following is not an amino acid (UHS MDCAT 2024)**

A	Folic acid	B	Glutamic acid
C	Glycine	D	Lysine

Solution: (a) Folic acid is a vitamin; the other three are amino acids.

MCQ 19.1.4 **Which of the following is produced by heating of bones? (PMC Practice 2021)**

A	Gelatine	B	Cheese
C	Albumin	D	Gelly

Solution: (a) Boiling bones breaks the collagen down to gelatine.

MCQ 19.1.5 **Based on the physico-chemical properties, proteins may be classified into the following types: (PMC MDCAT 2020)**

A	Simple proteins	B	Compound proteins
C	Derived proteins	D	All of the above

Solution: (d) Proteins are classed as simple, compound or derived.

MCQ 19.1.6 **Amino acids are bi-functional compounds, with a general formula NH2CH(R)CO2H. A tripeptide is formed between Alanine (ala), Glycine (gly), and lysine (lys). There is no repetition of amino acid in this tri-peptide; Suggest how many tri-peptides are possible? (UHS MDCAT 2019)**

A	9	B	6
C	3	D	12

Solution: (b) Three different residues can be arranged in 3! orders, that is six.

MCQ 19.1.7 **Which of the following bond is responsible for joining the amino acids in proteins? (UHS MDCAT 2019)**

A	Peptide Bond	B	Ionic Bond
C	Metallic Bond	D	Disulfide Bond

Solution: (a) Amino acids are joined by peptide bonds.

MCQ 19.1.8 **Amino acids react with each other such that -COOH group of one amino acid reacts with the -NH2 group of another amino acid to give a condensed structure as shown below: (UHS MDCAT 2018)**

A	Ester linkage	B	Peptide linkage
C	Carbide linkage	D	Azide linkage

Solution: (b) The link between two amino acids is the peptide bond.

MCQ 19.1.9 **The stability in the following structure is due to the: (UHS MDCAT 2018)**

A	Weak van der Waal's forces	B	Disulfide bridges
C	Presence of unpaired electron in the structure	D	Hydrogen bonding between NH group of one peptide and CO group of another peptide

Solution: (d) The helix is held by hydrogen bonds between the NH of one peptide group and the CO of another.

MCQ 19.1.10 **Phosphoprotein comes under the type of which proteins: (UHS MDCAT 2017)**

A	Simple protein	B	Conjugated protein
C	Derived protein	D	Both Conjugated & Derived protein

Solution: (b) A phosphoprotein is a protein with a non-protein group attached, so it is conjugated.

MCQ 19.1.11 **When acid is added to an amino acid, which one of the following will act as a base? (UHS MDCAT 2016)**

A	NH3+	B	COO-
C	H+	D	R group

Solution: (b) The carboxylate group of the zwitterion takes the added proton.

MCQ 19.1.12 **Which one of the following is simplest amino acid? (UHS MDCAT 2016)**

A	Lysine	B	Leucine
C	Alanine	D	Glycine

Solution: (d) Glycine has a single hydrogen atom for its side chain.

MCQ 19.1.13 **In the formation of Zwitter ion which one of the following donates the proton? (UHS MDCAT 2016)**

A	COOH	B	NH2
C	CH2COO-	D	OH-

Solution: (a) The carboxyl group gives its proton to the amino group, and the ion carries both charges.

Topic 19.2 Importance of Proteins

Past MDCAT Questions

MCQ 19.2.1 **Which of the following proteins acts as a carrier of copper in blood plasma? (MDCAT 2022)**

A	haemoglobin	B	glycoprotein
C	ceruloplasmin	D	histone

Solution: (c) Ceruloplasmin carries most of the copper of the plasma.

MCQ 19.2.2 **After digestion and before absorption, the products of proteins are: (MDCAT 2023)**

A	amino acids and small polypeptides	B	only amino acids
C	only small polypeptides	D	polysaccharides

Solution: (a) Proteases cut proteins down to amino acids and short peptides, and both are taken up by the intestinal wall.

MCQ 19.2.3 **Protein present in connective tissues of human body is: (NUMS MDCAT 2025)**

A	Phosphoprotein	B	Collagen
C	Lecithin	D	Cholesterol

Solution: (b) Collagen is the fibrous protein of tendon, ligament, skin and bone.

MCQ 19.2.4 **In human body Ferritin is used to store: (NUMS MDCAT 2025)**

A	P	B	Ca
C	Fe	D	Zn

Solution: (c) Ferritin is the iron store of the liver and the spleen.

MCQ 19.2.5 **In human body Ceruloplasmin acts as a carrier of: (NUMS MDCAT 2025)**

A	O2	B	Zn
C	Cu	D	Fe

Solution: (c) Ceruloplasmin is the copper carrying protein of the blood plasma.

MCQ 19.2.6 **Casein is used in manufacturing of _____. (PMC Practice 2021)**

A	Buttons & buckles	B	Tanning of leather
C	Gelatin	D	Bakery goods

Solution: (a) Casein from milk is moulded into buttons and buckles.

MCQ 19.2.7 **_____ is a macromolecule found in blood. (PMC Practice 2021)**

A	Hemoglobin	B	Plasma
C	Creatinine	D	Plasmids

Solution: (a) Haemoglobin is the large conjugated protein of the red cells.

MCQ 19.2.8 **Based on function, thyroxine can be classified as: (PMC MDCAT 2020)**

A	Hormonal protein	B	Structural protein
C	Transport protein	D	Genetic protein

Solution: (a) Thyroxine carries a message from a gland to its target, so it is classed as a hormonal protein.

MCQ 19.2.9 **According to Watson and Crick's model of DNA, the DNA molecule consists of a double helix. What type of forces are responsible to keep two strands of DNA together? (UHS MDCAT 2019)**

A	Van der Waals forces	B	Ionic bonding
C	Hydrogen bonding	D	Dipole-induced dipole forces

Solution: (c) The bases of the two strands are paired by hydrogen bonds.

MCQ 19.2.10 **An intermolecular force of attraction X is relatively stronger than the other intermolecular forces. It stabilizes alpha-helix and Beta-pleated sheets of proteins. The double helical structure of DNA is also stabilized by this force of attraction. Identify X. (UHS MDCAT 2019)**

A	Van Der Waals Forces	B	Hydrogen bonding
C	Ionic interactions	D	Dipole dipole attraction

Solution: (b) Hydrogen bonds hold the alpha helix, the pleated sheet and the two strands of DNA alike.

MCQ 19.2.11 **Haemoglobin is a (UHS MDCAT 2015)**

A	Genetic protein	B	Building protein
C	Transport protein	D	Structural protein

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Solution: (c) Haemoglobin carries oxygen, so it is a transport protein.

Topic 19.3 Enzymes as Biocatalysts

Past MDCAT Questions

MCQ 19.3.1 **Which of the following enzymes is raised in rickets? (MDCAT 2020)**

A	lactic dehydrogenase	B	alkaline phosphatase
C	amylase	D	lipase

Solution: (b) Bone turnover is high in rickets, and the osteoblasts release alkaline phosphatase into the blood.

MCQ 19.3.2 **When food reaches the stomach, the action of which enzyme comes to an end because of the acidic pH? (MDCAT 2022)**

A	lipase	B	amylase
C	maltase	D	hydrolases

Solution: (b) Salivary amylase works near neutral pH and is denatured by the acid of the stomach.

MCQ 19.3.3 **Inhibitors stop an enzyme from working by: (MDCAT 2023)**

A	changing the shape of the enzyme	B	merging with the substrate instead
C	blocking the active site of the enzyme	D	combining with the product of the reaction

Solution: (c) A competitive inhibitor occupies the active site, so the substrate cannot bind there.

MCQ 19.3.4 **Urease is present in: (PMC Practice 2021)**

A	Yeast	B	Grapes
C	Soya sauce	D	Soya bean

Solution: (d) Urease, the first enzyme to be crystallized, is got from soya bean.

MCQ 19.3.5 **L – Asparaginase enzyme has been used for the treatment of: (PMC MDCAT 2020)**

A	Jaundice	B	Blood cancer
C	Rickets	D	Heart disease

Solution: (b) L-asparaginase starves leukaemic cells of asparagine and is used against blood cancer.

Unit 20 Industrial Chemistry

Topic 20.1 Adhesives

Past MDCAT Questions

MCQ 20.1.1 **Which of following adhesive is used to bond broken pieces of jewelry? (SIBA MDCAT 2025)**

A	Super glue	B	Epoxy resin
C	Silicon resin	D	Starch

Solution: (a) Cyanoacrylate super glue sets in seconds on a thin joint, which suits broken jewellery.

Topic 20.2 Polymers

Past MDCAT Questions

MCQ 20.2.1 **Poly vinyl chloride (PVC) is the type of? (UHS MDCAT 2025)**

A	Homopolymer	B	Thermosetting polymer
C	Thermoplastic polymer	D	Copolymor

Solution: (a) PVC is built from one monomer, vinyl chloride, so it is a homopolymer.

MCQ 20.2.2 **Which one is addition polymer? (SIBA MDCAT 2025)**

A	polyvinyl chloride	B	nylon 6,6
C	nylon 6,10	D	polyester

Solution: (a) Poly(vinyl chloride) is made by adding monomers with nothing eliminated; the nylons and polyesters are condensation polymers.

MCQ 20.2.3 **Bakelite is formed upon polymerization of: (NUMS MDCAT 2024)**

A	Phenol + HCHO dilute base	B	Phenol + NaOH H2O
C	Phenol + H2SO4 H2O	D	Phenol + CH3-C(=O)-Cl H2SO4

Solution: (a) Bakelite is the condensation polymer of phenol with formaldehyde.

MCQ 20.2.4 **A polymer called Bakelite is formed by the reaction of phenol with: (PMC Practice 2021)**

A	Hydrogen	B	Ethers
C	Carboxylic acid	D	Formaldehyde

Solution: (d) Bakelite is the condensation polymer of phenol with formaldehyde.

MCQ 20.2.5 **Disposable cups are made of a polymer 'polystyrene'. Polystyrene is: (UHS MDCAT 2019)**

A	A polyamide	B	A condensation polymer
C	An addition polymer	D	A polyester

Solution: (c) Polystyrene is made by adding styrene monomers with nothing eliminated.

MCQ 20.2.6 **Which one of the following compounds is an additional polymer? (UHS MDCAT 2019)**

A	Polyvinyl chloride	B	Nylon
C	Carbohydrate	D	Polyester

Solution: (a) Poly(vinyl chloride) is built by adding monomers with nothing eliminated.

MCQ 20.2.7 **Which one of the following is the structure of Teflon? (UHS MDCAT 2018)**

A	(-CF2-CF2-)n	B	(-CF2-CCl2-)n
C	(-CH2-CH2-)n	D	(-CF2-CH2-)n

Solution: (a) Teflon is poly(tetrafluoroethene).

MCQ 20.2.8 **Nylon-6,6 is also called: (UHS MDCAT 2018)**

A	Poly styrene	B	Polyester
C	Polyamide	D	Polyvinyl alcohol

Solution: (c) Nylon-6,6 is a polyamide, made from a diamine and a diacid.

MCQ 20.2.9 **Which is the structure of polyvinyl chloride (polychloroethane)? (UHS MDCAT 2018)**

A	-[CCl2-CCl2]-	B	-[HCCl-CH-Cl]-
C	[H2C=CH-Cl]	D	-[H2C-CH-Cl]-

Solution: (d) Poly(vinyl chloride) is a chain of $-\mathrm{CH_2}-\mathrm{CHCl}-$ units.

MCQ 20.2.10 **Among the following, which compound is formed by addition polymerization: (UHS MDCAT 2017)**

A	Polystyrene	B	Polyester
C	Nylon	D	Both Polystyrene & Polyester

Solution: (a) Polystyrene is made by adding styrene monomers with nothing eliminated.

MCQ 20.2.11 **Identify the monomers of Polyvinyl chloride: (UHS MDCAT 2017)**

A	Vinyl acetate	B	Butyl maleate
C	Styrene	D	Vinyl chloride

Solution: (d) Poly(vinyl chloride) is made from vinyl chloride.

MCQ 20.2.12 **Which one of the following polymer is called as Nylon 6,6? (UHS MDCAT 2016)**

A	Polyester	B	Polyvinyl chloride
C	Polyamide	D	Polyvinyl acetate

Solution: (c) Nylon-6,6 is a polyamide made from a diamine and a diacid.

MCQ 20.2.13 **Polymide is formed due to the condensation od hexane-dioic acid with (UHS MDCAT 2015)**

A	Hexane-1,5-diamine	B	Hexane-1,6-diamine
C	Hexane-1,4-diamine	D	Hexane-2,5-diamine

Solution: (b) Nylon-6,6 is adipic acid condensed with hexane-1,6-diamine.

MCQ 20.2.14 **Which one of the following is an example of co-polymer? (UHS MDCAT 2015)**

A	Polyamide	B	Polystyrene
C	Polyvinyl acetate	D	Polyvinyl chloride

Solution: (a) A polyamide is built from two different monomers, so it is a copolymer.

PHYSICS

Unit 1 Vectors and Equilibrium

Topic 1.1 Addition of Vectors by Rectangular Components

Past MDCAT Questions

MCQ 1.1.1 **Force is a: (PMC MDCAT 2022)**

A	Vector	B	Scalar
C	Tensor	D	Base quantity

Solution: (a) Force has both magnitude and direction and adds by the parallelogram rule, so it is a vector.

MCQ 1.1.2 **Displacement is a: (PMC Practice 2021)**

A	Tensor	B	Vector
C	Scalar	D	None of these options is correct

Solution: (b) Displacement has magnitude and direction and adds by the parallelogram rule.

Topic 1.2 Scalar Product of Two Vectors

Past MDCAT Questions

MCQ 1.2.1 **Consider these two vectors A = 2i + 3j and B = -6i + 4j. The angle between these two vectors is: (SIBA MDCAT 2025)**

A	60°	B	90°
C	120°	D	180°

Solution: (b) The scalar product is $-12+12=0$, so the vectors are at right angles.

Topic 1.3 Vector Product of Two Vectors

Past MDCAT Questions

MCQ 1.3.1 **If we double the moment arm the value of torque becomes: (UHS MDCAT 2016)**

A	Half	B	Three-times
C	Two-times	D	Four-times

Solution: (c) Torque is force times moment arm, so twice the arm is twice the torque.

Topic 2.1 Displacement, Velocity and Acceleration

Past MDCAT Questions

MCQ 2.1.1 Which of the following is the correct definition of variable velocity? (MDCAT 2022)

A	unequal distances are covered in equal intervals of time	B	equal displacements are made in unequal intervals of time
C	unequal displacements are made in equal intervals of time	D	equal displacements are made in equal intervals of time

Solution: (c) Velocity is displacement per unit time, so it varies when the displacement in equal times is unequal.

MCQ 2.1.2 Which of the following is the correct definition of variable velocity? (MDCAT 2023)

A	unequal distances are covered in equal intervals of time	B	equal displacements are made in unequal intervals of time
C	unequal displacements are made in equal intervals of time	D	equal displacements are made in equal intervals of time

Solution: (c) Velocity is displacement per unit time, so it varies when the displacement in equal times is unequal.

MCQ 2.1.3 A man is in a car that is moving with a uniform velocity. His velocity with respect to the car is: (MDCAT 2023)

A	$10\,\mathrm{m\,s^{-1}}$	B	$36\,\mathrm{m\,s^{-1}}$
C	zero	D	infinite

Solution: (c) He does not move relative to the car, so his velocity in the frame of the car is zero.

MCQ 2.1.4 The instantaneous velocity along the curved path is: (MDCAT 2024)

A	along the tangent	B	perpendicular to the slope
C	parallel to the radius	D	antiparallel to the radius

Solution: (a) The instantaneous velocity is always directed along the tangent to the path at that point.

MCQ 2.1.5 The value of the ratio of displacement to distance is: (UHS MDCAT 2017)

A	always more than one	B	always less than one
C	equal to or more than one	D	equal to or less than one

Solution: (d) The displacement is the straight line between the two points, so it can equal the distance but can never exceed it.

MCQ 2.1.6 A body moves along a semicircular path of radius 10 m from one end of the diameter to the other. The ratio of distance to displacement is: (SIBA MDCAT 2025)

A	$\pi : 1$	B	$1 : \pi$
C	$\pi : 2$	D	$2 : \pi$

Solution: (c) The path is πr and the displacement is the diameter $2r$, so the ratio is $\pi : 2$.

MCQ 2.1.7 A person moves 600 m towards north then 300 m towards south. Its displacement to distance ratio is: (SZABMU MDCAT 2025)

A	1:3	B	1:2
C	2:3	D	3:1

Solution: (a) The displacement is $300\,\mathrm{m}$ and the distance walked is $900\,\mathrm{m}$, a ratio of $1 : 3$.

MCQ 2.1.8 The instantaneous velocity along the curved path is ; (UHS MDCAT 2024)

A	Along the tangent	B	Perpendicular to the slope
C	Parallel to the radius	D	Anti-parallel to the radius

Solution: (a) The velocity at any instant points along the tangent to the path.

MCQ 2.1.9 Two car traveling on straight road in opposite direction with speed 70 kmh-1 and 60 kmh-1, their relative velocity will be: (SZABMU MDCAT 2023)

A	10 kmh-1	B	130 kmh-1
C	65 kmh-1	D	5 kmh-1

Solution: (b) Moving towards each other, the speeds add: $70 + 60$ is $130\,\mathrm{km\,h^{-1}}$.

MCQ 2.1.10 A man is in a car that is moving with the velocity of 36km/hr.His speed with respect to the car (UHS MDCAT 2023)

A	10m/s	B	36m/s
C	Zero	D	Infinite

Solution: (c) He moves with the car, so relative to it his speed is zero.

MCQ 2.1.11 Q.77 The time rate of change of velocity is called: (NUMS MDCAT 2022)

A	Force	B	Acceleration
C	Power	D	Energy

Solution: (b) The rate of change of velocity is the acceleration.

MCQ 2.1.12 Two buses moving at 100 km/h and 80 km/h respectively cross each other while moving in opposite direction. Velocity of one bus relative to other bus is: (NUMS MDCAT 2022)

A	100 km/h	B	20 km/h
C	80 km/h	D	180 km/h

Solution: (d) Moving towards each other, the speeds add: $100 + 80$ is $180\,\mathrm{km\,h^{-1}}$.

MCQ 2.1.13 Displacement of sun with respect to earth is? (PMC Practice 2021)

A	r	B	2πr
C	2r	D	r2

Solution: (a) The displacement is the straight line between them, that is the distance r.

MCQ 2.1.14 Instantaneous velocity is: (PMC Practice 2021)

A	Always positive	B	Always negative
C	Positive and negative	D	Not enough info

Solution: (c) Velocity is a vector along a line, so its sign shows which way the body is going.

MCQ 2.1.15 If displacement = 15 m and time t = 10 seconds, then average velocity is: (PMC Practice 2021)

A	12.5 m/s	B	1.5 m/s
C	2.5 m /s	D	3 m/s

Solution: (b) $15/10$ is $1.5\,\mathrm{m\,s^{-1}}$.

MCQ 2.1.16 The displacement has _____. (PMC Practice 2021)

A	Magnitude only	B	Direction only
C	Magnitude and direction	D	No unit is required

Solution: (c) Displacement has both size and direction, so it is a vector.

MCQ 2.1.17 **Consider a car is travelling for one hour. Which of the following trips have the same average velocity? (PMC Practice 2021)**

A	Car travels 20 km due east and car travels 70 km due east	B	Car travels 40 km due east, then turns around and travels 20 km due west and a car that travels 20 km due east
C	Car travels 70 km due east and a car that travels 40 km due east, then turns around and travels 20 km due west	D	Car travels 30 km due west, then turns around and travels 30 km due east and a car that travels 40 km due east, then turns around and travels 20 km due west

Solution: (b) Average velocity is displacement over time, and both those trips end $20\,\mathrm{km}$ east of the start.

MCQ 2.1.18 **Consider a car is travelling for one hour. In which of the following cases is the average velocity zero? (PMC Practice 2021)**

A	The car travels 20 km due east	B	The car travels 60 km due east, then turns around and travels 40 km due west
C	The car travels 70 km due east	D	The car travels 30 km due west, then turns around and travels 30 km due east

Solution: (d) Going out and back returns the car to its start, so the displacement, and with it the average velocity, is zero.

MCQ 2.1.19 **Under what condition an object will have zero displacement but non zero distance? (PMC MDCAT 2020)**

A	Linear motion	B	Circular motion
C	Random motion	D	Oscillation

Solution: (b) A complete circle brings the body back to its start, so the displacement is zero but the path is not.

Topic 2.2 Displacement-Time and Velocity-Time Graphs

Past MDCAT Questions

MCQ 2.2.1 **In a displacement-time graph, if the slope is constant then the velocity is: (MDCAT 2023)**

A	variable	B	constant
C	may be variable or constant	D	infinite

Solution: (b) The slope of a displacement-time graph is the velocity, so a constant slope is a constant velocity.

MCQ 2.2.2 **The velocity-time plot for a moving particle is a straight line. This means: (MDCAT 2023)**

A	the particle has a constant acceleration	B	the particle has never turned around
C	the particle has zero displacement	D	the data are insufficient

Solution: (a) The slope of a velocity-time graph is the acceleration, and a straight line has a constant slope.

MCQ 2.2.3 **In a velocity-time graph the area under the graph is equal to the: (MDCAT 2024)**

A	speed of the object	B	velocity of the object
C	distance covered by the object	D	acceleration of the object

Solution: (c) The area is velocity multiplied by time, which is the distance covered.

MCQ 2.2.4 **A displacement time graph is a straight line inclined up at angle of 45° with X-axis, velocity of body according to this graph is: (SIBA MDCAT 2025)**

A	Increasing	B	Decreasing
C	Constant	D	Decreasing at start and then may decrease

Solution: (c) The slope of a displacement time graph is the velocity, and a straight line has a constant slope.

MCQ 2.2.5 **In velocity time graph the area under graph is equal to the: (UHS MDCAT 2024)**

A	Speed of an object	B	Velocity of an object
C	Distance covered by object	D	Acceleration of an object

Solution: (c) Velocity times time is distance, and that is the area under the graph.

MCQ 2.2.6 **What is the shape of velocity-time graph for constant acceleration? (UHS MDCAT 2023)**

A	Parabola line	B	Straight line
C	Incline curve	D	Decline curve

Solution: (b) Constant acceleration means a constant slope, so the graph is a straight line.

MCQ 2.2.7 **The gradient of velocity time is equal to: (SZABMU MDCAT 2023)**

A	Distance	B	Force
C	Acceleration	D	Speed

Solution: (c) The slope of a velocity time graph is the acceleration.

MCQ 2.2.8 **Slope of distance time graph can never be: (SZABMU MDCAT 2023)**

A	Positive	B	Negative
C	Constant	D	Zero

Solution: (b) Distance can only grow, so the slope of the graph is never below zero.

MCQ 2.2.9 **The slope of a displacement-time graph is equal to: (NUMS MDCAT 2023)**

A	Velocity	B	Displacement
C	Acceleration	D	Distance

Solution: (a) The slope of a displacement time graph is the velocity.

MCQ 2.2.10 **The velocity-time plot for a moving particle shows a straight line. This means: (UHS MDCAT 2023)**

A	The particle has a constant acceleration	B	The particle has never turned around
C	The particle has zero displacement	D	The data in insufficient

Solution: (a) A straight velocity time line has a constant slope, that is a constant acceleration.

MCQ 2.2.11 **In the displacement-time graph, if the slope is constant then the velocity is (UHS MDCAT 2023)**

A	Variable	B	Constant
C	May be variable or constant	D	Infinite

Solution: (b) The slope of a displacement time graph is the velocity, so a constant slope is a constant velocity.

MCQ 2.2.12 **The slope of distance – time graph will always be: (PMC MDCAT 2020)**

A	Negative	B	Positive
C	Zero	D	Maximum

Solution: (b) Distance can only grow, so the slope is never below zero.

Topic 2.3 Uniform and Variable Acceleration

Past MDCAT Questions

MCQ 2.3.1 **A car starts from rest and moves with a uniform acceleration of 3m/s^2. What will be its velocity after 5 seconds? (KMU MDCAT 2025)**

A	8m/s	B	12m/s
C	15m/s	D	18m/s

Solution: (c) $v = at = 3 \times 5$, which is $15\,\mathrm{m\,s^{-1}}$.

MCQ 2.3.2 **Unequal changes occurring in velocity of a body is called (SZABMU MDCAT 2025)**

A	Uniform acceleration	B	Instantaneous acceleration
C	variable acceleration	D	Uniform velocity

Solution: (c) Unequal changes of velocity in equal times are a variable acceleration.

MCQ 2.3.3 **If the car is slowing down along negative x axis then acceleration will be along: (NUMS MDCAT 2023)**

A	Positive x Axis	B	Negative x Axis
C	Positive y Axis	D	Negative y Axis

Solution: (a) Slowing down means the acceleration points against the motion, so along the positive axis.

MCQ 2.3.4 **If we drop an object, it's initial velocity is zero. How far will it fall in time 't'? (PMC MDCAT 2020)**

A	9.8 t2	B	4.9 t2
C	0.49 t2	D	98 t2

Solution: (b) $s = \frac{1}{2}gt^2$, and half of 9.8 is 4.9.

MCQ 2.3.5 **If slope of velocity time graph is not constant at different points then body is moving with: (UHS MDCAT 2018)**

A	Uniform velocity	B	changing acceleration
C	Average acceleration	D	Constant acceleration

Solution: (b) A changing slope means the acceleration is not constant.

MCQ 2.3.6 **A stone of mass 2.0 kg is dropped from a rest position 5.0 m above the ground. What is its velocity at a height of 3.0 m above the ground? (UHS MDCAT 2018)**

A	12.5 m/s	B	6.3m/s
C	9.3 m/s	D	16.0 m/s

Solution: (b) It has fallen $2\,\mathrm{m}$, so $v = \sqrt{2 \times 9.8 \times 2}$, about $6.3\,\mathrm{m\,s^{-1}}$.

MCQ 2.3.7 **A cyclist is travelling at 15 ms-1, she applies brakes so that she doesn't collide with the wall in front of her at a distance of 18 m. Calculate the magnitude of deceleration. (UHS MDCAT 2018)**

A	6.3 ms-1	B	5.3 ms-1
C	13 ms-1	D	12.5 ms-1

Solution: (a) $v^2 = 2as$ gives $225 = 36a$, so the deceleration is about $6.3\,\mathrm{m\,s^{-2}}$.

Topic 2.4 Projectile Motion

Past MDCAT Questions

MCQ 2.4.1 **A stone thrown horizontally from the top of a tall building follows a path that is: (MDCAT 2022)**

A	circular	B	made of two straight line segments
C	hyperbolic	D	parabolic

Solution: (d) The horizontal velocity is constant and the vertical motion is uniformly accelerated, and the two together give a parabola.

MCQ 2.4.2 **The two-dimensional motion under constant acceleration due to gravity is called: (MDCAT 2024)**

A	circular motion	B	rotational motion
C	projectile motion	D	vibratory motion

Solution: (c) A projectile moves in a vertical plane with the constant downward acceleration g.

MCQ 2.4.3 **A ball is thrown into the air with certain velocity v making an angle θ with horizontal. If air resistance is neglected, then at maximum height its velocity is: (UHS MDCAT 2025)**

A	Equal to initial velocity	B	Half of initial velocity
C	Equal to zero	D	Minimum but not zero

Solution: (d) The vertical component is spent at the top, but the horizontal component is carried right through.

MCQ 2.4.4 **A projectile is launched in air with certain angle; its velocity is maximum at: (UHS MDCAT 2025)**

A	Point of projection	B	Highest point
C	Between launching and highest point	D	At all points

Solution: (a) The projectile is slowest at the top and fastest where it started, before gravity has taken any of the vertical component.

MCQ 2.4.5 **Which of the following statement about projectile motion is CORRECT? (KMU MDCAT 2025)**

A	The horizontal velocity of a projectile changes constantly due to gravity	B	The vertical velocity of a projectile remains constant throughout the flight
C	At the highest point, the vertical velocity of the projectile is zero, but the horizontal velocity remains unchanged	D	The acceleration of the projectile is zero at the peak of its trajectory

Solution: (c) Gravity acts only downwards, so it empties the vertical component at the top and leaves the horizontal one alone.

MCQ 2.4.6 **126.The two dimensional motion under constant acceleration due to gravity is called: (UHS MDCAT 2024)**

A	Circular motion	B	Rotational motion
C	Projectile motion	D	Vibratory motion

Solution: (c) Motion in two dimensions under gravity alone is projectile motion.

MCQ 2.4.7 **The vertical and horizontal component of the projectile motion are (KMU MDCAT 2024)**

A	Correlated with each other	B	Dependent on each other
C	Independent of each other	D	Associated with each other

Solution: (c) Gravity acts only vertically, so the horizontal motion runs on unaffected.

MCQ 2.4.8 **A ball is kicked horizontally from the top of a 10m high cliff with an initial speed of 15m/s. After 2 seconds, which of the following statement describes the ball's horizontal and vertical components? (KMU MDCAT 2024)**

A	The horizontal velocity is 15m/s while vertical velocity is 20m/s downwards	B	The horizontal velocity is 15m/s while vertical velocity is 15m/s downwards
C	The horizontal velocity is 30m/s while vertical velocity is 20m/s downwards	D	The horizontal velocity is 15m/s while vertical velocity is 0m/s

Solution: (a) The horizontal component stays at $15\,\mathrm{m\,s^{-1}}$, and the vertical one grows to $gt = 20\,\mathrm{m\,s^{-1}}$.

MCQ 2.4.9 **At highest point in a projectile motion, the velocity will be: (SZABMU MDCAT 2023)**

A	Vx = 0 Vy = 0	B	Vx = 0 Vy = constant
C	Vx = constant Vy = constant	D	Vx = constant Vy = 0

Solution: (d) Gravity empties the vertical component at the top and leaves the horizontal one untouched.

MCQ 2.4.10 **At what point during the motion of projectile its vertical component of velocity is zero? (NUMS MDCAT 2023)**

A	Point of projection	B	Landing point
C	Highest point	D	Just before landing

Solution: (c) The vertical component is spent at the highest point of the path.

MCQ 2.4.11 **In a projectile motion, velocity at maximum height is: (PMC MDCAT 2022)**

A	$u\sin\theta$	B	$u\cos\theta$
C	$u\tan\theta$	D	$u\cot\theta$

Solution: (b) The vertical component is spent at the top, leaving the horizontal component $u\cos\theta$.

MCQ 2.4.12 **In the absence of air resistance, an object thrown into the air at an angle of 20 degrees to the ground. It will experience: (PMC MDCAT 2022)**

A	Constant vertical acceleration	B	Changing vertical acceleration
C	Changing horizontal acceleration	D	Constant (non zero) horizontal acceleration

Solution: (a) Gravity is the only force, so the vertical acceleration is g throughout and the horizontal one is nil.

MCQ 2.4.13 **Which of the following quantities has no effect on simple projectile motion? (PMC MDCAT 2022)**

A	Velocity	B	Force
C	Mass	D	Acceleration

Solution: (c) The path depends on the launch velocity and on g alone, so the mass makes no difference.

MCQ 2.4.14 **For projectile motion, in the absence of air resistance: (UHS MDCAT 2019)**

A	Horizontal acceleration is zero	B	Vertical acceleration is zero
C	Horizontal force is constant	D	Vertical speed is constant

Solution: (a) Gravity acts only downwards, so nothing accelerates the projectile horizontally.

Topic 2.5 Height, Range and Time of Flight

Past MDCAT Questions

MCQ 2.5.1 **The range of a projectile will be maximum if the factor $\sin 2\theta$ becomes: (MDCAT 2024)**

A	zero	B	1
C	$1/2$	D	-1

Solution: (b) $R = v^2\sin 2\theta/g$ is largest when $\sin 2\theta = 1$, that is at $\theta = 45°$.

MCQ 2.5.2 **If the horizontal range of a projectile becomes half of its maximum possible horizontal range, the probable angle of projection is; (UHS MDCAT 2025)**

A	15°	B	30°
C	45°	D	60°

Solution: (a) The range is largest at $45°$, and half of it needs $\sin 2\theta = 0.5$, so θ is $15°$.

MCQ 2.5.3 **Angle at which maximum range of projectile is achieved? (NUMS MDCAT 2025)**

A	0°	B	45°
C	90°	D	76°

Solution: (b) The range goes as $\sin 2\theta$, which is largest at $\theta = 45°$.

MCQ 2.5.4 **A body is projected with speed v making an angle θ with the horizontal and covers horizontal range R. If its speed is doubled, the new range will be: (SIBA MDCAT 2025)**

A	R/2	B	R
C	2R	D	4R

Solution: (d) The range goes as the square of the speed, so doubling the speed gives four times the range.

MCQ 2.5.5 **Two balls thrown with equal speeds but at different angles cover equal horizontal distance. If one is thrown at an angle of 40°, then the angle of projection of the other is: (SZABMU MDCAT 2025)**

A	20°	B	30°
C	45°	D	50°

Solution: (d) Two angles adding to $90°$ give the same range, so the other is $50°$.

MCQ 2.5.6 **The range of projectile will be maximum if the factor sin2θ becomes (UHS MDCAT 2024)**

A	Zero	B	1
C	-1	D	2

Solution: (b) $R = v^2\sin 2\theta/g$ is largest when the sine is one.

MCQ 2.5.7 **In projectile motion for which angle maximum height is half of its range? (NUMS MDCAT 2024)**

A	73°	B	65°
C	63°	D	68°

Solution: (c) $H = R/2$ gives $\tan\theta = 2$, so the angle is about $63°$.

MCQ 2.5.8 **Horizontal range of projectile will be maximum when: (NUMS MDCAT 2024)**

A	Sinθ = 1/2	B	Sin2θ = 1
C	Sinθ = 0	D	Sin2θ = 0

Solution: (b) $R = v^2\sin 2\theta/g$ is largest when $\sin 2\theta$ is one.

MCQ 2.5.9 **At what pair of angles for a projectile, the ranges are equal? (SZABMU MDCAT 2023)**

A	200, 600	B	600, 300
C	400, 600	D	250, 550

Solution: (b) Two angles adding to $90°$ give the same range.

MCQ 2.5.10 **The angle of projection of a projectile for which its maximum height and horizontal range are equal is: (SZABMU MDCAT 2023)**

A	860	B	46 0
C	66 0	D	76 0

Solution: (d) $H = R$ gives $\tan\theta = 4$, so the angle is about $76°$.

MCQ 2.5.11 **Range of a projectile on a horizontal plane is same for the following pair of angle: (NUMS MDCAT 2023)**

A	15 & 30	B	60 & 20
C	75 & 15	D	50 & 25

Solution: (c) Two angles adding to $90°$ give the same range, and $75 + 15$ is the only such pair.

MCQ 2.5.12 **The horizontal range is 4√3 times of the maximum height. Its angle of projection is: (PMC MDCAT 2022)**

A	90 degrees	B	45 degrees
C	60 degrees	D	30 degrees

Solution: (d) $R = 4\sqrt{3}H$ gives $\tan\theta = 4/(4\sqrt{3})$, so θ is $30°$.

MCQ 2.5.13 **At what angle of projectile horizontal range is minimum: (PMC MDCAT 2022)**

A	30 degrees	B	45 degrees
C	60 degrees	D	90 degrees

Solution: (d) $\sin 2\theta$ is zero at $90°$, so the projectile goes straight up and comes straight down.

MCQ 2.5.14 **For a projectile at angle (45+θ) and (45-θ), the ratio of horizontal range described by the projectile is: (PMC MDCAT 2022)**

A	1.00	B	0.50
C	2.00	D	0.08

Solution: (a) The two angles add to $90°$, so their ranges are equal and the ratio is one.

MCQ 2.5.15 **The projectile motion covers maximum range: (PMC MDCAT 2022)**

A	Horizontally	B	Vertically
C	Tangentially	D	Linearly

Solution: (a) The range of a projectile is measured along the horizontal.

MCQ 2.5.16 **If a particle launched with 5m/s at angle of 45 degree, then time of flight is: (PMC MDCAT 2022)**

A	1.44 s	B	0.72 s
C	0.6 s	D	0.5 s

Solution: (b) $T = 2u\sin\theta/g = 2 \times 5 \times 0.707/9.8$, about $0.72\,\text{s}$.

MCQ 2.5.17 **Q.78 In projectile motion, the rage of projectile will be maximum at an angle of: (NUMS MDCAT 2022)**

A	30 degrees	B	45 degrees
C	60 degrees	D	90 degrees

Solution: (b) The range goes as $\sin 2\theta$, which is largest at $45°$.

MCQ 2.5.18 **Which of the following pair of angles have same rang for a projectile? (NUMS MDCAT 2022)**

A	10° and 20°	B	75° and 15°
C	45° and 60°	D	0° and 30°

Solution: (b) Two angles adding to $90°$ give the same range.

MCQ 2.5.19 **At what angle of projection of a projectile the range becomes half of its maximum value? (PMC MDCAT 2020)**

A	15	B	20
C	30	D	40

Solution: (a) Half the maximum range needs $\sin 2\theta = 0.5$, so θ is $15°$.

MCQ 2.5.20 **The range Of the projectile depends upon the velocity of the projection and the angle of the projection i.e 45. For a fixed velocity, when the angle of projection is larger than 45. Which of the following is correct? (UHS MDCAT 2019)**

A	The height attained by the projectile will be more but the range is less	B	Both the height and the range attained by the projectile will be more.
C	The height attained by the projectile will be less but the range is more.	D	Both the height and the range attained by the projectile will be less.

Solution: (a) Above $45°$ more of the velocity goes into the vertical, so the projectile rises higher but lands nearer.

Topic 2.6 Newton's Laws of Motion

Past MDCAT Questions

MCQ 2.6.1 **A fireman slides down a rope whose breaking load is three quarters of his weight. With what acceleration should the fireman slide down, if the acceleration due to gravity is g? (MDCAT 2022)**

A	g	B	$g/4$
C	$3g/4$	D	zero

Solution: (b) The rope can pull up with at most $\frac{3}{4}mg$, so $ma = mg - \frac{3}{4}mg$ and $a = g/4$.

MCQ 2.6.2 **According to Newton's laws of motion the mass of an object is a quantitative measure of its: (MDCAT 2024)**

A	weight	B	inertia
C	speed	D	acceleration

Solution: (b) The greater the mass, the greater the force needed for a given acceleration, so mass measures inertia.

MCQ 2.6.3 **A passenger standing in a stationary bus. When the bus suddenly starts moving forward, the passenger falls backward. Which phenomenon best explains this observation? (KMU MDCAT 2025)**

A	Friction	B	Gravity
C	Inertia	D	Deceleration

Solution: (c) The passenger keeps the state of rest while the floor moves forward under them.

MCQ 2.6.4 **According to Newton's Law of Motion the mass of the object is a quantitative measure of its: (UHS MDCAT 2024)**

A	Weight	B	Inertia
C	Speed	D	Acceleration

Solution: (b) Mass measures how strongly a body resists a change in its motion, that is its inertia.

MCQ 2.6.5 **____ is the natural tendency of an object to remain at rest or in motion with constant velocity? (KMU MDCAT 2024)**

A	Friction	B	Inertia
C	Mass	D	Weight

Solution: (b) Inertia is the tendency of a body to keep its state of rest or of uniform motion.

MCQ 2.6.6 **A fireman wants to slide down a rope. The breaking load of the rope is 3/4 th of the weight of the man. With what acceleration should the fire man slide down? (Acceleration due to gravity is 'g') (UHS MDCAT 2023)**

A	g	B	g/4
C	3g/4	D	0

Solution: (b) The rope will bear only $3mg/4$, so the least downward force is $mg/4$ and the acceleration $g/4$.

MCQ 2.6.7 **Is it possible to have a non-zero number of forces acting on an object (of non-zero mass), yet the object doesn't accelerate? (PMC MDCAT 2022)**

A	No	B	Yes
C	Not necessarily	D	Not enough information

Solution: (b) If the forces balance, the resultant is zero and the body does not accelerate.

MCQ 2.6.8 **Which of the following is true about newton's laws of motion? (PMC MDCAT 2022)**

A	One of them is not related to forces	B	Two of them are not related to forces
C	All of them are related to forces	D	One of them is related forces

Solution: (c) The first defines force, the second measures it and the third pairs it with its reaction.

MCQ 2.6.9 **The value of acceleration due to gravity: (PMC MDCAT 2022)**

A	Is same on equator and poles	B	Is least on poles
C	Is least on equator	D	Increases from pole to equator

Solution: (c) The Earth bulges at the equator, so the surface there is furthest from the centre and g is least.

MCQ 2.6.10 **An eagle of mass 4 kg is locked inside a cage of mass 2 kg. If the eagle starts flying, what will be the mass of the bird and cage assembly? (PMC MDCAT 2022)**

A	5 kg	**B**	7 kg
C	2 kg	**D**	6 kg

Solution: (d) The cage is closed, so the eagle and the cage remain one system of 6 kg whether it flies or not.

MCQ 2.6.11 **A man of mass 50 kg on the top floor of a skyscraper steps into an elevator. (PMC MDCAT 2022)**

A	460 N	**B**	325 N
C	425 N	**D**	475 N

Solution: (c) With the lift accelerating down, the floor pushes up with $m(g-a) = 50 \times 8.5$, that is 425 N.

MCQ 2.6.12 **If we are standing in a bus and the driver applies a brake then we feel: (PMC Practice 2021)**

A	A pseudo force pushes backwards	**B**	A pseudo force pushes forwards
C	A real force pushes backwards	**D**	A real force pushes forwards

Solution: (b) The bus slows but we keep our forward motion, which feels like a push forward.

MCQ 2.6.13 **Newton first law of motion is also known as: (UHS MDCAT 2018)**

A	Law of inertia	**B**	Law of electromagnetism
C	Law of universal gravity	**D**	Law of conservation of momentum

Solution: (a) The first law says a body keeps its state unless a force acts, which is the law of inertia.

MCQ 2.6.14 **A man in elevator ascending with an acceleration will conclude that his weight is: (UHS MDCAT 2016)**

A	Increased	**B**	Decreased
C	Reduced to zero	**D**	Remain Constant

Solution: (a) The floor must push up with $m(g+a)$, and that is what the man feels as his weight.

Topic 2.7 Linear Momentum and the Second Law

Past MDCAT Questions

MCQ 2.7.1 **The product of force and time is equal to: (MDCAT 2020)**

A	angular momentum	**B**	force
C	change in momentum	**D**	velocity

Solution: (c) $F\Delta t$ is the impulse, and the impulse equals the change in momentum.

MCQ 2.7.2 **The time rate of change of linear momentum of a body is equal to its: (MDCAT 2020)**

A	force	**B**	momentum
C	power	**D**	acceleration

Solution: (a) Newton's second law in its general form is $F = \Delta p/\Delta t$.

MCQ 2.7.3 **If two equal masses are in motion with the same individual speeds, we can conclude that: (MDCAT 2023)**

A	their momenta are the same	**B**	their momenta can be different from each other
C	their kinetic energies are different from each other	**D**	their total energies are different

Solution: (b) Momentum is a vector, so equal masses at equal speeds in different directions have different momenta.

MCQ 2.7.4 **Product of force and time is equal to: (NUMS MDCAT 2025)**

A	Change in displacement	**B**	Change in momentum
C	Change in velocity	**D**	Change in acceleration

Solution: (b) Force times time is impulse, and impulse equals the change in momentum.

MCQ 2.7.5 **A 150 kg car has its velocity reduced from 20 m/s to 10 m/s in 3.0 sec. How large was the average retarding force? (SIBA MDCAT 2025)**

A	500 N	**B**	2500 N
C	1500 N	**D**	1000 N

Solution: (a) $F = m\Delta v/\Delta t = 150 \times 10/3$, which is 500 N.

MCQ 2.7.6 **A ball of mass m strikes a wall and rebounds with the same speed in the opposite direction, taking the initial direction as positive, the change in the momentum of the ball is: (SIBA MDCAT 2025)**

A	0	**B**	mv
C	-2mv	**D**	-mv

Solution: (c) The momentum goes from mv to $-mv$, a change of $-2mv$.

MCQ 2.7.7 **If you stop your car quickly by wearing seat belts, chance of injury is greatly reduced because seat belt applied: (NUMS MDCAT 2024)**

A	Extra force	**B**	Perpendicular force
C	Opposite force	**D**	Zero force

Solution: (c) The belt supplies the backward force that stops the passenger, and it spreads that stop over a longer time.

MCQ 2.7.8 **A ball with momentum 8 kg m/s hits a wall and bounces back without losing K.E. Change in momentum is: (NUMS MDCAT 2024)**

A	4 Ns	**B**	-16 Ns
C	16 Ns	**D**	8 Ns

Solution: (c) The momentum goes from $+8$ to -8, a change of 16 N s.

MCQ 2.7.9 **A car and truck is running with same velocity, a constant and same force applied to both, which will stop first: (PMC MDCAT 2022)**

A	Car	**B**	Truck
C	Both at the same time	**D**	Information insufficient

Solution: (a) The same force acting for the same change of velocity stops the smaller mass first.

MCQ 2.7.10 **A gun fires a bullet of mass 40 g with a velocity of 1200 ms-1 . The man holding it can exert a maximum force of 144 N on the gun. How many bullets can he fire per second at the most? (PMC MDCAT 2022)**

A	1	**B**	2
C	3	**D**	4

Solution: (c) Each shot carries $0.04 \times 1200 = 48$ N s of momentum, and $144/48$ is three a second.

MCQ 2.7.11 **A force of 50 dynes is acted on a body of mass 5g which is at rest for an interval of 3 seconds, then impulse is (PMC MDCAT 2022)**

A	0.00015 N.s	**B**	0.0015 N.s
C	0.15 N.s	**D**	1.6 N.s

Solution: (b) 50 dyne is 5×10^{-4} N, and over three seconds the impulse is 1.5×10^{-3} N s.

MCQ 2.7.12 **The newton-second is the unit of: (PMC MDCAT 2020)**

A	Work	**B**	Power
C	Impulse	**D**	Momentum

Solution: (c) Force times time is impulse, measured in newton seconds.

Topic 2.8 Third Law and Conservation of Momentum

Past MDCAT Questions

MCQ 2.8.1 Which of the following is incorrect? (MDCAT 2022)

A	the reaction force on a body is always balanced by the action force on the same body	B	reaction and action forces are always equal in magnitude
C	action and reaction forces never act on the same body	D	Newton's third law is always valid

Solution: (a) Action and reaction act on two different bodies, so they can never balance each other on one body.

MCQ 2.8.2 A canon is placed on a smooth surface. When it fires a shell, the canon moves backward, this recoil occurs due to: (UHS MDCAT 2025)

A	law of conservation of energy	B	Backward thrust of the gases
C	Newton's third law of motion	D	Newton's first law of motion

Solution: (c) The shell is pushed forward and the cannon takes an equal and opposite push backwards.

MCQ 2.8.3 A 0.02kg bullet moving at 300m/s embeds itself in a 2 kg block at rest on a smooth surface. What is the velocity of the block-bullet system just after impact? (KMU MDCAT 2025)

A	2m/s	B	3m/s
C	4m/s	D	5m/s

Solution: (b) Momentum is conserved, so 0.02×300 is shared by $2.02\,\text{kg}$, giving about $3\,\text{m s}^{-1}$.

MCQ 2.8.4 Two bodies in contact experience forces in: (PMC MDCAT 2022)

A	Same direction	B	Opposite directions
C	Perpendicular directions	D	five different direction

Solution: (b) Action and reaction are equal and opposite.

MCQ 2.8.5 Conservation of momentum is always applicable in a: (PMC MDCAT 2022)

A	Open system	B	Closed system
C	Isolated system	D	Any system

Solution: (c) Momentum is conserved when no external force acts, that is in an isolated system.

MCQ 2.8.6 While moving a boat forward we have to: (PMC MDCAT 2022)

A	Push water forward	B	Push water backward
C	Keeps the water steady	D	Keeps the water undisturbed

Solution: (b) The oar pushes the water back and the water pushes the boat forward.

MCQ 2.8.7 The horse pulling the wagon is able to move forward because of: (PMC MDCAT 2022)

A	The force exerted by the horse on the ground	B	The force exerted by the ground on the horse
C	The force exerted by the wagon on the horse	D	The force exerted by the horse on the wagon

Solution: (b) The horse pushes back on the ground and the ground pushes it forward.

MCQ 2.8.8 If a bird catches its prey from a height which was initially at rest then momentum will be conserved for: (PMC MDCAT 2022)

A	Bird	B	Prey
C	Either bird and prey	D	Both bird and prey

Solution: (d) No outside force acts on the pair, so the momentum of the bird and prey together is conserved.

MCQ 2.8.9 The total momentum of a flock of identical birds could be zero only if the birds are: (PMC MDCAT 2022)

A	Taking off from the ground	B	Flying in the same direction
C	Flying in different dlrections	D	Very tired and coming down to rest

Solution: (c) Momentum is a vector, so equal and opposite momenta can cancel only if the birds fly different ways.

MCQ 2.8.10 Q.79 Which of the following is NOT TRUE? (NUMS MDCAT 2022)

A	Action and reaction have same nature	B	Action and reaction have same line of action
C	Action and reaction never act on same body	D	Action and reaction can cancel each other

Solution: (d) They act on different bodies, so they can never cancel one another.

Topic 2.9 Elastic and Inelastic Collisions

Past MDCAT Questions

MCQ 2.9.1 In an elastic collision the total kinetic energy: (MDCAT 2024)

A	dissipates after the collision	B	increases after the collision
C	reduces after the collision	D	before and after the collision remains the same

Solution: (d) An elastic collision is defined as one in which the kinetic energy is conserved.

MCQ 2.9.2 If a body having mass ml (2 kg), moving with 5 m/s approaches another mass, m2 (3 kg) with speed of l m/s in same direction, relative speed of approach is 4 m/s. Relative speed of separation after collision will be: (UHS MDCAT 2025)

A	4 m/s	B	2 m/s
C	6 m/s	D	depends on masses

Solution: (a) In a perfectly elastic collision the relative speed of separation equals the relative speed of approach.

MCQ 2.9.3 A body of mass 2 kg moving with velocity 3 m/s collides with a body of mass l kg at rest. If they stick together, their common velocity after collision is: (SZABMU MDCAT 2025)

A	l m/s	B	2 m/s
C	3 m/s	D	4 m/s

Solution: (b) Momentum is conserved, so 2×3 is shared by $3\,\text{kg}$, giving $2\,\text{m s}^{-1}$.

MCQ 2.9.4 In an elastic collision the total kinetic energy (UHS MDCAT 2024)

A	Dissipates after collision	B	Increases after the collision
C	Reduces after the collision	D	Before and after collision remains the same

Solution: (d) A collision is called elastic precisely because the kinetic energy is the same before and after.

MCQ 2.9.5 A car in motion hits and gets crashed into a tree trunk, what is NOT conserved? (KMU MDCAT 2024)

A	Kinetic energy alone	B	Momentum alone
C	Momentum and kinetic energy both	D	Neither kinetic energy nor momentum

Solution: (a) The crash is inelastic: momentum still holds, but kinetic energy goes into deformation and heat.

MCQ 2.9.6 **Two balls collide each other, it has been observed that the collision is elastic. Which statement is advocates the observation? (SZABMU MDCAT 2023)**

A	K.E before collision = K.E after collision	B	Momentum before collision = Momentum after collision
C	K.E before collision ≠ K.E after collision	D	Momentum before collision ≠ Momentum after collision

Solution: (a) Momentum is conserved in every collision; it is the kinetic energy that marks an elastic one.

MCQ 2.9.7 **Two bodies having same mass undergo elastic collision then their velocities after collision will be: (SZABMU MDCAT 2023)**

A	v1' = 0 v2' = v1	B	v1' = v2 v2' = 0
C	v1' = v1 v2' = v2	D	v1' = v2 v2' = v1

Solution: (d) Equal masses in a head-on elastic collision simply exchange velocities.

MCQ 2.9.8 **In perfectly elastic collision: (NUMS MDCAT 2023)**

A	Only momentum is conserved	B	Only total energy is conserved
C	Only kinetic energy is conserved	D	Momentum, kinetic energy and total energy, all are conserved

Solution: (d) Momentum, kinetic energy and total energy are all conserved in a perfectly elastic collision.

MCQ 2.9.9 **A wagon weighing 1000kg is moving with a velocity 50 km/h on smooth horizontal rails. A mass of 250kg is dropped into it. The velocity with which it moves in km/h now is: (PMC MDCAT 2022)**

A	20 km/h	B	60 km/h
C	40 km/h	D	25 km/h

Solution: (c) $1000 \times 50 = 1250v$, so v is $40\,\mathrm{km\,h^{-1}}$.

MCQ 2.9.10 **Q.76 An elastic collision is the one in which: (NUMS MDCAT 2022)**

A	Kinetic energy and momentum is conserved	B	Kinetic energy is conserved but total energy is not con-served
C	Momentum is conserved but kinetic energy is not con-served	D	Both kinetic energy and momentum are not conserved

Solution: (a) In a perfectly elastic collision both the momentum and the kinetic energy are conserved.

MCQ 2.9.11 **A particle of mass 'm' is projected from the ground with an initial speed u0 at an angle 'α' with the horizontal. At the highest point of its trajectory, it makes a completely in-elastic collision with another particle of mass 'm' which was thrown vertically upward from the ground with the same initial speed u0. The angle that the composite system makes with the horizontal immediately after the collision is? (PMC Practice 2021)**

A	45°	B	45°-α
C	45°+α	D	90°

Solution: (a) At the top one particle carries $mu_0 \cos\alpha$ horizontally and the other the same magnitude vertically, so the pair moves at 45°.

MCQ 2.9.12 **If two objects of equal masses 'm' are moving towards each other with the same speeds 'v' then what will be the total final momentum after elastic head-on collision? (UHS MDCAT 2019)**

A	mv kg m/s	B	- mv kg's
C	2 mv kg's	D	0 kg m/s

Solution: (d) The two momenta are equal and opposite, so their sum is zero before and after.

Topic 2.10 Momentum and Explosive Forces

Past MDCAT Questions

MCQ 2.10.1 **The explosion of explosive material is application of: (NUMS MDCAT 2022)**

A	Law of conservation of energy	B	Law of conservation of mass
C	Law of conservation of momentum	D	Newton's third law of motion

Solution: (c) The fragments fly apart with momenta that add to the zero the charge began with.

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Topic 3.1 Work

Past MDCAT Questions

MCQ 3.1.1 A 10 N force moves a body around a circular path of radius 50 cm. What is the work done in completing one revolution? (MDCAT 2020)

A	25 J	B	zero
C	31.42 J	D	500 J

Solution: (b) The body returns to its starting point, so the displacement is zero and so is the work.

MCQ 3.1.2 The area under a force-displacement graph gives us the: (MDCAT 2020)

A	displacement	B	power
C	work	D	acceleration

Solution: (c) Force multiplied by displacement is work, and that product is the area under the graph.

MCQ 3.1.3 The work done by a variable force can be found by dividing the: (MDCAT 2023)

A	force into small intervals	B	displacement into small intervals
C	both force and displacement into small intervals	D	displacement into intervals at different angles

Solution: (b) Over a small enough displacement the force is effectively constant, so $W = \sum F\Delta d$ is the area under the force-displacement graph.

MCQ 3.1.4 Work done is equal to: (MDCAT 2024)

A	effort $\times$ distance	B	effort $+$ distance
C	effort $-$ distance	D	effort $\div$ distance

Solution: (a) Work is the product of the force and the distance moved in the direction of the force.

MCQ 3.1.5 When a force of 1 N displaces its point of application by 1 m in the direction of the force, the work done is: (MDCAT 2024)

A	1 J	B	10 J
C	0.1 J	D	100 J

Solution: (a) $W = Fd = 1 \times 1 = 1$ J, which is how the joule is defined.

MCQ 3.1.6 At what angle between the force and the displacement will the work done be maximum? (UHS MDCAT 2017)

A	0°	B	90°
C	45°	D	30°

Solution: (a) $W = Fd\cos\theta$ is largest when $\cos\theta = 1$, that is when the force acts along the displacement.

MCQ 3.1.7 An object of mass $2\,\mathrm{kg}$ is lifted vertically through a distance of $1.5\,\mathrm{m}$. The work done in the process is: (UHS MDCAT 2017)

A	29.4 J	B	19.4 J
C	17.4 J	D	20.4 J

Solution: (a) $W = mgh = 2 \times 9.8 \times 1.5 = 29.4$ J.

MCQ 3.1.8 Work done is positive if angle is: (NUMS MDCAT 2025)

A	$0^\circ < \theta < 90^\circ$	B	$0^\circ < \theta < 180^\circ$
C	$90^\circ < \theta < 270^\circ$	D	None of these

Solution: (a) $W = Fd\cos\theta$ is positive while the cosine is positive, that is for angles under 90°.

MCQ 3.1.9 The work done by centripetal force is: (NUMS MDCAT 2025)

A	Maximum	B	Minimum
C	Zero	D	Negative

Solution: (c) The centripetal force is always at right angles to the motion, so it does no work.

MCQ 3.1.10 When force and displacement are in opposite direction then the work done is said to be: (SIBA MDCAT 2025)

A	Positive	B	Negative
C	Infinite	D	Maximum

Solution: (b) With $\theta = 180^\circ$ the cosine is -1, so the work is negative.

MCQ 3.1.11 When a force of 1N displaces its point of application by 1m in the direction of force, the work done is (UHS MDCAT 2024)

A	1 J	B	10 J
C	0 J	D	1

Solution: (a) $W = Fd\cos 0^\circ = 1 \times 1$, which is one joule.

MCQ 3.1.12 How does an angle between the force applied and the direction of motion influence the work done on an object? (KMU MDCAT 2024)

A	Work is constant regardless of the angle	B	Work is maximum when the angle is 0°
C	Work is negative when the angle is 90°	D	Work is 0 when the angle is 45°

Solution: (b) $W = Fd\cos\theta$ is greatest when the cosine is one, that is when force and displacement are along each other.

MCQ 3.1.13 A nurse is pushing a wheelchair with an 80kg patient sitting on it. How much work is done by the patient's weight? (KMU MDCAT 2024)

A	Half of the work	B	Maximum work
C	Minimum work	D	No work

Solution: (d) The weight acts downwards and the chair moves horizontally, so the angle is 90° and the work is nil.

MCQ 3.1.14 If a constant force of 10N is applied to move an object 5m in the direction of the force, what is the work done? (KMU MDCAT 2024)

A	2 J	B	5 J
C	15 J	D	50 J

Solution: (d) $W = Fd = 10 \times 5$, which is 50 J.

MCQ 3.1.15 At what angle of applied force, work done will be 50%? (NUMS MDCAT 2024)

A	30°	B	60°
C	90°	D	45°

Solution: (b) $\cos\theta = 0.5$ gives $\theta = 60^\circ$.

MCQ 3.1.16 Work done will be negative if the angle between force and displacement is: (SZABMU MDCAT 2023)

A	0 0	B	45 0
C	60 0	D	180 0

Solution: (d) At 180° the cosine is -1, so the work is negative.

MCQ 3.1.17 The area under force-displacement graph gives: (NUMS MDCAT 2023)

A	Displacement	B	Power
C	Work	D	Acceleration

Solution: (c) Force times displacement is work, and that is the area under the graph.

MCQ 3.1.18 **Work done by the spring force in a time interval cannot be: (PMC MDCAT 2022)**

A	Positive	**B**	Negative
C	Zero	**D**	Constant

Solution: (c) The spring force and the displacement are along the same line, so their product is never zero while the spring moves.

MCQ 3.1.19 **A body is undergoing non uniform circular motion, work done by radial force on the body: (PMC MDCAT 2022)**

A	Positive	**B**	Zero
C	Negative	**D**	Variable

Solution: (b) The radial force is always at right angles to the motion, so it does no work.

MCQ 3.1.20 **In a simple pendulum, work done by the tension force is? (PMC Practice 2021)**

A	Positive	**B**	Negative
C	Zero	**D**	None of these

Solution: (c) The tension is along the string and the bob moves at right angles to it, so no work is done.

MCQ 3.1.21 **Two forces of 5 N and 15 N are work on a body in opposite directions. If the body displaced by 5 m in direction of the net force, what will be the work done by a net force? (PMC Practice 2021)**

A	50 J	**B**	75 J
C	25 J	**D**	100 J

Solution: (a) The net force is $15 - 5 = 10\,\text{N}$, and 10×5 is $50\,\text{J}$.

MCQ 3.1.22 **A 1.75 m tall weight-lifter raises a weight of mass 50 kg to a height of 0.5 m above its head. How much work is being done by it? (g = 10 ms-2) (PMC MDCAT 2020)**

A	2125 J	**B**	2500 J
C	50 J	**D**	1125 J

Solution: (d) The weight is lifted from the ground to $1.75 + 0.5\,\text{m}$, so $W = 50 \times 10 \times 2.25$, that is $1125\,\text{J}$.

MCQ 3.1.23 **Work done, due to centripetal force, for circular motion will be: (UHS MDCAT 2019)**

A	Reduced	**B**	Zero
C	Maximum	**D**	Half

Solution: (b) The centripetal force is always at right angles to the motion, so it does no work.

MCQ 3.1.24 **Which of the following statement shows that no work is done? (UHS MDCAT 2019)**

A	Pushing a car to start it moving	**B**	Lifting the weights.
C	The moon Orbiting the earth.	**D**	Writing an essay on a page.

Solution: (c) The moon moves at right angles to the pull on it, so gravity does no work.

Topic 3.2 Energy and Kinetic Energy

Past MDCAT Questions

MCQ 3.2.1 **A particle of mass m at rest is acted upon by a force P for a time t. Its kinetic energy after time t is: (MDCAT 2022)**

A	P^2t^2/m	**B**	$P^2t^2/2m$
C	$P^2t^2/3m$	**D**	$P^2t^2/4m$

Solution: (b) The impulse gives $p = Pt$, and $E_k = p^2/2m = P^2t^2/2m$.

MCQ 3.2.2 **An 8.0 kg box slides along a horizontal frictionless floor at $3\,\text{m}\,\text{s}^{-1}$ and meets a light spring that compresses 12 cm before the box stops. Calculate the retarding force of the spring. (MDCAT 2023)**

A	3 N	**B**	30 N
C	300 N	**D**	3000 N

Solution: (c) $\frac{1}{2}mv^2 = \frac{1}{2}(8)(3)^2 = 36$ J, and $F = W/d = 36/0.12 = 300$ N.

MCQ 3.2.3 **Two bodies with kinetic energies in the ratio 4 : 1 are moving with equal linear momentum. The ratio of their masses is: (MDCAT 2023)**

A	1 : 4	**B**	4 : 1
C	1 : 2	**D**	2 : 1

Solution: (a) With p equal, $E_k = p^2/2m$, so the kinetic energy is inversely proportional to the mass.

MCQ 3.2.4 **If P is the momentum of an object and m is its mass, then its kinetic energy is: (UHS MDCAT 2025)**

A	P/2m	**B**	P^2/2m
C	1/2 Pm^2	**D**	1/2 P^2/m^2

Solution: (b) From $p = mv$, $v = p/m$, so $K = \frac{1}{2}mv^2$ becomes $p^2/2m$.

MCQ 3.2.5 **Earth receives large amount of energy directly from: (UHS MDCAT 2025)**

A	Wind	**B**	Water
C	Sun	**D**	Moon

Solution: (c) Sunlight is the energy the Earth receives directly; wind and water carry it only after it has arrived.

MCQ 3.2.6 **A 0.5 kg ball moving at 6 m/s has kinetic energy (UHS MDCAT 2025)**

A	9 J	**B**	18 J
C	6 J	**D**	3 J

Solution: (a) $K = \frac{1}{2} \times 0.5 \times 6^2$, which is $9\,\text{J}$.

MCQ 3.2.7 **If velocity is doubled, what happens to kinetic energy: (NUMS MDCAT 2025)**

A	Remains same	**B**	Doubles
C	Quadruples	**D**	Halves

Solution: (c) $K = \frac{1}{2}mv^2$ goes as the square of the speed, so twice the speed is four times the energy.

MCQ 3.2.8 **The work done on a body is stored in it in the form of: (SZABMU MDCAT 2025)**

A	Power	**B**	Energy
C	Momentum	**D**	Impulse

Solution: (b) The work done on a body appears as its energy.

MCQ 3.2.9 **The relation between K.E and momentum P is given by: (NUMS MDCAT 2024)**

A	K.E = 1/2 P/M	**B**	K.E = 1/2 P/M2
C	K.E = 1/2 P2/M2	**D**	K.E = 1/2 P2/M

Solution: (d) From $p = mv$, the kinetic energy $\frac{1}{2}mv^2$ becomes $p^2/2m$.

MCQ 3.2.10 **A particle of mass m at rest is acted upon by a force P for time t. Its kinetic energy after time t is: (UHS MDCAT 2023)**

A	(P^2 t^2)/m	**B**	(P^2 t^2)/2m
C	(P^2 t^2)/3m	**D**	(P^2 t^2)/4m

Solution: (b) The impulse Pt is the momentum gained, and $K = p^2/2m$ gives $P^2t^2/2m$.

MCQ 3.2.11 **The unit of kinetic energy is same as that of: (SZABMU MDCAT 2023)**

A	Work	B	Power / Time
C	Time / Power	D	Work / Time

Solution: (a) Kinetic energy is measured in joules, the same unit as work.

MCQ 3.2.12 **A car of mass 800 Kg accelerates from 20m-1 to 30ms-1, the increase in K.E is: (SZABMU MDCAT 2023)**

A	2 J	B	200 KJ
C	200 J	D	2 KJ

Solution: (b) $\frac{1}{2} \times 800 \times (30^2 - 20^2)$ is $200\,\text{kJ}$.

MCQ 3.2.13 **A body of mass 'm' is moving with velocity 'v'. After a short interval of time its velocity becomes double. How many times its K.E will increase or decrease? (NUMS MDCAT 2023)**

A	2 time increased	B	2 time decreased
C	4 time increased	D	4 time decreased

Solution: (c) $K = \frac{1}{2}mv^2$ goes as the square of the speed, so doubling it gives four times the energy.

MCQ 3.2.14 **An 8.0-kg box slides along a horizontal frictionless floor at 3 m/s and collides with a relatively massless spring that compresses 12 cm before the box comes to a rest. Calculate the retarding force of the spring. (UHS MDCAT 2023)**

A	3N	B	30N
C	300N	D	3000N

Solution: (c) The kinetic energy $\frac{1}{2} \times 8 \times 3^2 = 36\,\text{J}$ is absorbed over $0.12\,\text{m}$, so the force is $300\,\text{N}$.

MCQ 3.2.15 **A ball is projected with kinetic energy E at 45 degree angle. At the highest point its kinetic energy is: (PMC MDCAT 2022)**

A	2E	B	0
C	E	D	E/2

Solution: (d) Only the horizontal component is left at the top, and at 45° that carries half the energy.

MCQ 3.2.16 **The K.E. of object at rest Is: (PMC MDCAT 2022)**

A	Maximum	B	Negative
C	Zero	D	Constant

Solution: (c) $K = \frac{1}{2}mv^2$, and at rest the speed is zero.

MCQ 3.2.17 **Minimum value of kinetic energy is: (PMC MDCAT 2022)**

A	Infinite	B	Zero
C	Negative constant	D	Minus infinite

Solution: (b) Kinetic energy is $\frac{1}{2}mv^2$ and can never fall below zero.

MCQ 3.2.18 **If the kinetic energy is increased 4 times then momentum will increase: (PMC MDCAT 2022)**

A	3 times	B	4 times
C	5 times	D	2 times

Solution: (d) $p = \sqrt{2mK}$, so four times the kinetic energy doubles the momentum.

MCQ 3.2.19 **A car and a train both have same kinetic energy. Which one has greater momentum? (PMC MDCAT 2022)**

A	Car	B	Train
C	Both have same	D	No change

Solution: (b) $p = \sqrt{2mK}$, so at the same kinetic energy the heavier body carries the greater momentum.

MCQ 3.2.20 **When the speed of your car is halved, by what factor does its kinetic energy decreases? (PMC MDCAT 2020)**

A	½	B	¼
C		D	

Solution: (b) K goes as the square of the speed, so half the speed leaves a quarter of the energy.

Topic 3.3 Potential Energy and Absolute Potential Energy

Past MDCAT Questions

MCQ 3.3.1 **A 3 kg stone falls from a 20 m high platform. Find its speed at a height of 10 m. (MDCAT 2020)**

A	$190\,\text{m s}^{-1}$	B	$14\,\text{m s}^{-1}$
C	$10\,\text{m s}^{-1}$	D	$100\,\text{m s}^{-1}$

Solution: (b) It has fallen 10 m, so $v = \sqrt{2gh} = \sqrt{2(10)(10)} \approx 14\,\text{m s}^{-1}$.

MCQ 3.3.2 **A long spring, when stretched by a distance x, has potential energy V. On increasing the stretching to nx, the potential energy of the spring will be: (MDCAT 2022)**

A	nV	B	V/n
C	n^2V	D	V/n^2

Solution: (c) $E = \frac{1}{2}kx^2$ goes as the square of the extension.

MCQ 3.3.3 **Ignoring friction and the extra forces exerted by the muscles, a pole vault is the conversion of an athlete's running kinetic energy into gravitational potential energy. If an athlete is to lift his body 5 m during a vault, what speed must he have when he plants his pole? (MDCAT 2022)**

A	$5\,\text{m s}^{-1}$	B	$10\,\text{m s}^{-1}$
C	$15\,\text{m s}^{-1}$	D	$20\,\text{m s}^{-1}$

Solution: (b) $\frac{1}{2}mv^2 = mgh$ gives $v = \sqrt{2gh} = \sqrt{2(10)(5)} = 10\,\text{m s}^{-1}$.

MCQ 3.3.4 **A fisherman lifts a fish of mass 250 g from rest through a vertical height of 1.8 m. The fish gains a speed of $1.1\,\text{m s}^{-1}$. What is the energy gained by the fish? (MDCAT 2023)**

A	0.15 J	B	4.3 J
C	4.4 J	D	4.6 J

Solution: (d) $mgh + \frac{1}{2}mv^2 = 0.25(9.8)(1.8) + \frac{1}{2}(0.25)(1.1)^2 = 4.41 + 0.15 \approx 4.6$ J.

MCQ 3.3.5 **The work done by the gravitational force on an object as it moves from a reference level to a higher point is (UHS MDCAT 2025)**

A	Always positive	B	Always negative
C	Zero	D	Depends on the path taken

Solution: (b) Gravity acts downwards while the body rises, so the force and the displacement are opposed and the work is negative.

MCQ 3.3.6 **A 5kg body falls from the height of 30m towards the ground. All its potential energy is converted into heat on impact. What is the heat energy produced? (KMU MDCAT 2025)**

A	1270J	B	1370J
C	1470J	D	1570J

Solution: (c) $mgh = 5 \times 9.8 \times 30$, which is $1470\,\text{J}$.

MCQ 3.3.7 **Potential energy decreases in the process of: (SIBA MDCAT 2025)**

A	Compressing a spring	B	Stretching a spring
C	Releasing a stretched spring	D	Holding the spring at maximum extension

Solution: (c) A stretched spring gives up its stored energy as it returns to its natural length.

MCQ 3.3.8 **A diver of mass m is swimming at a depth h below the sea level. If the reference level is taken at sea level, the gravitational potential energy of the diver is: (SIBA MDCAT 2025)**

A	0	B	mgh
C	-mgh	D	2mgh

Solution: (c) The diver is below the reference level, so the potential energy is negative.

MCQ 3.3.9 **The escape velocity of a body in the gravitational field of Earth is dependent on: (KMU MDCAT 2024)**

A	Angle on which it is thrown	B	Both mass of the body and the angle at which it is thrown
C	Mass of earth	D	Mass of the body

Solution: (c) Escape velocity is $\sqrt{2GM/R}$, which carries the mass of the Earth but not that of the body.

MCQ 3.3.10 **When dolphin leaves the water it has lots of kinetic energy. At its highest point its energy is: (NUMS MDCAT 2024)**

A	Kinetic energy	B	Potential energy
C	Elastic potential energy	D	Neither kinetic nor potential energy

Solution: (b) At the top the motion has stopped rising and all the energy is potential.

MCQ 3.3.11 **The absolute potential energy is given as Ug = -GmMe/R. The negative sign indicates Earth's gravitational field for mass 'm' is: (NUMS MDCAT 2024)**

A	Repulsive	B	Less attractive
C	Attractive	D	More repulsive less attractive

Solution: (c) Work must be done against the field to carry the mass away, so the bound state is negative.

MCQ 3.3.12 **Ignoring details associated with friction, extra forces exerted by arm and leg muscles, and other factors, we can consider a pole vault as the conversion of an athlete's running kinetic energy to gravitational potential energy. If an athlete is to lift his body 5 m during a vault, what speed must he have when he plants his pole? (UHS MDCAT 2023)**

A	5 m/s	B	10 m/s
C	15 m/s	D	20 m/s

Solution: (b) $\frac{1}{2}mv^2 = mgh$ gives $v = \sqrt{2 \times 10 \times 5}$, about $10\,\mathrm{m\,s^{-1}}$.

MCQ 3.3.13 **According to mechanical energy conservation: (PMC MDCAT 2022)**

A	KE remains constant	B	PE remains constant
C	KE+ PE = constant	D	Gravitatlonal energy is constant

Solution: (c) With no friction the sum of kinetic and potential energy stays the same.

MCQ 3.3.14 **If the water falls from a dam on the turbine wheel 19.6 m below, then the velocity of water at the turbine is: (PMC MDCAT 2022)**

A	9.8 m/s	B	19.6 m/s
C	32.8 m/s	D	98.0 m/s

Solution: (b) $v = \sqrt{2gh} = \sqrt{2 \times 9.8 \times 19.6}$, which is $19.6\,\mathrm{m\,s^{-1}}$.

MCQ 3.3.15 **The formula to estimate P.E is: (PMC MDCAT 2022)**

A	F.d	B	mgh
C	kx	D	mvr

Solution: (b) The potential energy gained in rising a height h is mgh.

MCQ 3.3.16 **The amount of work done in moving a body at certain point in a gravitational field to a position of zero potential such that the body is never accelerated is called: (NUMS MDCAT 2022)**

A	Kinetic energy	B	Potential energy
C	Gravitational potential energy	D	Absolute potential energy

Solution: (c) That work is the absolute gravitational potential energy of the body at the point.

MCQ 3.3.17 **A body of mass 10 kg is moving at a height of 2 m, with a uniform speed of 2 m/s. (PMC Practice 2021)**

A	316 J	B	216 J
C	392 J	D	416 J

Solution: (b) $mgh + \frac{1}{2}mv^2 = 10 \times 9.8 \times 2 + \frac{1}{2} \times 10 \times 4$, that is $216\,\mathrm{J}$.

MCQ 3.3.18 **What is the speed of 2.0 kg metallic bob at the mean position of a simple pendulum, when released from its extreme position 0.5m high? (g = 10 ms-2) (PMC MDCAT 2020)**

A	3.16 ms-1	B	10 ms-1
C	100 ms-1	D	50 ms -1

Solution: (a) $v = \sqrt{2gh} = \sqrt{2 \times 10 \times 0.5}$, that is $3.16\,\mathrm{m\,s^{-1}}$.

MCQ 3.3.19 **Which one of the following force is non-conservative: (PMC MDCAT 2020)**

A	Frictional force	B	Gravitational force
C	Electric force	D	Elastic spring force

Solution: (a) The work done against friction depends on the path taken, so friction is not conservative.

Topic 3.4 Power

Past MDCAT Questions

MCQ 3.4.1 **The kilowatt-hour is a unit of: (MDCAT 2020)**

A	electric energy	B	power
C	momentum	D	intensity

Solution: (a) It is a power multiplied by a time, so it measures energy.

MCQ 3.4.2 **One kilowatt-hour is equal to: (MDCAT 2020)**

A	1.6×10^6 J	B	3.6×10^6 J
C	9.1×10^6 J	D	1.6×10^{-19} J

Solution: (b) $1000\,\mathrm{W} \times 3600\,\mathrm{s} = 3.6 \times 10^6$ J.

MCQ 3.4.3 **The consumption of energy by a 60 W bulb in 2 s is: (MDCAT 2022)**

A	120 J	B	60 J
C	30 J	D	0.02 J

Solution: (a) $E = Pt = 60 \times 2 = 120$ J.

MCQ 3.4.4 **One kilowatt-hour is equal to: (MDCAT 2024)**

A	3.6 J	B	3.6 kJ
C	3.6 MJ	D	36 MJ

Solution: (c) $1\,\mathrm{kWh} = 1000 \times 3600 = 3.6 \times 10^6$ J, which is 3.6 MJ.

MCQ 3.4.5 **An electric motor is used to lift a weight of 2.0 N through a vertical distance of 100 cm in 4 s. What is the power output of the motor? (MDCAT 2024)**

A	0.25 W	B	0.5 W
C	0.75 W	D	1 W

Solution: (b) $P = W/t = (2.0 \times 1.0)/4 = 0.5$ W.

MCQ 3.4.6 **The rate of doing work at any instant of time is called: (KMU MDCAT 2025)**

A	Work done	B	Instantaneous power
C	Average power	D	Mechanical energy

Solution: (b) Instantaneous power is the rate of doing work at a given moment.

MCQ 3.4.7 **Two students, A and B, each carry a 20kg load to the top of a long staircase. Student A takes 10sec, while student B takes 20sec. Which statement is CORRECT? (KMU MDCAT 2025)**

A	Student A does more work than student B	B	Student B uses more power than student A
C	Both students do the same amount of work, but student A uses more power	D	Student A and B use the same power since they lifted the same weight

Solution: (c) The same load raised the same height is the same work, and the one who takes half the time delivers twice the power.

MCQ 3.4.8 **1 kWh is equal to: (NUMS MDCAT 2025)**

A	3.6 MW	B	3.6 MJ
C	3.6 kJ	D	3.6 GJ

Solution: (b) A kilowatt for an hour is 1000×3600 joules, that is $3.6\,\mathrm{MJ}$.

MCQ 3.4.9 **A constant force F acts on a body and displaces it by distance Δd in a time Δt. The rate at which force is doing work is: (SIBA MDCAT 2025)**

A	F x Δd	B	F x Δt
C	F x Δd/Δt	D	F x Δt/Δd

Solution: (c) Power is work over time, that is $F\Delta d/\Delta t$.

MCQ 3.4.10 **An electric motor is used to lift the weight of 2.0N through a vertical distance of 100 cm in 4 sec. What is the power output of the motor? (UHS MDCAT 2024)**

A	0.25 W	B	0.5 W
C	0.75 W	D	1 W

Solution: (b) $P = W/t = 2 \times 1/4$, which is $0.5\,\mathrm{W}$.

MCQ 3.4.11 **Which of the following pairs correctly matches a physical quantity with its SI unit? (KMU MDCAT 2024)**

A	Energy- Newton	B	Force- Joule
C	Power- Watt	D	Velocity-m/s^2

Solution: (c) Power is measured in watts; force in newtons and energy in joules.

MCQ 3.4.12 **What is the power of electric motor when it performs work of 64 × 106 J in 8 seconds? (NUMS MDCAT 2024)**

A	6 Kilowatts	B	7 Kilowatts
C	8 Megawatts	D	7 Megawatts

Solution: (c) $P = W/t = 64 \times 10^6/8$, which is $8\,\mathrm{MW}$.

MCQ 3.4.13 **Kilowatt hour is a unit of: (SZABMU MDCAT 2023)**

A	Energy	B	Energy x time
C	Power	D	(power)(energy)

Solution: (a) A kilowatt hour is power times time, that is energy.

MCQ 3.4.14 **The unit of power in British engineering system is: (SZABMU MDCAT 2023)**

A	Horse power	B	Watt
C	Js-1	D	Js

Solution: (a) The British engineering unit of power is the horsepower.

MCQ 3.4.15 **1 Nms-1 = : (SZABMU MDCAT 2023)**

A	1 Kilo watt hour	B	1 J.s
C	1 watt	D	1 J.s-2

Solution: (c) A newton metre per second is a joule per second, that is a watt.

MCQ 3.4.16 **1 kWh = (NUMS MDCAT 2023)**

A	0.36 × 106 J	B	36 × 105 J
C	3.6 × 106 J	D	0.036 × 105 J

Solution: (c) A kilowatt for an hour is 1000×3600, that is $3.6 \times 10^6\,\mathrm{J}$.

MCQ 3.4.17 **Power is dot product of: (NUMS MDCAT 2023)**

A	Force and displacement	B	Force and velocity
C	Force and time	D	Work and time

Solution: (b) Power is the scalar product of force and velocity.

MCQ 3.4.18 **For an ideal gas equation PV= nRT, the dimensions of Real Gas Constant R are: (UHS MDCAT 2023)**

A	[Ml L2 T-2 K-1]	B	[Ml L-3 T-1 K-1]
C	[Ml L-2 T-1 K-1]	D	[Ml L-3 T-2 K-1]

Solution: (a) $R = PV/nT$ is energy per mole per kelvin, that is $[\mathrm{M\,L^2\,T^{-2}\,K^{-1}}]$.

MCQ 3.4.19 **A car is moving at a velocity of 50 m/s and then the driver puts the brake and the car comes to rest. The force applied by car in the opposite direction is 2 N. (PMC MDCAT 2022)**

A	-100 watt	B	0 watt
C	25 watt	D	100 watt

Solution: (d) $P = Fv = 2 \times 50$, which is $100\,\mathrm{W}$.

MCQ 3.4.20 **A block moves in uniform circular motion because a cord tied to the block is anchored at the center of the circle. What will be the power exerted on the block by the cord? (PMC MDCAT 2022)**

A	Positive	B	Zero
C	Negative	D	variable

Solution: (b) The cord pulls at right angles to the motion, so it does no work and delivers no power.

MCQ 3.4.21 **A block of mass 2 kg is moving with the velocity 5 m/s in the horizontal direction under an influence of force 20 N. How much power is delivered by normal force? (PMC MDCAT 2022)**

A	-100 W	B	100 W
C	0 W	D	200 W

Solution: (c) The normal force is at right angles to the motion, so it does no work and delivers no power.

MCQ 3.4.22 **1 kilowatt =_____ Watts. (PMC MDCAT 2022)**

A	2000 watts	B	1000 watts
C	300 watts	D	100 Watts

Solution: (b) A kilowatt is a thousand watts.

MCQ 3.4.23 **A 1kW motor pumps out water from a well 10 meter deep. What is the quantity of water pumped out per second? (PMC MDCAT 2022)**

A	9.2 kg	B	9.5 kg
C	10.2 kg	D	10.8 kg

Solution: (c) $m = Pt/gh = 1000/(9.8 \times 10)$, about $10.2\,\text{kg}$ each second.

MCQ 3.4.24 **1hp is equal to: (NUMS MDCAT 2022)**

A	476 watts	B	647 watts
C	746 watts	D	487 watts

Solution: (c) One horsepower is $746\,\text{W}$.

MCQ 3.4.25 **The product of force and velocity is equal to: (NUMS MDCAT 2022)**

A	Kinetic energy	B	Potential energy
C	Power	D	Work done

Solution: (c) Force times velocity is power.

MCQ 3.4.26 **Which of the following is not a unit of power? (PMC Practice 2021)**

A	Horse power	B	Kilowatt
C	kWh	D	Nm/s

Solution: (c) A kilowatt hour is power times time, that is energy.

MCQ 3.4.27 **One kilowatt-hour is commonly termed as one commercial unit of electric energy which is equal to: (PMC MDCAT 2020)**

A	3.6 x 105 J	B	3.6 x 106 J
C	3.6 x 104 J	D	3.6 x 103 J

Solution: (b) A kilowatt for an hour is 1000×3600, that is $3.6 \times 10^6\,\text{J}$.

MCQ 3.4.28 **An automobile is moving forwards with uniform velocity due to the force exerted by its engine. If the force is doubled with the velocity remaining constant what happens to its total power? (UHS MDCAT 2019)**

A	It is squared	B	It is halved
C	It is doubled	D	It does not change

Solution: (c) $P = Fv$, so at the same speed twice the force is twice the power.

MCQ 3.4.29 **Energy consumed by 60 watt bulb in 2 minutes is equal to: (UHS MDCAT 2018)**

A	7.2 kilo joules	B	720 joules
C	120 joules	D	72000 joules

Solution: (a) 60×120 is $7200\,\text{J}$, that is $7.2\,\text{kJ}$.

MCQ 3.4.30 **The rate at which work is being done is called: (UHS MDCAT 2018)**

A	Power	B	Energy
C	Density	D	Force

Solution: (a) The rate of doing work is power.

Topic 3.5 Work Done Against Friction in a Resistive Medium

Past MDCAT Questions

MCQ 3.5.1 **Which of the following is a non-conservative force? (MDCAT 2024)**

A	frictional force	B	electric force
C	elastic spring force	D	gravitational force

Solution: (a) The work done against friction depends on the path taken and is not recovered, so friction is non-conservative.

MCQ 3.5.2 **In inter-conversion of energy, the work done against the friction is: (SZABMU MDCAT 2023)**

A	f + h	B	f - h
C	fh	D	f / h

Solution: (c) Work is force times distance, so the work against a friction f over a distance h is fh.

MCQ 3.5.3 **A bullet of mass 10 g leaves a rifle at an initial velocity of 1000 m/s and strikes earth at the same level with a velocity of 500 m/s. The work done in overcoming the resistance of air will be: (PMC Practice 2021)**

A	500 J	B	5000 J
C	3750 J	D	475 J

Solution: (c) $\frac{1}{2} \times 0.01 \times (1000^2 - 500^2)$ is $3750\,\text{J}$ lost to the air.

Topic 3.6 Energy Losses and Efficiency

Past MDCAT Questions

MCQ 3.6.1 **An engine pumps 400 kg of water through a height of 10 m in 40 s. Find the power of the engine if its efficiency is 80%? Take g = 10msJ\-2. (PMC MDCAT 2022)**

A	1.25 W	B	125 W
C	1.25 kW	D	12.5 kW

Solution: (c) The useful power is $400 \times 10 \times 10/40 = 1000\,\text{W}$, and at 80% efficiency the engine must supply $1.25\,\text{kW}$.

Topic 4.1 Angular Displacement

Past MDCAT Questions

MCQ 4.1.1 The number of revolutions in 3π radians is: (MDCAT 2022)

A	$1/60$	B	$3/2$
C	3	D	6

Solution: (b) One revolution is 2π radians, so $3\pi/2\pi = 1.5$ revolutions.

MCQ 4.1.2 One degree is equal to: (MDCAT 2023)

A	$\pi/90$ radians	B	$\pi/180$ radians
C	$\pi/270$ radians	D	$\pi/360$ radians

Solution: (b) A half turn is π radians and $180°$, so $1° = \pi/180$ radians.

MCQ 4.1.3 One radian is analogous to: (MDCAT 2023)

A	$57.3°$	B	57.3 radians
C	$1°$	D	$180°$

Solution: (a) $1\text{ rad} = 180°/\pi = 57.3°$.

MCQ 4.1.4 An angular displacement of 90° is equal to: (UHS MDCAT 2025)

A	One-fourth revolution	B	One- third revolution
C	One half revolution	D	One complete revolution

Solution: (a) One revolution is $360°$, so $90°$ is a quarter of it.

MCQ 4.1.5 The angle formed at the center of a circle as a body moves from one position to another is: (SIBA MDCAT 2025)

A	Angular displacement	B	Angular velocity
C	Angular acceleration	D	Angular momentum

Solution: (a) The angle swept at the centre is the angular displacement.

MCQ 4.1.6 A body moving in a circle, half revolution in terms of radians is equivalent to: (SIBA MDCAT 2025)

A	π	B	$\pi/6$
C	$\pi/2$	D	2π

Solution: (a) A whole revolution is 2π radians, so half of one is π.

MCQ 4.1.7 The true statement about angular displacement is: (SZABMU MDCAT 2025)

A	It always increases with time	B	It is treated as vector for small rotations
C	It is always a scalar quantity	D	It is measured in meters

Solution: (b) Only for small rotations does angular displacement obey the commutative law of vector addition.

MCQ 4.1.8 π radians are equivalent to (SZABMU MDCAT 2025)

A	$30°$	B	$270°$
C	$90°$	D	$180°$

Solution: (d) A half revolution is π radians, that is $180°$.

MCQ 4.1.9 A wheel makes 3 complete revolutions. What is the total number of radians through which a point on wheel has rotated? (KMU MDCAT 2024)

A	2π	B	3π
C	6π	D	9π

Solution: (c) Each revolution is 2π radians, so three of them are 6π .

MCQ 4.1.10 For rigid body that rotates about a fixed axis, the angle swept out by a line passing through any point on the body and intersecting the axis of rotation perpendicularly is called? (KMU MDCAT 2024)

A	Angular acceleration	B	Angular displacement
C	Angular momentum	D	Angular velocity

Solution: (b) That angle is the angular displacement of the body.

MCQ 4.1.11 Sara goes around a circular track of diameter 20m for distance 180m. Angular displacement is: (NUMS MDCAT 2024)

A	16 radians	B	18 radians
C	50 radians	D	8 radians

Solution: (b) $\theta = s/r = 180/10$, which is 18 radians.

MCQ 4.1.12 To find the direction of angular displacement, use: (NUMS MDCAT 2024)

A	Grasp axis of rotation in right hand	B	Grasp axis of rotation in left hand
C	Put thumb of right hand in direction of circular motion	D	Put thumb of left hand in direction of circular motion

Solution: (a) Grasp the axis in the right hand with the fingers along the turn, and the thumb gives the direction.

MCQ 4.1.13 For anti-clockwise rotation the angular displacement is: (NUMS MDCAT 2024)

A	Negative	B	Positive
C	Null	D	Zero

Solution: (b) An anticlockwise rotation is taken as positive, with its vector out of the page.

MCQ 4.1.14 How many degrees in $2\pi/5$ radians? (NUMS MDCAT 2024)

A	80°	B	50°
C	72°	D	20°

Solution: (c) π radians is $180°$, so $2\pi/5$ is $72°$.

MCQ 4.1.15 The number of revolutions in 3π radians is: (UHS MDCAT 2023)

A	1/60	B	3/2
C	2	D	6

Solution: (b) One revolution is 2π radians, so 3π is one and a half.

MCQ 4.1.16 How many radians are in one degree? (SZABMU MDCAT 2023)

A	0.0174 rad	B	0.174 rad
C	1.745 rad	D	0.00174 rad

Solution: (a) $\pi/180$ is about 0.0174 radians.

MCQ 4.1.17 The relation between radian and degree is: (NUMS MDCAT 2023)

A	1 rad = 57.3°	B	1° = 57.3 rad
C	1 rad = 1°	D	1° = π rad

Solution: (a) One radian is $180/\pi$ degrees, about $57.3°$.

MCQ 4.1.18 Angular displacement becomes linear for ____ arc lengths: (PMC MDCAT 2022)

A	Short	B	Circular
C	Curved	D	Large

Solution: (a) Only for a small arc does the angular displacement behave as a vector along the axis.

MCQ 4.1.19 The direction associated with angular displacement is given by : (PMC MDCAT 2022)

A	Left-hand rule	B	Head to tail rule
C	Right-hand rule	D	Fleming's rule

Solution: (c) Curl the fingers of the right hand along the rotation and the thumb gives the direction.

MCQ 4.1.20 **Earth's rotation in 24 hours covers ___ angle: (PMC MDCAT 2022)**

A	90	B	60
C	57.3	D	360

Solution: (d) A full rotation is $360°$.

MCQ 4.1.21 **One complete revolution of an object covers _____ angle in degrees (PMC MDCAT 2022)**

A	180	B	90
C	360	D	270

Solution: (c) A full revolution is $360°$.

MCQ 4.1.22 **During multiple revolutions, the centre of rotation is ____ (PMC MDCAT 2022)**

A	Fixed	B	Not fixed
C	May depend on condition of rotation	D	There is no centre in angular motion

Solution: (a) A body in circular motion turns about an axis that stays where it is.

MCQ 4.1.23 **The quantity used in angular measurement is: (PMC MDCAT 2022)**

A	Perimeter	B	Area
C	Circumference	D	Volume

Solution: (c) The angle in radians is the arc divided by the radius, and the whole circumference gives 2π.

MCQ 4.1.24 **Radian can be used to measure: (PMC MDCAT 2022)**

A	length of line	B	Diameter of circle
C	side of traingle	D	arc length

Solution: (d) The angle in radians is the arc divided by the radius, so it measures arc length.

MCQ 4.1.25 **1 radian = (NUMS MDCAT 2022)**

A	5.7°	B	73.5°
C	57.3°	D	37.5°

Solution: (c) One radian is $180/\pi$ degrees, about $57.3°$.

MCQ 4.1.26 **The angular displacement of an object after one complete revolution is: (PMC Practice 2021)**

A	0 radian	B	π radian
C	2π radian	D	(1 /3)xπradian

Solution: (c) One revolution is 2π radians.

MCQ 4.1.27 **If r= 1m and θ = 1° then what is the value of S? (PMC Practice 2021)**

A	0.01745 m	B	1 m
C	2 m	D	None of the options above are correct

Solution: (a) $s = r\theta$ with θ in radians, and $1°$ is $0.01745\,\text{rad}$.

MCQ 4.1.28 **1 radian is equal to: (PMC MDCAT 2020)**

A	57.1 degrees	B	57.2 degrees
C	57.3 degrees	D	57.4 degrees

Solution: (c) One radian is $180/\pi$ degrees, about $57.3°$.

MCQ 4.1.29 **An object is moving along a circular path of radius 4m. What will be its angular displacement if it moves 14 m on this circular path? (UHS MDCAT 2019)**

A	5.0 radians	B	3.5 radians
C	4.5 radians	D	5.5 radians

Solution: (b) $\theta = s/r = 14/4$, that is 3.5 radians.

Topic 4.2 Angular Velocity

Past MDCAT Questions

MCQ 4.2.1 **If a wheel turns at $3.0\,\text{rad}\,\text{s}^{-1}$, the time it takes to complete one revolution is about: (MDCAT 2022)**

A	0.67 s	B	10 s
C	1.3 s	D	2.1 s

Solution: (d) $T = 2\pi/\omega = 6.28/3.0 \approx 2.1$ s.

MCQ 4.2.2 **An aircraft makes a turn in a horizontal circle of radius 100 m. It is travelling with a velocity of $250\,\text{m}\,\text{s}^{-1}$. The angular velocity of the aircraft will be: (MDCAT 2024)**

A	$1.5\,\text{rad}\,\text{s}^{-1}$	B	$2.5\,\text{rad}\,\text{s}^{-1}$
C	$3\,\text{rad}\,\text{s}^{-1}$	D	$3.5\,\text{rad}\,\text{s}^{-1}$

Solution: (b) $\omega = v/r = 250/100 = 2.5\,\text{rad}\,\text{s}^{-1}$.

MCQ 4.2.3 **The angular speed of the minute hand of a mechanical watch is: (UHS MDCAT 2017)**

A	$\pi/30\,\text{rad}\,\text{s}^{-1}$	B	$\pi\,\text{rad}\,\text{min}^{-1}$
C	$\pi/2\,\text{rad}\,\text{min}^{-1}$	D	none of the above

Solution: (d) The minute hand turns 2π in 60 minutes, so $\omega = \pi/30\,\text{rad}\,\text{min}^{-1}$, which is $\pi/1800\,\text{rad}\,\text{s}^{-1}$ and is not among the options.

MCQ 4.2.4 **If an object is moving anticlockwise along a circular path, in a horizontal plane on a page then the direction of its angular velocity is: (KMU MDCAT 2025)**

A	Tangential to any point on the circle	B	Towards centre of the circle
C	Perpendicular to the plane and pointing out of the page	D	Perpendicular to the plane and pointing into the page

Solution: (c) By the right hand rule an anticlockwise rotation gives an angular velocity out of the page.

MCQ 4.2.5 **Direction of angular velocity can be found by: (NUMS MDCAT 2025)**

A	Right-hand rule	B	Fleming's left-hand rule
C	Lenz's law	D	Faraday's law

Solution: (a) Curl the fingers along the rotation and the thumb gives the direction of the angular velocity.

MCQ 4.2.6 **An air craft makes a turn in a horizontal circle of radius100m. It is travelling with a velocity of 250m/sec. The angular velocity of the air craft will be: (UHS MDCAT 2024)**

A	1.5 rad/sec	B	2.5 rad/sec
C	3 rad/sec	D	3.5 rad/sec

Solution: (b) $\omega = v/r = 250/100$, which is $2.5\,\text{rad}\,\text{s}^{-1}$.

MCQ 4.2.7 **The velocity of an object moving in a circle is: (NUMS MDCAT 2024)**

A	Constant	B	Variable
C	Zero	D	Negative

Solution: (b) The direction changes at every point, so the velocity is not constant even at constant speed.

MCQ 4.2.8 **Angle swept by minute hand in one minute is: (NUMS MDCAT 2024)**

A	6°	B	36°
C	8°	D	20°

Solution: (a) The hand sweeps $360°$ in sixty minutes, so $6°$ in one.

MCQ 4.2.9 **A particle moves in a circle of radius 10m with speed 20 m/s. Find angular velocity: (NUMS MDCAT 2024)**

A	2 rad/s	B	200 rad/s
C	20 rad/s	D	10 rad/s

Solution: (a) $\omega = v/r = 20/10$, which is $2\,\text{rad}\,\text{s}^{-1}$.

MCQ 4.2.10 **If a flywheel is rotating at 3.0 rad/s, the time it takes to complete one revolution is about (UHS MDCAT 2023)**

A	0.67 s	**B**	1.0 s
C	1.3 s	**D**	2.1 s

Solution: (d) $T = 2\pi/\omega = 2\pi/3$, about 2.1 s.

MCQ 4.2.11 **Which one of the following is the angular velocity of an electric motor if it rotates at 400 rpm? (SZABMU MDCAT 2023)**

A	51.2 rad/s	**B**	41.9 rad/s
C	45.2 rad/s	**D**	38.5 rad/s

Solution: (b) $400 \times 2\pi/60$ gives about $41.9\,\mathrm{rad\,s^{-1}}$.

MCQ 4.2.12 **Which one of the following is angular speed in radian per hour for daily rotation of our earth? (SZABMU MDCAT 2023)**

A	2 π	**B**	4 π
C	π /6	**D**	π /12

Solution: (d) 2π radians in 24 hours is $\pi/12$ radians an hour.

MCQ 4.2.13 **An electric motor turns at 400 revolutions per minute. Its angular velocity in rad/s will be: (NUMS MDCAT 2023)**

A	20π/3	**B**	30π/3
C	40π/3	**D**	30π/4

Solution: (c) $400 \times 2\pi/60$ is $40\pi/3\,\mathrm{rad\,s^{-1}}$.

MCQ 4.2.14 **An object travelling in a circle at 2 revolutions per second has an angular velocity of: (PMC MDCAT 2022)**

A	12.9 rad/s	**B**	13.3 rad/s
C	12.6 rad/s	**D**	14.6 rad/s

Solution: (c) $\omega = 2\pi f = 2 \times 2\pi$, about $12.6\,\mathrm{rad\,s^{-1}}$.

MCQ 4.2.15 **The rotation of the earth in 1 day covers approximately ____ radian angular distance. (PMC MDCAT 2022)**

A	6.3	**B**	7.3
C	10.3	**D**	5.3

Solution: (a) A full turn is 2π, about 6.3 radians.

MCQ 4.2.16 **When body moves in a circle _____ always changes: (PMC MDCAT 2022)**

A	Velocity	**B**	Acceleration
C	Mass	**D**	Force

Solution: (a) The direction changes at every point, so the velocity is never constant.

MCQ 4.2.17 **Earth covers its one revolution around the Sun in: (PMC MDCAT 2022)**

A	24 hours	**B**	7 days
C	12 months	**D**	60 minutes

Solution: (c) The Earth takes a year, that is twelve months, to go once round the Sun.

MCQ 4.2.18 **The earth rotates 360o about its axis in about 24 hours. By how many degrees will it rotate In 2 hours? (PMC MDCAT 2022)**

A	90	**B**	60
C	30	**D**	15

Solution: (c) 360° in 24 hours is 15° an hour, so 30° in two.

MCQ 4.2.19 **A rotating wheel coincides 12 rev in 4s. find the average angular velocity in rad/sec: (NUMS MDCAT 2022)**

A	24.6 rad/s	**B**	16.8 rad/s
C	10.4 rad/s	**D**	18.8 rad/s

Solution: (d) $12 \times 2\pi/4$ is about $18.8\,\mathrm{rad\,s^{-1}}$.

MCQ 4.2.20 **One rpm is equal to _____ rad/sec (PMC Practice 2021)**

A	2	**B**	1.5
C	2.5	**D**	0.105

Solution: (d) One revolution a minute is $2\pi/60$, about $0.105\,\mathrm{rad\,s^{-1}}$.

MCQ 4.2.21 **If a rotating body is moving anti-clockwise, the direction of angular velocity is: (PMC Practice 2021)**

A	Towards the centre	**B**	Along the linear velocity
C	Away from the centre	**D**	Perpendicular to both radius and linear velocity

Solution: (d) The angular velocity lies along the axis, at right angles to both the radius and the linear velocity.

MCQ 4.2.22 **If an object is undergoing an orbital motion around another object it is called? (PMC Practice 2021)**

A	Revolution	**B**	Rotation
C	Both of them	**D**	None of them

Solution: (a) A body going round another is said to revolve; turning on its own axis is rotation.

MCQ 4.2.23 **When a body moves in a circle, the angle between its linear velocity and angular velocity is always? (PMC Practice 2021)**

A	180°	**B**	0°
C	90°	**D**	45°

Solution: (c) The angular velocity lies along the axis and the linear velocity along the tangent, so they are at right angles.

MCQ 4.2.24 **The earth rotates on its axis once a day. Suppose, by some process the earth contracts so that it's radius is only half as large as at present, then how long the earth will take to complete it's rotation? (PMC MDCAT 2020)**

A	24 hours	**B**	18 hours
C	6 hours	**D**	12 hours

Solution: (c) Angular momentum is conserved and I goes as r^2, so a half radius spins four times as fast, in six hours.

MCQ 4.2.25 **A wheel starts rotating from result with angular acceleration of 2 rads-2 till its angular speed becomes 6 rad/s. The angular displacement of the wheel will be equal to: (UHS MDCAT 2018)**

A	4 rad	**B**	9 rad
C	12 rad	**D**	7 rad

Solution: (b) $\omega^2 = 2\alpha\theta$ gives $36 = 4\theta$, so θ is 9 rad.

Topic 4.3 Relation Between Angular and Linear Quantities

Past MDCAT Questions

MCQ 4.3.1 **A fighter plane is moving in a vertical circle of radius r. Its minimum velocity at the highest point of the circle will be: (MDCAT 2022)**

A	$\sqrt{3gr}$	**B**	$\sqrt{2gr}$
C	$\sqrt{gr}$	**D**	$\sqrt{gr/2}$

Solution: (c) At the least speed the weight alone supplies the centripetal force, so $mg = mv^2/r$ and $v = \sqrt{gr}$.

MCQ 4.3.2 **If a particle is moving with uniform circular motion, then: (MDCAT 2023)**

A	velocity and acceleration are antiparallel	**B**	velocity and acceleration are parallel
C	velocity and acceleration are perpendicular to each other	**D**	the acceleration is zero

Solution: (c) The speed does not change, so the acceleration is wholly centripetal and at right angles to the velocity.

MCQ 4.3.3 **On which car is a centripetal force acting? (MDCAT 2023)**

A	a car moving on a straight horizontal road	**B**	a car moving at constant speed around a bend
C	a car moving uphill at a constant velocity	**D**	a car that is stationary

Solution: (b) Only the car going round a bend has a curved path, and the force towards the centre of that curve is the centripetal force.

MCQ 4.3.4 **The centripetal acceleration of an object moving along a circle of radius r with an angular speed ω is given by the formula: (MDCAT 2024)**

A	$a = r\omega^2$	**B**	$a = r\omega$
C	$a = \omega^2/r$	**D**	$a = r/\omega^2$

Solution: (a) With $v = r\omega$, $a = v^2/r = r^2\omega^2/r = r\omega^2$.

MCQ 4.3.5 **A particle of mass m moving on a circular path of radius r with velocity v has a centripetal force F acting on it. If the velocity increases 2 times and the radius increases 4 times, the new centripetal force is: (MDCAT 2024)**

A	$2F$	**B**	$F/2$
C	$4F$	**D**	F

Solution: (d) $F = mv^2/r$, and $m(2v)^2/(4r) = 4mv^2/(4r) = F$.

MCQ 4.3.6 **A roller coaster is moving with $30\ \mathrm{m\,s^{-1}}$ on a circular track of radius 30 m. If the net mass of coaster and passengers is m, the centripetal force acting on it is: (MDCAT 2024)**

A	$900m$	**B**	$9m$
C	$450m$	**D**	$30m$

Solution: (d) $F = mv^2/r = m(30)^2/30 = 30m$.

MCQ 4.3.7 **If a particle moves along a circular path of radius r with angular displacement θ (in radians), then the arc length s is given by: (KMU MDCAT 2025)**

A	$r\theta$	**B**	r/θ
C	θ/r	**D**	$2\pi r\theta$

Solution: (a) With the angle in radians the arc is $s = r\theta$.

MCQ 4.3.8 **In circular motion, if angular displacement is kept constant, decreasing the radius will: (SIBA MDCAT 2025)**

A	Increase linear displacement	**B**	Increase linear velocity
C	Decrease linear displacement	**D**	Not affect linear displacement

Solution: (c) With $s = r\theta$ and the angle fixed, a smaller radius gives a shorter arc.

MCQ 4.3.9 **The centripetal acceleration of an object moving along a circle of radius 'r' with an angular speed 'w' is given by the formula: (UHS MDCAT 2024)**

A	a = rw^2	**B**	a = r ω
C	a = r^2 ω	**D**	A = r^2 ω^2

Solution: (a) With $v = r\omega$, the centripetal acceleration v^2/r becomes $r\omega^2$.

MCQ 4.3.10 **A particle of mass 'm' is moving on a circular path of radius 'r' with velocity 'v', then centripetal force acting on it is F. If the velocity of particle increases by 2 times and radius of circular path increases by 4 times then new centripetal force F' will be; (UHS MDCAT 2024)**

A	F' = 2 F	**B**	F' = 1/2 F
C	F' = 4 F	**D**	F' = F

Solution: (d) $F = mv^2/r$ gains a factor of four from the speed and loses four to the radius, so it is unchanged.

MCQ 4.3.11 **A roller coaster is moving with 30 ms-1 on a circular track of radius 30m. the net mass of coaster + passengers is 'm' the centripetal force acting on it is: (UHS MDCAT 2024)**

A	900m	**B**	m
C	450 m	**D**	30m

Solution: (d) $F = mv^2/r = m \times 900/30$, which is $30m$.

MCQ 4.3.12 **A car is moving in a circular path at a constant speed. What provides the necessary centripetal force to keep the car moving in this path? (KMU MDCAT 2024)**

A	The car's inertia resisting any change in direction	**B**	The car's mass pulling it towards the centre of the circle
C	The engine's power pushing the car forward	**D**	The friction between the tyres and the road

Solution: (d) The friction of the tyres on the road is the only inward force there is.

MCQ 4.3.13 **In a rotating spaceship, to produce artificial gravity, what does the centripetal force do? (KMU MDCAT 2024)**

A	Has no effect inside the spaceship	**B**	Increases spaceship's rotation
C	Pulls objects towards the centre	**D**	Pushes the objects towards the outer wall

Solution: (d) The wall must push the occupant inwards, and by the third law they press outwards on it, which feels like weight.

MCQ 4.3.14 **When the mass of a body moving along a circle becomes half and radius becomes double, and v is constant, the centripetal force becomes? (KMU MDCAT 2024)**

A	Double	**B**	Half
C	One-fourth	**D**	Remains Same

Solution: (c) $F = mv^2/r$ loses a half to the mass and another half to the radius, so a quarter is left.

MCQ 4.3.15 **Which one provides centripetal force in a circular motion of a body? (SZABMU MDCAT 2023)**

A	Vertical component of weight	**B**	Horizontal component of weight
C	Weight of the body	**D**	Force of friction

Solution: (d) For a car on a level bend the friction of the tyres is the only inward force.

MCQ 4.3.16 **The tension is string at top of vertical circle is: (SZABMU MDCAT 2023)**

A	Zero	**B**	mg
C	2mg	**D**	3mg

Solution: (a) At the least speed that keeps the string taut, gravity alone supplies the centripetal force and the tension is zero.

MCQ 4.3.17 **The centripetal force in terms of angular velocity is given by: (SZABMU MDCAT 2023)**

A	F c = m r ω	**B**	F c = m r ω^2
C	F c = m r α^2	**D**	F c = m r α

Solution: (b) With $v = r\omega$, mv^2/r becomes $mr\omega^2$.

MCQ 4.3.18 **In case of centripetal force the value of instantaneous acceleration is given by: (NUMS MDCAT 2023)**

A	ac = v/r	**B**	ac = v2/r
C	ac = vr	**D**	ac = v2r

Solution: (b) The centripetal acceleration is v^2/r, directed to the centre.

MCQ 4.3.19 **The centripetal force formula is: (NUMS MDCAT 2023)**

A	Fc = mω2	**B**	Fc = mrω
C	Fc = mrω2	**D**	Fc = mr2ω

Solution: (c) With $v = r\omega$, mv^2/r becomes $mr\omega^2$.

MCQ 4.3.20 **On which car there is resultant force? (UHS MDCAT 2023)**

A	Car moving on a straight horizontal road	**B**	Car moving at constant speed around a bend
C	Car moving uphill at a constant velocity	**D**	Car that is stationary

Solution: (b) A car on a bend is changing direction, so there is a resultant force towards the centre.

MCQ 4.3.21 **Centripetal force is provided by _____ in a frictional road around a circular path (PMC MDCAT 2022)**

A	Frictional force	**B**	normal force
C	gravitational force	**D**	pseudo force

Solution: (a) On a level road it is the friction of the tyres that turns the car.

MCQ 4.3.22 **The acceleration produced by the centripetal force is always: (PMC MDCAT 2022)**

A	Directed parallel to the center of the circle	**B**	Directed perpendicular to the center of the circle
C	Directed towards the center of the circle	**D**	Directed away from the center of the circle

Solution: (c) Centripetal acceleration points along the radius, towards the centre.

MCQ 4.3.23 **When an object experience circular motion, the direction of centripetal acceleration is: (NUMS MDCAT 2022)**

A	Towards center	**B**	Along tangent
C	Along the direction of motion	**D**	Opposite of the direction of motion

Solution: (a) Centripetal acceleration points along the radius towards the centre.

MCQ 4.3.24 **A force which acts on an object moving in a circle and is directed towards the center of the circle is called: (PMC Practice 2021)**

A	Bending Force	**B**	Centripetal Force
C	Centrifugal force	**D**	None of these

Solution: (b) A force directed to the centre of the circle is the centripetal force.

MCQ 4.3.25 **If during circular motion, tangential velocity of a body becomes double, then centripetal force becomes: (PMC MDCAT 2020)**

A	Double	**B**	One half
C	Four times	**D**	One fourth

Solution: (c) $F = mv^2/r$ goes as the square of the speed.

MCQ 4.3.26 **Which of the following gives the relationship between linear velocity and angular velocity? (UHS MDCAT 2018)**

A	v = rω	**B**	v = rθ
C	v=sω	**D**	v=sθ

Solution: (a) The linear velocity is the radius times the angular velocity.

Topic 5.1 Fluid Drag and Terminal Velocity

Past MDCAT Questions

MCQ 5.1.1 When a heavy coin falls a short distance towards the ground it does not reach terminal velocity. Why is this so? (MDCAT 2022)

A	the coin has not hit the ground	B	the weight of the coin is equal to the air resistance
C	the weight of the coin increases as the air resistance increases	D	the weight of the coin is more than the air resistance

Solution: (d) Terminal velocity is reached only when the drag has grown equal to the weight, and over a short fall it has not.

MCQ 5.1.2 A ball of weight Fg is falling vertically downward through air. If the drag force acting on it at some instant is Fd, what is the Fnet (net force) on the ball? (KMU MDCAT 2025)

A	Fg + Fd	B	Fg - Fd
C	Fd - Fg	D	Fd/Fg

Solution: (b) Drag acts upwards against the fall, so the net downward force is the weight less the drag.

MCQ 5.1.3 A body of mass 10 kg is falling through a viscous medium and reached terminal velocity. The net force on the body will be: (SIBA MDCAT 2025)

A	0 N	B	9.8 N
C	98 N	D	980 N

Solution: (a) At terminal velocity the drag and upthrust balance the weight, so there is no net force.

MCQ 5.1.4 When a droplet reaches terminal velocity, its acceleration is: (SIBA MDCAT 2025)

A	Zero	B	Variable
C	Not changed	D	Negative

Solution: (a) Terminal velocity is a steady velocity, so the acceleration has fallen to zero.

Topic 5.2 Fluid Flow

Past MDCAT Questions

MCQ 5.2.1 A fluid is flowing through a tube, to undergo transition from laminar to turbulent flow it's velocity must be: (UHS MDCAT 2025)

A	Slightly less than critical velocity	B	equal to critical velocity
C	greater than critical velocity	D	increasing gradually but less than critical velocity

Solution: (c) Flow stays laminar up to the critical velocity and turns turbulent once that value is passed.

MCQ 5.2.2 Most kinds of fluid flow are turbulent rather than laminar because of: (KMU MDCAT 2025)

A	Zero viscosity	B	Very low velocities
C	High velocities	D	No resistance

Solution: (c) Beyond the critical speed the layers break up, and most real flows are above it.

MCQ 5.2.3 In laminar flow of fluid, its adjacent layers: (SIBA MDCAT 2025)

A	Resist each other	B	Mix with each other
C	Slide smoothly pass each other	D	Produce turbulence

Solution: (c) In laminar flow the layers glide over one another without mixing.

MCQ 5.2.4 When fluid is incompressible, the quantity is constant is: (UHS MDCAT 2016)

A	Mass	B	Density
C	Pressure	D	Force

Solution: (b) An incompressible fluid is one whose density does not change however it is squeezed.

Topic 5.3 Equation of Continuity

Past MDCAT Questions

MCQ 5.3.1 An incompressible fluid flows through a pipe that becomes narrower in one section. The fluid speed in that region increases in that region to maintain: (UHS MDCAT 2025)

A	Constant pressure	B	constant energy
C	constant mass flow rate	D	constant volume

Solution: (c) What enters the pipe each second must leave it, so a narrower section is passed at a greater speed.

MCQ 5.3.2 According to law of continuity, when the cross-sectional area of a pipe decreases, the fluid velocity: (KMU MDCAT 2025)

A	Increases	B	Decreases
C	Remains the same	D	Becomes zero

Solution: (a) The product of area and speed is constant, so a narrower pipe is passed faster.

MCQ 5.3.3 Water flows through a pipe of 0.02 m^2 with a speed of 3 m/s. The pipe narrows to 0.01 m^2. The speed in narrow section is: (SZABMU MDCAT 2025)

A	1.5 m/s	B	3 m/s
C	6 m/s	D	9 m/s

Solution: (c) $A_1 v_1 = A_2 v_2$, so $0.02 \times 3 = 0.01 \times v_2$ and v_2 is $6\,\mathrm{m\,s^{-1}}$.

Topic 5.4 Bernoulli's Equation

Past MDCAT Questions

MCQ 5.4.1 In a pipe of varying cross-section as fluid enters the narrower region, it exhibits: (UHS MDCAT 2025)

A	high velocity, high pressure	B	high velocity, low pressure
C	low velocity, high pressure	D	low velocity, low pressure

Solution: (b) Bernoulli's equation trades pressure for speed, so the fast narrow section is the low pressure one.

MCQ 5.4.2 Water flows steadily through a pipe that gradually narrows. At the wider end, the velocity of water is 1m/s, at the narrower end, the velocity is 3m/s. Which statement is CORRECT about the pressure in the narrower end compared to the wider end? (KMU MDCAT 2025)

A	Pressure is lower at the narrow end because velocity is higher	B	Pressure is higher at the narrow end because velocity is higher
C	Pressure is the same at both ends since flow is continuous	D	Pressure is independent of velocity of water

Solution: (a) Bernoulli's equation trades pressure for speed, so the faster narrow end is at the lower pressure.

MCQ 5.4.3 The increase in kinetic energy associated with decreased pressure of a fluid in a horizontal pipe is a consequence of the: (SIBA MDCAT 2025)

A	Bernoulli's Principle	B	Equation of continuity
C	Pascal's principle	D	Torricelli's theorem

Solution: (a) Bernoulli's principle is the statement that pressure falls where the speed of a fluid rises.

MCQ 5.4.4 **In Bernoulli's equation the term 1/2 ρv2 is called: (UHS MDCAT 2016)**

A	K.E. per unit volume	**B**	K.E.
C	K.E. per unit area	**D**	K.E. per unit length

Solution: (a) Each term of Bernoulli's equation is an energy per unit volume, and this one is the kinetic part.

MCQ 5.4.5 **Potential energy per unit volume is given by: (UHS MDCAT 2016)**

A	mgh	**B**	mgh/ρ
C	gh	**D**	ρgh

Solution: (d) mgh divided by the volume gives ρgh.

Topic 5.5 Bernoulli's Effect and Blood Physics

Past MDCAT Questions

MCQ 5.5.1 **The curved shape of an airplane wing causes air to move faster over the top surface. This leads to: (UHS MDCAT 2025)**

A	greater pressure on the top	**B**	lower pressure on the top
C	equal pressure on both sides	**D**	zero pressure above the wing

Solution: (b) Faster air over the curved upper surface leaves a lower pressure there, and the difference is the lift.

MCQ 5.5.2 **In the human circulatory system, turbulent blood flow is most likely to occur when the: (SZABMU MDCAT 2025)**

A	Vessel diameter is very small	**B**	Velocity of blood is very low
C	Blood flows through a clogged vessel	**D**	Blood viscosity increases

Solution: (c) A deposit narrows the vessel and roughens it, so the speed rises past the critical value and the flow breaks up.

Unit 6 Waves

Topic 6.1 Wave Motion and Progressive Waves

Past MDCAT Questions

MCQ 6.1.1 **Mechanical waves are not produced in: (MDCAT 2022)**

A	electric and magnetic fields	**B**	springs
C	ropes	**D**	water

Solution: (a) A mechanical wave needs a material medium; a disturbance of the electric and magnetic fields travels without one.

MCQ 6.1.2 **Mechanical waves cannot travel through outer space because they: (UHS MDCAT 2025)**

A	have low speed in vacuum	**B**	disperse in space due to long wavelength
C	lose frequency in the absence of air	**D**	lose transmission without interacting particles

Solution: (d) A mechanical wave is carried by the particles of a medium, and space has none to pass it on.

MCQ 6.1.3 **What is the necessary condition of a wave motion? (KMU MDCAT 2025)**

A	The medium must be elastic	**B**	The medium must be inelastic
C	The particles of the medium must be independent of each other	**D**	The particles of the medium must not be dependent on each other

Solution: (a) A wave passes on because each displaced particle is pulled back and pulls its neighbour, which needs an elastic medium.

MCQ 6.1.4 **A progressive wave is one which: (KMU MDCAT 2025)**

A	Does not vibrate the medium	**B**	Carries energy across the medium
C	Propagates only through air	**D**	Requires a denser medium for propagation

Solution: (b) A progressive wave carries energy forward through the medium without carrying the medium with it.

MCQ 6.1.5 **In progressive waves, energy is transferred from one point to another through: (SZABMU MDCAT 2025)**

A	Circular motion of particles	**B**	Oscillatory motion of particles
C	Rotation of particles	**D**	Translation of particles

Solution: (b) Each particle oscillates about its own place and hands the energy on to the next.

MCQ 6.1.6 **The waves among the following which require a material medium for their propagation are: (SZABMU MDCAT 2025)**

A	Gamma rays	**B**	X-rays
C	Infrared waves	**D**	Infrasonic waves

Solution: (d) Infrasonic waves are sound, and sound needs a medium; the other three are electromagnetic.

MCQ 6.1.7 **The mechanical waves are not generated by: (UHS MDCAT 2023)**

A	Electric and magnetic fields	**B**	Coil of springs
C	Ropes	**D**	Water

Solution: (a) Electric and magnetic fields make electromagnetic waves, which need no medium at all.

MCQ 6.1.8 **Continuous, regular and rhythmic disturbance in a medium resulting periodic vibration of a source causes_____in the medium: (SZABMU MDCAT 2023)**

A	Complex waves	**B**	Stationary waves
C	Electromagnetic waves	**D**	Periodic waves

Solution: (d) A regular repeated disturbance sets up periodic waves.

MCQ 6.1.9 **Water waves are examples of: (PMC MDCAT 2022)**

A	Transverse waves	**B**	Progressive waves
C	Longitudinal waves	**D**	Compressional waves

Solution: (b) A progressive wave carries energy forward through the medium.

MCQ 6.1.10 **___ waves always need medium to travel? (PMC MDCAT 2022)**

A	Light	**B**	Stationary
C	Sound	**D**	Both sound and stationary

Solution: (d) Sound is mechanical, and a stationary wave is made of two mechanical waves, so both need a medium.

MCQ 6.1.11 **The velocity of sound in vacuum at 0 C: (PMC MDCAT 2022)**

A	332 m/s	**B**	344 m/s
C	330 m/s	**D**	0

Solution: (d) Sound needs a medium, so it does not travel through a vacuum at all.

Topic 6.2 Characteristics of a Wave and Wave Speed

Past MDCAT Questions

MCQ 6.2.1 **In a ripple tank 40 waves pass through a certain point in one second. If the wavelength of the waves is 5 cm, then find the speed of the wave. (MDCAT 2020)**

A	$2\,\mathrm{m\,s^{-1}}$	**B**	$8\,\mathrm{m\,s^{-1}}$
C	$20\,\mathrm{m\,s^{-1}}$	**D**	$200\,\mathrm{m\,s^{-1}}$

Solution: (a) $v = f\lambda = 40 \times 0.05 = 2\,\mathrm{m\,s^{-1}}$.

MCQ 6.2.2 **The product of frequency and time period is equal to: (MDCAT 2020)**

A	1	**B**	2
C	0	**D**	1/2

Solution: (a) $T = 1/f$, so $fT = 1$.

MCQ 6.2.3 **The shortest distance between any two points in phase on a wave is called the: (MDCAT 2022)**

A	displacement	**B**	amplitude
C	wavelength	**D**	frequency

Solution: (c) That distance is one wavelength.

MCQ 6.2.4 **Which of the following increases by increasing the amplitude? (MDCAT 2022)**

A	wavelength	**B**	frequency
C	time period	**D**	loudness

Solution: (d) The energy of a wave goes as the square of the amplitude, and for sound that is heard as loudness.

MCQ 6.2.5 **An observer standing near the shore observes 54 waves per minute. If the wavelength of the water wave is 2 m, the speed of the water wave is: (MDCAT 2023)**

A	$540\,\mathrm{m\,s^{-1}}$	**B**	$9\,\mathrm{m\,s^{-1}}$
C	$5.4\,\mathrm{m\,s^{-1}}$	**D**	none of these

Solution: (d) $f = 54/60 = 0.9$ Hz and $v = f\lambda = 0.9 \times 2 = 1.8\,\mathrm{m\,s^{-1}}$, which is none of the first three.

MCQ 6.2.6 **Wave trough refers to the: (MDCAT 2023)**

A	wavelength	**B**	wave speed
C	highest point of the wave	**D**	lowest point of the wave

Solution: (d) The trough is the lowest point of a transverse wave, as the crest is the highest.

MCQ 6.2.7 **When a wave goes from one medium to another, there is no change in the: (MDCAT 2023)**

A	frequency	**B**	amplitude
C	wavelength	**D**	velocity

Solution: (a) The source sets the frequency, so it is unchanged; the speed and hence the wavelength change with the medium.

MCQ 6.2.8 **In transverse waves the portion above the mean level is called the: (MDCAT 2024)**

A	wave front	**B**	wave crest
C	wave trough	**D**	wavelength

Solution: (b) The high point of a transverse wave is a crest; the low point is a trough.

MCQ 6.2.9 **The distance between two successive particles which are exactly in the same state of vibration is called: (MDCAT 2024)**

A	frequency	**B**	amplitude
C	wavelength	**D**	time period

Solution: (c) Particles one wavelength apart are in phase, which is what the same state of vibration means.

MCQ 6.2.10 **A source of sound moves towards a stationary observer with a speed one third that of sound. If the frequency of the source is $100\,\mathrm{Hz}$, the apparent frequency heard by the observer is: (UHS MDCAT 2017)**

A	60 Hz	**B**	100 Hz
C	200 Hz	**D**	150 Hz

Solution: (d) $f' = \dfrac{vf}{v-u} = \dfrac{100v}{v - v/3} = \dfrac{3}{2} \times 100 = 150\,\mathrm{Hz}$.

MCQ 6.2.11 **A source of frequency f moves with a velocity u towards a stationary listener. If v is the speed of sound, the apparent frequency heard is: (UHS MDCAT 2017)**

A	$\dfrac{vf}{v+u}$	**B**	$\left(\dfrac{v+u}{v}\right)$
C	$\dfrac{vf}{v-u}$	**D**	$\left(\dfrac{v-u}{v}\right)$

Solution: (c) An approaching source shortens the wavelength, so the speed of sound is divided by $v - u$ and the pitch rises.

MCQ 6.2.12 **A wave has velocity 300m/s and frequency 100Hz. If the medium is changed so that velocity doubles but frequency remains constant, the new wavelength will be: (KMU MDCAT 2025)**

A	Halved	**B**	Doubled
C	Same	**D**	Zero

Solution: (b) With the frequency fixed, $\lambda = v/f$ doubles when the speed doubles.

MCQ 6.2.13 **If 20 waves pass a point in 2 seconds and with a speed of 5m/s, then the wavelength of wave is: (SZABMU MDCAT 2025)**

A	0.5 m	**B**	1 m
C	1.5 m	**D**	2 m

Solution: (a) Twenty waves in two seconds is 10 Hz, and $\lambda = v/f = 5/10$ is 0.5 m.

MCQ 6.2.14 **A longitudinal wave has a frequency of 500 Hz and wavelength of 0.6 m, its speed is: (SZABMU MDCAT 2025)**

A	30 m/s	**B**	83 m/s
C	300 m/s	**D**	1200 m/s

Solution: (c) $v = f\lambda = 500 \times 0.6$, which is $300\,\mathrm{m\,s^{-1}}$.

MCQ 6.2.15 **In transverse waves the portion above the mean level is called: (UHS MDCAT 2024)**

A	Wave front	**B**	Wave crest
C	Wave trough	**D**	Wave length

Solution: (b) The rise above the undisturbed level is a crest; the dip below it is a trough.

MCQ 6.2.16 **The distance between two successive particles which are exactly in the same state of vibration is called (UHS MDCAT 2024)**

A	Frequency	**B**	Amplitude
C	Wavelength	**D**	Time period

Solution: (c) The distance between two particles in the same phase is one wavelength.

MCQ 6.2.17 **Normal person hears 20Hz to 20KHz. Maximum wavelength is: (NUMS MDCAT 2024)**

A	17m	**B**	17mm
C	17cm	**D**	17km

Solution: (a) The longest wavelength goes with the lowest frequency, $340/20$, that is about $17\,\mathrm{m}$.

MCQ 6.2.18 **Which of the following increase by increasing amplitude? (UHS MDCAT 2023)**

A	Wavelength	**B**	Frequently
C	Zero	**D**	Loudness

Solution: (d) Loudness follows the energy of the wave, which goes as the square of the amplitude.

MCQ 6.2.19 **The shortest distance between any two points in phase on a wave is called: (UHS MDCAT 2023)**

A	Displacement	**B**	Amplitude
C	Wavelength	**D**	Frequency

Solution: (c) The shortest distance between two points in the same phase is the wavelength.

MCQ 6.2.20 **Wavelength of wave is defined as: (SZABMU MDCAT 2023)**

A	Distance between two consecutive crests	**B**	Distance between two alternate crest
C	Distance between two alternate trough	**D**	Distance between two crest and two trough

Solution: (a) One wavelength is the distance from one crest to the next.

MCQ 6.2.21 **Maximum displacement of particles form it mean position is called: (SZABMU MDCAT 2023)**

A	Frequency	**B**	Amplitude
C	Wavelength	**D**	Crest

Solution: (b) The greatest displacement from the mean position is the amplitude.

MCQ 6.2.22 **The ultrasonic waves have frequency higher than: (SZABMU MDCAT 2023)**

A	20 Hz	**B**	20 KHz
C	200 Hz	**D**	2000 KHz

Solution: (b) Ultrasonic means above the upper limit of hearing, about $20\,\mathrm{kHz}$.

MCQ 6.2.23 **The maximum displacement of particles of a medium, on either side of the mean position of a wave, is called: (NUMS MDCAT 2023)**

A	Wavelength	**B**	Frequency
C	Amplitude	**D**	Crest

Solution: (c) That greatest displacement is the amplitude.

MCQ 6.2.24 **When a wave goes from one medium to another, there is a no change in the: (UHS MDCAT 2023)**

A	Frequency	**B**	Amplitude
C	Wavelength	**D**	Velocity

Solution: (a) The source sets the frequency, so it is unchanged; the speed and wavelength alter together.

MCQ 6.2.25 **An observer standing near the sea shore observes 54 waves per minute. If the wavelength of the water wave is 10m then the velocity of water wave is: (UHS MDCAT 2023)**

A	540 m/s	**B**	9 m/s
C	5.4 m/s	**D**	None

Solution: (b) Fifty-four waves a minute is $0.9\,\mathrm{Hz}$, and $v = f\lambda = 0.9 \times 10$ is $9\,\mathrm{m\,s^{-1}}$.

MCQ 6.2.26 **Pitch is ___ proportional to frequency. (PMC MDCAT 2022)**

A	Directly	**B**	Inversely
C	Exponentially	**D**	No effect

Solution: (a) The higher the frequency the higher the pitch.

MCQ 6.2.27 **The property of musical sound which differentiate between grave and shrill sound is called? (PMC MDCAT 2022)**

A	Pitch	**B**	Intensity
C	Beats	**D**	Quality

Solution: (a) A grave note is low and a shrill one high, so the difference is one of pitch.

MCQ 6.2.28 **Pitch depends upon: (PMC MDCAT 2022)**

A	Frequency	**B**	Timbre
C	Loudness	**D**	Amplitude

Solution: (a) The higher the frequency the higher the pitch.

MCQ 6.2.29 **Unit of frequency is: (PMC MDCAT 2022)**

A	Hertz	**B**	decibel
C	ampere	**D**	radian

Solution: (a) Frequency is measured in hertz, one cycle a second.

MCQ 6.2.30 **The horizontal distance travelled by wave during one complete cycle is called (NUMS MDCAT 2022)**

A	Frequency	**B**	Wavelength
C	Amplitude	**D**	Time period

Solution: (b) The distance covered in one complete cycle is the wavelength.

MCQ 6.2.31 **Loudness of the sound is directly rotated to: (NUMS MDCAT 2022)**

A	Intensity of sound	**B**	Frequency of sound
C	Wavelength of sound	**D**	Pitch of sound

Solution: (a) Loudness follows the intensity, which is the energy carried each second through unit area.

MCQ 6.2.32 **The phase angle between two points is 3π. The distance between these points is 15 cm. What is the wavelength of the wave? (PMC Practice 2021)**

A	30 cm	**B**	45 cm
C	5 cm	**D**	10 cm

Solution: (d) A phase of 2π is one wavelength, so 3π is 1.5λ, and $15/1.5$ is $10\,\mathrm{cm}$.

MCQ 6.2.33 **The shortest distance between two points on the wave that have a phase difference of (π/3) is 5 cm. What is its wavelength? (PMC Practice 2021)**

A	10 cm	B	20 cm
C	30 cm	D	40 cm

Solution: (c) A phase of 2π is one wavelength, so $\pi/3$ is $\lambda/6$, and 6×5 is $30\,\text{cm}$.

MCQ 6.2.34 **In a periodic wave, the distance between the second and fifth crest is 15 cm. What is the wavelength of the wave? (PMC Practice 2021)**

A	45 cm	B	5 cm
C	1/5 cm	D	1/3 cm

Solution: (b) From the second crest to the fifth is three wavelengths, so λ is $5\,\text{cm}$.

MCQ 6.2.35 **In a ripple tank, 40 waves pass through a certain point in 1 second. If the wavelength of the wave is 5 cm, then speed of the wave is: (PMC MDCAT 2020)**

A	0.5 ms-1	B	1 ms-1
C	1.5 ms-1	D	2 ms-1

Solution: (d) $v = f\lambda = 40 \times 0.05$, that is $2\,\text{m}\,\text{s}^{-1}$.

MCQ 6.2.36 **If the time period of the oscillation is 20 micro-sec, then what will be the frequency of that oscillating body? (UHS MDCAT 2018)**

A	5000 Hz	B	50000 Hz
C	20000 Hz	D	1000 Hz

Solution: (b) $f = 1/T = 1/(20 \times 10^{-6})$, that is $5 \times 10^4\,\text{Hz}$.

MCQ 6.2.37 **Frequency audible range to human hearing lies in the range: (UHS MDCAT 2016)**

A	2-2000 kHz	B	15-50000 kHz
C	20-20000 Hz	D	20-20000 kHz

Solution: (c) The human ear hears from about $20\,\text{Hz}$ to $20\,\text{kHz}$.

Topic 6.3 Transverse and Longitudinal Waves

Past MDCAT Questions

MCQ 6.3.1 **If transverse waves are passing through a medium, then the particles of the medium: (MDCAT 2023)**

A	remain stationary	B	move away with the wave
C	move towards the source	D	move in simple harmonic motion

Solution: (d) Each particle oscillates about its own mean position at right angles to the direction of travel.

MCQ 6.3.2 **The motion of transverse waves involves particle's vibration: (SIBA MDCAT 2025)**

A	Along the wave direction	B	Opposite to energy flow
C	Perpendicular to wave propagation	D	In random direction at every point

Solution: (c) In a transverse wave the particles move at right angles to the direction the wave travels.

MCQ 6.3.3 **Which type of waves can be polarized? (KMU MDCAT 2024)**

A	Longitudinal waves	B	Mechanical waves
C	Sound waves	D	Transverse waves

Solution: (d) Only a transverse wave has a vibration direction to single out, so only it can be polarized.

MCQ 6.3.4 **For longitudinal waves (KMU MDCAT 2024)**

A	The particles of the medium oscillate perpendicular to the wave's propagation	B	The particles of the medium remain stationary as the wave passes through
C	The particles of the medium oscillate along the direction of the wave's propagation	D	Their velocity is enhanced when they travel through vacuum

Solution: (c) In a longitudinal wave the particles move to and fro along the line the wave travels.

MCQ 6.3.5 **If transverse waves are passing through medium, then particle of medium: (UHS MDCAT 2023)**

A	Remain stationary	B	Move away
C	Move toward	D	Move in Simple Harmonic Motion

Solution: (d) Each particle of the medium oscillates about its mean position in simple harmonic motion.

MCQ 6.3.6 **Water waves are: (PMC MDCAT 2022)**

A	Longitudinal waves	B	Complex waves
C	Transverse waves	D	Both longitudinal and transverse wave

Solution: (d) A water particle moves in a circle, so the wave is part transverse and part longitudinal.

MCQ 6.3.7 **Example of mechanical waves is: (PMC MDCAT 2022)**

A	Transverse wave	B	Longitudinal wave
C	Both transverse and longitudinal wave	D	Compressional waves

Solution: (c) Mechanical waves may be transverse, as on a rope, or longitudinal, as in sound.

MCQ 6.3.8 **Sound waves are considered as ____ waves: (PMC MDCAT 2022)**

A	Compressional	B	Transverse
C	Longitudinal	D	Shock

Solution: (c) The air moves to and fro along the direction the sound travels.

MCQ 6.3.9 **A longitudinal wave is moving through a medium. Which of the following statements about the direction of the propagation of the wave and displacement of the medium is true? (PMC Practice 2021)**

A	Displacement of medium = parallel to the energy transfer Direction of the propagation of wave = parallel to the energy transfer	B	Displacement of medium = parallel to the energy transfer Direction of the propagation of wave = perpendicular to the energy transfer
C	Displacement of medium = perpendicular to the energy transfer Direction of the propagation of wave = parallel to the energy transfer	D	Displacement of medium= perpendicular to the energy transfer Direction of the propagation of wave = perpendicular to the energy transfer

Solution: (a) In a longitudinal wave the particles move to and fro along the line the energy travels.

MCQ 6.3.10 **Which one of the following properties is not exhibited by the longitudinal waves? (PMC MDCAT 2020)**

A	Interference	B	Reflection
C	Diffraction	D	Polarization

Solution: (d) Polarization needs a vibration across the direction of travel, which a longitudinal wave has not.

MCQ 6.3.11 **A shock wave is produced due to an earthquake which makes the buildings move in the direction of the shock wave. Which progressive wave would this be? (UHS MDCAT 2018)**

A	Longitudinal wave	B	Transverse wave
C	Material wave	D	Particle wave

Solution: (a) The ground moves along the direction the wave travels, so the wave is longitudinal.

Topic 6.4 Speed of Sound: Newton's Formula and Laplace's Correction

Past MDCAT Questions

MCQ 6.4.1 **Newton's original formula underestimated speed of sound in air because he: (SIBA MDCAT 2025)**

A	Ignored viscosity	B	Assumed isothermal
C	Considered vacuum conditions	D	Assumed adiabatic

Solution: (b) Newton took the compressions to be isothermal; Laplace corrected them to adiabatic and got the right speed.

MCQ 6.4.2 **The option that shows the conditions used by Laplace for connecting the velocity of sound is options medium used thermodynamics process 1 solid adiabatic 2 liquids isobaric 3 gas adiabatic 4 gas isothermal (SZABMU MDCAT 2025)**

A	1	B	2
C	3	D	4

Solution: (c) Laplace took the compressions and rarefactions in a gas to be too quick for heat to escape, that is adiabatic.

MCQ 6.4.3 **Speed of sound in solid is greater than in air because ratio: (NUMS MDCAT 2024)**

A	$(\sqrt{E}/\rho)$ solid < $(\sqrt{E}/\rho)$ air	B	$(\sqrt{E}/\rho)$ solid > $(\sqrt{E}/\rho)$ air
C	$(\sqrt{E}/\rho)$ solid = $(\sqrt{E}/\rho)$ air	D	$(\sqrt{E}/\rho)$ solid ≤ $(\sqrt{E}/\rho)$ air

Solution: (b) $v = \sqrt{E/\rho}$, and a solid gains far more in elasticity than it loses to density.

Topic 6.5 Factors Affecting the Speed of Sound in Air

Past MDCAT Questions

MCQ 6.5.1 **The speed of sound in an ideal gas depends upon its: (MDCAT 2023)**

A	temperature	B	frequency
C	amplitude	D	wavelength

Solution: (a) $v \propto \sqrt{T}$; the frequency, amplitude and wavelength of the sound do not change it.

MCQ 6.5.2 **Speed of sound in air increases with: (KMU MDCAT 2025)**

A	Higher temperature, higher humidity	B	Lower temperature, lower humidity
C	Higher pressure at constant temperature	D	Higher density at constant elasticity

Solution: (a) Sound travels faster in warmer air, and water vapour is lighter than the air it displaces, so humidity helps too.

MCQ 6.5.3 **If the speed of sound is measured at sea level and at the top of a mountain, both at the same temperature, it will be: (SZABMU MDCAT 2025)**

A	Greater at sea level	B	Greater at the mountain top
C	The same at both places	D	Greater where the air is denser

Solution: (c) The speed of sound depends on the temperature of the air, not on its pressure or density.

MCQ 6.5.4 **Which of the following factor does not affect the speed of sound in air? (SZABMU MDCAT 2023)**

A	Pressure	B	Density
C	Temperature	D	Medium

Solution: (a) Raising the pressure raises the density in the same proportion, so $\sqrt{P/\rho}$ is unchanged.

MCQ 6.5.5 **The increase in the speed of sound for each degree rise above 0o C is: (SZABMU MDCAT 2023)**

A	0.61 m/s	B	0.51 m/s
C	0.41 m/s	D	0.31 m/s

Solution: (a) Sound gains about $0.61\,\mathrm{m\,s^{-1}}$ for each degree above $0°\mathrm{C}$.

MCQ 6.5.6 **With increase in pressure, the speed of sound will: (NUMS MDCAT 2023)**

A	Increase	B	Decrease
C	First increase then decrease	D	Remain the same

Solution: (d) Raising the pressure raises the density in the same proportion, so the speed is unchanged.

MCQ 6.5.7 **Speed of sound does not depend on: (PMC MDCAT 2022)**

A	Pressure	B	Density
C	Adiabatic Index	D	Amplitude

Solution: (a) Raising the pressure raises the density in the same proportion, so $\sqrt{\gamma P/\rho}$ is unchanged.

MCQ 6.5.8 **The speed of sound cannot be greater than: (PMC MDCAT 2022)**

A	Speed of shock wave	B	Speed of light
C	Speed of water wave	D	Speed of sound in vacuum

Solution: (b) Nothing carries a signal faster than light, and sound is far slower than that.

MCQ 6.5.9 **The increase in the speed of sound in air for each degree rise above 0°C is: (NUMS MDCAT 2022)**

A	0.40 m/s	B	0.51 m/s
C	0.81 m/s	D	0.61 m/s

Solution: (d) Sound gains about $0.61\,\mathrm{m\,s^{-1}}$ for each degree above $0°\mathrm{C}$.

MCQ 6.5.10 **The speed of sound in air does not depend on: (NUMS MDCAT 2022)**

A	Density of medium	B	Pressure
C	Temperature	D	Moisture

Solution: (b) Raising the pressure raises the density in the same proportion, so the speed is unchanged.

MCQ 6.5.11 **The speed of sound in air is 332 m/s. The speed of sound at 22 degrees centigrade will be: (PMC MDCAT 2020)**

A	345.2 m/s	B	340 m/s
C	350 m/s	D	330 m/s

Solution: (a) $332 + 0.61 \times 22$ gives about $345\,\mathrm{m\,s^{-1}}$.

Topic 6.6 Superposition and Interference of Sound Waves

Past MDCAT Questions

MCQ 6.6.1 **If two speakers emit sound at same frequency and phase, maximum loudness occurs when: (UHS MDCAT 2025)**

A	Path difference = √2	B	Path difference = λ
C	Path difference = λ/4	D	Path difference = 3λ/43

Solution: (b) Constructive interference needs a path difference of a whole number of wavelengths.

MCQ 6.6.2 **Two waves identical traveling in the same medium are superposed: (NUMS MDCAT 2025)**

A	Interference	B	Diffraction
C	Reflection	D	Refraction

Solution: (a) Two waves of the same kind crossing in one medium add displacement to displacement, which is interference.

MCQ 6.6.3 **The path difference between two sound waves coming from a coherent source of wavelength 50 cm at a point is 100 cm. The superposition of the waves at that point produces: (SIBA MDCAT 2025)**

A	Beats	B	Echo
C	Loudness	D	Silence

Solution: (c) A path difference of $100\,\text{cm}$ is exactly two wavelengths, so the waves arrive in step and reinforce.

MCQ 6.6.4 **The phenomenon of interference of sound waves requires: (SIBA MDCAT 2025)**

A	Two sources with different frequencies	B	Two coherent sources
C	A single source	D	A single source and a reflecting surface

Solution: (b) A steady pattern needs two sources of the same frequency holding a constant phase relation.

MCQ 6.6.5 **When two identical waves arrive in phase at same point and in a region at the same time the resultant displacement is equal to (SZABMU MDCAT 2025)**

A	Displacement of a single wave	B	Difference of their displacements
C	Sum of their displacements	D	Product of their displacements

Solution: (c) Waves in step add displacement to displacement, which is constructive interference.

MCQ 6.6.6 **What happens when two waves of the same frequency and amplitude meet in phase? (KMU MDCAT 2024)**

A	They cancel each other out resulting in a destructive interference	B	They combine to form a wave double the amplitude, resulting in constructive interference
C	They produce a wave with zero amplitude	D	They produce a wave with the same amplitude as the individual waves

Solution: (b) Crest falls on crest, and the displacements add to give twice the amplitude.

MCQ 6.6.7 **According to the principle of superimposition, when 2 or more waves overlap at a point in space, the amplitude of the resultant wave at that point is (KMU MDCAT 2024)**

A	Always zero	B	The product of the individual wave amplitude
C	The product of the frequencies of the individual waves	D	The sum of the amplitudes of the individual waves

Solution: (d) The resultant displacement at any point is the sum of the separate displacements there.

MCQ 6.6.8 **When two ends of string are struck together simultaneously such that two troughs are traveling towards each other, than at reaching the centre of the string a _ is formed: (PMC MDCAT 2022)**

A	A higher amplitude wave	B	A Lower amplitude wave
C	Waves die immediately	D	Troughs are converted to crests

Solution: (a) Trough falls on trough, so the displacements add and the wave is twice as deep.

MCQ 6.6.9 **Beats can be used to find: (PMC Practice 2021)**

A	Speed	B	Frequency
C	Amplitude	D	Wavelength

Solution: (b) The number of beats a second is the difference of the two frequencies, so an unknown note can be measured against a standard.

Topic 6.7 Stationary Waves, Nodes and Antinodes

Past MDCAT Questions

MCQ 6.7.1 **Which one of the following is INCORRECT about the nodes when a string is plucked? (MDCAT 2024)**

A	the amplitude of vibration is zero	B	they do not move along the string
C	they are produced at the fixed ends of the string	D	the distance between consecutive nodes is one wavelength

Solution: (d) Consecutive nodes are half a wavelength apart, not a whole wavelength.

MCQ 6.7.2 **Which one of the following does not cause stationary waves? (MDCAT 2024)**

A	two waves of equal frequency	B	two waves of the same speed
C	two waves of unequal amplitude	D	two waves travelling in opposite directions

Solution: (c) Stationary waves need two waves of equal amplitude; unequal amplitudes leave a travelling wave over the pattern.

MCQ 6.7.3 **In a stationary wave the point that undergoes zero acceleration is: (SZABMU MDCAT 2025)**

A	Node	B	Antinode
C	Midpoint between node and antinode	D	Every point along the wave

Solution: (a) A node never moves, so its displacement, velocity and acceleration are all zero.

MCQ 6.7.4 **Which one of the following does not cause stationary waves? (UHS MDCAT 2024)**

A	Two waves of equal frequency	B	Two waves of same speed
C	Two waves of unequal amplitude	D	Two waves travelling in opposite directions

Solution: (c) Two waves need equal amplitude for the nodes to be true zeros; everything else here is required.

MCQ 6.7.5 **The distance between two consecutive nodes of a stationary wave is: (PMC MDCAT 2022)**

A	λ	B	$\lambda/2$
C	$\lambda/4$	D	$\lambda/6$

Solution: (b) Consecutive nodes of a stationary wave are half a wavelength apart.

MCQ 6.7.6 **Stationary waves are produced by: (PMC MDCAT 2022)**

A	Reflection	B	Interference
C	Diffraction	D	Rarefaction

Solution: (b) Two identical waves travelling opposite ways interfere to give a stationary pattern.

MCQ 6.7.7 **Stationary waves cannot be produced in: (PMC MDCAT 2022)**

A	Water waves	B	Finite ropes
C	Sound waves	D	None of the above.

Solution: (d) Stationary waves form in water, on a rope and in air alike, so there is no exception.

MCQ 6.7.8 **The sound waves have no: (PMC MDCAT 2022)**

A	Frequency of the wave	B	Energy
C	Nodes	D	Intensity

Solution: (c) A progressive sound wave carries no nodes; nodes belong to a stationary wave.

MCQ 6.7.9 **In a stationary wave, the distance between a node and consecutive antinode is: (PMC Practice 2021)**

A	A quarter of wavelength	B	3/4 of wavelength
C	One wavelength	D	Half of wavelength

Solution: (a) Nodes and antinodes alternate every quarter wavelength.

Topic 6.8 Stationary Waves in a Stretched String

Past MDCAT Questions

MCQ 6.8.1 **Stationary waves are formed in a stretched string of 2m length, such that two vibrating loops are formed. The distance between consecutive nodes formed is: (SZABMU MDCAT 2025)**

A	0.5 m	B	1 m
C	2 m	D	3 m

Solution: (b) Two loops in $2\,\mathrm{m}$ make each loop $1\,\mathrm{m}$, and a loop runs from one node to the next.

MCQ 6.8.2 **Which one of the following is INCORRECT about the nodes when the string is plucked; (UHS MDCAT 2024)**

A	Amplitude of vibration is zero	B	Do not move along the string
C	Produced at the fixed ends of strings	D	Distance between consecutive nodes is 1 wavelength

Solution: (d) Consecutive nodes are half a wavelength apart, not a whole one.

MCQ 6.8.3 **When a standing wave is set up on a string fixed at both ends, which of the following statements is true? (PMC Practice 2021)**

A	Sum of the number of antinodes and the number of nodes is always even	B	Wavelength = length string / number of nodes
C	The shape of the string at any instant shows a symmetry about the midpoint of the string	D	Frequency = number of nodes x fundamental frequency

Solution: (c) The pattern of loops between the fixed ends is symmetrical about the middle of the string.

MCQ 6.8.4 **The speed 'v' of the waves in the string depends upon the tension, F, of the string and m, the mass per unit length of the string. It is given by: (PMC Practice 2021)**

A	v2 = F/m	B	v = F/m
C	v x m = F	D	v = F x m

Solution: (a) The speed of a wave on a stretched string is $\sqrt{F/m}$.

Topic 6.9 Stationary Waves in Organ Pipes

Past MDCAT Questions

MCQ 6.9.1 **For a certain organ pipe three successive resonance frequencies are 425, 595 and $765\,\mathrm{Hz}$. Taking the speed of sound as $340\,\mathrm{m\,s^{-1}}$, the pipe is: (UHS MDCAT 2017)**

A	a closed pipe of length $1\,\mathrm{m}$	B	a closed pipe of length $2\,\mathrm{m}$
C	an open pipe of length $1\,\mathrm{m}$	D	an open pipe of length $2\,\mathrm{m}$

Solution: (a) The spacing is $170\,\mathrm{Hz}$, and the three are 5, 7 and 9 times $85\,\mathrm{Hz}$. Only odd harmonics appear, so the pipe is closed, and $85 = v/4L$ gives $L = 1\,\mathrm{m}$.

MCQ 6.9.2 **A pipe open at both ends resonates at a fundamental frequency fo. When one end is covered and the pipe is again made to resonate, the fundamental frequency is fc. Which of the following expressions describes the relationship between these two resonants? (PMC MDCAT 2022)**

A	fc = fo	B	2xfc = fo
C	fc = 2fo	D	none

Solution: (b) An open pipe sounds $v/2L$ and a closed one $v/4L$, so the open note is twice the closed.

MCQ 6.9.3 **For a certain organ pipe, three successive resonance frequencies are observed at 425, 595, and 765 Hz. The speed of the sound in air is 340 m/s. The pipe is: (UHS MDCAT 2017)**

A	Closed pipe of length 1 m	B	Closed pipe of length 2 m
C	Open pipe of length 1 m	D	Open pipe of length 2 m

Solution: (a) The frequencies differ by $170\,\mathrm{Hz}$ and are odd multiples of $85\,\mathrm{Hz}$, so the pipe is closed and $340/(4 \times 85)$ is $1\,\mathrm{m}$.

Topic 6.10 Simple Harmonic Motion

Past MDCAT Questions

MCQ 6.10.1 **When will the oscillations of a pendulum stop in the absence of resistive forces? (MDCAT 2022)**

A	never	B	after 10 minutes
C	in 10 minutes	D	immediately

Solution: (a) With nothing to take its energy away the motion is undamped and continues indefinitely.

MCQ 6.10.2 **Reducing the mass M of a suspended body to one fourth will change the frequency of oscillation to: (MDCAT 2022)**

A	one fourth	B	double
C	quadruple	D	half

Solution: (b) $f = \dfrac{1}{2\pi}\sqrt{k/m}$, so a quarter of the mass doubles the frequency.

MCQ 6.10.3 **If the length of a second's pendulum becomes four times, then its time period will become: (MDCAT 2023)**

A	four times	B	two times
C	half	D	one fourth

Solution: (b) $T = 2\pi\sqrt{l/g}$, so T goes as the square root of the length.

MCQ 6.10.4 **The energy of a Simple Harmonic oscillation depends upon the: (UHS MDCAT 2025)**

A	frequency	B	time period
C	wavelength	D	amplitude

Solution: (d) The total energy of an oscillator is $\frac{1}{2}kx_0^2$, which depends on the amplitude alone.

MCQ 6.10.5 **When a particle executing simple harmonic motion moves from the mean position to the extreme position, its kinetic energy: (KMU MDCAT 2025)**

A	Increases continuously	**B**	Decreases continuously and becomes zero at the extreme position
C	Remains constant throughout the motion	**D**	Becomes maximum at the extreme position

Solution: (b) The speed falls to zero at the extreme position, and with it the kinetic energy.

MCQ 6.10.6 **Body mass 10kg, spring k=20 N/m, max displacement 20cm. Acceleration is: (NUMS MDCAT 2024)**

A	2.2 ms-2	**B**	4 ms-2
C	2 ms-2	**D**	0.4 ms-2

Solution: (d) $a = kx/m = 20 \times 0.2/10$, which is $0.4\,\mathrm{m\,s^{-2}}$.

MCQ 6.10.7 **When will the oscillations stop in the absence of resistive forces? (UHS MDCAT 2023)**

A	Never	**B**	After 10 minutes
C	In 10 minutes	**D**	Immediately

Solution: (a) With nothing to take energy from it, an oscillator would go on for ever.

MCQ 6.10.8 **Reducing mass M of a suspending body to one fourth will change the frequency of oscillation to (UHS MDCAT 2023)**

A	One fourth	**B**	Double
C	Quadrupule	**D**	Half

Solution: (b) The frequency goes as $1/\sqrt{m}$, so a quarter of the mass doubles it.

MCQ 6.10.9 **If the length of second pendulum becomes four times, then its time period will become: (UHS MDCAT 2023)**

A	Four times	**B**	Two times
C	Half	**D**	One fourth

Solution: (b) $T = 2\pi\sqrt{l/g}$ goes as the square root of the length, so four times the length doubles the period.

MCQ 6.10.10 **Potential energy of a spring at the equilibrium position is: (PMC MDCAT 2022)**

A	Zero	**B**	Infinite
C	Maximum	**D**	Information is Insufficient

Solution: (a) At the equilibrium position the spring is unstretched, so it stores nothing.

MCQ 6.10.11 **Two springs having force constants in the ratio of 3:4, both the springs are stretched by equal force F, if elongation in first spring is x then elongation in the second spring is: (PMC MDCAT 2022)**

A	3x	**B**	4x
C	3x/4	**D**	4x/3

Solution: (c) $x = F/k$, so the stiffer spring stretches less, in the ratio $3/4$.

MCQ 6.10.12 **Kinetic energy of an oscillating simple pendulum at the equilibrium position is: (PMC MDCAT 2022)**

A	Maximum	**B**	Minimum
C	Zero	**D**	Information insufficient

Solution: (a) The bob moves fastest as it passes through the mean position.

MCQ 6.10.13 **If the period of oscillation of man (M) suspended from a spring is 1s, then the period of 16M will be: (NUMS MDCAT 2022)**

A	1s	**B**	2s
C	3s	**D**	4s

Solution: (d) T goes as $\sqrt{m}$, so sixteen times the mass gives four times the period.

MCQ 6.10.14 **The pendulum of a certain pendulum clock is made of brass. When the temperature increases, what happens to the period of the clock? (PMC Practice 2021)**

A	It increases	**B**	It decreases
C	It remains the same	**D**	It decreases with the square of temperature

Solution: (a) The brass rod lengthens as it warms, and $T = 2\pi\sqrt{l/g}$ grows with the length.

MCQ 6.10.15 **When the length of simple pendulum is doubled, the ratio of its new time period to old time period is: (UHS MDCAT 2019)**

A	3√2	**B**	l√2
C	2√2	**D**	√2

Solution: (d) $T = 2\pi\sqrt{l/g}$ goes as the square root of the length.

MCQ 6.10.16 **In simple harmonic motion, acceleration will be maximum, when object is at: (UHS MDCAT 2019)**

A	Maximum displacement from the mean position	**B**	Center position
C	Half of the maximum displacement from mean position	**D**	Mean position

Solution: (a) $a = -\omega^2 x$, so the acceleration is greatest where the displacement is greatest.

MCQ 6.10.17 **In SHM the kinetic energy of the body is maximum when: (UHS MDCAT 2018)**

A	The body is at mean position	**B**	The body is at extreme position from the mean
C	The body is exactly half way down between mean and extreme position	**D**	The body is somewhere between mean and extreme position

Solution: (a) The speed is greatest as the body passes the mean position.

MCQ 6.10.18 **When the frequency of the applied force becomes equal to one of natural frequencies of body then the body oscillates with maximum displacement this phenomenon is called: (UHS MDCAT 2018)**

A	Heating	**B**	Resonance
C	Reverbnation	**D**	Damping

Solution: (b) Driving a body at its own natural frequency is resonance.

MCQ 6.10.19 **The velocity and acceleration of a particle performing S.H.M. have a steady phase relationship. The acceleration showed a phase lead over the the velocity of: (UHS MDCAT 2017)**

A	π	**B**	π/2
C	-π/2	**D**	-π

Solution: (b) The acceleration leads the velocity by a quarter of a cycle.

MCQ 6.10.20 **A particle executes S.H.M. with frequency f. The frequency of variation of its maximum or minimum kinetic energy is: (UHS MDCAT 2017)**

A	f/2	**B**	f
C	2f	**D**	4f

Solution: (c) The kinetic energy passes through its maximum twice in each cycle, so it varies at $2f$.

MCQ 6.10.21 **The vertical extension in a light spring by a weight of 1 kg suspended from the wire is 9.8 cm, the period of the oscillation is: (UHS MDCAT 2017)**

A	20pi sec	**B**	2pi sec
C	2pi/10 sec	**D**	200pi sec

Solution: (c) $k = mg/x = 9.8/0.098 = 100\,\mathrm{N\,m^{-1}}$, so $T = 2\pi\sqrt{1/100}$, that is $2\pi/10\,\mathrm{s}$.

MCQ 6.10.22 **Resonance occurs when the driving frequency is: (UHS MDCAT 2016)**

A	Greater than natural frequency	B	Unequal the natural frequency
C	Less than natural frequency	D	Equal to the natural frequency

Solution: (d) Resonance comes when the driving frequency matches a natural frequency of the body.

Topic 6.11 Circular Motion and SHM

Past MDCAT Questions

MCQ 6.11.1 **A particle is moving in a uniform circular path whose projection is executing simple harmonic motion on horizontal diameter. The ratio of instantaneous velocity to the maximum velocity of the projection while passing through the center is: (SZABMU MDCAT 2025)**

A	1 : 1	B	1 : 2
C	2 : 1	D	1 : 4

Solution: (a) The projection is fastest as it passes the centre, so the instantaneous speed there is the maximum speed.

Unit 7 Thermodynamics

Topic 7.1 Thermal Equilibrium and Heat

Past MDCAT Questions

MCQ 7.1.1 **Thermodynamics is that branch of physics in which we study the: (MDCAT 2022)**

A	relations between heat and mechanical energies	B	relations between heat and internal energies only
C	relations between chemical and mechanical energies	D	relations between kinetic and potential energies

Solution: (a) Thermodynamics is about the exchange between thermal energy and mechanical work.

MCQ 7.1.2 **The pressure of a gas is directly proportional to the: (UHS MDCAT 2017)**

A	average kinetic energy of its molecules	B	average vibrational kinetic energy of its molecules
C	average translational kinetic energy of its molecules	D	all of the above

Solution: (c) The pressure comes from molecules striking the walls, so it is the translational part of the kinetic energy that counts.

MCQ 7.1.3 **Heat will spontaneously flow from: (KMU MDCAT 2025)**

A	Lower to higher internal energy only	B	High pressure to low pressure
C	High to low temperature	D	Low temperature to high temperature

Solution: (c) Heat of itself passes only from the hotter body to the colder one.

MCQ 7.1.4 **During rubbing of hands, internal energy: (NUMS MDCAT 2025)**

A	Increases	B	Decreases
C	Zero	D	Remains same

Solution: (a) Friction turns the work of rubbing into internal energy, so the hands warm.

MCQ 7.1.5 **During the drilling of a metal surface the drill bit heats up. This heat comes from the: (SIBA MDCAT 2025)**

A	Vibration of the tool	B	Work done against friction
C	Flow of electric current	D	Compression of air

Solution: (b) The work done against friction is turned into internal energy, which raises the temperature of the bit.

MCQ 7.1.6 **When thermal energy is transferred from a hot object to a cold one, the change occurs in the hot object as: (SZABMU MDCAT 2025)**

A	Increases in internal energy	B	Decrease in internal energy
C	Increase in temperature	D	Increase in heat content

Solution: (b) The hot body gives up heat, so its internal energy falls.

MCQ 7.1.7 **Consider an ideal gas confined to the cylinder with a fixed piston, on heating the gas, all the heat supplied increases (KMU MDCAT 2024)**

A	Kinetic energy of the molecules	B	Potential Energy of the molecules
C	The intermolecular forces between gas molecules	D	The number of gas molecules

Solution: (a) An ideal gas has no intermolecular forces, so all the heat goes into the motion of its molecules.

MCQ 7.1.8 **Thermodynamics is that branch of Physics in which we study (UHS MDCAT 2023)**

A	relations between heat and mechanical energies	B	relations between heat and ionization energies
C	relations between chemical and mechanical energies	D	relations between kinetic and potential energies

Solution: (a) Thermodynamics is the study of heat and its relation to mechanical work.

MCQ 7.1.9 **A fixed mass of an ideal gas is contained in a cylinder at constant temperature. Now, the pressure of the gas is decreased. (PMC Practice 2021)**

A	Their mean square speed decreases	B	Number of collision between molecules and walls of container decreased
C	The force of attraction between them increase	D	Their size decreases

Solution: (b) At the same temperature the molecules move as fast as before; there are simply fewer collisions with the walls.

MCQ 7.1.10 **Which of the following is not an assumption of the kinetic model of an ideal gas? (PMC Practice 2021)**

A	The size of the molecules is much smaller than the separation between molecules	B	Molecules suffer negligible momentum change during wall collisions
C	Molecules do not exert force on each other except during a collision	D	The gas molecules are in random motion and may change their direction of motion after every collision

Solution: (b) The collisions with the wall are what produce the pressure, and they are perfectly elastic but far from negligible.

MCQ 7.1.11 **The sum of all forms of molecular energies (Kinetic and Potential) of a substance is termed as? (UHS MDCAT 2019)**

A	Elastic energy	B	Absolute energy
C	Internal energy	D	Heat energy

Solution: (c) The sum of the kinetic and potential energies of all the molecules is the internal energy.

MCQ 7.1.12 **Molecules Of a gas at constant pressure for a fixed amount of gas have average kinetic energy X. Increasing temperature from 27 C to 327C, average K.E. of molecules will become: (UHS MDCAT 2019)**

A	20X	B	300X
C	200X	D	2X

Solution: (d) Mean kinetic energy goes as the absolute temperature, and $600/300$ is two.

MCQ 7.1.13 **Find the mean translational kinetic energy of ideal hydrogen gas at 17 degree Celcius. (UHS MDCAT 2018)**

A	6.21 x 10-21J	B	5 x 10-21J
C	6.21 x 10-12J	D	6 x 10-21J

Solution: (d) $\frac{3}{2}kT = 1.5 \times 1.38 \times 10^{-23} \times 290$, about 6×10^{-21} J .

MCQ 7.1.14 **The relation 'PV = nRT' shows which law of physics: (UHS MDCAT 2016)**

A	Charles Law	B	Avogadro's Law
C	Newton's Constant	D	Ideal Gas Law

Solution: (d) $PV = nRT$ is the ideal gas equation.

MCQ 7.1.15 **The relation R/NA = 1.38 x 10-25 JK-1 in a gas law is known as: (UHS MDCAT 2016)**

A	Avogadro's constant	B	Charles constant
C	Newton's constant	D	Boltzmann's constant

Solution: (d) The gas constant per molecule is Boltzmann's constant.

Topic 7.2 Work Done by a Thermodynamic System

Past MDCAT Questions

MCQ 7.2.1 **The temperature of a given mass of a gas is changed from $150°C$ to $300°C$ during an isobaric process. The volume of the gas will become: (MDCAT 2022)**

A	half	B	double
C	the same	D	less than double

Solution: (d) Volume goes as the absolute temperature, and $573/423 \approx 1.35$, which is less than twice.

MCQ 7.2.2 **Bursting of tire is an example of which process? (NUMS MDCAT 2025)**

A	Adiabatic	B	Isochoric
C	Isothermal	D	Isobaric

Solution: (a) The air escapes too fast for any heat to be exchanged, so the expansion is adiabatic.

MCQ 7.2.3 **A gas expands from 1 m^3 to 3 m^3 at constant pressure of 2 Pa. Work done is: (SIBA MDCAT 2025)**

A	2J	B	4J
C	6J	D	8J

Solution: (b) $W = P\Delta V = 2 \times 2$, which is $4\,\text{J}$.

MCQ 7.2.4 **During the isothermal process, the temperature (UHS MDCAT 2024)**

A	remains constant during the initial phase of the process of the process	B	remains constant throughout the process
C	alters throughout the process	D	increases throughout the process

Solution: (b) Isothermal means at one temperature, held so throughout the change.

MCQ 7.2.5 **In an adiabatic process, how does the temperature of a gas change as its volume decreases? (KMU MDCAT 2024)**

A	The temperature decreases	B	The temperature increases
C	The temperature remains constant	D	The temperature first increases then decreases

Solution: (b) No heat can escape, so the work done in compressing the gas all goes into its internal energy.

MCQ 7.2.6 **During an isothermal expansion of an ideal gas, which of the following statement is true? (KMU MDCAT 2024)**

A	Pressure and temperature of the gas increase	B	The internal energy of the gas increases
C	The temperature of the gas remains constant	D	The work done by the gas is zero

Solution: (c) Isothermal means at constant temperature, held so by heat flowing in as the gas does work.

MCQ 7.2.7 **When a gas is compressed isothermally, the product of its pressure and volume during the process is: (UHS MDCAT 2023)**

A	not constant	B	constant
C	zero	D	proportional to entropy

Solution: (b) At constant temperature $PV = nRT$ makes the product constant, which is Boyle's law.

MCQ 7.2.8 **Temperature of given mass of a gas is changed from 150°C to 300°C during an isobaric process, volume of the gas will become: (UHS MDCAT 2023)**

A	Half	B	Double
C	Remain same	D	Less than double

Solution: (d) On the Kelvin scale the temperature rises from 423 to 573, a factor of only 1.35.

MCQ 7.2.9 **The thermodynamic process during which volume of the system remains constant is called: (SZABMU MDCAT 2023)**

A	Isothermal	B	Isobaric
C	Isochoric	D	Adiabatic

Solution: (c) A change at constant volume is isochoric.

MCQ 7.2.10 **The conditions for application of Boyle's law holds good in: (SZABMU MDCAT 2023)**

A	Adiabatic process	B	Isothermal process
C	Isobaric process	D	Isochoric process

Solution: (b) Boyle's law holds at constant temperature, that is in an isothermal change.

MCQ 7.2.11 **In isochoric process: (NUMS MDCAT 2023)**

A	Pressure is kept constant	B	Exchange of heat is zero
C	Volume is kept constant	D	Temperature is kept constant

Solution: (c) Isochoric means at constant volume.

MCQ 7.2.12 **The thermodynamic process during which the pressure is kept constant is called: (NUMS MDCAT 2022)**

A	Isochoric process	B	Adiabatic proms
C	Isobaric proem	D	Isothermal proem

Solution: (c) A change at constant pressure is isobaric.

MCQ 7.2.13 **Which of this is constant in isochoric process? (PMC Practice 2021)**

A	Total heat	B	Work done
C	Entropy	D	Internal energy

Solution: (b) The volume does not change, so no work is done at any stage.

MCQ 7.2.14 **A gas expands from Vl to V2 at pressure P. Work done is: (PMC Practice 2021)**

A	P/(V2-Vl)	B	(P2-Pl) * V
C	P(VlV2/(V2-Vl))	D	P(V2-Vl)

Solution: (d) At constant pressure the work done is $P(V_2 - V_1)$.

MCQ 7.2.15 **Isothermal process can be defined as? (PMC Practice 2021)**

A	PV = constant	B	PV = RT
C	PIV = constant	D	P/V = Nrt

Solution: (a) At constant temperature $PV = nRT$ makes the product constant.

MCQ 7.2.16 **The rapid escape of air from a burst tyre is an example of: (UHS MDCAT 2016)**

A	Adiabatic processes	B	Isothermal process
C	Cooling process	D	First law of thermodynamics

Solution: (a) The air escapes far too fast for any heat to be exchanged.

Topic 7.3 First Law of Thermodynamics

Past MDCAT Questions

MCQ 7.3.1 **The rapid escape of air from a burst tyre is an example of a process that is: (MDCAT 2020)**

A	isothermal	B	adiabatic
C	isobaric	D	isochoric

Solution: (b) The escape is too quick for any heat exchange, so $Q = 0$ and the air cools as it does work.

MCQ 7.3.2 **When a gas expands isothermally, the product of its pressure and volume during the process is: (MDCAT 2022)**

A	not constant	B	constant
C	zero	D	proportional to entropy

Solution: (b) At constant temperature $PV = nRT$ is fixed, which is Boyle's law.

MCQ 7.3.3 **The first law of thermodynamics concerns the conservation of: (MDCAT 2023)**

A	heat	B	work
C	momentum	D	energy

Solution: (d) $\Delta U = Q - W$ is the conservation of energy written for a thermodynamic system.

MCQ 7.3.4 **During an isothermal process the temperature: (MDCAT 2024)**

A	remains constant during the initial phases of the process	B	remains constant throughout the process
C	alters throughout the process	D	increases throughout the process

Solution: (b) Isothermal means at one temperature, so the temperature is constant for the whole process.

MCQ 7.3.5 **What is the value of the heat energy Q in an adiabatic process? (MDCAT 2024)**

A	-1	B	$+1$
C	0	D	$+2$

Solution: (c) No heat enters or leaves the system in an adiabatic process, so $Q = 0$ and the work is done at the cost of internal energy.

MCQ 7.3.6 **During an adiabatic compression the work done on a gas is $200\,\mathrm{J}$. The change in its internal energy is: (UHS MDCAT 2017)**

A	$-200\,\mathrm{J}$	B	$+200\,\mathrm{J}$
C	$100\,\mathrm{J}$	D	$0\,\mathrm{J}$

Solution: (b) No heat is exchanged in an adiabatic change, so all the work done on the gas goes into its internal energy.

MCQ 7.3.7 **If $100\,\mathrm{J}$ of heat is taken out of a system while $400\,\mathrm{J}$ of work is done on it, the change in internal energy is: (UHS MDCAT 2017)**

A	$-300\,\mathrm{J}$	B	$300\,\mathrm{J}$
C	$-100\,\mathrm{J}$	D	$0\,\mathrm{J}$

Solution: (b) $\Delta U = \Delta Q - W = (-100) - (-400) = +300\,\mathrm{J}$.

MCQ 7.3.8 **According to First law of thermodynamics when heat flows into a system and no work is done the internal energy of the system must (UHS MDCAT 2025)**

A	Increase	B	Decrease
C	Remains constant	D	Becomes zero

Solution: (a) With no work done, all the heat taken in goes into the internal energy, which therefore rises.

MCQ 7.3.9 **What is the value of heat energy (Q) in an adiabatic process? (UHS MDCAT 2024)**

A	+l	B	-l
C	0	D	+2

Solution: (c) An adiabatic change is one in which no heat enters or leaves, so Q is zero.

MCQ 7.3.10 **A process in which all heat energy is used for increasing internal energy is: (NUMS MDCAT 2024)**

A	Isobaric	B	Isochoric
C	Isothermal	D	Adiabatic

Solution: (b) At constant volume no work is done, so by the first law all the heat goes into internal energy.

MCQ 7.3.11 **The internal energy of a system during an isothermal process: (SZABMU MDCAT 2023)**

A	Decreases	B	Increases
C	Becomes zero	D	Remains constant

Solution: (d) Internal energy depends only on temperature, which an isothermal change holds fixed.

MCQ 7.3.12 **If 42 J heat is transferred to the system during expansion, what is the change in internal energy when work done is 32 J? (NUMS MDCAT 2023)**

A	74 J	B	10 J
C	116 J	D	106 J

Solution: (b) $\Delta U = Q - W = 42 - 32$, which is $10\,\mathrm{J}$.

MCQ 7.3.13 **The Ist law of thermodynamics is the generalization of the law of conservation of: (NUMS MDCAT 2023)**

A	Mass	B	Charge
C	Energy	D	Momentum

Solution: (c) The first law is the conservation of energy applied to heat and work.

MCQ 7.3.14 **First law of thermodynamics concerns with the conservation of (UHS MDCAT 2023)**

A	Heat	B	Work
C	Momentum	D	Energy

Solution: (d) The first law is the conservation of energy written for heat and work.

MCQ 7.3.15 **First law of thermodynamics is based on: (NUMS MDCAT 2022)**

A	Law of conservation of momentum	B	Law of conservation of mass
C	Law of conservation of charge	D	Law of conservation of energy

Solution: (d) The first law is the conservation of energy written for heat and work.

MCQ 7.3.16 **The first law of thermodynamics can be stated as? (PMC Practice 2021)**

A	$Q = \Delta U + W$	**B**	$Q + \Delta U = W$
C	$Q = \Delta U \times W$	**D**	Option D

Solution: (a) The heat put in goes partly into internal energy and partly into work done by the system.

MCQ 7.3.17 **In which process the entire heat supplied to the gas is converted to the internal energy of the gas? (PMC MDCAT 2020)**

A	Isochoric process	**B**	Isobaric process
C	Isothermal process	**D**	Adiabatic process

Solution: (a) At constant volume no work is done, so all the heat goes into the internal energy.

MCQ 7.3.18 **During adiabatic compression work done is equal to 200 J. What will be the change in internal energy? (UHS MDCAT 2017)**

A	-200 J	**B**	+200 J
C	100 J	**D**	0 J

Solution: (b) No heat can escape, so all $200\,\mathrm{J}$ of work done on the gas goes into its internal energy.

MCQ 7.3.19 **Which relation exactly described the isothermal process? (UHS MDCAT 2016)**

A	$Q = W$	**B**	$W = -\Delta U$
C	$Q = -\Delta U$	**D**	$Q = \Delta U + W$

Solution: (a) The temperature is held, so the internal energy does not change and all the heat goes into work.

MCQ 7.3.20 **If a turbine is working as a heat engine and takes that from hot body (427 °C) and exhausts into a body at 77 °C then what is the possible efficiency? (UHS MDCAT 2016)**

A	50%	**B**	70%
C	90%	**D**	95%

Solution: (a) $1 - T_c/T_h = 1 - 350/700$, that is 50%.

Topic 7.4 Specific Heat and Molar Specific Heat of a Gas

Past MDCAT Questions

MCQ 7.4.1 **Which of the following has highest specific heat capacity? (NUMS MDCAT 2025)**

A	Copper	**B**	Iron
C	Water	**D**	Glass

Solution: (c) Water has an unusually high specific heat, about $4200\,\mathrm{J\,kg^{-1}\,K^{-1}}$.

MCQ 7.4.2 **The specific heat of a gas in adiabatic process is: (PMC MDCAT 2022)**

A	Zero	**B**	Infinite
C	Negative	**D**	Remains constant

Solution: (a) No heat is exchanged in an adiabatic change, so the heat per degree is zero.

MCQ 7.4.3 **Molar heat capacity at constant pressure is given by: (PMC MDCAT 2022)**

A	dQ/dV	**B**	dQ/dT
C	dU/dT	**D**	dU/dV

Solution: (b) Molar heat capacity is the heat needed per mole for each degree of temperature rise.

MCQ 7.4.4 **Given that the Cv of a gas is 8 J/K mol, calculate the change in heat for dT=50K of 2 mole gas? (PMC MDCAT 2022)**

A	800J	**B**	1631.4J
C	1700J	**D**	1800J

Solution: (a) $Q = nC_v\Delta T = 2 \times 8 \times 50$, which is $800\,\mathrm{J}$.

MCQ 7.4.5 **Molar heat capacity at constant volume is given by: (PMC MDCAT 2022)**

A	dQ/dN	**B**	dQ/dP
C	dU/dT	**D**	dU/dV

Solution: (c) At constant volume no work is done, so the heat per mole per degree is dU/dT.

MCQ 7.4.6 **Heat capacity is defined as _____ required to change the temperature of substance by_____ (PMC MDCAT 2022)**

A	Momentum, 1 degree C	**B**	Heat, 1 degree C
C	Heat, 2 degree C	**D**	Work, 2 degree C

Solution: (b) Heat capacity is the heat needed to raise the temperature of the body by one degree.

MCQ 7.4.7 **Molar heat capacity is defined as heat required to raise the temperature by 1 degree of ____ substance. (PMC MDCAT 2022)**

A	2 mole	**B**	2 kg
C	1 kg	**D**	1 mole

Solution: (d) Molar heat capacity is the heat needed to raise one mole by one degree.

MCQ 7.4.8 **Specific heat of gas in isothermal process is: (PMC MDCAT 2022)**

A	Infinite	**B**	Zero
C	Negative	**D**	Remain constant

Solution: (a) Heat is taken in with no rise in temperature, so the heat per degree is unbounded.

MCQ 7.4.9 **Unit of heat capacity is: (PMC MDCAT 2022)**

A	J/K	**B**	J/K.mole
C	J/K.kg	**D**	Joule

Solution: (a) Heat capacity is heat per degree, that is joules per kelvin.

MCQ 7.4.10 **Which of the following cases (if any) requires the greatest amount of heat? (In each case the material is the same) (PMC Practice 2021)**

A	1.5 kg of the material is to be heated by 7.0 C0	**B**	3.0 kg of the material is to be heated by 3.5 C0
C	0.50 kg of the material is to be heated by 21 C0	**D**	The amount of heat required is the same in each of the three previous case

Solution: (d) $Q = mc\Delta T$, and 1.5×7, 3.0×3.5 and 0.5×21 are all 10.5.

MCQ 7.4.11 **A liquid has mass m and specific heat capacity c. The rate of change in temperature of the liquid is R. What is the rate at which heat is transferred from the liquid. (PMC Practice 2021)**

A	Rmc	**B**	R/me
C	me/R	**D**	Rm/c

Solution: (a) $Q = mc\Delta T$, so the rate of heat loss is mcR.

Topic 7.5 Relation Between Cp and Cv

Past MDCAT Questions

MCQ 7.5.1 **An ideal gas has molar specific heat C_p at constant pressure. When the temperature of n moles is increased by ΔT, the increase in the internal energy is: (MDCAT 2023)**

A	$nC_p\Delta T$	**B**	$n(C_p + R)\Delta T$
C	$n(C_p - R)\Delta T$	**D**	$n(2C_p + R)\Delta T$

Solution: (c) $\Delta U = nC_v\Delta T$ and $C_p - C_v = R$, so $C_v = C_p - R$.

MCQ 7.5.2 **At a constant Pressure (Cp) and Volume (Cv), an ideal gas has C p - C v = R Then Cp will be? (KMU MDCAT 2025)**

A	R/2	**B**	3/2 R
C	5/2 R	**D**	7/2 R

Solution: (c) For a monatomic ideal gas $C_v = \frac{3}{2}R$, so $C_p = C_v + R = \frac{5}{2}R$.

MCQ 7.5.3 **For a monatomic ideal gas of 3 mole, Cp -Cv is: (PMC MDCAT 2022)**

A	R/3	**B**	3/2 R
C	2R	**D**	3R

Solution: (d) $C_p - C_v = R$ for each mole, so for three moles it is $3R$.

MCQ 7.5.4 **The value of Cp and Cv is the same for: (PMC MDCAT 2022)**

A	He	**B**	Ar
C	Aluminium	**D**	Neon

Solution: (c) A solid barely changes volume on heating, so it does almost no work and its two heat capacities are the same.

MCQ 7.5.5 **If Cp = 20 J/mol.K then for 1 mole gas we get Cv= _____. You can use Cp/Cv = 1.7. (PMC MDCAT 2022)**

A	10.6 J/K.mole	**B**	2.7 J/K.mole
C	13 J/K.mole	**D**	11.7 J/K.mole

Solution: (d) $C_v = C_p/\gamma = 20/1.7$, about $11.7\,\mathrm{J\,mol^{-1}\,K^{-1}}$.

MCQ 7.5.6 **Cp for monatomic gas in terms of R is: (PMC MDCAT 2022)**

A	3/5 R	**B**	5/3 R
C	5/4 R	**D**	5/2 R

Solution: (d) For a monatomic gas $C_v = \frac{3}{2}R$, so $C_p = \frac{5}{2}R$.

MCQ 7.5.7 **For a monatomic ideal gas of 6 mole Cp/Cv: (PMC MDCAT 2022)**

A	1.4	**B**	1.67
C	5	**D**	3

Solution: (b) For a monatomic gas $\gamma = \frac{5}{2}R/\frac{3}{2}R$, that is 1.67, whatever the amount.

MCQ 7.5.8 **Cp = 49 J/K.mole and Cv= 35 J/K,mol then what type of gas Is this? (PMC MDCAT 2022)**

A	Diatomic	**B**	Monatomic
C	Triatomic	**D**	Nonlinear-triatomic

Solution: (a) $C_p - C_v = 14$, about R, and $C_p/C_v = 1.4$, which is the value for a diatomic gas.

MCQ 7.5.9 **If Cv= 5/2 R , Cpwill be: (UHS MDCAT 2018)**

A	2 / 5 R	**B**	2 / 7 R
C	5 / 2 R	**D**	7 / 2 R

Solution: (d) $C_p = C_v + R = \frac{5}{2}R + R$, that is $\frac{7}{2}R$.

MCQ 7.5.10 **If one mole of an ideal gas is heated at constant pressure, then the first law of thermodynamics can be written as: (UHS MDCAT 2018)**

A	CpΔT = CvΔT + PΔV	**B**	CvΔT = CpΔT + PΔV
C	CpΔT = CvΔT + VΔP	**D**	ΔCpT = ΔCvT + PΔV

Solution: (a) The heat put in at constant pressure raises the internal energy and does the work $P\Delta V$.

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Topic 8.1 Coulomb's Law

Past MDCAT Questions

MCQ 8.1.1 If we double the separation between two charges, then Coulomb's force will become: (MDCAT 2020)

A	doubled	B	half
C	four times	D	one fourth

Solution: (d) $F \propto 1/r^2$, so twice the separation leaves a quarter of the force.

MCQ 8.1.2 Which one of the following statements is true? (MDCAT 2022)

A	the electrostatic force obeys the inverse square law while the gravitational force does not	B	both the gravitational force and the electrostatic force are repulsive in nature
C	the gravitational force is much weaker than the electrostatic force	D	neither force obeys the inverse square law

Solution: (c) Both are inverse square forces, but between two protons gravity is weaker by some 10^{36} times.

MCQ 8.1.3 The Coulomb constant depends upon the: (MDCAT 2022)

A	nature of the medium	B	system of units
C	type of charge	D	nature of the medium and the system of units

Solution: (d) $k = 1/4\pi\varepsilon$ carries the permittivity of the medium, and its number depends on the units used.

MCQ 8.1.4 As per Coulomb's law, the force of attraction or repulsion between two point charges is directly proportional to the: (MDCAT 2023)

A	sum of the magnitudes of the charges	B	product of the magnitudes of the charges
C	square of the distance between them	D	distance between them

Solution: (b) $F \propto q_1 q_2$, and it is inversely proportional to the square of the separation.

MCQ 8.1.5 Coulomb's law states that the force between two point charges is: (MDCAT 2024)

A	inversely proportional to the product of the charges and directly proportional to the square of the distance between them	B	directly proportional to the product of the charges and inversely proportional to the square of the distance between them
C	directly proportional to the sum of the charges and inversely proportional to the square of the distance between them	D	directly proportional to the product of the charges and to the square of the distance between them

Solution: (b) $F = q_1 q_2 / 4\pi\varepsilon_0 r^2$.

MCQ 8.1.6 A force of repulsion between two charges is taken as: (UHS MDCAT 2017)

A	negative	B	positive
C	either positive or negative	D	it cannot be determined

Solution: (b) Coulomb law gives a positive product for like charges, and the positive sign is read as repulsion.

MCQ 8.1.7 If a plastic sheet of relative permittivity 2.5 is inserted between two-point charges placed in vacuum, then the electrostatic force between them: (UHS MDCAT 2025)

A	Increases by a factor of 2.5	B	Decreases by a factor of 2.5
C	Increases by a factor of 5	D	Decreases by a factor of 5

Solution: (b) The medium divides the force by its relative permittivity, so the force falls to $1/2.5$ of its value.

MCQ 8.1.8 If the distance between two charges is halved and magnitude of charges are also doubled, then the force between these charges becomes: (UHS MDCAT 2025)

A	two times	B	four times
C	eight times	D	sixteen times

Solution: (d) Doubling both charges multiplies the force by four, and halving the separation by four again.

MCQ 8.1.9 Coulomb's law fits well into: (KMU MDCAT 2025)

A	Newton's Ist law	B	Newton's 2nd law
C	Newton's 3rd law	D	Gauss's law

Solution: (c) The two charges push or pull each other equally and oppositely, which is the third law.

MCQ 8.1.10 The force between two charges is 28 N in vacuum. If paraffin wax of relative permittivity 2.8 is introduced between the charges as a medium, then the force reduces to: (SIBA MDCAT 2025)

A	25 N	B	20 N
C	15 N	D	10 N

Solution: (d) The medium divides the force by its relative permittivity, and $28/2.8$ is $10\,\mathrm{N}$.

MCQ 8.1.11 Two equal charges experience a certain force when placed in vacuum. When the charges are placed in a medium, the force becomes 1/4th. The dielectric constant of the medium is: (SZABMU MDCAT 2025)

A	0.25	B	2
C	4	D	16

Solution: (c) The medium divides the force by its dielectric constant, so a quarter of the force means a constant of four.

MCQ 8.1.12 The Coulomb's law states (UHS MDCAT 2024)

A	Force, between two point charges is inversely proportional to the product of the charges and directly proportional to the square of the distance between them	B	Force between two point charges is directly proportional to the product of the charges and inversely proportional to the square of the distance between them
C	Force between two point charges is directly proportional to the sum of the charges and inversely proportional to the square of the distance between them	D	Force between two point charges is directly proportional to the product of the charges and the square of the distance between them

Solution: (b) $F = kq_1 q_2 / r^2$: proportional to the product of the charges and to the inverse square of the separation.

MCQ 8.1.13 151.Which one of the following Is NOT a feature of electric forces? (UHS MDCAT 2024)

A	They act on charges	B	They act on masses
C	They can be attractive	D	They can be repulsive

Solution: (b) Electric forces act on charge; it is gravitation that acts on mass.

MCQ 8.1.14 **What is the increase in force between two charges if the separation between them is decreased by 50 percent? (KMU MDCAT 2024)**

A	Becomes four times	B	Doubles
C	Increases by half	D	Triples

Solution: (a) Halving the separation multiplies the inverse square by four.

MCQ 8.1.15 **According to Coulomb's law, what happens to the electrostatic force between the 2-point charges if the distance between them is doubled? (KMU MDCAT 2024)**

A	The force becomes one-fourth	B	The force becomes half
C	The force doubles	D	The force remains the same

Solution: (a) Doubling the separation leaves a quarter of the force.

MCQ 8.1.16 **NaCl dissolves quickly in water due to: (NUMS MDCAT 2024)**

A	Low εr	B	High εr
C	$\varepsilon r = 0$	D	$\varepsilon r = \infty$

Solution: (b) Water has a very high relative permittivity, so it weakens the attraction between the ions to about a eightieth.

MCQ 8.1.17 **The Coulomb's constant k depends upon: (UHS MDCAT 2023)**

A	nature of medium	B	system of units
C	types of charge	D	nature of medium and system of units

Solution: (d) $k = 1/4\pi\varepsilon$ carries the permittivity of the medium, and its number depends on the units used.

MCQ 8.1.18 **The property of material due to which it attracts or repels other objects is: (PMC MDCAT 2022)**

A	Friction	B	Velocity
C	Acceleration	D	Charge

Solution: (d) That property is electric charge.

MCQ 8.1.19 **Which of the following forces are only attractive? (PMC MDCAT 2022)**

A	Electrostatic forces	B	Gravitational forces
C	Magnetic forces	D	Forces between same poles of magnet

Solution: (b) Gravitation pulls and never pushes; electric and magnetic forces do both.

MCQ 8.1.20 **When two positive charge particles move toward each other In opposite directions: (PMC MDCAT 2022)**

A	repulsion occurs	B	attraction occurs
C	Nothing will happen	D	Charge will be neutralized

Solution: (a) Like charges repel, so they push each other apart.

MCQ 8.1.21 **Two unlike charges attract each other with a force of 10 N. If the distance between them is doubled, the force between them is: (PMC Practice 2021)**

A	40 N	B	20 N
C	5 N	D	2.5 N

Solution: (d) Doubling the separation leaves a quarter of the force, 2.5 N.

MCQ 8.1.22 **Charged body attracts uncharged body by _____ induction. (PMC Practice 2021)**

A	Electrostatic	B	Magnetic
C	Both A and B	D	None of these

Solution: (a) The charged body draws the opposite charge to the near face of the neutral one, which is electrostatic induction.

MCQ 8.1.23 **Three objects are brought close to each other, two at a time. When objects A and B are brought together, they repel. When objects B and C are brought together, they also repel. Which of the following is true? (PMC Practice 2021)**

A	Objects A and C possess charges of the same sign, but not B	B	Objects A and C possess charges of the opposite sign
C	All three objects possess charges of the same sign	D	One object is neutral

Solution: (c) Only like charges repel, so all three must carry charge of the same sign.

Topic 8.2 Electric Field and Field Intensity

Past MDCAT Questions

MCQ 8.2.1 **A charged particle is moving in a uniform electric field. For the motion of the particle due to the field, which quantity has a constant non-zero value? (MDCAT 2022)**

A	acceleration	B	displacement
C	rate of change of acceleration	D	velocity

Solution: (a) A uniform field gives a constant force, so the acceleration qE/m is constant.

MCQ 8.2.2 **The electric field intensity inside a charged hollow sphere is: (MDCAT 2023)**

A	maximum	B	zero
C	negative	D	positive

Solution: (b) The charge resides on the outer surface and its contributions cancel everywhere inside, so the field there is zero.

MCQ 8.2.3 **Which one of the following is NOT a feature of electric forces? (MDCAT 2024)**

A	they act on charges	B	they act on masses
C	they can be attractive	D	they can be repulsive

Solution: (b) Electric forces act on charge; it is the gravitational force that acts on mass.

MCQ 8.2.4 **The electric field at a point due to two equal and opposite charges is 100 N/C. If the magnitude of each charge is doubled then the electric field at that point becomes: (UHS MDCAT 2025)**

A	50 N/C	B	100 N/C
C	200 N/C	D	400 N/C

Solution: (c) The field of each charge is proportional to that charge, so doubling both doubles the resultant.

MCQ 8.2.5 **For two equal positive charges, the electric field weakest? (UHS MDCAT 2025)**

A	Midway between them	B	Along the perpendicular bisector
C	Close to either charge	D	At infinity

Solution: (a) Midway between two equal positive charges the two fields are equal and opposite, so they cancel.

MCQ 8.2.6 **The electric field at a point is defined as: (KMU MDCAT 2025)**

A	Potential per unit charge	B	Work done per unit time
C	Charge per unit area	D	Force per unit positive test charge

Solution: (d) Field intensity is the force per unit positive charge placed at the point.

MCQ 8.2.7 **The point where the electric field is zero between two opposite charge lies: (SIBA MDCAT 2025)**

A	Closer to the positive charge	**B**	At the mid-point
C	Closer to the negative charge	**D**	Nowhere between them

Solution: (d) Between unlike charges both fields point the same way, so they add and never cancel.

MCQ 8.2.8 **A point lies 3m from a +5μC charge and 4m from a -3μC charge. The most appropriate direction of the net electric field at this point is directed: (SIBA MDCAT 2025)**

A	Away from +5μC charge	**B**	Towards +5μC charge
C	Away from the -3μC charge	**D**	Perpendicular to the line joining the charges

Solution: (a) The nearer and larger charge gives much the stronger field, so the resultant points away from it.

MCQ 8.2.9 **The electric field at a point due to a point charge is 200N/C. If suppose a -4C test charge is placed at that point then the magnitude of electric field and electric force on it is: (SIBA MDCAT 2025)**

A	200N/C and 50N	**B**	200N/C and 200N
C	200N/C and 800N	**D**	800N/C and 800N

Solution: (c) The field is a property of the source, so it stays $200\,\mathrm{N\,C^{-1}}$, and $F = qE = 4 \times 200$ is $800\,\mathrm{N}$.

MCQ 8.2.10 **If a test charge of magnitude 2C experience forces of 100N and 200N at two points A and B in an electric field respectively. The ratio of electric fields at A to that of B is: (SZABMU MDCAT 2025)**

A	1:1	**B**	1:2
C	1:4	**D**	2:1

Solution: (b) The field is F/q with the same q, so the ratio of fields is the ratio of forces, $1:2$.

MCQ 8.2.11 **A charged particle moves in a uniform electric field between two oppositely charged parallel metal plates. To calculate the force acting on the particle due to the electric field, which quantity is not required? (UHS MDCAT 2023)**

A	Particle charge	**B**	Particle speed
C	Plate separation	**D**	Potential difference between the plates

Solution: (b) The field is the potential difference over the separation, and the force is qE; the speed does not enter.

MCQ 8.2.12 **When a charge gets influenced by its surrounding, it has entered: (PMC MDCAT 2022)**

A	An electric field	**B**	A gravitational field
C	Thermal field	**D**	Closed field

Solution: (a) The region round a charge in which another charge feels a force is the electric field.

MCQ 8.2.13 **The force per unit charge is called: (PMC MDCAT 2022)**

A	Electric Force	**B**	Electric Flux
C	Electric Potential	**D**	Electric Intensity

Solution: (d) Force per unit charge is the electric field intensity.

MCQ 8.2.14 **Which of the following could not be the units of electric intensity? (PMC MDCAT 2022)**

A	Joule per coulomb per meter	**B**	Joule per coulomb
C	Volt per meter	**D**	Newton per coulomb

Solution: (b) Joules per coulomb is the volt, that is potential, not field.

MCQ 8.2.15 **Direction of electric force and electric field intensity for a positive charge is: (PMC MDCAT 2022)**

A	Parallel to each other	**B**	Perpendicular to each other
C	Opposite to each other	**D**	Random

Solution: (a) The field is defined as the force on unit positive charge, so for a positive charge the two are along each other.

MCQ 8.2.16 **Electric field intensity is: (NUMS MDCAT 2022)**

A	Force per unit mass	**B**	Force per unit tesla
C	Force per unit charge	**D**	Force per unit watt

Solution: (c) Field intensity is the force on unit positive charge.

MCQ 8.2.17 **Formula for electric field intensity is: (PMC Practice 2021)**

A	E=F/q	**B**	E=3F/2q
C	E=F/3q	**D**	None of them

Solution: (a) Field intensity is the force per unit charge.

MCQ 8.2.18 **The values of electric intensity will ____ due to the presence of dielectric medium: (PMC MDCAT 2020)**

A	Increase	**B**	Increase exponentially
C	Decrease	**D**	Remain same

Solution: (c) The medium divides the field by its relative permittivity.

MCQ 8.2.19 **Force experienced per unit positive test charge at a point in an electric field is the definition of: (UHS MDCAT 2018)**

A	Electric potential energy	**B**	Electric field strength
C	Electric potential	**D**	Electric field

Solution: (b) Force per unit positive test charge is the electric field strength.

Topic 8.3 Representation of the Electric Field by Lines

Past MDCAT Questions

MCQ 8.3.1 **A negatively charged particle initially at rest is placed in an electric field which varies from point to point, with no other field present. Then: (UHS MDCAT 2017)**

A	the particle moves along the electric line of force passing through it	**B**	the particle moves opposite to the electric line of force passing through it
C	the direction of acceleration of the particle is tangential to the electric line of force at every instant	**D**	the direction of acceleration of the particle is normal to the electric line of force at every instant

Solution: (c) The force is always along the field, so the acceleration is tangential to the line of force, but a curved line of force is not the path the particle takes.

MCQ 8.3.2 **Electric field lines due to a positive charge are: (PMC Practice 2021)**

A	Always horizontal	**B**	Always vertical
C	Radially towards the charge	**D**	Radially away from the charge

Solution: (d) Lines leave a positive charge and run straight outwards in every direction.

MCQ 8.3.3 **A negatively charged particle initially at rest is placed in an electric field that varies from point to point. There are no other fields. Then: (UHS MDCAT 2017)**

A	The particle moves along the electric line of force passing through it.	B	The particle moves opposite to the electric line of force passing through it.
C	The direction of acceleration of the particle is tangential to the electric line of force at every instant.	D	The direction of acceleration of the particle is normal to the electric line of force at every instant.

Solution: (c) The force, and so the acceleration, is along the field line at each point, that is along the tangent of the curved line.

Topic 8.4 Electric Field Due to an Infinite Sheet of Charge

Past MDCAT Questions

MCQ 8.4.1 **The electric intensity between two oppositely charged plates in the middle region is: (MDCAT 2024)**

A	non-uniform	B	uniform
C	unpredictable	D	variable

Solution: (b) Away from the edges the field between two parallel charged plates is uniform, $E = \sigma/\varepsilon_0$.

MCQ 8.4.2 **If the surface charge density of an infinite sheet increases by 25%, the electric field intensity: (UHS MDCAT 2025)**

A	Increases by 25%	B	Increases by 50%
C	Decreases by 25%	D	Remains the same

Solution: (a) The field of an infinite sheet is proportional to the surface charge density, so it rises in the same proportion.

MCQ 8.4.3 **Electric field intensity of infinite charge sheet: (NUMS MDCAT 2025)**

A	E = 2σ/ε0	B	E = 1/ε0
C	E = σ/ε0	D	σ/(2ε0)

Solution: (d) The field of an infinite sheet is $\sigma/2\varepsilon_0$ and does not fall off with distance.

MCQ 8.4.4 **149.Electric intensity between two oppositely charge plates in the middle region is_____ (UHS MDCAT 2024)**

A	Non-uniform	B	Uniform
C	Cannot be predicted	D	Variable

Solution: (b) Between two large parallel plates the field lines are straight and evenly spaced, so the field is uniform.

MCQ 8.4.5 **Gauss law cannot be used to find which of the following quantity? (UHS MDCAT 2023)**

A	Electric field intensity	B	Electric flux density
C	Charge	D	Permittivity

Solution: (d) Permittivity is a property of the medium and must be known before Gauss's law can be used at all.

MCQ 8.4.6 **Electric intensity due to charge distributions are calculated using which following law? (SZABMU MDCAT 2023)**

A	Ohm's law	B	Faraday's law
C	Gauss's law	D	Ampere's law

Solution: (c) Gauss's law gives the field of a symmetrical charge distribution from the flux through a closed surface.

MCQ 8.4.7 **Electric field intensity inside a hollow charged sphere is: (UHS MDCAT 2023)**

A	Maximum	B	Zero
C	Negative	D	Positive

Solution: (b) The charge sits on the surface, so by Gauss's law the field inside the shell is zero.

MCQ 8.4.8 **The flux through a surface will be zero when angle between E and △A is: (PMC MDCAT 2022)**

A	90o	B	60o
C	30o	D	0o

Solution: (a) Flux is $EA\cos\theta$, which vanishes when the field lies along the surface.

MCQ 8.4.9 **Charge inside conductor is: (PMC MDCAT 2022)**

A	Possible	B	Can be greater than zero
C	Zero	D	Negative always

Solution: (c) Charge on a conductor sits on its outer surface, so the interior encloses none.

MCQ 8.4.10 **The number of field lines passing through a certain element of area is known as: (PMC MDCAT 2022)**

A	Electric flux through that area	B	Electric current through that area
C	voltage through that area	D	Amperes through that area

Solution: (a) The number of field lines crossing an area is the electric flux through it.

MCQ 8.4.11 **The electric flux through a closed surface depends upon the: (PMC MDCAT 2022)**

A	Size of the surface	B	Shape of the surface
C	Position of charge enclosed in the surface	D	Magnitude of charge enclosed in the surface

Solution: (d) By Gauss's law the flux out of a closed surface depends only on the charge inside it.

MCQ 8.4.12 **The electric flux through the surface of the sphere is directly proportional to the: (PMC MDCAT 2022)**

A	Surface area of the sphere	B	Radius of the sphere
C	Charge at the centre of the sphere	D	Nature of charge

Solution: (c) By Gauss's law the flux out of a closed surface is the enclosed charge over ε_0.

MCQ 8.4.13 **Electric Flux through the surface of a sphere which has constant charge at its centre depends on: (PMC MDCAT 2022)**

A	The radius of the sphere	B	The surface area of the sphere
C	The amount of charge inside the sphere	D	The amount of charge outside the sphere

Solution: (c) By Gauss's law only the enclosed charge matters, not the size of the surface.

MCQ 8.4.14 **The flux through a surface will be minimum when angle between E and △A is: (PMC MDCAT 2022)**

A	90°	B	60°
C	30°	D	0o

Solution: (a) Flux is $EA\cos\theta$, which falls to zero when the field lies along the surface.

MCQ 8.4.15 **Electric field strength at a point between oppositely charged plates is 'E'. If the distance between plates is reduced to half, what will be the new value of electric intensity? (UHS MDCAT 2019)**

A	4E	B	E/2
C	E/4	D	2E

Solution: (d) $E = V/d$ between parallel plates, so halving the separation doubles the field.

Topic 8.5 Electric Potential and Potential Energy

Past MDCAT Questions

MCQ 8.5.1 **The formula $V = W/q$ represents: (MDCAT 2024)**

A	electric intensity	**B**	electric power
C	electric potential	**D**	electric field gradient

Solution: (c) Potential is the work done per unit positive charge in bringing it from infinity to that point.

MCQ 8.5.2 **Find the potential difference in moving a 2 C charge which requires 600 J of work between two points. (MDCAT 2024)**

A	1200 V	**B**	300 V
C	150 V	**D**	2400 V

Solution: (b) $V = W/q = 600/2 = 300$ V.

MCQ 8.5.3 **How much power is used in moving a charge of $0.03\,\mathrm{C}$ from a point at $40\,\mathrm{V}$ to a point at $60\,\mathrm{V}$ in $2\,\mathrm{s}$? (UHS MDCAT 2017)**

A	$0.30\,\mathrm{W}$	**B**	$0.15\,\mathrm{W}$
C	$0.60\,\mathrm{W}$	**D**	$0.012\,\mathrm{W}$

Solution: (a) $W = q\Delta V = 0.03 \times 20 = 0.6\,\mathrm{J}$, so $P = 0.6/2 = 0.30\,\mathrm{W}$.

MCQ 8.5.4 **The work done in moving a unit positive charge from one point to another while keeping the charge in electrostatic equilibrium is called: (KMU MDCAT 2025)**

A	Kinetic energy	**B**	Potential energy
C	Elastic potential energy	**D**	Potential difference

Solution: (d) The work per unit charge in carrying it between two points is the potential difference.

MCQ 8.5.5 **The electric potential at a point due to a point charge is 100J/C. If a test charge of magnitude 1C placed at that point is replaced with a 2C charge, then the physical quantity that will change is: (SZABMU MDCAT 2025)**

A	Electric Field at that point	**B**	Electric potential at that point
C	Electric Potential Energy of the system	**D**	Temperature

Solution: (c) The potential belongs to the source charge, but the energy qV of the charge placed there doubles with q.

MCQ 8.5.6 **The formula V = W / qo represents (UHS MDCAT 2024)**

A	Electric intensity	**B**	Electric power
C	Electric potential	**D**	Electric field gradient

Solution: (c) Work per unit charge is the electric potential.

MCQ 8.5.7 **150.Find potential difference in moving 2 C charge which requires 600J of work between two points. (UHS MDCAT 2024)**

A	1200V	**B**	300V
C	150V	**D**	2400V

Solution: (b) $V = W/q = 600/2$, which is $300\,\mathrm{V}$.

MCQ 8.5.8 **Electron Volt (eV) is another unit of (KMU MDCAT 2024)**

A	Charge	**B**	Current
C	Energy	**D**	Power

Solution: (c) An electron volt is the energy an electron gains through a potential difference of one volt.

MCQ 8.5.9 **A particle with charge 1C moves through potential difference 5V. Energy required: (NUMS MDCAT 2024)**

A	5×10-10 J	**B**	8×10-18 J
C	8J	**D**	5J

Solution: (d) $W = qV = 1 \times 5$, which is $5\,\mathrm{J}$.

MCQ 8.5.10 **What is the potential difference between two points in an electric field if it takes 600 J of energy to move a charge of 2 C between these two points? (UHS MDCAT 2023)**

A	1200 J	**B**	800 J
C	300 J	**D**	0 J

Solution: (c) $V = W/q = 600/2$, which is $300\,\mathrm{V}$.

MCQ 8.5.11 **The SI unit of potential difference is: (SZABMU MDCAT 2023)**

A	Volt	**B**	Coulomb
C	Watt	**D**	eV

Solution: (a) Potential difference is measured in volts.

MCQ 8.5.12 **Electric potential is defined as: (SZABMU MDCAT 2023)**

A	Work per unit charge	**B**	Force per unit charge
C	Power per unit charge	**D**	Force

Solution: (a) Potential is the work done per unit charge in bringing it from infinity.

MCQ 8.5.13 **1eV is equal to: (SZABMU MDCAT 2023)**

A	1.602 x 10-19 J	**B**	16.02 x 10-19 J
C	1620 J	**D**	162.0 x 10-19 J

Solution: (a) An electron volt is $1.602 \times 10^{-19}\,\mathrm{J}$.

MCQ 8.5.14 **Change in P.E per unit charge in the electric field is: (PMC MDCAT 2022)**

A	Electric potential	**B**	Power
C	K.E	**D**	Work done

Solution: (a) The change in potential energy per unit charge is the potential difference.

MCQ 8.5.15 **Electric potential determines the flow of? (PMC MDCAT 2022)**

A	Atom	**B**	Molecule
C	Compound	**D**	Charge

Solution: (d) Charge flows from a point of higher potential to one of lower potential.

MCQ 8.5.16 **The change in potential energy per unit charge between two points in an electric field is called: (PMC MDCAT 2022)**

A	Potential difference	**B**	Absolute potential
C	Electric Intensity	**D**	Permitivity

Solution: (a) The change in potential energy per unit charge is the potential difference.

MCQ 8.5.17 **Electrical potential energy between two charges at distance "r" is given by: (PMC MDCAT 2022)**

A	(k*q1*q2)/r	**B**	(k*q1*q2)/r2
C	k*q1*q2	**D**	k*q1*q2/2r

Solution: (a) The mutual potential energy of two point charges is kq_1q_2/r.

MCQ 8.5.18 **A particle, carrying a charge of 5e, falls through a potential difference of 25 V. What would be energy acquired by the particle in 'J'. (UHS MDCAT 2019)**

A	1.6 x 10-19J	**B**	125 J
C	125 x 10-19 J	**D**	125 x 1.6 x 10-19 J

Solution: (d) $W = qV = 5e \times 25$, that is $125 \times 1.6 \times 10^{-19}\,\mathrm{J}$.

MCQ 8.5.19 **How much power is used in moving a 0.03 C charge from point A at a potential of 40 V to point B at 60 V, if this takes 2 seconds? (UHS MDCAT 2017)**

A	0.30 W	**B**	0.15 W
C	0.60 W	**D**	0.012 W

Solution: (a) $W = q\Delta V = 0.03 \times 20 = 0.6\,\mathrm{J}$, and $0.6/2$ is $0.3\,\mathrm{W}$.

Topic 8.6 Electric Potential Due to a Point Charge

Past MDCAT Questions

MCQ 8.6.1 **The electric potential at a distance r is given by the formula: (NUMS MDCAT 2025)**

A	$V = kq/r$	**B**	$1/4\pi\varepsilon 0qr$
C	Ed	**D**	Ir

Solution: (a) The potential of a point charge at a distance r is kq/r .

MCQ 8.6.2 **Two points charges, +5μC and -5μC are placed at points A and B, respectively, which are separated by a distance 2d. What is the electric potential at the midpoint M of the line joining A and B? (KMU MDCAT 2024)**

A	$2kQ/d$	**B**	kQ/d
C	$-kQ/d$	**D**	zero

Solution: (d) Potential is a scalar, and the two equal and opposite contributions cancel at the midpoint.

MCQ 8.6.3 **At midpoint P between two +4μc charges. V and E at midpoint P: (NUMS MDCAT 2024)**

A	$V=0,\ E\neq 0$	**B**	$V=0,\ E=0$
C	$V\neq 0,\ E\neq 0$	**D**	$V\neq 0,\ E=0$

Solution: (d) The two potentials add and the two fields cancel, so the potential is finite and the field is zero.

MCQ 8.6.4 **Electric Potential which is measured with respect to the zero potential is called: (PMC MDCAT 2022)**

A	Absolute electric potential	**B**	Change in K.E
C	Change in potential energy	**D**	Electric intensity

Solution: (a) Potential measured from infinity, where the potential is taken as zero, is the absolute potential.

MCQ 8.6.5 **If the potential at a point which is 1m from a charge is 1 volt, then the potential at a point which is 2m from the same charge will be: (PMC MDCAT 2020)**

A	2 V	**B**	1 V
C	0.5 V	**D**	3 V

Solution: (c) The potential of a point charge goes as $1/r$, so twice the distance halves it.

MCQ 8.6.6 **Electric field strength of a point charge is E and electric potential is V, at a distance 'r' from the point charge. What is the electric potential at a point for the same point charge where electric field strength is E/4? (UHS MDCAT 2019)**

A	4V	**B**	2V
C	V/2	**D**	V/4

Solution: (c) E goes as $1/r^2$ and V as $1/r$, so a quarter of the field means twice the distance and half the potential.

MCQ 8.6.7 **Electric potential due to 2uC charge at distance of one meter is equal to: (UHS MDCAT 2018)**

A	18 x 104volt	**B**	1.8 x 106volt
C	1.8 x 109volt	**D**	1.8 x 104volt

Solution: (d) $V = kq/r = 9\times 10^9 \times 2\times 10^{-6}/1$, that is 1.8×10^4 V.

Topic 8.7 Charging and Discharging of a Capacitor

Past MDCAT Questions

MCQ 8.7.1 **By increasing the area of the plates and decreasing the distance between them, the capacitance of a capacitor: (MDCAT 2020)**

A	increases	**B**	decreases
C	remains unchanged	**D**	depends only upon temperature

Solution: (a) $C = \varepsilon_0 A/d$ rises with the area and falls with the separation.

MCQ 8.7.2 **A capacitor is charged with a battery and the energy stored is U. After disconnecting the battery, another capacitor of the same capacity is connected in parallel to the first one. The energy stored in each capacitor is: (MDCAT 2022)**

A	$U/2$	**B**	$U/4$
C	U	**D**	$2U$

Solution: (b) The charge is shared equally, and $E = Q^2/2C$ with half the charge is a quarter of the energy.

MCQ 8.7.3 **A capacitor of capacitance C has a charge Q and stored energy W. If the charge is increased to $2Q$, the stored energy will be: (MDCAT 2022)**

A	$2W$	**B**	$4W$
C	$W/4$	**D**	$W/2$

Solution: (b) $E = Q^2/2C$ goes as the square of the charge.

MCQ 8.7.4 **The SI unit of the capacitance of a capacitor is the: (MDCAT 2024)**

A	coulomb	**B**	volt
C	farad	**D**	ampere

Solution: (c) One farad is one coulomb per volt.

MCQ 8.7.5 **The energy stored in a capacitor is: (NUMS MDCAT 2025)**

A	QV	**B**	QV/2
C	Q2V	**D**	2QV

Solution: (b) The charge builds up as the voltage rises, so the stored energy is $\frac{1}{2}QV$, not QV.

MCQ 8.7.6 **The unit of RC in case of charging a capacitor is: (SZABMU MDCAT 2025)**

A	Farad	**B**	Seconds
C	Ohm	**D**	Volt

Solution: (b) Ohms times farads give seconds, which is why RC is called the time constant.

MCQ 8.7.7 **The S.I unit of capacitance of a capacitor is: (UHS MDCAT 2024)**

A	Coulomb	**B**	Volt
C	Farad	**D**	Ampere

Solution: (c) Capacitance is measured in farads, one farad being a coulomb per volt.

MCQ 8.7.8 **In the case of a parallel plate capacitor, when the distance between the two plates is reduced to half and the area of the plate doubled, the capacitance (KMU MDCAT 2024)**

A	Increases four times	**B**	Increases six times
C	Is doubled	**D**	Remains the same

Solution: (a) $C = \varepsilon A/d$ gains two from the area and two from the halved separation.

MCQ 8.7.9 **If the dielectric material between the plates of the capacitor is removed, what happens to the electric field between the plates? (KMU MDCAT 2024)**

A	The electric field becomes zero	**B**	The electric field decreases
C	The electric field increases	**D**	The electric field remains the same

Solution: (c) The dielectric was weakening the field; with the charge unchanged, taking it out lets the field rise.

MCQ 8.7.10 **Capacitance of a capacitor increases with a decrease in: (KMU MDCAT 2024)**

A	Dielectric constant	**B**	Plate area
C	Permittivity	**D**	Plate separation

Solution: (d) $C = \varepsilon A/d$, so the closer the plates the greater the capacitance.

MCQ 8.7.11 **A capacitor can be fully charged because time required is: (NUMS MDCAT 2024)**

A	1 time constant	**B**	2 time constant
C	4 time constant	**D**	Infinity

Solution: (d) The charge approaches its final value asymptotically, so strictly it is never quite reached.

MCQ 8.7.12 **If electric field intensity between capacitor plates doubles, energy stored becomes: (NUMS MDCAT 2024)**

A	Double	**B**	One half
C	One Fourth	**D**	Quadruple

Solution: (d) The energy density goes as the square of the field, so doubling the field gives four times the energy.

MCQ 8.7.13 **A capacitor of capacitance 'C' has a charge 'Q' and stored energy is 'w'. If the charge is increases to '2Q'. The stored energy will be: (UHS MDCAT 2023)**

A	2W	**B**	4W
C	W/4	**D**	W/2

Solution: (b) $U = Q^2/2C$ goes as the square of the charge, so twice the charge stores four times the energy.

MCQ 8.7.14 **The capacitance of capacitor does not depend on: (SZABMU MDCAT 2023)**

A	Area of plates	**B**	Medium
C	Distance between plates	**D**	Thickness of plates

Solution: (d) $C = \varepsilon A/d$ carries the area, the separation and the medium, but not how thick the plates are.

MCQ 8.7.15 **While studying charging and discharging of a capacitor, Rc = Resistance × Capacitance is known as: (NUMS MDCAT 2023)**

A	Electrostatic constant	**B**	Time constant
C	Dielectric constant	**D**	Proportionality constant

Solution: (b) RC has the dimension of time and is called the time constant of the circuit.

MCQ 8.7.16 **In parallel combination of two capacitors, their equivalent capacitance is equal to: (NUMS MDCAT 2023)**

A	C1 + C2	**B**	1/C1 + 1/C2
C	C1C2 / C1 + C2	**D**	2C1C2 / C1 + C2

Solution: (a) Capacitors in parallel share the same voltage, so their capacitances add.

MCQ 8.7.17 **To store the electric charge the ultra-capacitors use _____ effect. (UHS MDCAT 2023)**

A	Single layer	**B**	Double layer
C	Triple layer	**D**	Quadruple layer

Solution: (b) An ultracapacitor stores charge in the electrical double layer at the electrode surface.

MCQ 8.7.18 **The device used to store a charge is called: (PMC MDCAT 2022)**

A	Electric box	**B**	Capacitor
C	Inductor	**D**	Transistor

Solution: (b) A capacitor stores charge, and with it energy.

MCQ 8.7.19 **In the combination of capacitors in series, the capacitors are connected: (PMC MDCAT 2022)**

A	Parallel	**B**	side by side
C	Up and down	**D**	In circle only

Solution: (b) Capacitors in series are joined end to end, so the same charge passes through all of them.

MCQ 8.7.20 **In parallel plate capacitor Capacitance depends on: (PMC MDCAT 2022)**

A	Charge	**B**	Electric field
C	Voltage	**D**	Cross-sectional area

Solution: (d) $C = \varepsilon A/d$ carries the area and the separation, not the charge or the voltage.

MCQ 8.7.21 **Parallel combination of two capacitor C1 and C2 Is: (PMC MDCAT 2022)**

A	C1+ C2	**B**	(C1)(C2)
C	(C1C2)/(C1+C2)	**D**	C1/C2

Solution: (a) Capacitors in parallel share the same voltage, so their capacitances add.

MCQ 8.7.22 **Energy stored in a capacitor is given by: (NUMS MDCAT 2022)**

A	E = ½ cv^2	**B**	E.2 cv^2
C	E . cv^2	**D**	E = 2 cv^2

Solution: (a) The stored energy is $\frac{1}{2}CV^2$.

MCQ 8.7.23 **Q.64 It stores electrical potential energy: (NUMS MDCAT 2022)**

A	Capacitor	**B**	Conductor
C	Inductor	**D**	Generator

Solution: (a) A capacitor stores charge and with it electrical potential energy.

MCQ 8.7.24 **Consider two capacitors with capacitance 2μF and 4μF. With which type of connection will the 4μF capacitor have a greater amount of stored energy than the 2μF capacitor? (PMC Practice 2021)**

A	Series	**B**	Parallel
C	Either series or parallel	**D**	Neither series nor parallel

Solution: (b) In parallel both hold the same voltage, and $\frac{1}{2}CV^2$ is larger for the larger capacitance.

MCQ 8.7.25 **Ohm multiplied by farad is equivalent to: (PMC MDCAT 2020)**

A	Time	**B**	Charge
C	Distance	**D**	Capacitor

Solution: (a) Ohms times farads give seconds, which is why RC is a time constant.

MCQ 8.7.26 **In what form is the energy stored in a charged capacitor? (PMC MDCAT 2020)**

A	gravitational	**B**	electrical potential
C	magnetic field	**D**	potential

Solution: (b) The work done in charging it is stored as electrical potential energy in the field between the plates.

MCQ 8.7.27 **If the length, width and separation between the plates of a parallel plate capacitor is doubled then its capacitance becomes: (UHS MDCAT 2016)**

A	Double	**B**	Half
C	Four-times	**D**	Eight-times

Solution: (a) $C = \varepsilon A/d$: four times the area over twice the separation is twice the capacitance.

Topic 9.1 Steady Current

Past MDCAT Questions

MCQ 9.1.1 A charge of 90 C passes through a wire for 30 seconds. The current in the wire will be: (MDCAT 2024)

A	3 A	B	0.3 A
C	3 mA	D	0.3 mA

Solution: (a) $I = q/t = 90/30 = 3$ A.

MCQ 9.1.2 152.A charge of 90 C passes through a wire for 30 seconds. Then the current in the wire will be: (UHS MDCAT 2024)

A	3A	B	0.3 A
C	3 mA	D	0.3 mA

Solution: (a) $I = q/t = 90/30$, which is 3 A.

MCQ 9.1.3 What does one Coulomb represent in terms of charge? (KMU MDCAT 2024)

A	The amount of charge transported by a current of one Ampere in one second	B	The charge of one proton
C	The charge of one electron	D	The charge required to create a force of 1 Newton between two charges separated by 1meter

Solution: (a) One coulomb is the charge carried past a point by one ampere in one second.

MCQ 9.1.4 The flow of charges produce: (PMC MDCAT 2022)

A	Current only	B	Magnetic field only
C	Electric field only	D	All of the above

Solution: (d) Moving charge is a current, and it carries both an electric and a magnetic field with it.

MCQ 9.1.5 The SI unit of charge is: (PMC MDCAT 2022)

A	Newton	B	Coulomb
C	Pascal	D	Ampere

Solution: (b) Charge is measured in coulombs.

MCQ 9.1.6 ____ potential difference is required for establishing steady current? (PMC MDCAT 2022)

A	Minimum	B	Constant
C	Maximum	D	Varying

Solution: (b) A steady current needs a steady potential difference to drive it.

MCQ 9.1.7 SI Unit of current is ? (PMC MDCAT 2022)

A	Ampere	B	Volt
C	Joules	D	Watt

Solution: (a) Current is measured in amperes.

MCQ 9.1.8 Electric current may be defined as: (PMC MDCAT 2022)

A	Rate of flow of charge	B	Rate of flow of momentum
C	Rate of flow of power	D	Rate of flow of energy

Solution: (a) Current is the charge passing a point each second.

MCQ 9.1.9 Steady current does not change with respect to _____ (PMC MDCAT 2022)

A	conductor	B	source
C	time	D	potential difference

Solution: (c) A steady current is one whose value does not change with time.

MCQ 9.1.10 Current is _____ physical quantity (PMC MDCAT 2022)

A	scalar quantity	B	vector quantity
C	variable quantity	D	constant quantity

Solution: (a) Current has a direction of flow but adds as an ordinary number, so it is a scalar.

MCQ 9.1.11 _____ is a source of electrical energy having fixed polarity and terminals. (PMC MDCAT 2022)

A	Motor	B	Metals
C	Battery	D	Generator

Solution: (c) A battery has a fixed positive and negative terminal.

MCQ 9.1.12 Kirchhoff's first law/rule corresponds to: (UHS MDCAT 2019)

A	Law of conservation of energy	B	Law Of conservation Of momentum
C	Law of conservation of charge	D	Law of conservation of mass

Solution: (c) What flows into a junction must flow out of it, which is the conservation of charge.

MCQ 9.1.13 Kirchhoff's first law is manifestation of: (UHS MDCAT 2018)

A	Law of conservation of momentum	B	Law of conservation mass
C	Law of conservation of energy	D	Law of conservation of charge

Solution: (d) What flows into a junction must flow out, which is the conservation of charge.

MCQ 9.1.14 The unit for electric charge is Coulomb and one Coulomb in terms of base unit is equivalent to: (UHS MDCAT 2016)

A	Am	B	Js-1
C	As	D	C

Solution: (c) A coulomb is an ampere second.

Topic 9.2 Ohm's Law

Past MDCAT Questions

MCQ 9.2.1 The statement that the magnitude of the current in a metal is proportional to the potential difference across it as long as the temperature of the conductor is kept constant is known as: (MDCAT 2024)

A	Joule's law	B	Gauss's law
C	Ohm's law	D	Ampere's law

Solution: (c) That proportionality at constant temperature is Ohm's law, $V = IR$.

MCQ 9.2.2 A resistor of $6\,\Omega$ with a tolerance of 10% and another of $4\,\Omega$ with a tolerance of 10% are joined in series. The tolerance of the combination is about: (UHS MDCAT 2017)

A	5%	B	12%
C	10%	D	13%

Solution: (c) The uncertainties add: $0.6 + 0.4 = 1.0\,\Omega$ in $10\,\Omega$, which is again 10%.

MCQ 9.2.3 A wire of resistance $4\,\Omega$ is bent into a circle. The resistance between the ends of any diameter is: (UHS MDCAT 2017)

A	$1\,\Omega$	B	$2\,\Omega$
C	$4\,\Omega$	D	$8\,\Omega$

Solution: (a) A diameter splits the wire into two $2\,\Omega$ halves in parallel, giving $1\,\Omega$.

MCQ 9.2.4 **When resistances are joined in series, the equivalent resistance is equal to the: (UHS MDCAT 2017)**

A	product of the reciprocals of the individual resistances	**B**	sum of the reciprocals of the individual resistances
C	product of the individual resistances	**D**	sum of the individual resistances

Solution: (d) The same current passes through each, so the potential drops add and the resistances add with them.

MCQ 9.2.5 **If the potential difference (V) across a conductor is doubled, keeping resistance (R) constant, the power dissipated (P) becomes: (KMU MDCAT 2025)**

A	Doubled	**B**	Halved
C	Four times	**D**	Remains unchanged

Solution: (c) $P = V^2/R$, so twice the voltage across the same resistance dissipates four times the power.

MCQ 9.2.6 **If voltage across a resistor is doubled then its resistance will become: (temperature and physical state of the conductor remains constant). (SZABMU MDCAT 2025)**

A	Doubled	**B**	Half
C	Four times	**D**	Remains constant

Solution: (d) Resistance is a property of the conductor, so it is unchanged; the current doubles instead.

MCQ 9.2.7 **High slope of Ohm's law graph means (SZABMU MDCAT 2025)**

A	Low resistance	**B**	High resistance
C	Open circuit	**D**	Low current

Solution: (a) On a graph of current against potential difference the slope is $1/R$, so a steep line means a small resistance.

MCQ 9.2.8 **What will potential difference, if a wire has resistance of 10Ω and current 2A flow through it : (SZABMU MDCAT 2025)**

A	5V	**B**	10V
C	20V	**D**	40V

Solution: (c) $V = IR = 2 \times 10$, which is $20\,\text{V}$.

MCQ 9.2.9 **153.The magnitude of the current in metals is proportional to the potential difference across it as long as temperature of conductor is kept constant is known as: (UHS MDCAT 2024)**

A	Joule's Law	**B**	Gauss Law
C	Ohm's Law	**D**	Ampere's Law

Solution: (c) That is Ohm's law.

MCQ 9.2.10 **156.Volt x Ampere is the measure of; (UHS MDCAT 2024)**

A	Current	**B**	Volt
C	Resistance	**D**	Power

Solution: (d) Volts times amperes is watts, the unit of power.

MCQ 9.2.11 **The I-V Graph for a non-Ohmic material is always (KMU MDCAT 2024)**

A	Curved	**B**	Horizontal
C	Linear	**D**	Perpendicular

Solution: (a) A non-ohmic conductor has no constant resistance, so its current voltage graph is not a straight line.

MCQ 9.2.12 **If R1 and R2 are respectively the filament resistance of a 100-Watt bulb and 200-Watt bulb designed to operate on the same voltage, then power of: (KMU MDCAT 2024)**

A	R1 is two times R2	**B**	R2 is two times R1
C	R2 is four times R1	**D**	R1 is four times R2

Solution: (a) $R = V^2/P$ at the same voltage, so the $100\,\text{W}$ filament has twice the resistance of the $200\,\text{W}$ one.

MCQ 9.2.13 **Equivalent resistance between A and B (three 1Ω resistors in parallel): (NUMS MDCAT 2024)**

A	3/2 Ω	**B**	1/3 Ω
C	3 Ω	**D**	2/3 Ω

Solution: (b) Three equal resistors in parallel give a third of one of them.

MCQ 9.2.14 **How much potential drop exist across closed switch? (UHS MDCAT 2023)**

A	0 V	**B**	1V
C	2V	**D**	3V

Solution: (a) A closed switch is a length of conductor with no resistance, so no potential is dropped across it.

MCQ 9.2.15 **A 3 V battery is connected in series with ammeter and 2 ohm resistance after short circuiting circuiting. What will be the reading of ammeter? (UHS MDCAT 2023)**

A	1 A	**B**	1.5 A
C	5 A	**D**	6 A

Solution: (b) $I = V/R = 3/2$, which is $1.5\,\text{A}$.

MCQ 9.2.16 **Which of the following statement is NOT CORRECT about Kirchhoff's rule? (UHS MDCAT 2023)**

A	Kirchhoff's current rule based upon the law of conservation of charge	**B**	Wheatstone bridge is an application of Kirchhoff's rule
C	Kirchhoff's rules are more suitable in AC circuits	**D**	Kirchhoff's voltage rule based upon the law of conservation of energy

Solution: (c) The rules were framed for steady currents; alternating circuits need reactance as well as resistance.

MCQ 9.2.17 **Volt × Ampere is the unit of: (NUMS MDCAT 2023)**

A	Current	**B**	Volt
C	Resistance	**D**	Power

Solution: (d) Volts times amperes is watts, the unit of power.

MCQ 9.2.18 **The ohmmeter of a portable digital multi meter need: (UHS MDCAT 2023)**

A	Internal battery	**B**	Wet cell
C	Voltmeter	**D**	Ammeter

Solution: (a) An ohmmeter must drive its own current through the resistor, so it carries a battery.

MCQ 9.2.19 **Calculate the work done in a resistor of 20 ohm carrying 5A of current in 3 hours? (PMC MDCAT 2022)**

A	1 kWh	**B**	1.5 kWh
C	2 kWh	**D**	3 kWh

Solution: (b) $P = I^2R = 25 \times 20 = 500\,\text{W}$, and 500×3 watt hours is $1.5\,\text{kWh}$.

MCQ 9.2.20 **Basically a potentiometer is a device for: (PMC MDCAT 2022)**

A	Comparing two voltage	**B**	Measuring current
C	Comparing two currents	**D**	Measuring voltage

Solution: (a) A potentiometer balances one emf against another, so it compares voltages without drawing current.

MCQ 9.2.21 **Which of the following statements is true? (PMC MDCAT 2022)**

A	Power is proportional to voltage only	**B**	Power is proportional to current only
C	Power is neither proportional to voltage nor to the current	**D**	Power is proportional to both the voltage and current

Solution: (d) $P = VI$, so it rises with either.

MCQ 9.2.22 **Ohm's law is applicable to (PMC MDCAT 2022)**

A	Semiconductors	**B**	Vacuum tubes
C	Carbon resistors	**D**	Conductors

Solution: (d) Ohm's law holds for metallic conductors at constant temperature; semiconductors and valve tubes are non-ohmic.

MCQ 9.2.23 **In series circuit, current remains? (PMC MDCAT 2022)**

A	Same	**B**	Different
C	Variable	**D**	Zero

Solution: (a) There is only one path in a series circuit, so the same current passes through every element.

MCQ 9.2.24 **In parallel voltage remains? (PMC MDCAT 2022)**

A	Same	**B**	Different
C	Variable	**D**	Zero

Solution: (a) Elements in parallel are connected across the same two points, so they share the same voltage.

MCQ 9.2.25 **A current of 16 amperes divides between two branches in parallel of resistances 8 ohms and 12 ohms respectively. The current in each branch is: (PMC MDCAT 2022)**

A	6.4 a,6.9 a	**B**	6.4 a, 9.6 a
C	4.6 a,6.9 a	**D**	4.6 a,9.6 a

Solution: (b) The current divides in inverse ratio to the resistances, giving $9.6\,\mathrm{A}$ in the $8\,\Omega$ branch and $6.4\,\mathrm{A}$ in the other.

MCQ 9.2.26 **The circuit which gives continuously varying potential is called: (PMC MDCAT 2022)**

A	Complex network	**B**	Wheatstone bridge
C	Potential divider	**D**	Galvanometer

Solution: (c) A potential divider taps off any fraction of the supply voltage as the slider is moved.

MCQ 9.2.27 **The sensitivity of a potentiometer can be Increased by ____ (PMC MDCAT 2022)**

A	Increasing the e.m.f of the primary coil	**B**	Increasing the Potential gradient
C	Increasing the length of the potentiometer wire	**D**	Decreasing the length of the potentiometer wire

Solution: (c) A longer wire gives a smaller potential gradient, so a given voltage is balanced over a greater length.

MCQ 9.2.28 **Which one of the following is a disadvantage of a potentiometer over a voltmeter? (PMC MDCAT 2022)**

A	It can measure internal resistance of a cell	**B**	It can measure the e.m.f. of a cell
C	It is heavy and not portable	**D**	It can measure accurately very small pd. of the microvolt

Solution: (c) The potentiometer is accurate but bulky, and it must be set up and balanced for each reading.

MCQ 9.2.29 **The SI Unit for resistance is? (PMC MDCAT 2022)**

A	Ohm	**B**	Ampere
C	Watt	**D**	Volts

Solution: (a) Resistance is measured in ohms.

MCQ 9.2.30 **_____ relationship exists between current and voltage in terms of Ohm's law: (PMC MDCAT 2022)**

A	Non linear	**B**	Varying
C	Linear	**D**	Alternating

Solution: (c) $V = IR$ with R constant is the equation of a straight line.

MCQ 9.2.31 **Ohm's Law is applicable only when temperature is: (PMC MDCAT 2022)**

A	changing	**B**	absolute zero
C	constant	**D**	decreasing

Solution: (c) Resistance changes with temperature, so Ohm's law holds only while the temperature is held.

MCQ 9.2.32 **Ohm's law is valid when the temperature of conductor Is : (PMC MDCAT 2022)**

A	Very low	**B**	Very high
C	Varying	**D**	Constant

Solution: (d) Resistance changes with temperature, so the law holds only while the temperature is held constant.

MCQ 9.2.33 **Correct form of ohm's law (PMC MDCAT 2022)**

A	I = VR	**B**	V = I/R
C	V = IR	**D**	R= IV

Solution: (c) Ohm's law is $V = IR$.

MCQ 9.2.34 **In order to achieve high accuraccy, the slide wire of a potentiometer should be (PMC MDCAT 2022)**

A	As long as possible	**B**	As short as possible
C	Neither too small not to large	**D**	Very thick

Solution: (a) A long wire gives a small potential gradient, so the balance point can be read finely.

MCQ 9.2.35 **Q.65 A magnitude of the current in metals is proportional to the applied voltage as long as temperature of conductor is kept constant. It is statement of: (NUMS MDCAT 2022)**

A	Joule's law	**B**	Gauss's law
C	Ohm, law	**D**	Ampere's law

Solution: (c) That is Ohm's law.

MCQ 9.2.36 **Ohm's Law is not applicable when the temperature is: (PMC Practice 2021)**

A	Changing	**B**	Constant
C	All of These	**D**	None of these

Solution: (a) Resistance changes with temperature, so the law holds only while the temperature is held.

MCQ 9.2.37 **Formula for Power is? (PMC Practice 2021)**

A	P =IV	**B**	P=V/I
C	p=V+I	**D**	p=VQ

Solution: (a) Electrical power is the product of current and potential difference.

MCQ 9.2.38 **In a lamp load, when more than one lamp are switched on, the total resistance of the load: (PMC Practice 2021)**

A	Increases	**B**	Decreases
C	Remains same	**D**	None of the above

Solution: (b) The lamps are in parallel, so each one added gives the current another path.

MCQ 9.2.39 **Electric power is? (PMC Practice 2021)**

A	Rate of electric work done per unit time	**B**	Voltage per unit time
C	Electric charge per unit time	**D**	Current per unit time

Solution: (a) Electrical power is the work done by the current in unit time.

MCQ 9.2.40 **An example of a non-ohmic resistor is: (PMC Practice 2021)**

A	Diode	**B**	Tungsten wire
C	Carbon resistor	**D**	Copper wire

Solution: (a) A diode conducts one way and not the other, so its current voltage graph is not a straight line.

MCQ 9.2.41 **Galvanometer is an? (PMC Practice 2021)**

A	Electromechanical device	B	Electrosolar device
C	Electrothermal device	D	None of these options is correct

Solution: (a) A galvanometer turns a current into a mechanical deflection, so it is electromechanical.

MCQ 9.2.42 **Find the resistance if the voltage of a circuit is 45 volts and current is 30 Amperes? (PMC Practice 2021)**

A	1.6 Ohms	B	1.5 Ohms
C	1.7 Ohms	D	1.8 Ohms

Solution: (b) $R = V/I = 45/30$, that is $1.5\,\Omega$.

MCQ 9.2.43 **One of the following is an Ohmic device: (PMC MDCAT 2020)**

A	Filament bulb	B	Semiconductor diode
C	Transistor	D	Copper wire

Solution: (d) A copper wire at constant temperature obeys Ohm's law; the other three do not.

MCQ 9.2.44 **Calculate the rate at which energy is transferred by 220 V mains supply, which provides a current of 0.1 A to a LED? (UHS MDCAT 2019)**

A	2.2 W	B	2.2 kW
C	22 kW	D	22 W

Solution: (d) $P = VI = 220 \times 0.1$, that is $22\,\mathrm{W}$.

MCQ 9.2.45 **A wire of resistance 4Ω is bent in the form of a circle. The resistance between the ends of any diameter is: (UHS MDCAT 2017)**

A	1 Ω	B	2 Ω
C	4 Ω	D	8 Ω

Solution: (a) The diameter divides the ring into two arcs of $2\,\Omega$ each in parallel, that is $1\,\Omega$.

MCQ 9.2.46 **A resistor of 6 Ω with a tolerance of 10% and another of 4 Ω with a tolerance of 10% are connected in series. The tolerance of combination is about: (UHS MDCAT 2017)**

A	5%	B	12%
C	10%	D	13%

Solution: (c) Both resistances carry the same fractional uncertainty, so the sum carries it too.

MCQ 9.2.47 **When resistances are connected in series, the equivalent resistances is equal to: (UHS MDCAT 2017)**

A	Product of the reciprocals of the individual resistances	B	Sum of the reciprocals of the individual resistances
C	Product of the individual resistances	D	Sum of the individual resistances

Solution: (d) Resistances in series simply add.

Topic 9.3 Resistivity and its Temperature Dependence

Past MDCAT Questions

MCQ 9.3.1 **The unit of resistivity is the: (MDCAT 2020)**

A	ohm	B	ohm metre
C	ohm per metre	D	metre per ohm

Solution: (b) From $\rho = RA/L$ the unit is the ohm metre.

MCQ 9.3.2 **The resistance of a conductor does not depend on which of the following? (MDCAT 2022)**

A	area of cross-section	B	resistivity
C	length	D	mass

Solution: (d) $R = \rho L/A$ has no mass in it.

MCQ 9.3.3 **What do substances whose resistance decreases with a rise in temperature have? (MDCAT 2022)**

A	a high temperature coefficient	B	a negative temperature coefficient
C	a positive temperature coefficient	D	a zero temperature coefficient

Solution: (b) A falling resistance means the temperature coefficient of resistance is negative, as it is for semiconductors.

MCQ 9.3.4 **A wire of uniform cross-sectional area A, length L and resistance R is cut into two equal parts. What will happen to the resistivity of each part? (MDCAT 2023)**

A	it will be doubled	B	it will be one fourth
C	it will be halved	D	it will remain the same

Solution: (d) Resistivity depends on the material and its temperature, not on the size of the piece.

MCQ 9.3.5 **When the length of a copper wire is doubled, its resistivity becomes: (MDCAT 2024)**

A	double	B	half
C	the same	D	four times

Solution: (c) Resistivity is a property of the material and not of the length; it is the resistance that doubles.

MCQ 9.3.6 **The resistance of a semiconductor with a rise in temperature: (MDCAT 2024)**

A	increases	B	decreases
C	remains the same	D	becomes infinite

Solution: (b) Heating a semiconductor frees many more charge carriers, so its resistance falls.

MCQ 9.3.7 **The reciprocal of the resistivity of a material is called its: (UHS MDCAT 2025)**

A	impedance	B	conductivity
C	admittance	D	reactance

Solution: (b) Conductivity is the reciprocal of resistivity.

MCQ 9.3.8 **If the length of the conductor is made 4 times its original length, its resistance becomes (UHS MDCAT 2025)**

A	quarter	B	half
C	zero	D	4 times

Solution: (d) Resistance is proportional to length, so four times the length is four times the resistance.

MCQ 9.3.9 **The unit of temperature coefficient of resistivity is (UHS MDCAT 2025)**

A	1/C	B	1/K
C	1/A	D	1/Ω

Solution: (b) It is a fractional change in resistivity per degree, so its unit is the reciprocal kelvin.

MCQ 9.3.10 **Conductance is reciprocal of resistance, its unit is: (NUMS MDCAT 2025)**

A	Siemen	B	Ohm
C	Ampere	D	Watt

Solution: (a) Conductance is the reciprocal of resistance and is measured in siemens.

MCQ 9.3.11 **The fraction change in resistance per kelvin is: (NUMS MDCAT 2025)**

A	Coefficient of conductivity	B	Temperature coefficient of resistance
C	Coefficient of conductance	D	Coefficient of resistivity

Solution: (b) That fraction is the temperature coefficient of resistance.

MCQ 9.3.12 **The value of temperature co-efficient of a conductor is zero. This indicates that with the rise in temperature, resistance of conductor: (SIBA MDCAT 2025)**

A	Increases	**B**	Decreases
C	Remain same	**D**	Becomes zero

Solution: (c) A zero coefficient means the resistance does not change with temperature at all.

MCQ 9.3.13 **154.When length of copper wire is doubled then resistivity becomes: (UHS MDCAT 2024)**

A	Double	**B**	Half
C	Remains same	**D**	Four times

Solution: (c) Resistivity is a property of the material, so stretching the wire does not change it.

MCQ 9.3.14 **155.The resistance of semi-conductor with rise in temperature (UHS MDCAT 2024)**

A	Increases	**B**	Decreases
C	Remain same	**D**	Infinite

Solution: (b) Heating a semiconductor frees more carriers, so its resistance falls.

MCQ 9.3.15 **Temperature coefficient of resistance is defined as increase in resistance per ohm original resistance per ___? (KMU MDCAT 2024)**

A	Degree rise in temperature	**B**	Unit increase in electric current
C	Unit decrease in capacitance	**D**	Degree drop in temperature

Solution: (a) It is the fractional rise in resistance for each degree of temperature.

MCQ 9.3.16 **For metals, the temperature coefficient of resistance is: (KMU MDCAT 2024)**

A	Infinity	**B**	Negative
C	Positive	**D**	Zero

Solution: (c) A metal grows more resistive as it is heated, so its coefficient is positive.

MCQ 9.3.17 **The substance having negative temperature coefficient of resistance is: (NUMS MDCAT 2024)**

A	Insulators	**B**	Conductor
C	Semi-conductor	**D**	Alloys

Solution: (c) Heating a semiconductor frees carriers, so its resistance falls and its coefficient is negative.

MCQ 9.3.18 **What do the substances whose resistance decreases with increase in temperature have? (UHS MDCAT 2023)**

A	high temperature coefficient	**B**	negative temperature coefficient
C	positive temperature coefficient	**D**	zero temperature coefficient

Solution: (b) A substance whose resistance falls as it warms has a negative temperature coefficient.

MCQ 9.3.19 **Ohm meter us the unit of: (SZABMU MDCAT 2023)**

A	Resistance	**B**	Resistivity
C	Conductance	**D**	conductivity

Solution: (b) $\rho = RA/L$ has the unit ohm metre.

MCQ 9.3.20 **The total resistance of wire isinversely proportional to: (SZABMU MDCAT 2023)**

A	Length	**B**	Area
C	Temperature	**D**	Time

Solution: (b) $R = \rho L/A$, so the thicker the wire the smaller its resistance.

MCQ 9.3.21 **If length of the wire becomes two times to its original value and area becomes one half to its original value, then resistance of the wire becomes: (NUMS MDCAT 2023)**

A	Double	**B**	Four times
C	One half	**D**	One forth

Solution: (b) $R = \rho L/A$ doubles with the length and doubles again as the area is halved.

MCQ 9.3.22 **Which of the following the fractional change in resistance per kelvin? (UHS MDCAT 2023)**

A	Conductivity	**B**	Resistivity
C	Temperature coefficient of resistivity	**D**	Temperature coefficient of resistance

Solution: (d) That fraction is the temperature coefficient of resistance.

MCQ 9.3.23 **The following formula can be used to determine the resistance of a length of conductor. R pl/A In the formula, the symbol p stands for the: (UHS MDCAT 2023)**

A	Cross-sectional area of the conductor in m2	**B**	Product of the length of the conductor in meters
C	Resistivity of the material in units of ohm meters	**D**	Resistance of the conductor in units of ohms per meter

Solution: (c) In $R = \rho L/A$ the symbol ρ is the resistivity, measured in ohm metres.

MCQ 9.3.24 **The resistance of the wire varies inversely as: (UHS MDCAT 2023)**

A	Area of cross section	**B**	length
C	Resistivity	**D**	Temperature

Solution: (a) $R = \rho L/A$, so the wider the wire the smaller its resistance.

MCQ 9.3.25 **A wire of uniform area of cross-section A', length 'L', and resistance R is cut into two equal parts. What will happen to the resistivity of each part? (UHS MDCAT 2023)**

A	It will be doubled	**B**	It will be one fourth
C	It will be halved	**D**	It will remain the same

Solution: (d) Resistivity is a property of the material, so cutting the wire does not change it.

MCQ 9.3.26 **The resistance of a conductor at absolute zero (OK) is: (PMC MDCAT 2022)**

A	Almost zero	**B**	Almost infinite
C	No prediction at all	**D**	May increase or decrease

Solution: (a) With the lattice almost still there is nothing to scatter the electrons, so the resistance falls away.

MCQ 9.3.27 **Resistance of a conductor depends upon: (PMC MDCAT 2022)**

A	Temperature	**B**	Nature of a conductor
C	Length	**D**	Color

Solution: (c) $R = \rho L/A$: the longer the conductor the greater its resistance.

MCQ 9.3.28 **Resistivity of a substance Is defined as the resistance of a _____ of that substance. (PMC MDCAT 2022)**

A	meter	**B**	meter square
C	meter cube	**D**	centimeter

Solution: (b) Resistivity is the resistance of a cube of the material of unit side, measured between opposite faces.

MCQ 9.3.29 **The specific resistance of a conductor Increases with: (PMC MDCAT 2022)**

A	Increase in temperature	B	increase in cross-sectional area
C	Decrease in length	D	decrease In cross-sectional area

Solution: (a) Heating makes the lattice vibrate more and scatter the electrons, so the resistivity rises.

MCQ 9.3.30 **Q.66 The resistance of pure metal increases with: (NUMS MDCAT 2022)**

A	Increase in temperature	B	Increase in pressure
C	Decrease in temperature	D	Decrease in pressure

Solution: (a) A metal grows more resistive as it is heated.

MCQ 9.3.31 **When a wire is compressed and it's radius becomes 2R then it's resistance will be: (PMC MDCAT 2020)**

A	16R	B	4 R
C	1 / 16 R	D	1 / 4 R

Solution: (c) The volume is fixed, so four times the area means a quarter of the length, and R falls to a sixteenth.

MCQ 9.3.32 **The change in resistance of metallic conductor at temperature below 0 degrees is: (PMC MDCAT 2020)**

A	Non-linear	B	Curve
C	Linear	D	Curvilinear

Solution: (c) Away from very low temperatures the resistance of a metal rises in a straight line with temperature.

MCQ 9.3.33 **A copper wire has length L and cross-sectional area A. Its resistance is R. If we halved the length and halved the diameter of wire, then what will be the resistance of this wire? (UHS MDCAT 2019)**

A	4R	B	3R
C	2R	D	R

Solution: (c) Halving the diameter quarters the area, so $R = \rho(L/2)/(A/4)$ is $2R$.

MCQ 9.3.34 **When a potential difference is applied across the ends of a uniform wire of length l and radius r, a current I flows in the wire. If same potential difference is applied to the ends of another wire of the same material but of length 2l and radius 2r, the current in the wire is: (UHS MDCAT 2018)**

A	I/4	B	2I
C	I	D	I/2

Solution: (b) Twice the length doubles the resistance and twice the radius quarters it, so R halves and the current doubles.

MCQ 9.3.35 **Resistance between two opposite faces of square thin film of area 1 mm2 having thickness of 1 μm if resistivity of material is 10-6 Ω will be: (UHS MDCAT 2016)**

A	1000 Ω	B	100 Ω
C	1 Ω	D	10 Ω

Solution: (c) $R = \rho L/A = 10^{-6} \times 10^{-3}/(10^{-3} \times 10^{-6})$, that is $1\,\Omega$.

Topic 9.4 Internal Resistance of a Source

Past MDCAT Questions

MCQ 9.4.1 **The terminal voltage V_t of a battery is greater than the emf of the battery when the: (MDCAT 2020)**

A	battery is charging	B	battery is discharging
C	battery is connected with a resistance	D	battery is connected with a voltmeter

Solution: (a) While charging, the current is driven into the battery, so $V_t = \varepsilon + Ir$ is above the emf.

MCQ 9.4.2 **A low voltage supply of e.m.f. 20 V and internal resistance $1.5\,\Omega$ is used to work a heater of resistance $6.5\,\Omega$ in a fish tank. What is the power delivered to the water in the fish tank? (MDCAT 2022)**

A	41 W	B	50 W
C	53 W	D	62 W

Solution: (a) $I = 20/(1.5 + 6.5) = 2.5$ A, so $P = I^2R = (2.5)^2(6.5) \approx 41$ W.

MCQ 9.4.3 **When current is neither drawn from a source nor given to it, then: (UHS MDCAT 2017)**

A	$E = V_T$	B	$V_T > E$
C	$E > V_T$	D	both $V_T > E$ and $E > V_T$

Solution: (a) With no current there is no drop across the internal resistance, so the terminal potential difference equals the emf.

MCQ 9.4.4 **Terminal voltage of a cell equals its EMF only when: (UHS MDCAT 2025)**

A	No current flows	B	Current is maximum
C	Internal resistance is infinite	D	Load resistance is zero

Solution: (a) With no current there is no drop across the internal resistance, so the terminals read the full emf.

MCQ 9.4.5 **Internal resistance reduces the terminal voltage because it: (SIBA MDCAT 2025)**

A	Produces back emf	B	Causes power loss inside the battery
C	Increases the current	D	Decreases the emf

Solution: (b) Some of the emf is spent driving the current through the cell itself, and that part appears as heat inside it.

MCQ 9.4.6 **A high internal resistance battery is not suitable for heavy loads due to: (SZABMU MDCAT 2025)**

A	Excess voltage drop	B	High terminal voltage
C	Infinite emf	D	Constant current

Solution: (a) A heavy load draws a large current, and the drop inside the cell then leaves little at the terminals.

MCQ 9.4.7 **A low voltage supply with an e.m.f. of 20 V and an internal resistance of 1.5 ohms is used to supply power to a heater of resistance 6.5 ohms in a fish tank. What is the power supplied to the water in the fish tank? (UHS MDCAT 2023)**

A	41 W	B	50 W
C	53 W	D	62 W

Solution: (a) $I = 20/8 = 2.5\,\text{A}$, and $I^2R = 6.25 \times 6.5$ gives about $41\,\text{W}$ in the heater.

MCQ 9.4.8 **The terminal potential difference of a battery is greater than its emf when: (PMC MDCAT 2022)**

A	The internal resistance of a battery is infinite	B	The internal resistance of a battery is zero
C	The battery is being charged	D	The battery is discharged

Solution: (c) When current is driven into the cell the drop across the internal resistance adds to the emf.

MCQ 9.4.9 **Terminal potential difference of a cell: (PMC MDCAT 2022)**

A	Increases with increase in its internal resistance	B	Decreases with increase in its internal resistance
C	Its independent of its internal resistance	D	Varies exponentially with resistance

Solution: (b) The greater the internal resistance the more of the emf is spent inside the cell.

MCQ 9.4.10 **Internal resistance of a battery is ____ ohm. if E=10V, Vt=9V, I= 1A. (PMC Practice 2021)**

A	1	B	0.1
C	0.01	D	None of these

Solution: (a) $r = (E - V)/I = (10 - 9)/1$, that is $1\,\Omega$.

MCQ 9.4.11 **EMF becomes equal to the terminal potential difference when the: (PMC Practice 2021)**

A	Circuit is closed	**B**	Current is max
C	Circuit is open	**D**	All of these options are correct

Solution: (c) With no current there is no drop inside the cell, so the terminals read the full emf.

MCQ 9.4.12 **When the current is neither drawn from a source nor given to it then: (UHS MDCAT 2017)**

A	E=VT	**B**	VT>E
C	E>VT	**D**	Both "VT>E" & "E>VT"

Solution: (a) With no current there is no drop across the internal resistance, so the terminal voltage equals the emf.

Topic 9.5 Maximum Power Transfer

Past MDCAT Questions

MCQ 9.5.1 **Volt $\times$ ampere is the measure of: (MDCAT 2024)**

A	current	**B**	potential difference
C	resistance	**D**	power

Solution: (d) $P = VI$, so a volt-ampere is a watt.

MCQ 9.5.2 **The maximum power transfer theorem states that maximum power is delivered to the load when (KMU MDCAT 2024)**

A	The load resistance is half of the source resistance	**B**	The load resistance is zero
C	The load resistance is double the source resistance	**D**	The load resistance is equal to the source resistance

Solution: (d) Most power reaches the load when its resistance matches the internal resistance of the source.

MCQ 9.5.3 **Which equation represents the maximum output power of source? (PMC MDCAT 2022)**

A	P = VI	**B**	P = I2R
C	P = V2/R	**D**	P = E2/4R

Solution: (d) Most power reaches the load when its resistance matches the internal one, and then $P = E^2/4R$.

MCQ 9.5.4 **Maximum power delivered by a battery is? (PMC Practice 2021)**

A	Pmax = E2/4r	**B**	Pmax =4rE2
C	Pmax =VIT	**D**	Unlimited

Solution: (a) Most power is delivered when the load matches the internal resistance, and then $P = E^2/4r$.

Unit 10 Electromagnetism

Topic 10.1 Magnetic Flux Density

Past MDCAT Questions

MCQ 10.1.1 **The source of a magnetic field is: (MDCAT 2022)**

A	an isolated magnetic pole	**B**	a static electric charge
C	a current loop	**D**	a stationary magnet only

Solution: (c) Moving charge is what makes a magnetic field, and the current loop is its simplest source.

MCQ 10.1.2 **Which of the following statements is incorrect for magnetic field lines? (MDCAT 2024)**

A	lines start at the north pole and end at the south pole	**B**	lines never touch or cross each other
C	the lines are curved	**D**	the magnetic field is strongest where the lines are farthest apart

Solution: (d) The field is strongest where the lines are closest together, not farthest apart.

MCQ 10.1.3 **The unit of magnetic flux density is: (MDCAT 2024)**

A	$\mathrm{Wb\,m^2}$	**B**	$\mathrm{Wb\,m}$
C	$\mathrm{Wb\,m^{-2}}$	**D**	Wb

Solution: (c) Flux density is flux per unit area, and $1\ \mathrm{Wb\,m^{-2}} = 1$ T.

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MCQ 10.1.4 **A conductor of length $1\,\mathrm{m}$ carrying a current of $1\,\mathrm{A}$ is placed parallel to a magnetic field of $1\,\mathrm{gauss}$. The magnetic force on the conductor is: (UHS MDCAT 2017)**

A	zero	B	$1\,\mathrm{N}$
C	$10^{-4}\,\mathrm{N}$	D	$1\,\mathrm{dyne}$

Solution: (a) $F = BIL\sin\theta$, and the conductor lies along the field, so $\sin 0^\circ = 0$.

MCQ 10.1.5 **A current carrying solenoid is cut in the ratio $1:3$ and each part is connected independently to the same source of current. If the field of the first part is B_A and of the second B_B, then: (UHS MDCAT 2017)**

A	$B_A = 3B_B$	B	$B_A = B_B/3$
C	$B_A = B_B$	D	$B_A = 4B_B$

Solution: (c) $B = \mu_o nI$ depends on the turns per unit length, and cutting a solenoid leaves that unchanged in both pieces.

MCQ 10.1.6 **158.Which of the following statement is incorrect for any magnetic field lines? (UHS MDCAT 2024)**

A	Lines start at north pole and ends at south pole	B	Lines never touch or cross each other
C	The lines are curved	D	Magnetic field is strongest when the lines are farthest

Solution: (d) The field is strongest where the lines are crowded together, not where they are far apart.

MCQ 10.1.7 **159.The unit of magnetic flux density is ; (UHS MDCAT 2024)**

A	Wbm-1	B	Wbm
C	Wbm-2	D	Wb

Solution: (c) Flux density is flux per unit area, that is webers per square metre, or tesla.

MCQ 10.1.8 **Which of the following statement is true about the magnetic filed inside a solenoid? (KMU MDCAT 2024)**

A	It is along the axis of the coil	B	It is circular around the wires
C	It is strongest at the ends of the solenoid	D	It is zero when current flows through it

Solution: (a) Inside a long solenoid the field is uniform and runs along the axis.

MCQ 10.1.9 **Q.162 The source of magnetic field is: (UHS MDCAT 2023)**

A	An isolated magnetic pole	B	Static electric charge
C	Nonmagnetic substance	D	Current loop

Solution: (d) A magnetic field is made by moving charge, that is by a current.

MCQ 10.1.10 **The dimension of magnetic field strength is same as that of: (NUMS MDCAT 2023)**

A	Magnetic flux	B	Magnetic induction
C	Work done	D	Magnetic force

Solution: (b) Magnetic field strength and magnetic induction are the same quantity, measured in tesla.

MCQ 10.1.11 **Tesla is unit of ____ per unit area: (PMC MDCAT 2022)**

A	Magnetic field lines	B	Electric field lines
C	Optical field lines	D	Gravitational field lines

Solution: (a) One tesla is one weber of flux through each square metre.

MCQ 10.1.12 **If we cut a magnet in half then both magnets are now (PMC MDCAT 2022)**

A	Monopole	B	Dipole
C	Quadrupole	D	magnetsim is lost

Solution: (b) A magnet cut in two gives two magnets, each with its own north and south pole.

MCQ 10.1.13 **Magnetic field inside a long solenoid is: (PMC MDCAT 2022)**

A	Varying with radial distance	B	Uniform
C	Zero	D	Not enough Information

Solution: (b) Inside a long solenoid the field is uniform and along the axis.

MCQ 10.1.14 **When a bar magnet is broken from middle, the broken pieces will have: (PMC MDCAT 2022)**

A	North pole only	B	Sooth pole only
C	Both south and north poles	D	Magnetism will be removed

Solution: (c) A magnet cut in two gives two magnets, each with its own pair of poles.

MCQ 10.1.15 **The study of magnets is called: (PMC MDCAT 2022)**

A	Electromagnetism	B	Magnetism
C	Electrostatics	D	Current electricity

Solution: (b) The study of magnets and their fields is magnetism.

MCQ 10.1.16 **If the current in a wire is doubled then magnetic field would be: (PMC MDCAT 2022)**

A	halved	B	remain same
C	triple	D	double

Solution: (d) The field of a current is proportional to it, so twice the current gives twice the field.

MCQ 10.1.17 **When two magnets come closer such that same poles face each other than field lines: (PMC MDCAT 2022)**

A	Intersect	B	Repel
C	Come closer	D	Nothing will happen

Solution: (b) Field lines never cross, so like poles brought together push their lines apart.

MCQ 10.1.18 **The strength of a magnetic field is called? (PMC Practice 2021)**

A	Strength	B	Flux
C	Magnetic flux density	D	Density

Solution: (c) The strength of a magnetic field is its flux density, measured in tesla.

MCQ 10.1.19 **Magnetic field lines created by current carrying wire are? (PMC Practice 2021)**

A	Helical	B	Elliptical
C	Hyperbolic	D	Circular

Solution: (d) The lines round a straight wire are circles centred on it.

MCQ 10.1.20 **Two parallel straight conductors, in which current is flowing in the same direction, attract each other. The cause of it is: (PMC MDCAT 2020)**

A	magnetic force between the two	B	electric force between the two
C	potential difference between the two	D	mutual induction between the two

Solution: (a) Each current sits in the magnetic field of the other, and parallel currents are drawn together.

MCQ 10.1.21 **When current are flowing through two long parallel wires in same direction electric field between them is: (PMC MDCAT 2020)**

A	Strong	B	Weak
C	Remains constant	D	Infinite

Solution: (c) The wires carry no net charge, so the electric field between them does not change; it is the magnetic force that draws them together.

MCQ 10.1.22 **Two long, parallel conductors which are free to move are arranged 1.0 cm apart. A steady current of 20 A flows in each of the conductors in the same direction. The conductors: (UHS MDCAT 2018)**

A	Remains stationary	B	Move towards each other
C	Move away from each other	D	Move at right angles to each other

Solution: (b) Parallel currents in the same direction attract one another.

MCQ 10.1.23 **A current carrying solenoid is cut into a ratio 1:3 such that both are independently connected with the same source of current. Now if the magnetic field of the first part is "BA" while the second part respectively is "BB" then what is true? (UHS MDCAT 2017)**

A	BA=3BB	B	BA=(BB)/3
C	BA=BB	D	BA=4BB

Solution: (c) $B = \mu_0 n I$ depends on the turns per unit length, which cutting does not change.

Topic 10.2 Magnetic Flux

Past MDCAT Questions

MCQ 10.2.1 **Which surface has the greater magnetic flux in the same magnetic field, each having an area of $1\ \mathrm{m}^2$? (MDCAT 2022)**

A	circular	B	rectangular
C	square	D	the flux is independent of the shape

Solution: (d) $\Phi = BA\cos\theta$ depends on the area and its orientation, not on the shape of the boundary.

MCQ 10.2.2 **The formula $\Phi = \vec{B} \cdot \vec{A}$ represents: (MDCAT 2024)**

A	electric flux	B	magnetic flux
C	electric flux density	D	gravitational flux

Solution: (b) Magnetic flux is the scalar product of the magnetic field and the area it threads.

MCQ 10.2.3 **The SI unit of magnetic flux is: (NUMS MDCAT 2025)**

A	Tesla	B	Weber
C	Henry	D	Farad

Solution: (b) Magnetic flux is measured in webers, one weber being a tesla square metre.

MCQ 10.2.4 **The magnetic flux through a loop of 1m^2 in a 0.5T magnetic field is same as magnetic flux through a loop of 0.5 m^2 in a magnetic field of: (SIBA MDCAT 2025)**

A	1.0 T at 0°	B	1.0 T at 60°
C	2.0 T at 90°	D	0.5 T at 90°

Solution: (a) Flux is $BA\cos\theta$, so $0.5\ \mathrm{m}^2$ facing a $1.0\ \mathrm{T}$ field square on gives the same $0.5\ \mathrm{Wb}$.

MCQ 10.2.5 **157.The formula Φ = B.A represents (UHS MDCAT 2024)**

A	Electric flux	B	Magnetic flux
C	Electric flux density	D	Gravitational flux

Solution: (b) Flux density times area, taken as a scalar product, is the magnetic flux.

MCQ 10.2.6 **Q.161 Which surface has greater magnetic flux in same magnetic field, each has an area 1 m^2. (UHS MDCAT 2023)**

A	Circular	B	Rectangular
C	Square	D	Flux is independent of shape

Solution: (d) Flux is the product of flux density and area, whatever the outline of that area.

MCQ 10.2.7 **The weber is unit of measure of: (NUMS MDCAT 2023)**

A	Conductance	B	Electric current
C	Magnetic flux	D	Electric flux

Solution: (c) Magnetic flux is measured in webers.

MCQ 10.2.8 **If 0.5 T field is applied over an area of 2-meter square which lies at an angle of 60 degree with the field, then the resulting flux will be: (UHS MDCAT 2023)**

A	0.5 T	B	0.5 Wb
C	0.25 Wb	D	0.25 T

Solution: (b) $\Phi = BA\cos\theta = 0.5 \times 2 \times \cos 60°$, which is $0.5\ \mathrm{Wb}$.

MCQ 10.2.9 **The magnetic flux is a _____ quantity: (PMC MDCAT 2022)**

A	Scalar	B	Vector
C	Vector In some cases	D	Scalar In some cases

Solution: (a) Flux is the scalar product of flux density and area, so it is a scalar.

MCQ 10.2.10 **Magnetic flux is defined as: (PMC MDCAT 2022)**

A	Magnetic field lines passing over a volume	B	Magnetic field lines passing through a surface
C	Current passing through volume	D	current passing through surface

Solution: (b) Flux is the number of field lines crossing a surface.

MCQ 10.2.11 **The magnetic flux density is: (PMC MDCAT 2022)**

A	magnetic field lines per unit area	B	magnetic field lines per unit volume
C	electric field lines per unit area	D	electric field lines per unit volume

Solution: (a) Flux density is the flux crossing unit area held at right angles to the field.

MCQ 10.2.12 **Q.68 Magnetic flux is maximum when Angle between magnetic field and vector area is: (NUMS MDCAT 2022)**

A	0°	B	90°
C	30°	D	45°

Solution: (a) $\Phi = BA\cos\theta$ is greatest when the area vector lies along the field.

MCQ 10.2.13 **Magnetic flux is maximum when the angle, between the area vector and the magnetic field lines, is? (PMC Practice 2021)**

A	0°	B	90°
C	120°	D	All of these

Solution: (a) $\Phi = BA\cos\theta$ is greatest when the area vector lies along the field.

MCQ 10.2.14 **If the magnetic field is parallel to a surface, then the magnetic flux through the surface is: (PMC Practice 2021)**

A	Zero	B	Small but not zero
C	Infinite	D	Larger than 1

Solution: (a) With the field along the surface no lines cross it, so the flux is zero.

MCQ 10.2.15 **Magnetic flux is maximum when angle between magnetic field and vector area is: (PMC MDCAT 2020)**

A	0	B	90
C	180	D	45

Solution: (a) $\Phi = BA\cos\theta$ is greatest when the area vector lies along the field.

Topic 10.3 Force on a Charged Particle in a Magnetic

Past MDCAT Questions

MCQ 10.3.1 **Electric forces change the magnitude and direction of velocity, while magnetic forces change the: (MDCAT 2022)**

A	magnitude only	B	direction only
C	magnitude and direction	D	neither magnitude nor direction

Solution: (b) The magnetic force is always perpendicular to the velocity, so it does no work and only turns the particle.

MCQ 10.3.2 **The magnitude of the magnetic force on a current-carrying conductor in a uniform magnetic field is maximum if the conductor is: (MDCAT 2023)**

A	perpendicular to the magnetic field	B	parallel to the magnetic field
C	at 45° to the magnetic field	D	antiparallel to the magnetic field

Solution: (a) $F = BIL\sin\theta$ is greatest when $\theta = 90^\circ$.

MCQ 10.3.3 **A proton is projected with a uniform velocity v along the axis of a current carrying solenoid. Then: (UHS MDCAT 2017)**

A	the proton will be accelerated along the axis	B	the path of the proton will be circular about the axis
C	the proton moves along a helical path	D	the proton will continue to move with velocity v along the axis

Solution: (d) Inside the solenoid the field is along the axis, so the velocity is parallel to it and $F = qvB\sin 0^\circ = 0$.

MCQ 10.3.4 **Magnetic force acting on a charge at rest is: (NUMS MDCAT 2025)**

A	Zero	B	Positive
C	Negative	D	Infinite

Solution: (a) The force is $qvB\sin\theta$, and a charge at rest has no velocity, so there is no force.

MCQ 10.3.5 **An electron is projected along the positive x-axis in a magnetic field lying in xz-plane. The magnetic force on the electron will act along the: (SIBA MDCAT 2025)**

A	x-axis	B	-x-axis
C	y-axis	D	-y-axis

Solution: (c) The force is along $qv \times B$, and with the velocity along x and the field in the xz plane the product lies along y.

MCQ 10.3.6 **An electron is moving perpendicular to the magnetic field, which of the following is correct statement about electromagnetic force acting on the electron? (KMU MDCAT 2024)**

A	Force acting is equal to electron charge	B	Force acting is equal to the magnetic field strength
C	Force acting is maximum	D	Zero force is acting on it

Solution: (c) $F = qvB\sin\theta$ is greatest when the angle is a right angle.

MCQ 10.3.7 **For a positive charged particle (q) moving with a velocity (v) in a magnetic Filed of flux density B, the force (F) acting on the charge particle is given by the expression? (KMU MDCAT 2024)**

A	F = Fv x B	B	F = qv x B
C	F = v x B/q	D	q = v x B/F

Solution: (b) The magnetic force on a moving charge is the vector product $q\mathbf{v} \times \mathbf{B}$.

MCQ 10.3.8 **Electric forces change the magnitude and direction of velocity while magnetic forces change_____ of velocity (UHS MDCAT 2023)**

A	Only Magnitude	B	Only direction
C	Magnitude and direction	D	Neither magnitude nor direction

Solution: (b) The magnetic force is always at right angles to the velocity, so it can only turn it.

MCQ 10.3.9 **The force exerted on charged particle will be maximum when it enters the magnetic field at: (SZABMU MDCAT 2023)**

A	600	B	900
C	00	D	450

Solution: (b) $F = qvB\sin\theta$ is greatest when the particle crosses the field at a right angle.

MCQ 10.3.10 **The magnitude of magnetic force will be maximum on current carrying conductor in uniforrn magnetic field if conductor is placed? (UHS MDCAT 2023)**

A	Parallel to magnetic field	B	At 45 degree in magnetic field
C	Perpendicular to magnetic field	D	Antiparallel in magnetic field

Solution: (c) $F = BIL\sin\theta$ is greatest when the conductor lies across the field.

MCQ 10.3.11 **If electron and proton projected in a magnetic fleld simultaneously then _ _ _ _ will be deflected more: (PMC MDCAT 2022)**

A	Electron	B	Proton
C	Electron and proton both	D	No effect

Solution: (a) The force is the same but the electron is about two thousand times lighter, so it turns far more sharply.

MCQ 10.3.12 **When two positive and negative particles are moving opposite to each other in uniform magnetic field: (PMC MDCAT 2022)**

A	Deflection occurs	B	Attraction occurs
C	Repulsion occurs	D	Nothing will happen

Solution: (a) Opposite charges moving opposite ways feel forces the same way round, and both are deflected.

MCQ 10.3.13 **Force on a proton of charge 2e in a magnetic field of B at 45° while moving with 2 m/s is: (PMC Practice 2021)**

A	2✓2eB	B	4eB
C	2eB	D	eB

Solution: (a) $F = qvB\sin 45^\circ = 2e \times 2 \times B \times 1/\sqrt{2}$, that is $2\sqrt{2}\,eB$.

MCQ 10.3.14 **If a charge of 2C is moving with 5m/s enter at 30° in 3 T, calculate the force experienced by it. (PMC Practice 2021)**

A	10N	B	15N
C	20N	D	30N

Solution: (b) $F = qvB\sin 30^\circ = 2 \times 5 \times 3 \times 0.5$, that is $15\,\text{N}$.

MCQ 10.3.15 **During the circular path in magnetic field, what is the magnetic force? (PMC Practice 2021)**

A	F = Qb	B	F = qB2
C	F = qB/v	D	F = qvB

Solution: (d) The magnetic force on a moving charge is qvB when the velocity crosses the field.

MCQ 10.3.16 **Which, among the following qualities, is not affected by the magnetic field? (PMC Practice 2021)**

A	Moving charge	B	Charge in magnetic flux
C	Current flowing in conductor	D	Stationary charge

Solution: (d) A magnetic force needs motion, so a charge at rest feels nothing.

MCQ 10.3.17 **If a conductor of length 7m is placed in a magnetic field of strength 0.3 T carrying current 1 A, parallel to the field. What will be the force, acting on it, due to this magnetic field? (UHS MDCAT 2019)**

A	7 N	**B**	0 N
C	3.1 N	**D**	2.1 N

Solution: (b) $F = BIL\sin\theta$, and with the current along the field the sine is zero.

MCQ 10.3.18 **The horizontal component of Earth magnetic flux density is 1.8 x 10-6 T. The current in a horizontal cable is 160 A. Calculate the maximum force per unit length? (UHS MDCAT 2019)**

A	2.88x 10-6N/m	**B**	2.88x 10-4N/m
C	2.88x 10-2N/m	**D**	2.88x 10-8N/m

Solution: (b) $F/L = BI = 1.8 \times 10^{-6} \times 160$, that is $2.88 \times 10^{-4}\,\mathrm{N\,m^{-1}}$.

MCQ 10.3.19 **A neutron having mass equal to a proton (mp = 1.6 x 10-27 kg) is moving in a magnetic field of intensity 1.20 x 10-3 T with a speed of 2.0 x 107 ms-1 . What is the maximum force experienced by the neutron? (UHS MDCAT 2018)**

A	3.84 x 10-15N	**B**	0
C	3.84 x 10-12N	**D**	38.4 x 10-15N

Solution: (b) A neutron carries no charge, so the magnetic field exerts no force on it.

MCQ 10.3.20 **E/m of an electron is given by the relationship. (UHS MDCAT 2018)**

A	e/m2(VB2r2)	**B**	e/m=(V/Br)2
C	e/m=V.r/B	**D**	e/m=V/Br

Solution: (d) With the electric and magnetic forces balanced, $v = E/B$ and e/m works out as V/Br.

MCQ 10.3.21 **A conductor of length 1m carrying current of 1A is placed parallel to a magnetic field of 1 Gauss. The magnetic force acting on the conductor is: (UHS MDCAT 2017)**

A	Zero	**B**	1 Newton
C	10-4 Newton	**D**	1 dyne

Solution: (a) $F = BIL\sin\theta$, and with the current along the field the sine is zero.

MCQ 10.3.22 **The force acting on current carrying conductor will be maximum if the angle between magnetic field and conductor is: (UHS MDCAT 2016)**

A	0°	**B**	30°
C	90°	**D**	60°

Solution: (c) $F = BIL\sin\theta$ is greatest when the conductor lies across the field.

MCQ 10.3.23 **'F' is maximum force acting on a conductor. Now if we change the direction of conductor by making an angle of 45° with the magnetic field then the force becomes: (UHS MDCAT 2016)**

A	F/2	**B**	2F
C	F/√2	**D**	√2 F

Solution: (c) $F = BIL\sin 45°$, and the sine of 45° is $1/\sqrt{2}$.

MCQ 10.3.24 **If we doubled all the parameters of the force acting on current carrying conductor and θ = 90° then magnetic force becomes: (UHS MDCAT 2016)**

A	Half	**B**	Double
C	Eight-times	**D**	Four-times

Solution: (c) $F = BIL$, and doubling each of the three multiplies the force by eight.

Topic 10.4 Path of a Charged Particle in a Magnetic Field

Past MDCAT Questions

MCQ 10.4.1 **The path of a charged particle in a plane perpendicular to a uniform magnetic field is: (NUMS MDCAT 2025)**

A	Circular	**B**	Helical
C	Parabola	**D**	Elliptical

Solution: (a) With the velocity always at right angles to the field, the magnetic force is centripetal and the path is a circle.

MCQ 10.4.2 **If mass of a charged particle is doubled, cyclotron frequency becomes: (NUMS MDCAT 2025)**

A	Doubled	**B**	Halved
C	Quadrupled	**D**	One fourth

Solution: (b) The cyclotron frequency is $qB/2\pi m$, so twice the mass halves it.

MCQ 10.4.3 **When a charged particle enters the magnetic field parallel then it will: (SZABMU MDCAT 2023)**

A	Deflect toward north	**B**	Deflect toward south
C	Move straight	**D**	Move in circular path

Solution: (c) With the velocity along the field the sine is zero, so there is no force and the path stays straight.

MCQ 10.4.4 **When a charged particle enters the magnetic field parallel, it will: (NUMS MDCAT 2023)**

A	Deflect toward north	**B**	Deflect toward south
C	Move straight	**D**	Move in circular path

Solution: (c) With the velocity along the field there is no force, so the path is a straight line.

MCQ 10.4.5 **A charged particle moving with velocity v, enters a uniform magnetic field B. The direction of v is perpendicular to B. What is the path of the charged particle inside the magnetic field? (PMC Practice 2021)**

A	Parabolic	**B**	Circular
C	Parallel to v	**D**	Parallel to B

Solution: (b) The force is always at right angles to the velocity, so the path curls into a circle.

MCQ 10.4.6 **A proton is projected with a uniform velocity 'v' along the axis of a current carrying solenoid. (UHS MDCAT 2017)**

A	The proton will be accelerated along the axis.	**B**	The proton path will be circular about the axis.
C	The proton moves along a helical path.	**D**	The proton will continue to move with velocity 'v' along the axis.

Solution: (d) The velocity lies along the field inside the solenoid, so there is no magnetic force at all.

Topic II.1 Faraday's Law of Electromagnetic Induction

Past MDCAT Questions

MCQ II.1.1 **A one metre long copper rod is moved with a speed of $20\ \mathrm{m\,s^{-1}}$ in a magnetic field of strength 0.6 tesla. What is the value of the induced emf? (MDCAT 2022)**

A	10 V	B	12 V
C	14 V	D	16 V

Solution: (b) $\varepsilon = BvL = 0.6 \times 20 \times 1 = 12$ V.

MCQ II.1.2 **The unit of $\Delta\Phi/\Delta t$ can be written as: (MDCAT 2022)**

A	$\mathrm{N\,m\,A^{-2}\,s^{-1}}$	B	$\mathrm{N\,m\,A\,s^{-2}}$
C	$\mathrm{N\,m\,A^{-1}\,s^{-1}}$	D	$\mathrm{N\,m\,A^{-2}\,s}$

Solution: (c) The rate of change of flux is an emf, and $1\ \mathrm{V} = 1\ \mathrm{J\,C^{-1}} = 1\ \mathrm{N\,m\,A^{-1}\,s^{-1}}$.

MCQ II.1.3 **A copper hoop is held in a vertical east-west plane in a uniform magnetic field whose field lines run along the north-south direction. The largest induced emf is produced when the hoop is: (MDCAT 2022)**

A	rotated about a north-south axis	B	rotated about an east-west axis
C	moved rapidly, without rotation, towards the east	D	moved rapidly, without rotation, towards the south

Solution: (b) Turning about an east-west axis swings the plane of the hoop through the field and changes the flux fastest; the other motions leave the flux unchanged.

MCQ II.1.4 **In an AC generator the emf will be maximum when the factor $\sin\omega t$ is equal to: (MDCAT 2024)**

A	zero	B	1
C	2	D	1/2

Solution: (b) $\varepsilon = \varepsilon_0 \sin\omega t$ is greatest when $\sin\omega t = 1$.

MCQ II.1.5 **Electric generators and transformers are based on the principle of: (MDCAT 2024)**

A	Coulomb's law	B	Faraday's law
C	Ampere's law	D	Hooke's law

Solution: (b) Both work by inducing an emf with a changing magnetic flux, which is Faraday's law.

MCQ II.1.6 **A coil is rotated in a uniform magnetic field about an axis perpendicular to the field. The induced emf is maximum when the plane of the coil is: (UHS MDCAT 2017)**

A	parallel to the field	B	perpendicular to the field
C	at 45° to the field	D	none of the given options

Solution: (a) With the plane along the field the flux through the coil is zero and its rate of change is greatest, so the emf is at its peak.

MCQ II.1.7 **The cause of an induced emf is the: (UHS MDCAT 2017)**

A	rate of change of magnetic flux	B	decrease in magnetic flux
C	increase in magnetic flux	D	change in magnetic flux

Solution: (a) Faraday law fixes the emf as $-N\Delta\Phi/\Delta t$, so it is the rate at which the flux changes, not merely the change.

MCQ II.1.8 **Basic requirement for induced emf is: (NUMS MDCAT 2025)**

A	Flux linked to coil	B	No flux linked to coil
C	Coil should be circular	D	Change in flux links to the coil

Solution: (d) An emf appears only while the flux through the coil is changing.

MCQ II.1.9 **EMF induced is zero when plane of coil is: (NUMS MDCAT 2025)**

A	Perpendicular to B	B	Parallel to B
C	Antiparallel	D	None of these

Solution: (a) With the plane perpendicular to the field the flux is already at its maximum, so it is momentarily not changing.

MCQ II.1.10 **161.In an AC generator the emf will be maximum when factor sinωt is equal to (UHS MDCAT 2024)**

A	Zero	B	1
C	2	D	1 / 2

Solution: (b) The emf is $\varepsilon_0 \sin\omega t$, largest when the sine reaches one.

MCQ II.1.11 **162.Electric generators and transformers are based on the principles of: (UHS MDCAT 2024)**

A	Coulomb's law	B	Faraday's law
C	Ampere's law	D	Hook's law

Solution: (b) Both work by inducing an emf with a changing flux, which is Faraday's law.

MCQ II.1.12 **One-meter-long copper rod is moving with speed 20 m/sec in the magnetic field of strength 0.6 tesla what is the value of induced emf? (KMU MDCAT 2024)**

A	12 V	B	19.4 V
C	20.6 V	D	25 V

Solution: (a) $\varepsilon = BLv = 0.6 \times 1 \times 20$, which is 12 V.

MCQ II.1.13 **The inductance of a coil depends on. (KMU MDCAT 2024)**

A	Number of turns	B	Resistance of the wire used
C	Type of insulation used on the wire	D	Voltage applied to the coil

Solution: (a) Inductance goes as the square of the number of turns, with the area, the length and the core.

MCQ II.1.14 **Q.163 One meter long copper rod is moving with speed 20 m/sec in the magnetic field of strength 0.6 tesla. What is the value of induced emf ? (UHS MDCAT 2023)**

A	10 v	B	12 v
C	14 v	D	16 v

Solution: (b) $\varepsilon = BLv = 0.6 \times 1 \times 20$, which is 12 V.

MCQ II.1.15 **Q.164 The unit of Δφ/Δt can be written as ? (UHS MDCAT 2023)**

A	NmA^-2s^-1	B	NmAs^-1
C	NmA^-1s^-1	D	NmA^-2s1

Solution: (c) The rate of change of flux is an emf, that is a volt, and a volt is $\mathrm{N\,m\,A^{-1}\,s^{-1}}$.

MCQ II.1.16 **Q.166 A copper hoop is held in a vertical east-west plane in a uniform magnetic field whose field lines run along the north-south direction. The largest induced emf is produced when the hoop is ? (UHS MDCAT 2023)**

A	Rotated about a north-south axis	B	Rotated about an east-west axis
C	Moved rapidly, without rotation, toward the east	D	Moved rapidly, without rotation, toward the south

Solution: (b) Turning about the east-west axis sweeps the plane of the hoop right through the north-south field lines.

MCQ II.1.17 **In Fleming's right hand rule the middle finger indicates: (SZABMU MDCAT 2023)**

A	Force	B	Magnetic field
C	Induced current	D	Volt

Solution: (c) Thumb for motion, first finger for field, second finger for the induced current.

MCQ 11.1.18 **In Fleming's right hand rule, the second finger indicates: (NUMS MDCAT 2023)**

A	Force	**B**	Magnetic field
C	Induced current	**D**	Motion

Solution: (c) Thumb for motion, first finger for field, second finger for the induced current.

MCQ 11.1.19 **A current generator is a device that converts: (NUMS MDCAT 2023)**

A	Mechanical energy into electrical energy	**B**	Chemical energy into mechanical energy
C	Sound energy into mechanical energy	**D**	Electrical energy into mechanical energy

Solution: (a) A generator turns the work done in rotating the coil into electrical energy.

MCQ 11.1.20 **The expression for the emf produced by A. C. generator is? (UHS MDCAT 2023)**

A	NωAB Sinθ	**B**	NωAB Cosθ
C	NωAB	**D**	ILB Cosθ

Solution: (a) The emf of a rotating coil is $NAB\omega \sin\theta$.

MCQ 11.1.21 **The induced emf produced in the coil is sometimes called as? (UHS MDCAT 2023)**

A	Self-inductance	**B**	Back emf
C	Motional emf	**D**	Mutual inductance

Solution: (b) The emf induced in a coil by its own changing current opposes that current, so it is called the back emf.

MCQ 11.1.22 **AC generator consists of __ poles: (PMC MDCAT 2022)**

A	0	**B**	1
C	2	**D**	3

Solution: (c) The armature turns between a north and a south pole, so there are two.

MCQ 11.1.23 **The emf induced in a circuit according to Faraday's law depends on the (PMC MDCAT 2022)**

A	Maximum magnetic flux	**B**	Initial magnetic flux
C	Change in magnetic flux	**D**	The rate of change of magnetic flux

Solution: (d) Faraday's law makes the emf equal to the rate at which the flux changes.

MCQ 11.1.24 **AC generators are similar to : (PMC MDCAT 2022)**

A	Transformers	**B**	Inductors
C	Capacitors	**D**	Motor

Solution: (d) A generator is a motor run backwards: turn the coil and it gives current instead of taking it.

MCQ 11.1.25 **AC generator cannot generate: (PMC MDCAT 2022)**

A	AC voltage	**B**	High AC voltage
C	DC voltage	**D**	Low AC voltage

Solution: (c) A rotating coil in a field gives an emf that reverses every half turn, so its output is alternating.

MCQ 11.1.26 **The mechanical energy of our hand used to push the magnet towards or away from the coil results into: (PMC MDCAT 2022)**

A	Heat energy	**B**	Potential energy
C	Electrical energy	**D**	Mechanical energy

Solution: (c) The work done against the induced current appears as electrical energy in the coil.

MCQ 11.1.27 **AC generator converts _____ energy: (PMC MDCAT 2022)**

A	Mechanical to electrical	**B**	Electrical to mechanical
C	Electrical to heat	**D**	Heat to electrical

Solution: (a) A generator turns the work of rotating the coil into electrical energy.

MCQ 11.1.28 **When coil is rotated in magnetic field, the current produced is: (PMC MDCAT 2022)**

A	Constant	**B**	Decrease
C	Increase	**D**	Continuously changing

Solution: (d) The flux through the coil changes from moment to moment, so the induced current does too.

MCQ 11.1.29 **The current produced by a moving coil is called: (PMC MDCAT 2022)**

A	Induced current	**B**	Direct current
C	Polarized current	**D**	No current

Solution: (a) A current produced by a changing flux is an induced current.

MCQ 11.1.30 **The self inductance of a coil does not depend upon: (PMC MDCAT 2022)**

A	length	**B**	current
C	the number of turns	**D**	the area of the coil

Solution: (b) Self inductance depends on the turns, the area, the length and the core, not on the current flowing.

MCQ 11.1.31 **Motional e.m.f induced in a coil is dependent on? (PMC Practice 2021)**

A	Magnetic field	**B**	Orientation
C	Length	**D**	All of these

Solution: (d) $\varepsilon = BLv$ with the orientation, so the field, the length and the angle all enter.

MCQ 11.1.32 **A metal rod of length 4 m, velocity 5 m/s and magnetic field 0.5 T will have an induced EMF of: (PMC Practice 2021)**

A	10 V	**B**	20 V
C	30 V	**D**	4 V

Solution: (a) $\varepsilon = BLv = 0.5 \times 4 \times 5$, that is $10\,\text{V}$.

MCQ 11.1.33 **If a stationary bar magnet is placed near a coil so that maximum lines of force passes through the coil, the galvanometer shows: (PMC MDCAT 2020)**

A	Maximum current	**B**	Minimum current
C	No current	**D**	Intermediate value of current

Solution: (c) An emf appears only while the flux is changing, and a stationary magnet changes nothing.

MCQ 11.1.34 **If we change the magnetic flux linking a coil by rotating the coil in a constant magnetic field, the rate of change of this flux is: (UHS MDCAT 2019)**

A	Proportional to the emf produced in it	**B**	Proportional to the material Of the coil
C	Proportional to the resistance of the coil	**D**	Proportional to the change in magnetic field

Solution: (a) Faraday's law makes the emf equal to the rate of change of flux.

MCQ 11.1.35 **A metal rod of length 10.0 cm is moving at a speed of 0.5 ms-1 in a direction perpendicular to a 0.20 T magnetic field. Find the emf produced in the rod. (UHS MDCAT 2018)**

A	2.0 x 10-3V	**B**	0.50 x 10-2V
C	1.0 x 10-2V	**D**	1.0 x 10-3V

Solution: (c) $\varepsilon = BLv = 0.20 \times 0.10 \times 0.5$, that is $1.0 \times 10^{-2}\,\text{V}$.

MCQ 11.1.36 **The cause of induced emf is: (UHS MDCAT 2017)**

A	Rate of change of magnetic flux	B	Decrease in magnetic flux
C	Increase in magnetic flux	D	Change in magnetic flux

Solution: (d) An emf appears whenever the flux through the circuit changes.

MCQ 11.1.37 **A coil is rotated in a uniform magnetic field about an axis perpendicular to the field. The emf induced in the coil would be maximum when the plane of the coil is: (UHS MDCAT 2017)**

A	Parallel to the field	B	Perpendicular to the field
C	At 45° to the field	D	None of the given options are correct

Solution: (a) With the plane along the field the flux is momentarily zero and changing fastest.

Topic 11.2 Lenz's Law

Past MDCAT Questions

MCQ 11.2.1 **The working principle of the magnetic levitation train is: (MDCAT 2022)**

A	Faraday's law	B	Planck's law
C	Ohm's law	D	Lenz's law

Solution: (d) The induced currents oppose the approaching magnets, and that repulsion is Lenz's law at work.

MCQ 11.2.2 **The statement that the induced current will flow in such a direction as to oppose the cause that produces it is: (MDCAT 2024)**

A	Ampere's law	B	Faraday's law
C	Lenz's law	D	Joule's law

Solution: (c) That is Lenz's law, and it is the conservation of energy applied to induction.

MCQ 11.2.3 **A metallic circular ring is suspended by a string in a vertical plane. When a magnet is brought towards the ring, the ring will: (UHS MDCAT 2017)**

A	remain stationary	B	get displaced away from the magnet
C	get displaced towards the magnet	D	nothing can be said

Solution: (b) By Lenz law the induced current opposes the approach, so the ring is repelled and swings away.

MCQ 11.2.4 **A loop moves toward a stationary magnet. The induced current will: (UHS MDCAT 2025)**

A	enhance the motion	B	try to stop the approach
C	become zero	D	become alternating

Solution: (b) By Lenz's law the induced current opposes the change that made it, so it opposes the approach.

MCQ 11.2.5 **According to Lenz's Law, the direction of induced current in a conductor is such that it: (KMU MDCAT 2025)**

A	Opposes the change in magnetic flux	B	Enhances the change in magnetic flux
C	Is perpendicular to the magnetic field	D	Is parallel to the magnetic field

Solution: (a) The induced current always sets up a flux that opposes the change producing it.

MCQ 11.2.6 **A conducting ring is placed near a current-carrying coil. As the current in the coil increases, the induced current in the ring flows: (SZABMU MDCAT 2025)**

A	In the direction of magnetic field	B	To increases the magnetic flux
C	To oppose increasing magnetic flux	D	Randomly without a definite direction

Solution: (c) By Lenz's law the ring drives a current whose own flux opposes the rise.

MCQ 11.2.7 **160.The induced current will flow in such a direction so as to oppose the cause that produces it is statement of: (UHS MDCAT 2024)**

A	Ampere's Law	B	Faraday's Law
C	Lenz's Law	D	Joule's Law

Solution: (c) That is Lenz's law.

MCQ 11.2.8 **The direction of induced current is determined by? (KMU MDCAT 2024)**

A	Ampere's law	B	Faraday's law
C	Lenz's law	D	Ohm's law

Solution: (c) Lenz's law fixes the direction; Faraday's law gives the size.

MCQ 11.2.9 **Lenz's law is consistent with the (KMU MDCAT 2024)**

A	Ampere's Law	B	Faraday's law
C	Law of conservation of energy	D	Ohm's law

Solution: (c) If the induced current helped the change, energy would be made from nothing.

MCQ 11.2.10 **Q.165 Working principal of magnetic levitation train is according to ? (UHS MDCAT 2023)**

A	Faraday law	B	Max planks law
C	Ohm law	D	Lenz law

Solution: (d) The induced currents oppose the approaching magnet, and the repulsion is what lifts the train.

MCQ 11.2.11 **Lenz's law is also a statement of law of conservation of: (SZABMU MDCAT 2023)**

A	Charge	B	Energy
C	Momentum	D	Mass

Solution: (b) If the induced current helped the change, energy would be created out of nothing.

MCQ 11.2.12 **The Lenz's law is also statement of law of conservation of: (NUMS MDCAT 2023)**

A	Charge	B	Mass
C	Energy	D	Pressure

Solution: (c) If the induced current helped the change, energy would be made from nothing.

MCQ 11.2.13 **The negative sign in Lenz's law indicates that the induced emf opposes the rate of change of: (PMC MDCAT 2022)**

A	Electric flux	B	Magentic flux
C	Electric field	D	Magentic field

Solution: (b) The induced emf opposes the change of flux that produced it.

MCQ 11.2.14 **The Lenz's law is used to find out the direction of (PMC MDCAT 2022)**

A	Current induced in circuit	B	Potential energy
C	Magnetic field	D	Force

Solution: (a) Lenz's law fixes the direction of the induced current.

MCQ 11.2.15 **Q.69 Lenz's law is based on the law of conservation of: (NUMS MDCAT 2022)**

A	Mass	B	Energy
C	Charge	D	Momentum

Solution: (b) If the induced current helped the change, energy would be created out of nothing.

MCQ 11.2.16 **The Lenz's law refers to: (PMC Practice 2021)**

A	Induced current	B	Induced potential
C	Motional emf	D	All of these

Solution: (d) Lenz's law fixes the direction of the induced current, and so of the emf that drives it.

MCQ 11.2.17 **Lenz's law in electromagnetic induction is the direct consequence of the principle of conservation of: (UHS MDCAT 2018)**

A	Energy	B	Charge
C	Momentum	D	Mass

Solution: (a) If the induced current helped the change, energy would be made from nothing.

MCQ 11.2.18 **A metallic circular ring is suspended by a string and is kept in a vertical plane. When a magnet is approached towards the ring, then it will: (UHS MDCAT 2017)**

A	Remain stationary	B	Get displaced away from the magnet
C	Get displaced towards the magnet	D	Nothing can be said

Solution: (b) The changing flux induces a current in the ring whose field opposes the magnet, so the ring is pushed away.

Topic 11.3 The Transformer

Past MDCAT Questions

MCQ 11.3.1 **In a transformer there is no _____ connection between the two coils, but they are _____ linked. (MDCAT 2022)**

A	magnetic, electrically	B	electrical, magnetically
C	magnetic, magnetically	D	electrical, optically

Solution: (b) The two windings are insulated from each other and the flux in the core is what couples them.

MCQ 11.3.2 **In principle, a transformer consists of two coils of copper, electrically insulated from each other, wound on the same: (MDCAT 2023)**

A	iron core	B	copper core
C	gold core	D	steel core

Solution: (a) A soft iron core carries almost all the flux of the primary through the secondary.

MCQ 11.3.3 **In an ideal transformer: (MDCAT 2024)**

A	the power input is equal to the power output	B	the power input is less than half the power output
C	the power input is greater than the power output	D	the power input is more than half the power output

Solution: (a) An ideal transformer is lossless, so $V_p I_p = V_s I_s$.

MCQ 11.3.4 **In an ideal transformer, if the primary voltage is doubled and the turns ratio remains the same, what happens to the secondary current? (UHS MDCAT 2025)**

A	Doubles	B	Halves
C	Remains the same	D	Becomes four times

Solution: (a) The turns ratio doubles the secondary voltage too, and across the same load that doubles the secondary current.

MCQ 11.3.5 **In a step-up transformer, if the secondary voltage is increased by a factor of 10, the current in secondary coil will be: (SIBA MDCAT 2025)**

A	10 times higher than the primary current	B	10 times lower than the primary current
C	Equal to the primary current	D	One-tenth of the primary current in transformer

Solution: (d) Power is conserved in an ideal transformer, so ten times the voltage means a tenth of the current.

MCQ 11.3.6 **The basic principle behind the operation of the transformer is (KMU MDCAT 2024)**

A	Coulomb's law	B	Electromagnetic induction
C	Gas's Law	D	Hess's law

Solution: (b) A changing flux in the primary induces an emf in the secondary, which is mutual induction.

MCQ 11.3.7 **A transformer uses 220V line and delivers 22A at 1800V. Current drawn from line (100% efficiency)? (NUMS MDCAT 2024)**

A	22A	B	180A
C	200A	D	50A

Solution: (b) Power is the same on both sides, so $1800 \times 22/220$ gives 180 A.

MCQ 11.3.8 **Q.167 In transformer, there is no _____ connection between the two coils but they are _____ linked ? (UHS MDCAT 2023)**

A	Magnetic, electrically	B	Electrical, magnetically
C	Magnetic, magnetically	D	Electrical, optically

Solution: (b) The coils share no wire; they are coupled only by the flux in the common core.

MCQ 11.3.9 **Transformer works on the principle of: (SZABMU MDCAT 2023)**

A	Lenz's Law	B	Faraday's Law
C	Mutual Induction	D	Ampere's Law

Solution: (c) The changing flux of the primary induces an emf in the secondary, which is mutual induction.

MCQ 11.3.10 **The efficiency of transformer is: (SZABMU MDCAT 2023)**

A	60 %	B	70 %
C	80 %	D	90 %

Solution: (d) A well made transformer wastes little, so its efficiency is around ninety per cent or better.

MCQ 11.3.11 **In principle, the transformer consists of two coils of copper, electrically insulated from each other, wound on the same? (UHS MDCAT 2023)**

A	Iron core	B	Copper core
C	Gold core	D	Steel core

Solution: (a) A soft iron core carries the flux from one winding to the other with little loss.

MCQ 11.3.12 **Power loss in the actual transformer is due to: (PMC MDCAT 2022)**

A	Back emf	B	Strong magnetic field
C	Eddy currents	D	Weak magnetic field

Solution: (c) Currents induced in the core itself waste energy as heat, which is why the core is laminated.

MCQ 11.3.13 **In step down transformer, current in secondary coil is ___ than current in primary coil: (PMC MDCAT 2022)**

A	Equal	B	Less
C	Greater	D	Unchanged

Solution: (c) Power is conserved, so a lower secondary voltage means a larger secondary current.

MCQ 11.3.14 **Transformer can convert _____ (PMC MDCAT 2022)**

A	Low DC voltage	**B**	High DC voltage
C	Battery voltage	**D**	AC voltage

Solution: (d) A transformer works on a changing flux, so only alternating voltage can be transformed.

MCQ 11.3.15 **Eddy currents flow in: (PMC MDCAT 2022)**

A	Open loops	**B**	Closed loops
C	Straight lines	**D**	Vertlcal loops

Solution: (b) Eddy currents circulate in closed loops within the body of the metal.

MCQ 11.3.16 **Q.71 Transformer works on the principle of: (NUMS MDCAT 2022)**

A	Half wave rectification	**B**	Self-Induction
C	Mutual Induction	**D**	Full wave rectification

Solution: (c) A changing flux in the primary induces an emf in the secondary, which is mutual induction.

MCQ 11.3.17 **If the supply frequency of a transformer increases, the secondary output voltage of the transformer: (PMC Practice 2021)**

A	Increases	**B**	Decreases
C	Remains unchanged	**D**	Any of above

Solution: (c) The output depends on the turns ratio, and a higher frequency raises the induced emf per turn equally in both coils.

MCQ 11.3.18 **Step up transformer have _____ turns in secondary coil. (PMC Practice 2021)**

A	More	**B**	Less
C	Equal	**D**	Zero

Solution: (a) A step-up transformer has more turns on the secondary than on the primary.

MCQ 11.3.19 **The mutual induction happens in? (PMC Practice 2021)**

A	AC generator	**B**	DC generator
C	Battery	**D**	Transformer

Solution: (d) The changing flux of the primary induces an emf in the secondary of a transformer.

MCQ 11.3.20 **Voltage in secondary winding is _____ to the current in the secondary coil. (PMC Practice 2021)**

A	Directly proportional	**B**	Inversely proportional
C	Directly squared proportional	**D**	Not enough information is available

Solution: (b) Power is the same on both sides, so a higher secondary voltage means a smaller secondary current.

MCQ 11.3.21 **Transformer is a device which steps up or steps down the input: (PMC MDCAT 2020)**

A	Current	**B**	Voltage
C	Energy	**D**	Power

Solution: (b) A transformer changes the voltage; the power stays much the same.

MCQ 11.3.22 **In transmission from grid station, power losses are minimized by: (PMC MDCAT 2020)**

A	Increasing current	**B**	Decreasing current
C	Increasing resistance	**D**	Increasing voltage

Solution: (d) The loss is I^2R, so the voltage is stepped up and the current down for transmission.

MCQ 11.3.23 **If we give a direct current to the transformer's primary coil, then there will be: (UHS MDCAT 2019)**

A	No emf produced in the secondary	**B**	More emf in the secondary
C	Equal emf produced in the secondary	**D**	Less emf produced in the secondary

Solution: (a) A steady current gives a steady flux, and only a changing flux induces an emf.

MCQ 11.3.24 **In a practical transformer mutual induction between primary and secondary coils takes place. In such transformer what can be deduced about the power. (UHS MDCAT 2018)**

A	Power output = Power input	**B**	Power output > Power input
C	Power output ≥ Power input	**D**	Power output < Power input

Solution: (d) Some power is always lost as heat in the windings and the core, so the output falls short of the input.

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Topic 12.1 Phase of Alternating Current

Past MDCAT Questions

MCQ 12.1.1 A phase difference of 90° is equal to: (UHS MDCAT 2025)

A	π radians	B	$\pi/2$ radians
C	2π radians	D	$\pi/4$ radians

Solution: (b) A full cycle is 2π radians, so a quarter of it is $\pi/2$.

MCQ 12.1.2 The domestic electricity supply has a frequency of: (PMC MDCAT 2020)

A	150 Hz	B	100 Hz
C	50 Hz	D	25 Hz

Solution: (c) Mains electricity in Pakistan is supplied at 50 Hz.

Topic 12.2 A.C. Through a Resistor, a Capacitor and an Inductor

Past MDCAT Questions

MCQ 12.2.1 In a pure capacitance AC circuit, the current: (KMU MDCAT 2025)

A	Lags behind voltage by 90°	B	Leads the voltage by 90°
C	Is in phase with the voltage	D	Leads the voltage by 45°

Solution: (b) A capacitor must be charged before a voltage appears across it, so the current runs a quarter cycle ahead.

MCQ 12.2.2 If frequency of AC is doubled, the inductive reactance will: (SIBA MDCAT 2025)

A	Remain same	B	Be halved
C	Be doubled	D	Become zero

Solution: (c) Inductive reactance is $2\pi fL$, so it is proportional to the frequency.

MCQ 12.2.3 A capacitor is connected to an AC source. If the frequency of the AC source is doubled the current in a purely capacitive circuit will: (SZABMU MDCAT 2025)

A	Be doubled	B	Remains Unchanged
C	Become Half	D	Becomes zero

Solution: (a) Capacitive reactance is $1/2\pi fC$, so twice the frequency halves it and doubles the current.

MCQ 12.2.4 Phase shift between voltage and current when AC flows through capacitor is: (NUMS MDCAT 2024)

A	V leads I by 90°	B	I leads V by 90°
C	V and I in phase	D	V leads I by 45°

Solution: (b) The capacitor must be charged before a voltage appears, so the current runs a quarter cycle ahead.

MCQ 12.2.5 What is the instantaneous power dissipated through a resistor of resistance 10 ohm if it is connected to an AC source of frequency 15 Hz at 1/180 sec if peak value is 20 V? (UHS MDCAT 2018)

A	10 W	B	100 W
C	40 W	D	Cannot be determined

Solution: (a) At $t = 1/180\,\text{s}$ the phase is 30°, so $v = 10\,\text{V}$ and $P = v^2/R$ is 10 W.

MCQ 12.2.6 Tuning a radio is a best example of: (UHS MDCAT 2016)

A	Natural resonance	B	Mechanical resonance
C	Free resonance	D	Electrical resonance

Solution: (d) A radio is tuned by matching the natural frequency of its circuit to that of the station.

Topic 12.3 The Electromagnetic Spectrum

Past MDCAT Questions

MCQ 12.3.1 The wave that has the highest frequency & penetrating power is: (UHS MDCAT 2025)

A	X-rays	B	Ultraviolet rays
C	Gamma rays	D	Microwaves

Solution: (c) Gamma rays sit at the top of the electromagnetic spectrum in frequency and penetrate the most.

MCQ 12.3.2 Red light is used in photographic dark room because of: (SZABMU MDCAT 2023)

A	More frequency, less wavelength	B	Less frequency, less wavelength
C	Less frequency, more wavelength	D	More frequency, more wavelength

Solution: (c) Red is at the low frequency, long wavelength end, so its photons carry too little energy to expose the film.

MCQ 12.3.3 The direct exposure of sun light where ozone layer is depleted will cause: (PMC MDCAT 2022)

A	Skin cancer	B	Sugar
C	Corona	D	Sun burn

Solution: (a) The ozone layer absorbs the ultraviolet, and without it that radiation reaches the skin.

MCQ 12.3.4 In amplitude modulation what remains the same: (PMC MDCAT 2022)

A	Frequency of the wave	B	Amplitude of the wave
C	Wavelength of the wave	D	Intensity of waves

Solution: (a) In amplitude modulation the carrier frequency is held and only the amplitude is varied.

MCQ 12.3.5 In frequency modulation, which of the following property of the original signal does not change: (PMC MDCAT 2022)

A	Pitch	B	Frequency
C	Wavelength	D	Amplitude

Solution: (d) In frequency modulation the amplitude of the carrier is held steady and only its frequency is varied.

MCQ 12.3.6 Energy emitted in the form of visible radiation is called: (PMC MDCAT 2022)

A	Light energy	B	Sound energy
C	Tidal energy	D	Geothermal energy

Solution: (a) Radiation the eye can see is light.

MCQ 12.3.7 The electromagnetic radiation which moves with high frequency will have _____ wavelength: (PMC MDCAT 2022)

A	Short	B	Long
C	Unchanged	D	Variable

Solution: (a) $c = f\lambda$ is fixed, so a high frequency goes with a short wavelength.

MCQ 12.3.8 Microwave is: (PMC MDCAT 2022)

A	An electromagnetic wave	B	Sound wave
C	Longitudinal wave	D	Standing wave

Solution: (a) Microwaves lie between the radio waves and the infrared in the electromagnetic spectrum.

MCQ 12.3.9 The wavelength of the electromagnetic wave having frequency of 3 kHz will be? (UHS MDCAT 2019)

A	120 km	B	100 km
C	80 km	D	140 km

Solution: (b) $\lambda = c/f = 3 \times 10^8/3 \times 10^3$, that is $10^5\,\text{m}$, or 100 km.

Topic 13.1 The PN Junction and its Biasing

Past MDCAT Questions

MCQ 13.1.1 A diode characteristic curve is a plot between: (MDCAT 2024)

A	current and time	B	voltage and time
C	voltage and current	D	reverse voltage and forward voltage

Solution: (c) The characteristic curve of a diode plots the current through it against the voltage across it.

MCQ 13.1.2 Which of the following is NOT true about an LED? (UHS MDCAT 2017)

A	two wires, called leads, are attached to an LED	B	while connecting it in a circuit, the longer lead of the LED is always connected to the positive terminal of the battery
C	while connecting it in a circuit, the shorter lead of the LED is always connected to the positive terminal of the battery	D	an LED can be used to detect weak current

Solution: (c) The longer lead is the anode and goes to the positive terminal, so the statement about the shorter lead is the false one.

MCQ 13.1.3 Which of the following is false? (UHS MDCAT 2017)

A	in a p-type substance the majority charge carriers are holes	B	during forward biasing of a diode the width of the depletion region decreases
C	the leakage current is due to minority charge carriers	D	none of the given options

Solution: (d) All three statements are correct, so none of them is false.

MCQ 13.1.4 Which of the following act as a semiconductor? (NUMS MDCAT 2025)

A	Iron	B	Silicon
C	Zinc	D	Tungsten

Solution: (b) Silicon is the tetravalent element of which most semiconductor devices are made.

MCQ 13.1.5 The current in forward biased PN junction is mainly due to: (SZABMU MDCAT 2025)

A	Majority carriers	B	Minority carriers
C	leakage carrier	D	Thermionic emission

Solution: (a) Forward bias narrows the barrier, so the majority carriers cross in numbers.

MCQ 13.1.6 When the PN junction is reverse-biased, its reverse current is of the order of: (KMU MDCAT 2024)

A	Gigamperes	B	Kiloamperes
C	Megaamperes	D	Microamperes

Solution: (d) Reverse bias leaves only the small leakage of the minority carriers, of the order of microamperes.

MCQ 13.1.7 Q.168 When the temperature of semiconductor suddenly drops to zero kelvin, then a semiconductor acts as: (UHS MDCAT 2023)

A	Conductor	B	Semi-conductor
C	Super conductor	D	Insulator

Solution: (d) At absolute zero no electron has the energy to cross the gap, so no charge can move.

MCQ 13.1.8 Transistors can be used as: (PMC MDCAT 2022)

A	Half-wave rectifier	B	Full-wave rectifier
C	Photocell	D	Switch

Solution: (d) A transistor can be driven fully on or fully off, which makes it a switch.

MCQ 13.1.9 Which of the following is not true about LEDs? (UHS MDCAT 2017)

A	There are two wires (called leads) attached to an LED	B	While connecting to a circuit, the longer lead of LED is always connected to the positive terminal of the battery
C	While connecting to a circuit, the shorter lead of LED is always connected to the positive terminal of the battery	D	LED can be used to detect weak current

Solution: (c) The long lead is the anode and goes to the positive terminal, so the third statement is the false one.

Topic 13.2 Rectification

Past MDCAT Questions

MCQ 13.2.1 The conversion of A.C. into D.C. is called rectification and the circuit is called a rectifier. Which component of electronics acts as a rectifier? (MDCAT 2024)

A	diode	B	transistor
C	transformer	D	inductor

Solution: (a) A diode conducts in one direction only, which is what rectification needs.

MCQ 13.2.2 Full wave rectification is given by: (MDCAT 2024)

A	one diode connected in a bridge type arrangement	B	two diodes connected in a bridge type arrangement
C	three diodes connected in a bridge type arrangement	D	four diodes connected in a bridge type arrangement

Solution: (d) The bridge rectifier uses four diodes, so both halves of the cycle drive the load the same way.

MCQ 13.2.3 In a full-wave rectifier using two diodes, the diodes: (KMU MDCAT 2025)

A	DI and D2 operate:	B	Simultaneously during both half-cycles
C	In alternate switching mode	D	Only when both ends of transformer are positive

Solution: (c) Each diode conducts on the half cycle that makes its end of the secondary positive, so they take turns.

MCQ 13.2.4 The process of converting AC into pulsating DC is called: (NUMS MDCAT 2025)

A	Amplification	B	Modulation
C	Rectification	D	Filtration

Solution: (c) Rectification is the conversion of alternating current into a direct current that flows one way only.

MCQ 13.2.5 The conversion of A.C into D.C is called rectification and circuit is called rectifier. Which component of electronics acts as a rectifier? (UHS MDCAT 2024)

A	Diode	B	Transistor
C	Transformer	D	Inductor

Solution: (a) A diode passes current one way only, which is what rectification needs.

MCQ 13.2.6 **For rectification, transformer used is: (NUMS MDCAT 2024)**

A	With low input voltage	**B**	With low input resistance
C	Step up	**D**	Step down

Solution: (d) A rectifier works on a low voltage, so the mains is stepped down first.

MCQ 13.2.7 **A process in which only one half of alternating current is converted into direct current is called: (SZABMU MDCAT 2023)**

A	Full wave rectification	**B**	Amplification
C	Half wave rectification	**D**	Magnification

Solution: (c) A single diode passes only the half cycles of one sign, which is half wave rectification.

MCQ 13.2.8 **Efficiency of full wave rectifier circuit is almost_____than half wave rectifier circuit: (SZABMU MDCAT 2023)**

A	Four times	**B**	Same as
C	Sixteen times	**D**	Double

Solution: (d) Both half cycles are used instead of one, so the output is about twice as effective.

MCQ 13.2.9 **The conversion of alternating current into direct current is called rectification and circuit is called rectifier. Which component of electronics acts as a rectifier? (SZABMU MDCAT 2023)**

A	Diode	**B**	Transistor
C	Transformer	**D**	Inductor

Solution: (a) A diode passes current one way only, which is what rectification needs.

MCQ 13.2.10 **A device that converts AC into DC is called: (NUMS MDCAT 2023)**

A	Diode	**B**	Transistor
C	Capacitor	**D**	Inductor

Solution: (a) A diode passes current one way only, so it turns alternating into direct current.

MCQ 13.2.11 **The conversion of alternating current into direct current is called: (NUMS MDCAT 2023)**

A	Amplification	**B**	Rectification
C	Magnification	**D**	Resolution

Solution: (b) That process is rectification.

MCQ 13.2.12 **In full wave rectification, _____ diodes are used. (NUMS MDCAT 2023)**

A	1	**B**	2
C	3	**D**	4

Solution: (d) A bridge rectifier uses four diodes, two conducting on each half cycle.

MCQ 13.2.13 **Which of the following rectifier uses wheatstone bridge to rectify signal: (PMC MDCAT 2022)**

A	Half wave	**B**	Full wave
C	Bridge	**D**	Both half and full wave

Solution: (c) A bridge rectifier is four diodes in a Wheatstone arrangement.

MCQ 13.2.14 **Most widely used rectifier is: (PMC MDCAT 2022)**

A	Half wave rectifier	**B**	Full wave rectifier
C	Bridge rectifier	**D**	Loop rectifier

Solution: (c) The bridge rectifier needs no centre-tapped transformer, so it is the one usually used.

MCQ 13.2.15 **A full wave rectifier passes _____ into positive cycles: (PMC MDCAT 2022)**

A	Lower half cycle	**B**	Upper half cycle
C	Both lower and upper half cycles	**D**	One quarter cycle

Solution: (c) A full wave rectifier turns both half cycles the same way up.

MCQ 13.2.16 **Ripple factor of half wave rectifier Is: (PMC MDCAT 2022)**

A	1.21	**B**	0.8
C	0.6	**D**	0.4

Solution: (a) The ripple factor of a half wave rectifier is 1.21.

MCQ 13.2.17 **Q.72 A device that converts AC into DC is called: (NUMS MDCAT 2022)**

A	Diode	**B**	Transistor
C	Capacitor	**D**	Inductor

Solution: (a) A diode passes current one way only.

MCQ 13.2.18 **Q.73 The conversion of alternating current into direct current is called: (NUMS MDCAT 2022)**

A	Amplification	**B**	Rectification
C	Magnification	**D**	Resolution

Solution: (b) That process is rectification.

MCQ 13.2.19 **Which of the following are component of half wave rectifier? (PMC Practice 2021)**

A	Transformer	**B**	Load resistance
C	Power supply	**D**	All of the above

Solution: (d) A half wave rectifier is a transformer, a diode and a load resistance fed from the supply.

MCQ 13.2.20 **The basic purpose of filter is to? (PMC Practice 2021)**

A	Minimize variation in ac signal	**B**	Suppress hannonics in rectified output
C	Remove ripples from the rectified output	**D**	Stabilize dc output voltage

Solution: (c) A filter smooths the rectified output by charging on the peaks and discharging between them.

MCQ 13.2.21 **In which rectifier is the ripple factor less? (PMC Practice 2021)**

A	Full wave	**B**	Half wave
C	Both A and B	**D**	None of them

Solution: (a) A full wave rectifier uses both half cycles, so its output is far smoother.

MCQ 13.2.22 **A full wave rectifier is operating from 50 Hz mains. Fundamental frequency of ripple will be: (PMC Practice 2021)**

A	100 Hz	**B**	25 Hz
C	50 Hz	**D**	200 Hz

Solution: (a) Both half cycles give a pulse, so the ripple runs at twice the mains frequency.

MCQ 13.2.23 **The bridge rectifier is preferred to an ordinary two diode full-wave rectifier because? (PMC Practice 2021)**

A	It needs a much smaller transformer for the same output	**B**	No center tap required
C	Less PIV rating per diode	**D**	All of the above options are correct

Solution: (d) It needs no centre tap, uses a smaller transformer and puts a lower reverse voltage on each diode.

MCQ 13.2.24 **If a half-wave rectifier is used to convert 50 Hz AC into DC, then the number of pulses present in the rectifier voltage is: (PMC Practice 2021)**

A	25	B	50
C	100	D	75

Solution: (b) Only one half cycle in each is passed, so there are fifty pulses a second.

MCQ 13.2.25 **In a centre tap full-wave rectifier, if Vm is the peak voltage across the secondary coil of a transformer, the maximum voltage across the reverse bias is: (PMC Practice 2021)**

A	Vm	B	Vm/√2
C	2Vm	D	Vm/3

Solution: (c) The idle diode sees the whole secondary, so it must stand $2V_m$ in reverse.

MCQ 13.2.26 **In a full-wave rectification, the number of diodes used are: (PMC MDCAT 2020)**

A	1	B	2
C	3	D	4

Solution: (d) A bridge rectifier uses four diodes.

MCQ 13.2.27 **PIV stands for : (PMC MDCAT 2020)**

A	Positive inverse voltage	B	Pawn Bh Integrated voltage
C	Peak inverse voltage	D	Peak integrated voltage

Solution: (c) PIV is the peak inverse voltage a diode must stand when it is not conducting.

MCQ 13.2.28 **The direction of current through the load resistance of a full-wave rectification circuit: (UHS MDCAT 2019)**

A	remains constant	B	inverts for positive cycle
C	changes for every cycle	D	inverts for negative cycle

Solution: (a) Both half cycles are turned the same way up, so the current through the load never reverses.

MCQ 13.2.29 **In case of half wave rectification the resistance of diode during negative half of A.C is: (UHS MDCAT 2018)**

A	Very high	B	Very low
C	A few ohms	D	Negative

Solution: (a) On the reverse half cycle the diode is reverse biased, so its resistance is enormous.

Unit 14 Dawn of Modern Physics

Topic 14.1 Quantum Theory and Photons

Past MDCAT Questions

MCQ 14.1.1 **The process of ejection of loosely bound electrons from a photosensitive surface by the absorption of photons is called: (MDCAT 2022)**

A	the Compton effect	B	the photoelectric effect
C	pair production	D	black body radiation

Solution: (b) One photon gives its whole energy to one electron and ejects it, which is the photoelectric effect.

MCQ 14.1.2 **In a photoelectric effect experiment, the stopping potential is: (MDCAT 2022)**

A	the kinetic energy of the most energetic electron ejected	B	the potential energy of the most energetic electron ejected
C	the photon energy	D	the electric potential that causes the electron current to vanish

Solution: (d) It is the reverse potential at which even the fastest photoelectron is turned back, so the current falls to zero.

MCQ 14.1.3 **The value of Planck's constant is: (MDCAT 2024)**

A	$6.63 \times 10^{-34}\,\mathrm{J\,s}$	B	$6.63 \times 10^{34}\,\mathrm{J\,s}$
C	$6.63 \times 10^{-24}\,\mathrm{J\,s}$	D	$6.63 \times 10^{-34}\,\mathrm{J\,s^{-1}}$

Solution: (a) $h = 6.63 \times 10^{-34}\,\mathrm{J\,s}$, and $E=h

MCQ 14.1.4 **Light propagates in space as a wave, as is evident by all of the following EXCEPT: (MDCAT 2024)**

A	interference	B	photoelectric effect
C	diffraction	D	polarization

Solution: (b) The photoelectric effect is the evidence for the particle model of light, not for the wave model.

MCQ 14.1.5 **If light whose photons carry an energy of $2.4\,\mathrm{eV}$ is used, the stopping potential required will be: (UHS MDCAT 2017)**

A	$2.4\,\mathrm{V}$	B	$2.6\,\mathrm{V}$
C	$2.5\,\mathrm{V}$	D	$0\,\mathrm{V}$

Solution: (a) Taking the whole photon energy as the maximum kinetic energy, $eV_o = 2.4\,\mathrm{eV}$, so $V_o = 2.4\,\mathrm{V}$.

MCQ 14.1.6 **The de Broglie wavelength of a particle of mass $1\,\mathrm{g}$ moving with a velocity of $100\,\mathrm{m\,s^{-1}}$ is: (UHS MDCAT 2017)**

A	$6.63 \times 10^{-35}\,\mathrm{m}$	**B**	$6.63 \times 10^{-34}\,\mathrm{m}$
C	$6.63 \times 10^{-33}\,\mathrm{m}$	**D**	$6.63 \times 10^{-32}\,\mathrm{m}$

Solution: (c) $\lambda = \dfrac{h}{mv} = \dfrac{6.63 \times 10^{-34}}{10^{-3} \times 100} = 6.63 \times 10^{-33}\,\mathrm{m}$.

MCQ 14.1.7 **The energy of a quantum is given by which equation? (KMU MDCAT 2025)**

A	E = mc^2	**B**	E = hf
C	E = 1/2 mv^2	**D**	E = qV

Solution: (b) Planck's relation gives the energy of one quantum as $E = hf$.

MCQ 14.1.8 **In photoelectric effect, stopping potential depends upon: (NUMS MDCAT 2025)**

A	Intensity of light	**B**	Frequency of light
C	Speed of light	**D**	Amplitude of light

Solution: (b) The stopping potential measures the maximum kinetic energy, which depends on the frequency alone.

MCQ 14.1.9 **If different colored light beams have same total energy, which color beam will contain the smallest number of photons? (SZABMU MDCAT 2025)**

A	Violet	**B**	Blue
C	Green	**D**	Red

Solution: (a) Violet photons carry the most energy each, so the fewest of them are needed to make up the same total.

MCQ 14.1.10 **According to the particle model of light, a photon is: (SZABMU MDCAT 2025)**

A	A particle with mass and charge	**B**	A quantum of energy with zero rest mass and zero charge
C	A continuous energy wave	**D**	A particle that travels slower than light

Solution: (b) A photon is a packet of energy with no rest mass and no charge.

MCQ 14.1.11 **The value of Planck constant is (UHS MDCAT 2024)**

A	6.63x10^-34 Js	**B**	6.63x10^34 Js
C	6.63x10-34 Js-1	**D**	6.63x10^34 Js-1

Solution: (a) Planck's constant is $6.63 \times 10^{-34}\,\mathrm{J\,s}$.

MCQ 14.1.12 **The de-Broglie wavelength associated with a particle moving at 10^6 m/s and having mass 10^-30 kg (UHS MDCAT 2024)**

A	6.6x10^-10 m	**B**	1.5x10^9 m
C	1.9x10^-5 m	**D**	7.2x10^-8 m

Solution: (a) $\lambda = h/mv = 6.63 \times 10^{-34}/(10^{-30} \times 10^{6})$, which is $6.6 \times 10^{-10}\,\mathrm{m}$.

MCQ 14.1.13 **Light propagates through space as a wave is evident by all of the following EXCEPT (UHS MDCAT 2024)**

A	Interference	**B**	Photoelectric effect
C	Diffraction	**D**	Polarization

Solution: (b) Interference, diffraction and polarization are wave effects; the photoelectric effect is what showed light to be particulate.

MCQ 14.1.14 **The momentum of moving photon is: (KMU MDCAT 2024)**

A	mc^2	**B**	λ / h
C	h / λ	**D**	zero

Solution: (c) A photon has no mass, but it carries momentum h/λ.

MCQ 14.1.15 **In every instant of time, wavelength associated with a freely falling body: (KMU MDCAT 2024)**

A	Decreases	**B**	Increases two times
C	Increases four times	**D**	Remains constant

Solution: (a) It falls faster and faster, and $\lambda = h/mv$ shrinks as the speed grows.

MCQ 14.1.16 **As per 2nd photoelectric experiment, photoelectric effect does not occur if the frequency of the incident light is? (KMU MDCAT 2024)**

A	Below the threshold frequency	**B**	Equals the threshold frequency
C	Three times the threshold frequency	**D**	Twice the threshold frequency

Solution: (a) Below the threshold no photon carries enough energy to free an electron, however bright the light.

MCQ 14.1.17 **Q.169 If electron, proton, neutron, and alpha particle have same velocity, which of them has the shortest wavelength? (UHS MDCAT 2023)**

A	Electron	**B**	Proton
C	Neutron	**D**	Alpha particle

Solution: (d) At the same speed the alpha particle has much the largest momentum, and $\lambda = h/mv$ is smallest for it.

MCQ 14.1.18 **Q.170 The process of ejection of loosely bound electrons from a certain photo sensitive surface by absorption of photon is called: (UHS MDCAT 2023)**

A	Compton effect	**B**	Photoelectric effect
C	Pair production	**D**	Black body radiation

Solution: (b) That is the photoelectric effect.

MCQ 14.1.19 **Q.171 In a photoelectric effect experiment, the stopping potential is: (UHS MDCAT 2023)**

A	The kinetic energy of the most energetic electron ejected	**B**	The potential energy of the most energetic electron ejected
C	The photon energy	**D**	The electric potential that causes the electron current to vanish

Solution: (d) The stopping potential is the reverse voltage at which even the fastest electron fails to reach the anode.

MCQ 14.1.20 **Which photons carries the most energy? (SZABMU MDCAT 2023)**

A	Blue	**B**	Violet
C	Red	**D**	Green

Solution: (b) Energy is hf, and violet has the highest frequency of the four.

MCQ 14.1.21 **Wave nature and particle nature of photon is linked by: (PMC MDCAT 2022)**

A	Rest mass of photon	**B**	Wavelength of photon
C	Light speed	**D**	Momentum of photon

Solution: (d) $p = h/\lambda$ ties the momentum of the particle to the wavelength of the wave.

MCQ 14.1.22 **The word radiation means: (PMC MDCAT 2022)**

A	To propagate	**B**	stay at rest
C	Mass less objects	**D**	Charged object

Solution: (a) To radiate is to send energy out through space.

MCQ 14.1.23 **If the temperature of Sun is doubled, heat energy reached on earth become: (PMC MDCAT 2022)**

A	Three Times	**B**	Sixteen Times
C	Four Times	**D**	Same

Solution: (b) By Stefan's law the power radiated goes as T^4, so twice the temperature is sixteen times the energy.

MCQ 14.1.24 **A body at temperature T radiates heat according to relation: (PMC MDCAT 2022)**

A	T2	**B**	T4
C	T-4	**D**	T-3

Solution: (b) Stefan's law gives the radiated power as proportional to the fourth power of the temperature.

MCQ 14.1.25 **Photons of energy 10.25 eV fall on the surface of the metal emitting photoelectrons of maximum kinetic energy 5.0 eV. What is the stopping voltage required for these electrons? (PMC MDCAT 2022)**

A	10V	**B**	8V
C	5V	**D**	4V

Solution: (c) The stopping potential is the maximum kinetic energy in electron volts, that is $5\,\mathrm{V}$.

MCQ 14.1.26 **Blackbody shows a _____ spectra: (PMC MDCAT 2022)**

A	Continuous	**B**	Discrete
C	Band	**D**	Line

Solution: (a) A hot body radiates at every wavelength, so its spectrum is continuous.

MCQ 14.1.27 **Planck's constant is analogous to: (PMC MDCAT 2022)**

A	Inertia	**B**	Wave nature
C	Angular momentum	**D**	Linear momentum

Solution: (c) Planck's constant has the units of energy times time, which are the units of angular momentum.

MCQ 14.1.28 **Among the following four spectral regions, which photon has the highest energy? (PMC MDCAT 2022)**

A	Infrared	**B**	Violet
C	Blue	**D**	red

Solution: (b) Energy is hf, and violet has the highest frequency of the four.

MCQ 14.1.29 **Planck constant is named after: (PMC MDCAT 2022)**

A	Einstein	**B**	Newton
C	Maxwell	**D**	Max planck

Solution: (d) It is named after Max Planck, who introduced it in 1900.

MCQ 14.1.30 **The black body always __ radiations: (PMC MDCAT 2022)**

A	Emit	**B**	Absorb
C	Both Emit And Absorb	**D**	Reflects

Solution: (c) A black body is a perfect absorber and, at the same temperature, a perfect emitter.

MCQ 14.1.31 **Photocell is based on: (PMC MDCAT 2022)**

A	Photoelectric effect	**B**	Compton effect
C	Photoluminescence	**D**	Pair production

Solution: (a) Light falling on the cathode of a photocell frees electrons, which is the photoelectric effect.

MCQ 14.1.32 **Work function depends on: (PMC Practice 2021)**

A	Structure of metals only	**B**	Nature of surface only
C	Both metals and nature of surface	**D**	Threshold frequency

Solution: (c) The work function is the energy needed to free an electron, and that depends on the metal and on the state of its surface.

MCQ 14.1.33 **Momentum of a photon is? (PMC Practice 2021)**

A	0	**B**	λ
C	hf/c	**D**	mv

Solution: (c) A photon carries momentum E/c, that is hf/c.

MCQ 14.1.34 **What is the de Broglie wavelength associated with an electron, accelerated through a potential difference of 200 volts? (PMC Practice 2021)**

A	1 nm	**B**	0.5 nm
C	0.0056 nm	**D**	0.086 nm

Solution: (d) $\lambda = 12.27/\sqrt{V}$ ångström, and $\sqrt{200}$ gives about $0.087\,\mathrm{nm}$.

MCQ 14.1.35 **The wavelength associated with an electron is of the order of: (PMC MDCAT 2020)**

A	Visible light	**B**	X rays
C	Radio waves	**D**	Infrared

Solution: (b) An accelerated electron has a wavelength of about an ångström, the wavelength of X-rays.

MCQ 14.1.36 **Which photon carries the most energy? (PMC MDCAT 2020)**

A	Blue	**B**	Violet
C	Red	**D**	Green

Solution: (b) Energy is hf, and violet has the highest frequency of the four.

MCQ 14.1.37 **The value and units of the Planck constant 'h' can be expressed as: (UHS MDCAT 2019)**

A	3.63 x 10-34 Js	**B**	6.63 x 10-34 Js-1
C	6.63 x 10-34 Js	**D**	6.63 x 10-43 Js

Solution: (c) Planck's constant is $6.63 \times 10^{-34}\,\mathrm{J\,s}$.

MCQ 14.1.38 **Minimum energy required to eject an electron from metal surface is called: (UHS MDCAT 2019)**

A	Stopping potential	**B**	Electromotive force
C	Work function	**D**	Threshold frequency

Solution: (c) That least energy is the work function of the metal.

MCQ 14.1.39 **Calculate the energy of a photon, with a frequency of 3.0 x 1018 Hz. (UHS MDCAT 2019)**

A	19.89 x 10-16 J	**B**	11.89 x 10-16 J
C	1.89 x 10-16 J	**D**	19.89 x 10-18 J

Solution: (a) $E = hf = 6.63 \times 10^{-34} \times 3.0 \times 10^{18}$, that is $19.89 \times 10^{-16}\,\mathrm{J}$.

MCQ 14.1.40 **A 5 watt LED bulb converts 80% of the power into light photons wavelength 660 nm. What is the number of photons emitted from the bulb in one second. (UHS MDCAT 2018)**

A	5.8 x 1034	**B**	7.5 x 1018
C	6.6 x 107	**D**	1.3 x 1019

Solution: (d) $4\,\mathrm{W}$ of light with photons of $hc/\lambda = 3.0 \times 10^{-19}\,\mathrm{J}$ gives about 1.3×10^{19} photons a second.

MCQ 14.1.41 **Light photons, each of energy 3.5 x 10-19J falls on the cathode of a photocell. The current through the cell is reduced to zero by taking the cathode to a potential +0.25 V relative to anode. The work function of the cathode is: (UHS MDCAT 2018)**

A	3.35 x 10-19J	**B**	3.5 x 10-19J
C	3.25 x 10-19J	**D**	3.1 x 10-19J

Solution: (d) $W = hf - eV_s = 3.5 \times 10^{-19} - 1.6 \times 10^{-19} \times 0.25$, that is $3.1 \times 10^{-19}\,\mathrm{J}$.

MCQ 14.1.42 **The de Broglie wavelength of an electron travelling with a speed of 1.0 x 107m/s is equal to, (h=6.6 x 10-34 Js and me= 9.1 x 10-31 kg) (UHS MDCAT 2018)**

A	7.3 x 1011m	**B**	7.3 x 108m
C	7.3 x 10-11m	**D**	7.3 x 10-13m

Solution: (c) $\lambda = h/mv = 6.6 \times 10^{-34}/(9.1 \times 10^{-31} \times 10^{7})$, about $7.3 \times 10^{-11}\,\mathrm{m}$.

MCQ 14.1.43 **If we use a light of photons having energy 2.4 eV then the stopping potential required will be: (UHS MDCAT 2017)**

A	2.4 V	**B**	2.6 V
C	2.5 V	**D**	0 V

Solution: (a) With no work function to subtract the stopping potential would be the full $2.4\,\mathrm{V}$.

MCQ 14.1.44 **The de Broglie wavelength of a particle of mass 1 gram and velocity 100 ms-1 is: (UHS MDCAT 2017)**

A	6.63 x 10-35	**B**	6.63 x 10-34
C	6.63 x 10-33	**D**	6.63 x 10-32

Solution: (c) $\lambda = h/mv = 6.63 \times 10^{-34}/(10^{-3} \times 100)$, that is $6.63 \times 10^{-33}\,\mathrm{m}$.

MCQ 14.1.45 **When light has exactly the same energy as the work done function of a metal surface then: (UHS MDCAT 2017)**

A	No photoelectrons are produced	**B**	No photoelectric effect is observed
C	No photo electric current is produced	**D**	All of these options are correct

Solution: (c) The electrons are just freed with no energy to spare, so none reaches the anode and no current flows.

Unit 15 Atomic Spectra

Topic 15.1 Atomic Spectra

Past MDCAT Questions

MCQ 15.1.1 **The line spectrum of the hydrogen atom contains spectral lines in the region of: (MDCAT 2022)**

A	ultraviolet	**B**	infrared
C	visible	**D**	all of these

Solution: (d) The Lyman series is ultraviolet, the Balmer series visible and the Paschen and later series infrared.

MCQ 15.1.2 **The speed of an electron in the first Bohr orbit is: (MDCAT 2022)**

A	$2.19 \times 10^{5}\,\mathrm{m\,s^{-1}}$	**B**	$2.19 \times 10^{6}\,\mathrm{m\,s^{-1}}$
C	$2.19 \times 10^{7}\,\mathrm{m\,s^{-1}}$	**D**	$2.19 \times 10^{8}\,\mathrm{m\,s^{-1}}$

Solution: (b) The first orbit speed is about $2.19 \times 10^{6}\,\mathrm{m\,s^{-1}}$, roughly one hundredth of the speed of light.

MCQ 15.1.3 **Which of the following is the longest wavelength available for the Paschen series? (MDCAT 2023)**

A	$1.87 \times 10^{8}\,\mathrm{m}$	**B**	$1.87 \times 10^{8}\,\mathrm{m^{-1}}$
C	$1.87 \times 10^{-6}\,\mathrm{m}$	**D**	$1.87 \times 10^{-6}\,\mathrm{m^{-1}}$

Solution: (c) The longest wavelength of a series comes from its smallest energy step, $n = 4 \to 3$, and is about 1.87×10^{-6} m, in the infrared.

MCQ 15.1.4 **Which series falls in the ultraviolet region? (MDCAT 2024)**

A	Lyman	**B**	Brackett
C	Pfund	**D**	Paschen

Solution: (a) The Lyman series ends on $n = 1$ and its photons are the most energetic, in the ultraviolet.

MCQ 15.1.5 **The potential through which an electron should be accelerated so that on collision it can lift an electron in an atom from its ground state to some higher state is known as the: (MDCAT 2024)**

A	ionization potential	**B**	excitation potential
C	string potential	**D**	acceleration potential

Solution: (b) Raising an electron to a higher level rather than removing it altogether needs the excitation potential.

MCQ 15.1.6 **Which of the following X-rays has the largest intensity? (UHS MDCAT 2017)**

A	K_α X-ray	**B**	K_β X-ray
C	K_γ X-ray	**D**	all of these have the same intensity

Solution: (a) The jump from the nearest shell is the most probable one, so the K_α line is the strongest.

MCQ 15.1.7 **The hardest photon coming out of a Coolidge tube belongs to: (UHS MDCAT 2017)**

A	characteristic X-rays	**B**	continuous X-rays
C	both characteristic and continuous X-rays	**D**	none of the options given

Solution: (b) The most energetic photon is the one emitted when an electron loses all its energy in a single stop, which is the short wavelength limit of the continuous spectrum.

MCQ 15.1.8 **The Balmer series of hydrogen spectrum appears in the (UHS MDCAT 2025)**

A	Infrared region	**B**	Ultraviolet region
C	X-ray region	**D**	Visible region

Solution: (d) The Balmer lines end on the second level and fall in the visible part of the spectrum.

MCQ 15.1.9 **In hydrogen spectrum, the Brackett series lies in (KMU MDCAT 2025)**

A	Ultraviolet region	**B**	Visible region
C	Infrared region	**D**	X ray region

Solution: (c) The Brackett lines end on the fourth level, and their photons fall in the infrared.

MCQ 15.1.10 **Which of the following spectrum is produced when atoms are in the gaseous state? (NUMS MDCAT 2025)**

A	Continuous spectrum	**B**	Band spectrum
C	Line spectrum	**D**	Absorption spectrum

Solution: (c) Free atoms of a gas emit at sharply defined frequencies, so the spectrum is a set of lines.

MCQ 15.1.11 Quantized momentum was explained by: (NUMS MDCAT 2025)

A	Einstein	**B**	Bohr
C	de-Broglie	**D**	Rutherford

Solution: (b) Bohr postulated that the angular momentum of the orbiting electron is a whole multiple of $h/2\pi$.

MCQ 15.1.12 The spectra obtained by absorption or emission of radiation by atoms of the gas: (NUMS MDCAT 2025)

A	Atomic spectra	**B**	Molecular spectra
C	Band spectra	**D**	Continuous spectra

Solution: (a) Spectra given out or taken up by free atoms are atomic spectra.

MCQ 15.1.13 Two spectral lines in the Hydrogen atom spectrum are close together. This likely means: (SZABMU MDCAT 2025)

A	The energy difference is zero	**B**	The energy difference is small
C	The light intensity is low	**D**	The atom become unstable

Solution: (b) Photon energy sets the frequency, so lines close together come from levels close in energy.

MCQ 15.1.14 Which series falls in ultra violet region? (UHS MDCAT 2024)

A	Lyman	**B**	Brachett
C	Pfund	**D**	Paschen

Solution: (a) The Lyman lines end on the ground level, and their photons are ultraviolet.

MCQ 15.1.15 The potential through which an electron should be accelerated , so that,on collision it can lift the electron in the atom from its ground state to some higher state is known as (UHS MDCAT 2024)

A	Ionization potential	**B**	Excitation potential
C	String potential	**D**	Acceleration potential

Solution: (b) The potential that just lifts an electron to a higher level is the excitation potential.

MCQ 15.1.16 Which of the following regarding X Rays is INCORRECT (UHS MDCAT 2024)

A	Have higher wavelength than visible light	**B**	They are part of electromagnetic spectrum
C	They are highly penetrating in soft body tissues	**D**	They are high energy photons

Solution: (a) X-rays have a far shorter wavelength than visible light, which is why they carry so much energy.

MCQ 15.1.17 If an electron in the hydrogen atom jumps from second to first orbit, the emitted radiation has a wavelength of? (KMU MDCAT 2024)

A	4/3RH	**B**	3/4RH
C	RH	**D**	4RH

Solution: (a) $1/\lambda = R(1 - 1/4) = 3R/4$, so the wavelength is $4/3R$.

MCQ 15.1.18 Q.172 The line spectrum of hydrogen atom contains the spectral lines in the region of: (UHS MDCAT 2023)

A	ultraviolet	**B**	infrared
C	visible	**D**	all of these

Solution: (d) The Lyman lines are ultraviolet, the Balmer visible, and the rest infrared.

MCQ 15.1.19 Q.173 The speed of electron in the first Bohr orbit is: (UHS MDCAT 2023)

A	2.19 x 10^6 ms^-1	**B**	2.19 x 10^-6 ms^-1
C	2.19x 10^4 ms^-1	**D**	2.19 x 10^-4 ms^-1

Solution: (a) In the first Bohr orbit the electron moves at about $2.19 \times 10^6\,\mathrm{m\,s^{-1}}$.

MCQ 15.1.20 Which one of the following series lies in the ultraviolet region? (SZABMU MDCAT 2023)

A	Balmer series	**B**	Paschen series
C	Lyman series	**D**	Bracket series

Solution: (c) The Lyman lines end on the ground level and lie in the ultraviolet.

MCQ 15.1.21 Which x-ray photon will have longest wavelength? (SZABMU MDCAT 2023)

A	Kα	**B**	Kβ
C	Kγ	**D**	Mα

Solution: (a) The K alpha line comes from the smallest energy drop of the K series, so its wavelength is the longest.

MCQ 15.1.22 The Balmer series of hydrogen is important because it: (UHS MDCAT 2023)

A	Is the only one for which the quantum theory can be used	**B**	Is the only series that occurs for hydrogen
C	Is in the visible region	**D**	Involves the lowest possible quantum number n

Solution: (c) The Balmer lines end on the second level, and they are the ones the eye can see.

MCQ 15.1.23 X-ray is the reverse process of: (PMC MDCAT 2022)

A	Pair production	**B**	Compton effect
C	Photoelectric effect	**D**	Annihilation

Solution: (c) In the photoelectric effect a photon frees an electron; in X-ray production a stopped electron makes a photon.

MCQ 15.1.24 Where does the energy lost by fast moving electron go: (PMC MDCAT 2022)

A	Appears as photon	**B**	Appears as electrom - positron pair
C	Appears as its k.e.	**D**	It vanishes

Solution: (a) A fast electron stopped suddenly gives up its energy as an X-ray photon.

MCQ 15.1.25 Lasers are produced by: (PMC MDCAT 2022)

A	Stimulated emission	**B**	Spontaneous emission
C	Absorption	**D**	Random Absorption

Solution: (a) A laser works by stimulated emission, which is what makes its light coherent.

MCQ 15.1.26 Bright Lines in pattern shows: (PMC MDCAT 2022)

A	Absorption	**B**	Emission
C	Reflection	**D**	Free particle

Solution: (b) Bright lines are made by atoms giving out photons, that is by emission.

MCQ 15.1.27 When electron absorbs a photon and jumps to higher states it is called: (PMC MDCAT 2022)

A	De-excitation	**B**	Excitation
C	Emission	**D**	Conversion

Solution: (b) Absorbing a photon lifts the electron to a higher level, which is excitation.

MCQ 15.1.28 X rays are also known as: (PMC MDCAT 2022)

A	Low energy invisible photons	**B**	High energy visible photons
C	High energy invisible photons	**D**	Low energy visible photons

Solution: (c) X-rays are photons far beyond the violet in energy, and the eye cannot see them.

MCQ 15.1.29 **Spectral lines is like a –– of absorbed or emission energy in a spectrum: (PMC MDCAT 2022)**

A	Charged Pattern	**B**	Fingerprint Pattern
C	Discharged Pattem	**D**	Scattered Pattern

Solution: (b) Every element has its own set of lines, so the spectrum identifies it as a fingerprint would.

MCQ 15.1.30 **The source of x-rays generation is: (PMC Practice 2021)**

A	Cu	**B**	H
C	Na	**D**	Al

Solution: (a) A heavy metal target such as copper or tungsten stops the electrons and gives out X-rays.

MCQ 15.1.31 **The fast-moving electrons stopped by a heavy metallic target in an evacuated glass tube, give rise to the production of: (PMC Practice 2021)**

A	α- particles	**B**	X-rays
C	Laser	**D**	β-particles

Solution: (b) Fast electrons stopped by a heavy target give out X-rays.

MCQ 15.1.32 **Which one of them is a type of emission? (PMC Practice 2021)**

A	Spontaneous	**B**	Stimulated
C	Both Options A and B are correct	**D**	None of these options is correct

Solution: (c) An atom may drop of itself, which is spontaneous emission, or be triggered by a passing photon, which is stimulated.

MCQ 15.1.33 **Which of the following series lies in the ultraviolet range: (PMC MDCAT 2020)**

A	Balmer series	**B**	Pashcher series
C	Lyman series	**D**	Brackett series

Solution: (c) The Lyman lines end on the ground level and lie in the ultraviolet.

MCQ 15.1.34 **The main difference between X rays and Y rays is: (PMC MDCAT 2020)**

A	Frequency	**B**	Wave length
C	Energy	**D**	Origin

Solution: (d) X-rays come from the electron cloud and gamma rays from the nucleus; their wavelengths overlap.

MCQ 15.1.35 **The hardest photon coming out from a Coolidge tube belongs to: (UHS MDCAT 2017)**

A	Characteristic X-Rays	**B**	Continuous X-Rays
C	Characteristic & Continuous X-Rays	**D**	None of the options given

Solution: (a) The hardest photons come from the sharp characteristic lines, where an inner shell vacancy is filled.

MCQ 15.1.36 **The continuous spectrum of X-ray is formed due to: (UHS MDCAT 2016)**

A	Characteristics of X-rays	**B**	Bremsstrahlung X-ray
C	Soft X-ray	**D**	Hard X-ray

Solution: (b) Electrons braked by the target give up energy in any amount, so the background is continuous.

MCQ 15.1.37 **The shadow of the bones in X-rays photographic film appears lighter than the surrounding flesh due to: (UHS MDCAT 2016)**

A	Bones reflect greater amount of X-rays	**B**	Bones absorb less amount of X-rays
C	Bones absorb greater amount of X-rays	**D**	Bones totally reflect X-rays

Solution: (c) Bone contains calcium and absorbs the X-rays strongly, so less reaches the film behind it.

MCQ 15.1.38 **Wavelength of γ-rays is: (UHS MDCAT 2016)**

A	Equal to the X-rays	**B**	Longer to the X-rays
C	Shorter to the X-rays	**D**	Boarder to the X-rays

Solution: (c) Gamma rays come from the nucleus and carry more energy still, so their wavelength is the shorter.

MCQ 15.1.39 **The target of X-ray tube is made up of which metal? (UHS MDCAT 2016)**

A	Iron	**B**	Nickel
C	Brass	**D**	Tungsten

Solution: (d) Tungsten is used because it is dense and stands the heat.

MCQ 15.1.40 **The X-rays consists of: (UHS MDCAT 2016)**

A	High energy proton	**B**	High energy electrons
C	High energy γ-rays	**D**	High energy photons

Solution: (d) X-rays are electromagnetic radiation, that is photons of high energy.

Unit 16 Nuclear Physics

Topic 16.1 Composition of the Atomic Nucleus

Past MDCAT Questions

MCQ 16.1.1 **The protons in the nucleus of an atom DO NOT exit due to (UHS MDCAT 2025)**

A	Electromagnetic force	**B**	Gravitational Force
C	Weak Nuclear Force	**D**	Strong Nuclear Force

Solution: (b) Gravitation between protons is far too feeble to matter; it is the strong nuclear force that holds them.

MCQ 16.1.2 **Mass number A refers to _____ (KMU MDCAT 2024)**

A	Number of electrons	**B**	Number of nucleons
C	Number of neutrons	**D**	Number of protons

Solution: (b) The mass number counts the protons and neutrons together, that is the nucleons.

MCQ 16.1.3 **For two down quarks total charge is: (PMC MDCAT 2022)**

A	-2/3 e	**B**	-2 e
C	-1 e	**D**	-1/2 e

Solution: (a) A down quark carries $-\frac{1}{3}e$, so two of them carry $-\frac{2}{3}e$.

MCQ 16.1.4 **Naturally occuring fusion reaction source Is: (PMC MDCAT 2022)**

A	Moon	**B**	Sun
C	Earth	**D**	satellite

Solution: (b) Hydrogen fusing to helium is what keeps the Sun shining.

MCQ 16.1.5 **How many up quarks in proton: (PMC MDCAT 2022)**

A	1	**B**	2
C	3	**D**	4

Solution: (b) A proton is two up quarks and one down quark.

MCQ 16.1.6 Which particle has no charge (PMC MDCAT 2022)

A	Electrons	B	Proton
C	Neutron	D	Positron

Solution: (c) The neutron carries no charge.

MCQ 16.1.7 The total mass of protium deuterium and tritium is _____ more than three H atoms. (PMC Practice 2021)

A	3 neutrons	B	3 protons
C	3 electrons	D	None of these

Solution: (a) Deuterium carries one neutron and tritium two, so the three together have three more than three protium atoms.

MCQ 16.1.8 Mass and energy are related to each other by: (PMC Practice 2021)

A	Newton's law	B	Einstein's law
C	Coulomb's law	D	All of these options are correct

Solution: (b) Einstein's relation $E = mc^2$ ties mass to energy.

MCQ 16.1.9 According to Einstein, mass and energy are: (PMC Practice 2021)

A	Inversely proportional	B	Directly proportional
C	Equal to each other	D	None of these options is correct

Solution: (b) $E = mc^2$ makes the energy proportional to the mass.

MCQ 16.1.10 The nuclear forces are considered as? (PMC Practice 2021)

A	Strong force	B	Weak force
C	Electromagnetic force	D	All of these options are correct

Solution: (a) The nucleons are held by the strong nuclear force.

MCQ 16.1.11 Heavy nucleus of atoms go through fission so that they can: (UHS MDCAT 2019)

A	absorb low amount of energy	B	absorb high amount of energy
C	reduce their binding energy nucleon	D	increase their binding energy per nucleon

Solution: (d) The fragments lie nearer the peak of the binding energy curve, and the difference is released.

MCQ 16.1.12 What is the quark composition of a Proton? (UHS MDCAT 2019)

A	Two up quarks and one down quark	B	Two up quarks and one strange quark
C	One up quark and two strange quarks	D	Two down quarks and one up quark

Solution: (a) A proton is two up quarks and one down quark.

MCQ 16.1.13 What is the name of the energy which is released when an atom is formed from its constituent particles? (UHS MDCAT 2018)

A	Atomic Energy	B	Radioactive Energy
C	Nuclear Energy	D	Binding Energy

Solution: (d) The energy released when the nucleons come together is the binding energy.

Topic 16.2 Spontaneous and Random Nuclear Decay

Past MDCAT Questions

MCQ 16.2.1 It has been observed that thorium $^{234}_{90}\mathrm{Th}$ is transformed into protactinium $^{234}_{91}\mathrm{Pa}$ after the emission of a _____ particle. (MDCAT 2022)

A	alpha	B	beta
C	gamma	D	alpha and gamma together

Solution: (b) The mass number is unchanged and the atomic number rises by one, which is beta-minus decay.

MCQ 16.2.2 Which of the following has the maximum ionizing power? (UHS MDCAT 2017)

A	α	B	β
C	γ	D	neutron

Solution: (a) The alpha particle is the heaviest and carries two units of charge, so it ionizes most strongly and is stopped soonest.

MCQ 16.2.3 Stability of radioactivity element is determined by: (NUMS MDCAT 2025)

A	Decay constant	B	Rate of the radioactive decay
C	Time of decay	D	Number of radioactive nuclei

Solution: (a) The decay constant is the probability of decay per second, so the smaller it is the more stable the nuclide.

MCQ 16.2.4 The unit of decay constant is ; (UHS MDCAT 2024)

A	m	B	s
C	s-1	D	m-1

Solution: (c) The decay constant is a probability per second, so its unit is the reciprocal second.

MCQ 16.2.5 An artificial radioactive element can be made by bombarding (UHS MDCAT 2024)

A	High energy particles on unstable elements	B	Low energy particles on unstable elements
C	High energy particles on stable elements	D	Low energy particles on stable elements

Solution: (c) A stable nucleus struck by a fast particle is left in an unstable form that then decays.

MCQ 16.2.6 Q.175 It has been observed that Thorium (_90^234)Th is transformed into Protactinium (_91^234)Pa after the emission of _____ particle: (UHS MDCAT 2023)

A	Alpha	B	Beta
C	Gamma	D	Alpha, Beta, Gamma

Solution: (b) The mass number is unchanged and the atomic number rises by one, which is beta emission.

MCQ 16.2.7 Q.176 The half-life of Strontium (Sr) is 8.70 hours. Its decay constant is: (UHS MDCAT 2023)

A	0.000022 s	B	45000 /s
C	0.000022 / s	D	0.000032 / s

Solution: (c) $\lambda = 0.693/t_{1/2} = 0.693/(8.70 \times 3600)$, about $2.2 \times 10^{-5}\,\mathrm{s}^{-1}$.

MCQ 16.2.8 The decay rate of radioactive substance is: (UHS MDCAT 2023)

A	Constant with time	B	Varies inversely with time
C	Decreases exponentially with time	D	Decreases linearly with time

Solution: (c) The activity is proportional to the number left, and that falls exponentially.

MCQ 16.2.9 When gamma photon is entered in nucleus it_ _ : (PMC MDCAT 2022)

A	De-excite the nucleus	B	excite the nucleus
C	Scatter by nucleus	D	No effect on nucleus

Solution: (b) A gamma photon absorbed by a nucleus lifts it to a higher energy state.

MCQ 16.2.10 C-14 decays by emitting a beta particle. After decay new element becomes: (PMC MDCAT 2022)

A	C-13	B	N-14
C	O-15	D	O-16

Solution: (b) Beta emission leaves the mass number alone and raises the atomic number by one, giving nitrogen-14.

MCQ 16.2.11 **Which radiation will be deflected more by magnetic field? (PMC MDCAT 2022)**

A	α-radiation	**B**	β-radiation
C	x-rays	**D**	Electromagnetic radiation

Solution: (b) A beta particle is far lighter than an alpha, so the same force bends it much more.

MCQ 16.2.12 **Three types of radioactive elements are emitted when unstable nuclei undergo radioactive decay. Which of the following is not one of them? (PMC Practice 2021)**

A	Alpha	**B**	Beta
C	Gamma	**D**	Delta

Solution: (d) Radioactive decay gives alpha, beta and gamma radiation; there is no delta radiation.

MCQ 16.2.13 **When the nucleus of an unstable atom emits only gamma radiation, the nucleus must: (PMC Practice 2021)**

A	Gain energy	**B**	Lose energy
C	Lose protons	**D**	Gain protons

Solution: (b) A gamma photon carries energy away and leaves the same nucleus in a lower state.

MCQ 16.2.14 **Which of the following is a radioactive substance? (PMC Practice 2021)**

A	Uranium	**B**	Radium
C	Thorium	**D**	All of the above options are correct

Solution: (d) Uranium, radium and thorium are all radioactive.

MCQ 16.2.15 **In relation, which quantity is represented by λ? (UHS MDCAT 2019)**

A	Decay constant	**B**	Half life
C	Activity	**D**	Wavelength

Solution: (a) λ is the decay constant, the probability of decay per second.

MCQ 16.2.16 **Calculate the activity (decaying atom per unit time) of radioactive strontium – 90 having 6.7 x 1021 atoms at t = 0. Decay constant of strontium – 90 is 8.3 x 10-10 s-1 (UHS MDCAT 2018)**

A	8.01 x 1010Bq	**B**	5.6 x 1011s-1
C	5.6 x 1012Bq	**D**	12 x 1011Bq

Solution: (c) $A = \lambda N = 8.3 \times 10^{-10} \times 6.7 \times 10^{21}$, about 5.6×10^{12} Bq.

MCQ 16.2.17 **Which of the following has maximum ionizing power? (UHS MDCAT 2017)**

A	α	**B**	β
C	γ	**D**	Neutron

Solution: (a) The alpha particle is heavy and doubly charged, so it ionizes most strongly.

MCQ 16.2.18 **Thorium is transformed after the transmission of β-particle into: (UHS MDCAT 2016)**

A	Bismuth	**B**	Protactinium
C	Polonium	**D**	Palladium

Solution: (b) Beta emission raises the atomic number by one, taking thorium to protactinium.

MCQ 16.2.19 **Emission of γ-rays from radioactive element results into: (UHS MDCAT 2016)**

A	Bismuth	**B**	Protactinium
C	Polonium	**D**	Palladium

Solution: (c) Gamma emission changes neither the mass number nor the atomic number, so the element is unchanged in kind.

Topic 16.3 Half-Life and Rate of Decay

Past MDCAT Questions

MCQ 16.3.1 **The half-life of strontium is 8.70 hours. Its decay constant is: (MDCAT 2022)**

A	$0.000022\ \text{s}^{-1}$	**B**	$45000\ \text{s}^{-1}$
C	$0.0022\ \text{s}^{-1}$	**D**	$0.22\ \text{s}^{-1}$

Solution: (a) $\lambda = 0.693/T_{1/2} = 0.693/(8.70 \times 3600) = 2.2 \times 10^{-5}\ \text{s}^{-1}$.

MCQ 16.3.2 **The unit of the decay constant is: (MDCAT 2024)**

A	m	**B**	s
C	s^{-1}	**D**	mm

Solution: (c) The decay constant is the fraction decaying per unit time, so it is measured per second.

MCQ 16.3.3 **If we have N_0 atoms of a radioactive element, then after a period of n half-lives the number of atoms left behind is: (MDCAT 2024)**

A	$2^n N_0$	**B**	$(1/2)^n N_0$
C	$(N_0)^n$	**D**	N_0/n

Solution: (b) Each half-life halves the number, so n of them leave $N_0/2^n$.

MCQ 16.3.4 **The half life of radium is about 1600 years. If $100\,\mathrm{g}$ of radium exists now, $25\,\mathrm{g}$ will remain undecayed after: (UHS MDCAT 2017)**

A	4800 years	**B**	6400 years
C	2400 years	**D**	3200 years

Solution: (d) A quarter is left after two half lives, so $2 \times 1600 = 3200$ years.

MCQ 16.3.5 **After 3 half-lives, the remaining fraction of a radioactive sample is: (UHS MDCAT 2025)**

A	1/2	**B**	1/4
C	1/8	**D**	1/16

Solution: (c) Each half life halves what is left, so after three of them $1/8$ remains.

MCQ 16.3.6 **The time in which half of the given number of radioactive nuclei decay is known as (UHS MDCAT 2025)**

A	1/2 life of radioactive element.	**B**	2/3 life of radioactive element.
C	1/4 life of radioactive element.	**D**	2/5 life of radioactive element.

Solution: (a) That time is the half life of the element.

MCQ 16.3.7 **Half-life of a radioactive element is 10 days. After 30 days, fraction remaining is: (NUMS MDCAT 2025)**

A	1/2	**B**	1/4
C	1/8	**D**	1/16

Solution: (c) Thirty days is three half lives, and each halves what is left, so $1/8$ remains.

MCQ 16.3.8 **If we have "No" number of any radioactive element then after a period of "n" half-lives the number of atoms left behind is (UHS MDCAT 2024)**

A	2^n No	**B**	(½)^n No
C	(½ No)^n	**D**	(2No)^n

Solution: (b) Each half life halves the number left, so after n of them $(1/2)^n N_0$ remain.

MCQ 16.3.9 **The half-life of Iodine – 31 is: (SZABMU MDCAT 2023)**

A	10 days	**B**	8 days
C	45 days	**D**	60 days

Solution: (b) Iodine-131 has a half life of about eight days.

MCQ 16.3.10 **The half-life of carbon is 5730 years. How much carbon will left after 22920 years? (SZABMU MDCAT 2023)**

A	1/32nd	B	1/16th
C	1/64th	D	1/4th

Solution: (b) $22920/5730$ is four half lives, and each halves what is left, leaving a sixteenth.

MCQ 16.3.11 **The time taken for half the number of atoms of radioactive isotopes to disintegrate is called: (NUMS MDCAT 2023)**

A	Average life	B	Mean life
C	Total life	D	Half life

Solution: (d) That time is the half life.

MCQ 16.3.12 **A 32g radioactive element decays and remains 2g after 60 days. What is half-life of this radioactive element? (NUMS MDCAT 2023)**

A	2 days	B	6 days
C	10 days	D	15 days

Solution: (d) Going from 32 to 2 g is four half lives, and $60/4$ is 15 days.

MCQ 16.3.13 **What is the relationshlp between the half life of a radioactive isotope and its wavelength? (PMC MDCAT 2022)**

A	they are equal in magnitude	B	they are directly proportional
C	they are inversely proportional	D	No relation

Solution: (d) Half life is a property of the nucleus and has nothing to do with any wavelength.

MCQ 16.3.14 **Q.75 A 32g radioactive element decays and remains 2g after 60 days. What is the half-life of radioactive element? (NUMS MDCAT 2022)**

A	2 days	B	6 days
C	10 days	D	15 days

Solution: (d) From 32 to 2 g is four half lives, and $60/4$ is 15 days.

MCQ 16.3.15 **What will happen in a time of 7 hours, if a radioactive substance has an average life of 7 hours? (PMC Practice 2021)**

A	Half of the active nuclei decay	B	Less than half of the active nuclei decay
C	More than half of the active nuclei decay	D	Total nuclei decay

Solution: (c) The average life is longer than the half life, so more than half have gone by then.

MCQ 16.3.16 **C14 has a half-life of 5700 years. At the end of 11400 years, the actual amount left is? (PMC Practice 2021)**

A	0.0625 of the original amount	B	0.5 of the original amount
C	0.25 of the original amount	D	0.125 of the original amount

Solution: (c) Eleven thousand four hundred years is two half lives, so a quarter is left.

MCQ 16.3.17 **There are initially 400 atoms in a radioactive sample. What would be the number of atoms after 3 half - life? (PMC MDCAT 2020)**

A	400	B	200
C	50	D	25

Solution: (c) Three half lives leave an eighth, and $400/8$ is 50.

MCQ 16.3.18 **Calculate the half life of Bismuth-214 which has a decay constant of 4.3 x 10-4 s-1: (UHS MDCAT 2018)**

A	2.9 x 10-3s	B	1.6 x 10^3 s
C	3.9 x 103s	D	2.9 x 103s

Solution: (b) $t_{1/2} = 0.693/\lambda = 0.693/4.3 \times 10^{-4}$, about 1.6×10^3 s.

MCQ 16.3.19 **The relation between decay constant 'λ' and half-life 'T½' of radioactive substance is: (UHS MDCAT 2016)**

A	λ = 1/T1/2	B	λ = 0693 T1/2
C	λ = T1/2	D	λ = 0.693/T1/2

Solution: (d) $\lambda = 0.693/t_{1/2}$.

Topic 16.4 Biological and Medical Uses of Radiation

Past MDCAT Questions

MCQ 16.4.1 **Which of the following is NOT a somatic biological effect of radiation? (MDCAT 2024)**

A	skin burn	B	loss of hair
C	induction of cancer	D	gene mutation

Solution: (d) A mutation of the genes is a genetic effect, carried to the offspring; the others appear in the body of the exposed person.

MCQ 16.4.2 **Which of the following is NOT the Somatic biological effect of radiation? (UHS MDCAT 2024)**

A	Skin burn	B	Loss of hair
C	Induction of cancer	D	Genes mutation

Solution: (d) A somatic effect appears in the person irradiated; a mutation in the germ cells is a genetic effect.

MCQ 16.4.3 **Gamma ray camera can observe radiations from the ____ that are concentrated in the organs (KMU MDCAT 2024)**

A	Atoms	B	Isotopes
C	Nucleons	D	Neutrons

Solution: (b) A gamma camera images the radioisotope that has gathered in the organ under study.

MCQ 16.4.4 **One rem is equal to: (NUMS MDCAT 2024)**

A	0.01 Gy / RBE	B	0.01 Gy × RBE
C	0.01 RBE	D	0.01 Gy

Solution: (b) The dose equivalent in rem is the absorbed dose in rad multiplied by the relative biological effectiveness.

MCQ 16.4.5 **1 rad is equal to: (NUMS MDCAT 2024)**

A	0.01 J/Kg	B	0.01 Kg/J
C	0.01 J	D	0.01 Kg

Solution: (a) One rad is 0.01 J absorbed in each kilogram.

MCQ 16.4.6 **60 kg man absorbs lethal dose of 200 rem with RBE factor of 10. Energy absorbed is: (NUMS MDCAT 2024)**

A	9J	B	8J
C	10J	D	12J

Solution: (d) 200 rem with an RBE of ten is 20 rad, that is $0.2\,\mathrm{J\,kg^{-1}}$, and 0.2×60 is 12 J.

MCQ 16.4.7 **Somatic effect causes: (NUMS MDCAT 2024)**

A	Gene deformation	B	Chromosomes deformation
C	Skin burns	D	Eye burns

Solution: (c) A somatic effect shows in the body irradiated; damage to the genes is a genetic effect.

MCQ 16.4.8 **Each person experiences background radiation dose in one year: (NUMS MDCAT 2024)**

A	1mSv	B	1mGy
C	1Gy	D	1Sv

Solution: (a) Natural background gives about a millisievert a year.

MCQ 16.4.9 **Q.174 A low energy neutron has RBE factor of 10. How much energy is absorbed by a man of mass 80 Kg if the value of equivalent dose is 400 rem? (UHS MDCAT 2023)**

A	16 J	**B**	32 J
C	48 J	**D**	64 J

Solution: (b) 400 rem with an RBE of ten is 40 rad, that is $0.4\,\mathrm{J\,kg^{-1}}$, and 0.4×80 is 32 J.

MCQ 16.4.10 **Skin burns, loss of hair, drop in the white blood cells etc. are examples of: (SZABMU MDCAT 2023)**

A	Somatic effect	**B**	Genetic effect
C	Metabolism effect	**D**	Mutation effect

Solution: (a) These appear in the person irradiated, so they are somatic effects.

MCQ 16.4.11 **The SI unit of equivalent dose is: (UHS MDCAT 2023)**

A	Gray	**B**	Mass
C	Rad	**D**	Sievert

Solution: (d) Equivalent dose is measured in sieverts.

MCQ 16.4.12 **In water pipes _____ is used to detect leakages: (PMC MDCAT 2022)**

A	Radioisotope	**B**	Light
C	Current	**D**	Heat

Solution: (a) A tracer added to the water shows up where it escapes from the buried pipe.

MCQ 16.4.13 **Which radiation is used in smoke detectors? (PMC Practice 2021)**

A	Alpha	**B**	Beta
C	Gamma	**D**	All of these

Solution: (a) Alpha particles ionize the air in the chamber, and smoke interrupts the tiny current.

MCQ 16.4.14 **Radiations are classified by its _____ nature. (PMC Practice 2021)**

A	Ionizing	**B**	Non ionizing
C	Both a and b	**D**	Radiations cannot be classified

Solution: (c) Radiation is classed as ionizing or non-ionizing by what it does to the atoms it passes.

MCQ 16.4.15 **While using radiation therapy, cancerous thyroid is treated with ____ radioisotope: (PMC MDCAT 2020)**

A	Carbon	**B**	235 Uranium
C	Thorium	**D**	Iodine

Solution: (d) Iodine-131 gathers in the thyroid, so it is used to treat thyroid cancer.

MCQ 16.4.16 **Sodium-24 is used for: (UHS MDCAT 2016)**

A	Sterilization	**B**	Study of circulation of blood
C	Skin Cancer	**D**	Thyroid Cancer

Solution: (b) Sodium-24 is injected as common salt and followed with a counter to trace the circulation.

MCQ 16.4.17 **Radioisotope which is used to combat cancer of thyroid gland is: (UHS MDCAT 2016)**

A	Iodine-131	**B**	Phosphorous-32
C	Strontium-90	**D**	Cobalt-60

Solution: (a) Iodine-131 gathers in the thyroid and irradiates it from within.

MCQ 16.4.18 **Energy radiation absorbed at the rate of one joule per kilogram is called: (UHS MDCAT 2016)**

A	1 Rad	**B**	1 Sievert
C	1 Yellow	**D**	1 Gray

Solution: (d) One gray is one joule absorbed in each kilogram.

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ENGLISH

Unit 1 Reading and Thinking Skills

Topic 1.1 Scanning to Answer Short Questions

Past MDCAT Questions

MCQ 1.1.1 **At last the fly was _____. The most appropriate word to be filled in is: (UHS MDCAT 2023)**

A	Trapped by the spider	B	Entertained by the spider
C	Invited by the spider	D	Spared by the spider.

Solution: (a) A fly that meets a spider is caught in its web.

MCQ 1.1.2 **Right after the Civil War, many distraught soldiers made their way West to find fame and fortune. Some could not go home because there were no homes to go to. The war had devastated them. One young man, Will Goodlad, made his fortune in the hills of Colorado. He found gold in a little river near Grand Junction. His fortune was short lived, however. In 1875, he declared bankruptcy and returned to the land of his birth- the Piedmont of South Carolina. For which side did Will fight during the War? (UHS MDCAT 2023)**

A	East	B	West
C	North	D	South

Solution: (d) He returned to South Carolina, the land of his birth, so he had fought for the South.

Topic 1.2 Deducing Meaning from Context

Past MDCAT Questions

MCQ 1.2.1 **Order is the law of civilization as chaos is the law of the _____. The most appropriate word to be filled in is: (KMU MDCAT 2024)**

A	City	B	Metropolis
C	Universe	D	Wilderness

Solution: (d) Civilization is set against the wild, so chaos belongs to the wilderness.

MCQ 1.2.2 **Blueprint is to architect as algorithm is to _____ (KMU MDCAT 2024)**

A	Designer	B	Engineer
C	Physician	D	Programmer

Solution: (d) An architect works from a blueprint as a programmer works from an algorithm.

Topic 1.3 Figurative Language

Past MDCAT Questions

MCQ 1.3.1 **"Revenge is a kind of wild justice." The sentence illustrates the use of: (KMU MDCAT 2025)**

A	Personification	B	Pun
C	Metaphor	D	Hyperbole

Solution: (c) Revenge is called justice without like or as, which makes it a metaphor.

MCQ 1.3.2 **What does "I've told you a million times" means? (SZABMU MDCAT 2025)**

A	To provide an exact count	B	To emphasize frustration or impatience
C	To confuse the listener	D	To make the character sound foolish

Solution: (b) A million is not a count but an exaggeration, and it carries the speaker's impatience.

Unit 2 Formal and Lexical Aspect of Language

Topic 2.1 Meaning from Contextual Clues

Past MDCAT Questions

MCQ 2.1.1 **"She was elated when she got first position in exams." What is the meaning of "elated" In this sentence? (UHS MDCAT 2025)**

A	Defeated	B	Worried
C	Excited	D	Mad

Solution: (c) To be elated is to be filled with joy, so excited is the closest of the four.

MCQ 2.1.2 **The writer has unearthed serious irregularities in the entire project. The word 'unearthed' In this sentence means (UHS MDCAT 2025)**

A	written	B	mentioned
C	exposed	D	stated

Solution: (c) To unearth something is to bring it to light, so it means exposed.

MCQ 2.1.3 **The old man was feeble, barely able to walk. The word 'feeble' means: (KMU MDCAT 2025)**

A	Healthy	B	Weak
C	Strong	D	Fat

Solution: (b) Feeble means lacking strength.

MCQ 2.1.4 **People approach the situation differently depending on who they are. The word 'approach' in this sentence means ..... (SZABMU MDCAT 2025)**

A	relate	B	coordinate
C	comprehend	D	verify

Solution: (a) To approach a situation here is to deal with it, that is to relate to it.

MCQ 2.1.5 **What does the word "SURPLUS" mean? (UHS MDCAT 2024)**

A	In excess	B	A mathematical term
C	Within reach	D	Salutation

Solution: (a) A surplus is what is left over, that is an amount in excess of need.

MCQ 2.1.6 **What does the word "ANCESTOR" mean? (UHS MDCAT 2024)**

A	Collection of stars	B	Branch of astrology
C	Forefathers	D	Type of receptors

Solution: (c) Ancestors are the forefathers from whom a family descends.

MCQ 2.1.7 **A person who sells goods and services is a _____ (KMU MDCAT 2024)**

A	Consumer	B	Purchaser
C	Patron	D	Vendor

Solution: (d) A vendor is one who sells.

MCQ 2.1.8 **The detective noticed a subtle change in the suspect's tone when he asked about her whereabouts on the night of the crime, which hinted at something more significant. What does "subtle" most likely mean? (KMU MDCAT 2024)**

A	Dramatic	B	Notable
C	Obvious	D	Slight

Solution: (d) Something subtle is slight and easily missed.

MCQ 2.1.9 **Despite the complicated situation, she remained _____, calmly assessing her options before deciding. Fill in the blank with the appropriate choice: (KMU MDCAT 2024)**

A	Composed	B	Erratic
C	Frantic	D	Hysterical

Solution: (a) To assess options calmly is to be composed; the other three mean the opposite.

MCQ 2.1.10 **Q.178 Diseases like diabetes are supposed to be taken seriously or they can be ..... Which of the following words will fill in the blank most appropriately? (UHS MDCAT 2023)**

A	Cursing	B	Healthy
C	Fatal	D	Impersonating

Solution: (c) Neglected, such a disease can kill, so fatal is the word.

MCQ 2.1.11 **The word 'RITUAL' means: (SZABMU MDCAT 2023)**

A	Original	B	Religion
C	Routine	D	Custom

Solution: (d) A ritual is a customary observance.

MCQ 2.1.12 **Hundreds of years old palace could not withstand the of heavy rain: (SZABMU MDCAT 2023)**

A	Aftermath	B	Havoc
C	Annoyance	D	Massacre

Solution: (b) Havoc is widespread destruction, which is what heavy rain does to an old building.

MCQ 2.1.13 **He began to the heap of corns very carefully. (SZABMU MDCAT 2023)**

A	Assess	B	Inspect
C	Analyze	D	Evaluate

Solution: (b) To look over a heap carefully is to inspect it.

MCQ 2.1.14 **The word 'CREDENTIALS' means: (SZABMU MDCAT 2023)**

A	Trust	B	Qualifications
C	Credits	D	Beliefs

Solution: (b) Credentials are the qualifications that entitle one to belief or to a post.

MCQ 2.1.15 **What does the word 'SPILL' mean? (NUMS MDCAT 2023)**

A	Coil	B	Deliver
C	Spoil	D	Spread

Solution: (d) To spill is to let something scatter or spread out.

MCQ 2.1.16 **What does the word 'CURIOUS' mean? (NUMS MDCAT 2023)**

A	Keen	B	Careful
C	Quest	D	Cruel

Solution: (a) A curious person is keen to know.

MCQ 2.1.17 **A carpenter carves _____ on cab doors. Choose the right word to fill in the blank. (UHS MDCAT 2023)**

A	Arabesque	B	Ornate
C	Decked	D	Floral

Solution: (a) An arabesque is the flowing ornamental carving used on doors and panels.

MCQ 2.1.18 **I like this shirt a lot, but the _____ are too short. (PMC MDCAT 2022)**

A	Buttons	B	Heels
C	Collars	D	Sleeves

Solution: (d) The parts of a shirt that cover the arms are its sleeves.

MCQ 2.1.19 **You have to make sure the knife is ____ before you cut the vegetables. (PMC MDCAT 2022)**

A	Flat	B	Sharp
C	Sliced	D	Thick

Solution: (b) A knife for cutting must be sharp.

MCQ 2.1.20 **The train was so ____ that we could not get into it. (PMC MDCAT 2022)**

A	Crowded	B	Deep
C	Thick	D	Rushed

Solution: (a) A train too full to board is crowded.

MCQ 2.1.21 **We have a ____ climate so the summers are not very hot. (PMC MDCAT 2022)**

A	Bright	B	Fair
C	High	D	Mild

Solution: (d) A climate that is neither hot nor cold is mild.

MCQ 2.1.22 **Give her a break. It was not her _____ that the bus arrived late. (PMC MDCAT 2022)**

A	Blame	B	Error
C	Crime	D	Fault

Solution: (d) It was not her fault: the blame did not lie with her.

MCQ 2.1.23 **I don't like doing _____, especially mopping the floor. (PMC MDCAT 2022)**

A	Homework	B	House chores
C	House job	D	Jobs

Solution: (b) Mopping the floor is one of the house chores.

MCQ 2.1.24 **When we were in Singapore last year, we _____ at a beautiful resort near an Island. (PMC MDCAT 2022)**

A	Stayed	B	Stopped
C	Lived	D	Left

Solution: (a) One stays at a hotel or resort.

MCQ 2.1.25 **The ice is very _____ so do not walk on it, or you will fall into it. (PMC MDCAT 2022)**

A	High	B	Low
C	Thick	D	Thin

Solution: (d) Ice too thin to bear a weight is what gives way.

MCQ 2.1.26 **I must book the ____ for our tennis game on Sunday. (PMC MDCAT 2022)**

A	field	B	court
C	green	D	team

Solution: (b) Tennis is played on a court.

MCQ 2.1.27 **The ___ climbed up the tree and hid Inside the branches. (PMC MDCAT 2022)**

A	deer	B	rabbit
C	squirrel	D	tortoise

Solution: (c) A squirrel climbs and hides in the branches.

MCQ 2.1.28 **Can you please ___ your name at the bottom of the contract? (PMC MDCAT 2022)**

A	cross	B	answer
C	sign	D	lay

Solution: (c) One signs a contract at the bottom.

MCQ 2.1.29 **Ali sent his mother a _ _ _ of flowers for her birthday. (PMC MDCAT 2022)**

A	bar	B	bouquet
C	pack	D	packet

Solution: (b) Flowers are sent as a bouquet.

MCQ 2.1.30 **He is appreciated for being ambidextrous. The underlined word means: (NUMS MDCAT 2022)**

A	Active and skillful	B	Uses skills and wisdom
C	Uses both hands for same skills	D	Remains to the point

Solution: (c) Ambidextrous means able to use either hand equally well.

MCQ 2.1.31 **He visited the ghettos for the first time. The underlined word means: (NUMS MDCAT 2022)**

A	Clean area	B	Under privileged area
C	Privileged area	D	Modernly constructed

Solution: (b) A ghetto is a poor, crowded quarter of a city.

MCQ 2.1.32 **My friend has a fine _____ of old stamps. (NUMS MDCAT 2022)**

A	Group	B	Bridge
C	Band	D	Collection

Solution: (d) Stamps gathered together make a collection.

MCQ 2.1.33 **We went to the President as a last _____. (PMC Practice 2021)**

A	Recourse	B	Resort
C	Resource	D	Resound

Solution: (b) A last resort is the final course left to try.

MCQ 2.1.34 **The accident happened due to the driver's _____ . (UHS MDCAT 2019)**

A	Negligence	B	Reluctance
C	Regret	D	Quotation

Solution: (a) Negligence is a failure to take proper care, which is what causes an accident.

MCQ 2.1.35 **They sometimes feel a _____ for the mountains and the sea. (UHS MDCAT 2019)**

A	Yearning	B	Yapping
C	Yelling	D	Yielding

Solution: (a) A yearning is a strong longing for something.

MCQ 2.1.36 **I _____ caution in interpreting these results. (UHS MDCAT 2019)**

A	Urge	B	Usher
C	Usurp	D	Uproot

Solution: (a) To urge caution is to press it strongly on someone.

MCQ 2.1.37 **The parents were stunned when they saw that children had created complete _____ in the bedroom. (UHS MDCAT 2019)**

A	Knack	B	Groggy
C	Dank	D	Mayhem

Solution: (d) Mayhem is violent disorder.

MCQ 2.1.38 **She was feeling _____ even after five hours of the surgery. (UHS MDCAT 2019)**

A	Mumbled	B	Haggard
C	Pally	D	Grope

Solution: (b) Haggard means drawn and exhausted in appearance.

MCQ 2.1.39 **The new teacher showed no _____ about hitting the students. (UHS MDCAT 2019)**

A	Quakes	B	Qualms
C	Quarrel	D	Quotation

Solution: (b) A qualm is a misgiving about doing something.

MCQ 2.1.40 **The culpable child _____ some words to her mother for pardoning his delinquency. (UHS MDCAT 2019)**

A	Mumbled	B	Showy
C	Rude	D	Crazy

Solution: (a) To mumble is to speak indistinctly, as a guilty child might.

MCQ 2.1.41 **In the following question, four alternative sentences are given. Choose the CORRECT one. (UHS MDCAT 2018)**

A	China is now the fashion around the world.	B	China is now the fusion around the world.
C	China is not the function around the world	D	China is now fissure around the world.

Solution: (a) Fashion is the word that fits: China is now what everyone follows.

MCQ 2.1.42 **The assassination of the president _____ the country into war. (UHS MDCAT 2016)**

A	Articulated	B	Boomed
C	Hobbled	D	Precipitated

Solution: (d) To precipitate an event is to bring it on suddenly.

MCQ 2.1.43 **His theories have been _____ by recent research. (UHS MDCAT 2016)**

A	Pronounced	B	Rearmed
C	Dammed	D	Debunked

Solution: (d) To debunk a theory is to show it up as false.

MCQ 2.1.44 **She might be forgiven for _____ beneath the pressure. (UHS MDCAT 2016)**

A	Undertaking	B	Extricating
C	Buckling	D	Resounding

Solution: (c) To buckle under pressure is to give way beneath it.

MCQ 2.1.45 **International rules _____ the number of foreign entrants. (UHS MDCAT 2016)**

A	Hoodwink	B	Stipulate
C	Fabricate	D	Traverse

Solution: (b) To stipulate is to lay down as a condition.

MCQ 2.1.46 **In spite of all the torture, the police has failed to (UHS MDCAT 2015)**

A	Convince	B	Elicit
C	Refuse	D	Agree

Solution: (b) To elicit is to draw something out of somebody.

MCQ 2.1.47 **Youngsters who indulge in love affairs are usually (UHS MDCAT 2015)**

A	Adjoined	B	Addled
C	Affinity	D	Array in worldly manners. SPOT THE ERROR: In the following sentences, some segments of each sentence are underlined. Your task is to identify that underlined segment of the sentence, which contains the mistake that needs to be corrected. Fill the Circle corresponding to that letter under the segment in the MCQ Response From.

Solution: (b) Addled means muddled or confused.

Topic 2.2 Synonyms and Shades of Meaning

Past MDCAT Questions

MCQ 2.2.1 **Which literary device involves using words or phrases that convey the opposite of their literal meaning? (KMU MDCAT 2025)**

A	Irony	B	Parody
C	Satire	D	Sarcasm

Solution: (a) Saying the opposite of what is meant is irony.

MCQ 2.2.2 **What is the effect of using synonyms with different shades of meaning in satire? (SZABMU MDCAT 2025)**

A	To create a serious tone	B	To highlight the absurdity or irony of a situation
C	To confuse the reader	D	To add complexity to the language

Solution: (b) Satire sets a flattering word beside an unworthy thing, and the mismatch shows up the absurdity.

MCQ 2.2.3 **Find out synonym for "Elated" (KMU MDCAT 2024)**

A	Confused	B	Disappointed
C	Nervous	D	Overjoyed

Solution: (d) To be elated is to be overjoyed.

MCQ 2.2.4 **Which of the following words is a synonym for "meticulous"? (KMU MDCAT 2024)**

A	Abhorrent	B	Heedless
C	Incautious	D	Precise

Solution: (d) To be meticulous is to be exact and careful over detail.

MCQ 2.2.5 **Q.177 Synonym of the word "Capricious" is: (UHS MDCAT 2023)**

A	Fickle	B	Predictable
C	Uniform	D	Invariable

Solution: (a) To be capricious is to change one's mind without reason, that is to be fickle.

MCQ 2.2.6 **Q.179 Choose the most appropriate antonym for "abandonment": (UHS MDCAT 2023)**

A	cessation	B	stoppage
C	halt	D	extension

Solution: (d) Abandonment is a giving up; its opposite is a carrying on, that is extension.

MCQ 2.2.7 **Choose the similar meaning of the bracketed word. (Providentially), his mind was not injured. (UHS MDCAT 2023)**

A	Slowly	B	Steadily
C	Really	D	Luckily

Solution: (d) Providentially means by good fortune, that is luckily.

MCQ 2.2.8 **What is a synonym of the word 'pedestrian'? (PMC MDCAT 2022)**

A	Pavement	B	Passerby
C	Precinct	D	Person

Solution: (b) A pedestrian is one who goes on foot, that is a passer-by.

MCQ 2.2.9 **I'm now going to give you 10 _____ tips for running a really successful website. (PMC Practice 2021)**

A	Invaluable	B	Valueless
C	Unworthy	D	Unprofitable

Solution: (a) Invaluable means beyond price, that is extremely valuable.

MCQ 2.2.10 **The prince abdicated the crown and returned to his castle. Abdicated means; (UHS MDCAT 2019)**

A	Gave up	B	Sold
C	Reinvested into	D	Auctioned

Solution: (a) To abdicate is to give up a throne or an office.

MCQ 2.2.11 **EMPATHY (UHS MDCAT 2015)**

A	Understanding	B	Animosity
C	Friendship	D	Sympathy PLSPOT 14 of 20

Solution: (d) Empathy is entering into another's feeling, and of these sympathy is the nearest.

MCQ 2.2.12 **FELICITY (UHS MDCAT 2015)**

A	Boredom	B	Business
C	Happiness	D	Relaxation

Solution: (c) Felicity is great happiness.

MCQ 2.2.13 **UNCANNY (UHS MDCAT 2015)**

A	Exact	B	Opposite
C	Good	D	Strange

Solution: (d) Uncanny means strange in an unsettling way.

MCQ 2.2.14 **VIRULENT (UHS MDCAT 2015)**

A	Progressive	B	Harmful
C	Healthy	D	Positive

Solution: (b) Virulent means severely harmful or poisonous.

MCQ 2.2.15 **RAPT (UHS MDCAT 2015)**

A	Trumpet	B	Bewitched
C	Rapid	D	Rash

Solution: (b) To be rapt is to be spellbound.

MCQ 2.2.16 **PEDAGOGY (UHS MDCAT 2015)**

A	The study of pediatrics	B	The study of teaching methods
C	The study of cultural heritage	D	The study of pectoral muscle

Solution: (b) Pedagogy is the study of teaching.

MCQ 2.2.17 **INDICTMENT (UHS MDCAT 2015)**

A	Humiliation	B	Offended
C	Accusation	D	Invisible

Solution: (c) An indictment is a formal accusation.

MCQ 2.2.18 **MITIGATION (UHS MDCAT 2015)**

A	Alleviation	B	Classification
C	Formidable	D	Poisonous

Solution: (a) To mitigate is to make less severe, that is to alleviate.

MCQ 2.2.19 **CONCERTED (UHS MDCAT 2015)**

A	Strenuous	B	Furious
C	Curious	D	Precious

Solution: (a) A concerted effort is a strenuous, combined one.

MCQ 2.2.20 **ARCANE (UHS MDCAT 2015)**

A	Mysterious	B	Furious
C	Arid	D	Clear BIOLOGY

Solution: (a) Arcane means hidden or mysterious.

Topic 2.3 Pronoun-Antecedent Agreement

Past MDCAT Questions

MCQ 2.3.1 **The board of directors expressed_____disappointment with the financial results. (UHS MDCAT 2025)**

A	their	B	its
C	his or her	D	one's

Solution: (b) A board is a collective noun treated as one body here, so the singular its is right.

MCQ 2.3.2 **All of the players forgot ____ jerseys. (KMU MDCAT 2025)**

A	his	B	her
C	them	D	their

Solution: (d) Players is plural, so the possessive that refers back to it is their.

MCQ 2.3.3 **The market is nearer to them than _____. (PMC MDCAT 2022)**

A	We	B	Ourself
C	Us	D	Ourselves

Solution: (c) After than the pronoun stands as the object of the comparison here, so us is used.

MCQ 2.3.4 **The man _____ wallet was stolen, called the police. (PMC MDCAT 2022)**

A	Who	B	Whose
C	Whom	D	Which

Solution: (b) Whose is the possessive relative, and the wallet belongs to the man.

MCQ 2.3.5 **Identify the errors and choose the correct option: There's mr. Hashim whom they say is the best portrait painter in the town (NUMS MDCAT 2022)**

A	There's mr. Hashim whom they say is the best portrait painter in the town.	B	There's Mr. Hashim who they say is the best portrait painter in the town.
C	Theres' Mr. Hashim which they say is the portrait painter in the town.	D	There's Mr. Hashim who they say is best portrait painter in the town.

Solution: (b) The relative is the subject of is, so it takes who, and the name is capitalized.

Topic 2.4 Tenses

Past MDCAT Questions

MCQ 2.4.1 **I suggest that you _____ visit a doctor. (NUMS MDCAT 2025)**

A	Must	B	Should
C	Ought to	D	Have to

Solution: (b) After suggest that, English takes should with the plain form of the verb.

MCQ 2.4.2 **Choose the sentence with the correct tense and sentence structure: (KMU MDCAT 2024)**

A	He is going to the market yesterday.	B	I had been waiting for the bus, and it arrives.
C	She will finish her homework before she went to bed.	D	They were playing football when it started to rain.

Solution: (d) Only the fourth keeps its tenses consistent: the past continuous interrupted by the simple past.

MCQ 2.4.3 **Choose the correct sentence: (KMU MDCAT 2024)**

A	She didn't knew about the surprise party.	B	She hasn't knew about the surprise party.
C	She didn't know about the surprise party.	D	She doesn't know about the surprise party.

Solution: (c) After did, the verb takes its plain form: she did not know.

MCQ 2.4.4 **After she _____ the stairs, her heart almost gave out from exhaustion. (KMU MDCAT 2024)**

A	Has climbed	B	Have climbed
C	Had climbed	D	Was climbing

Solution: (c) The climbing was over before her heart gave out, so it takes the past perfect.

MCQ 2.4.5 **Fill in blank with Past Perfect Continuous: He _____ home from work regularly since he joined his office. (NUMS MDCAT 2024)**

A	Had walked	B	Had been walking
C	Walked	D	Has been walking

Solution: (b) Had been walking is the past perfect continuous, which suits an action running on since a point in the past.

MCQ 2.4.6 **All desire wealth and some acquire it. The sentence exemplifies _____ tense. (NUMS MDCAT 2024)**

A	Present indefinite	B	Past indefinite
C	Present perfect	D	Simple future

Solution: (a) Desire and acquire are simple present forms stating a general truth.

MCQ 2.4.7 **If I were a doctor, I would serve humanity. The sentence is an example of _____ conditional. (NUMS MDCAT 2024)**

A	Zero	B	Type I
C	Type II	D	Type III

Solution: (c) Were with would marks the second conditional, for something imagined and unreal.

MCQ 2.4.8 **Choose the sentence which is correctly structured: (NUMS MDCAT 2024)**

A	If we had found him earlier, we could have saved his life.	B	If we had found him earlier, we have saved his life.
C	If we had found him earlier, we had saved his life.	D	If we had found him earlier, we could save his life.

Solution: (a) The third conditional pairs had found with could have saved.

MCQ 2.4.9 **Q.181 To give one some idea of Rabies' horrors, one ..... only read such descriptions as the following: spasms, restlessness, shudders at the least breath of air, an ardent thirst, convulsive movements, and fits of furious rage. (UHS MDCAT 2023)**

A	needs	B	need
C	needed	D	has needed

Solution: (a) One is singular, so the verb takes its s: one needs only read.

MCQ 2.4.10 **Q.182 By 2030, people ..... been reading the works of Charles Dickens for more than 190 years. (UHS MDCAT 2023)**

A	had	B	will
C	have	D	will have

Solution: (d) By a future date, a state running on since the past takes will have been.

MCQ 2.4.11 **I don't think I be able to go. (SZABMU MDCAT 2023)**

A	Can	B	Should
C	Shall	D	must

Solution: (c) With the first person, plain futurity takes shall.

MCQ 2.4.12 **Engineers working on a new project for the last three days. (SZABMU MDCAT 2023)**

A	Are	B	Has been
C	Have been	D	Ought to be

Solution: (c) A plural subject with an action running on since a past point takes have been.

MCQ 2.4.13 **I _____ English for five years. (NUMS MDCAT 2023)**

A	Study	B	Am Studying
C	Have been studying	D	studies

Solution: (c) An action begun in the past and still going on takes the present perfect continuous.

MCQ 2.4.14 **Unless we _____ now, we cannot be on time (NUMS MDCAT 2023)**

A	Start	B	Will start
C	Do not start	D	Are starting

Solution: (a) Unless introduces a condition, which in English takes the present tense.

MCQ 2.4.15 **We just _____ a game of tennis. (UHS MDCAT 2023)**

A	Has	**B**	Had
C	Have	**D**	Have had

Solution: (b) Just with a completed action in the recent past takes the simple past here.

MCQ 2.4.16 **The pen is expensive; still I _____ it. (UHS MDCAT 2023)**

A	Bought	**B**	Will buy
C	Have bought	**D**	Buyed

Solution: (a) The buying is over and done with, so the simple past is right.

MCQ 2.4.17 **Choose the sentence in the future tense: (PMC MDCAT 2022)**

A	He went to school yesterday	**B**	He loves apples
C	I will go to the market	**D**	He is fighting with John

Solution: (c) Only will go refers to time still to come.

MCQ 2.4.18 **Which one is not a past tense sentence? (PMC MDCAT 2022)**

A	She finished all the exercices	**B**	Dr Smith healed the patient
C	Michael studied hard all year	**D**	He will have eaten lunch

Solution: (d) Will have eaten is future perfect; the other three are simple past.

MCQ 2.4.19 **There will be a rush for the seats when the train _____. (PMC MDCAT 2022)**

A	Will arrive	**B**	Arrived
C	Is arriving	**D**	Arrives

Solution: (d) A clause of time about the future takes the present tense.

MCQ 2.4.20 **I am going to the U.S.A next year. Which type of tense is it? (PMC MDCAT 2022)**

A	Present	**B**	Past
C	Future	**D**	Interrogative

Solution: (c) Going to with next year points to time still to come.

MCQ 2.4.21 **When I was young,I_____ (use) play cricket a lot. (PMC MDCAT 2022)**

A	Use	**B**	Used
C	Used to	**D**	Use to

Solution: (c) A past habit takes used to with the plain form of the verb.

MCQ 2.4.22 **Choose the present tense. (PMC MDCAT 2022)**

A	They lived happily	**B**	They live happily
C	They will live happily	**D**	They had lived happily

Solution: (b) They live is the simple present.

MCQ 2.4.23 **One day people _____ to Moon (PMC MDCAT 2022)**

A	Travel	**B**	Travelled
C	Will travel	**D**	Were travelling

Solution: (c) One day points to time still to come, so the verb is will travel.

MCQ 2.4.24 **He often _ _ _ to school on time. (PMC MDCAT 2022)**

A	will go	**B**	goes
C	will be going	**D**	have gone

Solution: (b) Often marks a habit, which takes the simple present.

MCQ 2.4.25 **Which sentence is correct? (PMC MDCAT 2022)**

A	If it had not been this sort of a school, I would probably not have gotten into this university.	**B**	If it had not been this sort of school, I would probably not have gotten into this university.
C	If it had not been this sort of a school, I will probably not have gotten in this university	**D**	If it have not been this sort of a school, i will probably not have gotten in this university.

Solution: (b) Sort of takes no article after it, and the third conditional pairs had been with would have gotten.

MCQ 2.4.26 **I _ _ _ to quit my job and have planned to apply for another one. (PMC MDCAT 2022)**

A	decided	**B**	have decided
C	had decided	**D**	was decided

Solution: (b) The decision still stands, so the present perfect is right.

MCQ 2.4.27 **Children always _____ the truth. (PMC MDCAT 2022)**

A	are speaking	**B**	speak
C	will speak	**D**	spoke

Solution: (b) Always marks a habit, which takes the simple present.

MCQ 2.4.28 **We will go to Dubai. Which tense is used here? (PMC MDCAT 2022)**

A	Present	**B**	Past
C	Future	**D**	Past Perfect

Solution: (c) Will go points to time still to come.

MCQ 2.4.29 **Which one is future tense? (PMC MDCAT 2022)**

A	They are going to the market.	**B**	I will play football.
C	We watched a movie yesterday.	**D**	He has done his work.

Solution: (b) I will play football is the simple future.

MCQ 2.4.30 **I_____ to learn a lot of new words within one month. (PMC MDCAT 2022)**

A	am going	**B**	will
C	about	**D**	can be

Solution: (a) Am going to expresses an intention already formed.

MCQ 2.4.31 **The head master _____ to speak to you. (NUMS MDCAT 2022)**

A	Wants	**B**	is wanting
C	was wanting	**D**	Want

Solution: (a) Want is a state verb and is not used in the continuous.

MCQ 2.4.32 **Which verb is NOT in the present tense? (PMC Practice 2021)**

A	She listened	**B**	She talks
C	She waits	**D**	She eats

Solution: (a) Listened is the simple past; the other three are present.

MCQ 2.4.33 **Have you _____ the examination? (PMC Practice 2021)**

A	Take	**B**	Took
C	Taken	**D**	Taking

Solution: (c) After have the verb takes its past participle, taken.

MCQ 2.4.34 **They will bake the pies. Which tense is used here? (PMC Practice 2021)**

A	Present	**B**	Past
C	Future	**D**	Universal

Solution: (c) Will bake points to time still to come.

MCQ 2.4.35 I _____ English since my childhood. (PMC Practice 2021)

A	Study	B	Am studying
C	Have been studying	D	Studied

Solution: (c) An action begun in the past and still going on takes the present perfect continuous.

MCQ 2.4.36 Find an error in the following sentence: (PMC Practice 2021)

A	If I had been thirsty	B	I would have
C	Drank the lemonade	D	Without waiting for you.

Solution: (c) After would have the verb takes its past participle, drunk.

MCQ 2.4.37 Find the error in the following sentence: (PMC Practice 2021)

A	They have been	B	Very close friends
C	Until they quarelled	D	Over a petty issue.

Solution: (a) The friendship ended at the quarrel, so it takes the past perfect: they had been friends.

MCQ 2.4.38 'She always carried an umbrella'. The sentence indicates ____ tense. (PMC MDCAT 2020)

A	Present Simple	B	Past Simple
C	Past Perfect	D	Present Perfect

Solution: (b) Carried is the simple past.

Topic 2.5 Infinitives and Infinitive Phrases

Past MDCAT Questions

MCQ 2.5.1 Pick out the sentence which illustrates the use of infinitive. (SZABMU MDCAT 2025)

A	He refused to obey the orders.	B	He refused obeying the orders.
C	He refused obey the orders.	D	He refused obeyed the orders.

Solution: (a) Refused is followed by the infinitive to obey.

Topic 2.6 Gerunds and Gerund Phrases

Past MDCAT Questions

MCQ 2.6.1 In the sentence "Jogging every morning improves my mood," what role does the gerund phrase play? (KMU MDCAT 2025)

A	Object of a verb	B	Direct object
C	Predicative noun	D	Subject

Solution: (d) The gerund phrase names what improves the mood, so it is the subject of the sentence.

Topic 2.8 Prepositions

Past MDCAT Questions

MCQ 2.8.1 The keys were found _____ the drawer where you left them last week. (UHS MDCAT 2025)

A	under	B	in
C	on	D	beside

Solution: (b) Something inside a drawer is in it, not under or on it.

MCQ 2.8.2 The meeting has been scheduled ___ 3 p.m. sharp. (KMU MDCAT 2025)

A	on	B	at
C	in	D	to

Solution: (b) A clock time takes at.

MCQ 2.8.3 Which of the following verbs takes the preposition 'from' with it? (NUMS MDCAT 2025)

A	Abstain	B	Accused
C	Desirous	D	Ignorant

Solution: (a) One abstains from something; the others take of or with.

MCQ 2.8.4 Choose the correct preposition. One hour _____ glorious life is worth an age without a name. (NUMS MDCAT 2025)

A	In	B	Of
C	To	D	With

Solution: (b) The idiom is one hour of glorious life.

MCQ 2.8.5 Do you usually take a bus..... the market? (KMU MDCAT 2024)

A	By	B	For
C	Of	D	To

Solution: (d) Movement towards a place takes to.

MCQ 2.8.6 I have been working _____ this project for two weeks. (KMU MDCAT 2024)

A	At	B	By
C	To	D	On

Solution: (d) One works on a project.

MCQ 2.8.7 Q.187 Distribute the handouts _____ the candidates. The correct preposition to be filled in is: (UHS MDCAT 2023)

A	into	B	among
C	in	D	on

Solution: (b) Among is used for a distribution over more than two.

MCQ 2.8.8 Choose correct option from the following: Finally the accused was found guilty the crime. (SZABMU MDCAT 2023)

A	From	B	Of
C	For	D	To

Solution: (b) One is found guilty of a crime.

MCQ 2.8.9 Abide _____ the traffic laws for smooth and safe flow of traffic. (NUMS MDCAT 2023)

A	On	B	With
C	By	D	To

Solution: (c) One abides by a law.

MCQ 2.8.10 He prefers death _____ dishonor. (NUMS MDCAT 2023)

A	Over	B	On
C	Upon	D	To

Solution: (d) Prefer takes to, not than.

MCQ 2.8.11 The plane will stay on the runway ____ five minutes. (PMC MDCAT 2022)

A	For	B	In
C	Below	D	On

Solution: (a) A length of time takes for.

MCQ 2.8.12 I'll show you a picture ____ the palace. (PMC MDCAT 2022)

A	off	B	of
C	in	D	at

Solution: (b) A picture of something.

MCQ 2.8.13 What are you doing ____ the afternoon? (PMC MDCAT 2022)

A	with	B	in
C	during	D	around

Solution: (b) Parts of the day take in: in the afternoon.

MCQ 2.8.14 **Are the boys still swimming ____ the pool? (PMC MDCAT 2022)**

A	into	B	in
C	on	D	at

Solution: (b) Something inside a pool is in it.

MCQ 2.8.15 **He started learning Englsh ______ 2005 (PMC MDCAT 2022)**

A	In	B	On
C	At	D	Through

Solution: (a) A year takes in.

MCQ 2.8.16 **You have to wait. He'll be with you ____ a minute. (PMC MDCAT 2022)**

A	In	B	On
C	At	D	Of

Solution: (a) A period after which something will happen takes in.

MCQ 2.8.17 **Choose the sentence with the correct preposition (PMC MDCAT 2022)**

A	He was accused of theft	B	He was accused from theft
C	He was accused off theft	D	He was accused with theft

Solution: (a) One is accused of an offence.

MCQ 2.8.18 **I woke up ____ five o'clock ____ the morning. (PMC MDCAT 2022)**

A	for ... in	B	at.. in
C	In ... at	D	at .. for

Solution: (b) A clock time takes at and a part of the day takes in.

MCQ 2.8.19 **The weather is pleasant here_____the spring. (PMC MDCAT 2022)**

A	above	B	around
C	in	D	on

Solution: (c) Seasons take in.

MCQ 2.8.20 **Sumafra was surprised when her boss didn't ______ the dinner that they had at the restaurant. (PMC Practice 2021)**

A	Buy	B	Pay
C	Pay for	D	Spend

Solution: (c) One pays for a meal; pay alone would take the person or the bill.

MCQ 2.8.21 **We prefer fruits ____ sweets. (PMC MDCAT 2020)**

A	Then	B	On
C	Over	D	From

Solution: (c) Prefer takes to or over, not than.

MCQ 2.8.22 **Female workers are entitled 56 days rest on full salary before giving birth to children. (UHS MDCAT 2017)**

A	Entitled	B	56 days rest
C	On full salary	D	Giving birth

Solution: (a) One is entitled to something, so the preposition is missing.

Topic 2.9 Transitional Devices

Past MDCAT Questions

MCQ 2.9.1 **It rained all night; _____ the roads were flooded in the morning. (UHS MDCAT 2025)**

A	similarly	B	instead
C	as a result	D	in contrast

Solution: (c) The flooding follows from the rain, so the connective must mark a consequence.

MCQ 2.9.2 **"She studied hard; _____, she passed the exam with distinction." Choose the CORRECT transitional device: (KMU MDCAT 2025)**

A	however	B	for instance
C	consequently	D	in contrast

Solution: (c) Passing followed from the studying, so the connective must mark a consequence.

MCQ 2.9.3 **Take your warm jacket with you ____ it gets breezy. (PMC MDCAT 2022)**

A	Although	B	In case
C	Rather	D	Until

Solution: (b) In case introduces a precaution against something that may happen.

Topic 2.10 Punctuation

Past MDCAT Questions

MCQ 2.10.1 **Identify the sentence among of the following, which is punctuated correctly? (UHS MDCAT 2025)**

A	The teaching staff asked the principal what time the meeting would start.	B	The teaching staff asked the principal: "What time would the meeting start?"
C	The teaching staff asked the principal, "What time would the meeting start?"	D	The teaching staff asked the principal; "What time would the meeting start?"

Solution: (c) A comma introduces the quoted words, and the quotation marks enclose them.

MCQ 2.10.2 **Clive had been only a few months in the army when announced that peace had been concluded between great britain and france. The sentence contains errors of: (NUMS MDCAT 2025)**

A	Comma	B	Comma and full stop
C	Comma and capitalization	D	Capitalization

Solution: (d) Great Britain and France are proper nouns and must be capitalized.

MCQ 2.10.3 **Punctuate the given sentence correctly. The teacher asked did you complete your homework (KMU MDCAT 2024)**

A	The teacher asked, did you complete your homework?	B	The teacher asked, "Did you complete your homework?"
C	The teacher asked, "did you complete your homework".	D	The teacher asked, did you complete your homework.

Solution: (b) A comma introduces the quoted question, which keeps its capital and its question mark inside the quotation marks.

MCQ 2.10.4 **Punctuate the following sentence correctly. Lets meet at Sarahs house after school (KMU MDCAT 2024)**

A	Let's meet at Sarah's house after school.	B	Let's meet at Sarahs house after school.
C	Lets meet at Sarah's house after school.	D	Let's meet, at Sarah's house after school.

Solution: (a) Let us contracts to let's, and Sarah's house takes the possessive apostrophe.

MCQ 2.10.5 **Q.184 Which one of the following is correct? (UHS MDCAT 2023)**

A	We visited, Istanbul, Turkey, and Kowloon, Hong Kong last summer.	B	We visited: Istanbul, Turkey, and Kowloon, Hong Kong last summer.
C	We visited Istanbul, Turkey, Kowloon, Hong Kong last summer.	D	We visited Istanbul, Turkey, and Kowloon, Hong Kong last summer.

Solution: (d) Each city is followed by its country in commas, and the two places are joined by and.

MCQ 2.10.6 **Identify the errors in the sentence to choose the correct option from below: (SZABMU MDCAT 2023)**

A	Tennis gives you plenty of exercise it develops quickness of eye, and limb. It calls your brain your thinking power into action.	B	Tennis gives you plenti off exercise, it develops quickness of eye, limb. It calls your brain, your thinking power intoo action.
C	Tennis gives you plenty of exercise, It develops quickness of eye, limb. It calls your brane, your thinking power over action.	D	Tennis gives you plenty of exercise; It develops quickness of eye and limb. It callsyour brain, your thinking power into action.

Solution: (d) Only the last spells every word correctly and joins the two independent clauses with a semicolon.

MCQ 2.10.7 **Identify the errors and choose the correct option: (SZABMU MDCAT 2023)**

A	The wind blew, the rain fell, and the lightening flashed.	B	The wind blue the rain fell, and the lightening flashed.
C	The wind blew, the rain fell and le lightening flashed.	D	The wind blew the rain fell, and the lightening Flashed.

Solution: (a) Three independent clauses in a series are separated by commas with and before the last.

MCQ 2.10.8 **Pick the sentence with correct punctuation: (NUMS MDCAT 2023)**

A	He had one motto "serving humanity."	B	He, had one motto, serving humanity.
C	He had one motto; serving humanity.	D	He had one motto: serving humanity.

Solution: (d) A colon introduces the statement of what the motto was.

MCQ 2.10.9 **Punctuate the given sentence correctly. (UHS MDCAT 2023)**

A	My father is Chairman of the Committee on Internal Relations. He also heads the Discipline Committee,	B	My father is Chairman of the Committee on Internal Relations - he also heads the Discipline Committee.
C	My father is Chairman of the Committee on Internal Relations: he also heads the Discipline Committee.	D	My father is Chairman of the Committee on Internal Relations, but he also heads the Discipline Committee.

Solution: (a) Two complete statements are written as two sentences, each closed with a full stop.

MCQ 2.10.10 **The applicants had some questions during the interview? (PMC MDCAT 2022)**

A	Grammar	B	Capatalization
C	Spelling	D	Punctuation

Solution: (d) It is a statement, so it should end with a full stop, not a question mark.

MCQ 2.10.11 **Choose the correct option: He had no worries his pension was adequate and there was a little money saved up besides. (NUMS MDCAT 2022)**

A	He had no worries his pension was adequate and there was a little money saved up besides.	B	He had no worries, his pension was adequate and there was a little money saved up besides.
C	He had no worries; his pension was adequate, and there was a little money saved up besides.	D	He had no worries; his pension was adequate and there was a little money saved up besides.

Solution: (d) A semicolon separates the two independent statements, and no comma is needed before and here.

MCQ 2.10.12 **Identify the errors and choose the correct option. The english man thinks that he and his country are the best. (NUMS MDCAT 2022)**

A	The english man thinks that he and his country are the best.	B	The English man think that he and his country are the best.
C	The English man thinks that he and his country are the best	D	The English man think that he and his country are best.

Solution: (c) English is a proper adjective and takes a capital, and the singular subject takes thinks.

MCQ 2.10.13 **Choose the correct sentence from the following options: (PMC Practice 2021)**

A	Did you know that they're leaving the city for good.	B	Did you know that they're leaving the city for good?
C	Did you know that the'yre leaving the city for good?	D	Did you know that theyre leaving the city for good.

Solution: (b) It is a question, so it ends with a question mark, and they are contracts to they're.

MCQ 2.10.14 **Choose the correctly punctuated sentence: (PMC MDCAT 2020)**

A	What a fall was there, my country men! Long live the king!	B	What a fall was there! My countrymen. Long live the king!
C	What a fall was there, my countrymen. Long live the king.	D	What a fall was there, my countrymen, long live the King.

Solution: (a) The exclamation is closed with an exclamation mark and the address is set off by a comma.

Topic 2.11 Classes of Sentences and Phrases

Past MDCAT Questions

MCQ 2.11.1 **'Whatever you order for dinner' is fine with me. The underlined part is: (NUMS MDCAT 2025)**

A	Noun clause	B	Adjective clause
C	Adverb clause	D	Independent clause

Solution: (a) The clause stands where a noun would, as the subject of is fine.

MCQ 2.11.2 **After midnight, the ghost will come out of the haunted attic to scare the people. The sentence is: (NUMS MDCAT 2025)**

A	Simple	B	Compound
C	Complex	D	Compound-Complex

Solution: (a) There is one subject and one finite verb, so the sentence is simple however many phrases hang off it.

MCQ 2.11.3 **Identify the sentence with correct structure. (NUMS MDCAT 2025)**

A	We noticed the boy, walking down the street.	B	We noticed, the boy walk down the, street.
C	We noticed, that the boy was walking down the street.	D	We noticed the boy, who was walking down the street.

Solution: (d) A non-defining relative clause is marked off by a comma and introduced by who.

MCQ 2.11.4 **Identify the underlined part of the sentence: I know you have already read this book. (NUMS MDCAT 2025)**

A	Independent clause	B	Adjective clause
C	Adverb clause	D	Noun clause

Solution: (d) The clause is the object of know, so it does a noun's work.

MCQ 2.11.5 **Identify the example of complex sentence. (SZABMU MDCAT 2025)**

A	I both thanked him and rewarded him.	**B**	Life is what we make it.
C	He owed his success to his father.	**D**	Jumping up, he ran away.

Solution: (b) It carries a main clause and a subordinate noun clause, so it is complex.

MCQ 2.11.6 **Travelling in a hot dusty train gives me no pleasure. The underlined part of the sentence is: (SZABMU MDCAT 2025)**

A	Adverb phrase	**B**	Adjective phrase
C	Noun phrase	**D**	Infinitive phrase

Solution: (c) Travelling in a hot dusty train is a gerund phrase doing the work of a noun, as the subject.

MCQ 2.11.7 **The plane ought to be taking off in a minute. The underlined word 'ought to' is: (NUMS MDCAT 2024)**

A	Linking verb	**B**	Modal auxiliary
C	Helping verb	**D**	Finite verb

Solution: (b) Ought to is a modal auxiliary, expressing what is expected or proper.

MCQ 2.11.8 **After heavy rain, the sky grew dark. The underlined verb 'grew' is: (NUMS MDCAT 2024)**

A	Non-Finite	**B**	Transitive
C	Di-transitive	**D**	Linking

Solution: (d) Grew here links the subject to its complement dark rather than taking an object.

MCQ 2.11.9 **His courage earned him honour. The underlined verb 'earned' is: (NUMS MDCAT 2024)**

A	Intransitive	**B**	Di-transitive
C	Complex transitive	**D**	Linking

Solution: (b) It takes both an indirect object, him, and a direct object, honour.

MCQ 2.11.10 **The teacher assigned the students an assignment to be completed during vacation. The underlined verb 'assigned' is: (NUMS MDCAT 2024)**

A	Mono-transitive	**B**	Di-transitive
C	Complex transitive	**D**	Intransitive

Solution: (b) It takes an indirect object, the students, and a direct object, an assignment.

MCQ 2.11.11 **Of two evils choose the less. The sentence contains an adjective that is: (NUMS MDCAT 2024)**

A	Comparative	**B**	Positive
C	Numeral	**D**	Distributive

Solution: (a) Less compares two, so it is the comparative degree.

MCQ 2.11.12 **This is the very thing we want. The underlined word 'very' is a/an: (NUMS MDCAT 2024)**

A	Emphatic pronoun	**B**	Emphasizing adjective
C	Reflexive pronoun	**D**	Exclamatory adjective

Solution: (b) Very here qualifies thing, so it is an adjective used for emphasis.

MCQ 2.11.13 **Don't be in such a hurry. The sentence contains an adjective of: (NUMS MDCAT 2024)**

A	Number	**B**	Distributive
C	Quantity	**D**	Demonstrative

Solution: (c) Such a hurry says how much, not how many, so the adjective is one of quantity.

MCQ 2.11.14 **Choose the sentence that is grammatically correct. (UHS MDCAT 2023)**

A	We agreed that the play was rather boring so we felt bored	**B**	We agreed that the play was rather bored so we felt boring
C	We agreed that the play was rather bore so we felt bores	**D**	We agreed that the play was rather bores so we felt bored

Solution: (a) The play was boring and it made us bored: the -ing form describes the cause, the -ed form the feeling.

MCQ 2.11.15 **How cold the night is! Which kind of sentence is it? (SZABMU MDCAT 2023)**

A	Interrogative	**B**	Declarative
C	Exclamatory	**D**	Imperative

Solution: (c) It begins with how and ends in an exclamation mark, so it is exclamatory.

MCQ 2.11.16 **Choose the correct option: Negotiations between the two sides have . (SZABMU MDCAT 2023)**

A	Broken off	**B**	Broken down
C	Broken up	**D**	Broken in

Solution: (b) Negotiations that fail have broken down.

MCQ 2.11.17 **Daud is better than _____ of the college. (NUMS MDCAT 2023)**

A	All teachers	**B**	Any teachers
C	All other teachers	**D**	Any teacher

Solution: (c) He is one of the teachers, so the comparison must exclude him: all other teachers.

MCQ 2.11.18 **Pick the correct option: (NUMS MDCAT 2023)**

A	How has the chair leg broken?	**B**	How has the leg of the chair broken?
C	How the leg of the chair has broken?	**D**	How the chair's leg is broken?

Solution: (b) English does not make a possessive of an inanimate noun here, so it is the leg of the chair, with the auxiliary before the subject.

MCQ 2.11.19 **Which of the following sentences is correct? (UHS MDCAT 2023)**

A	I want to live near my parents live.	**B**	I want to live where my parents live.
C	I want to live where, my parents live.	**D**	I want to live where: my parents live.

Solution: (b) Where introduces the adverbial clause of place, and no punctuation comes before it.

MCQ 2.11.20 **_____ methods don't work. Choose the correct option: (UHS MDCAT 2023)**

A	This	**B**	These
C	The	**D**	That

Solution: (b) Methods is plural, so the demonstrative is these.

MCQ 2.11.21 **He made ____ a story when he was late for the first class, but the teacher didn't believe him. (PMC MDCAT 2022)**

A	On	**B**	Up
C	Off	**D**	Under

Solution: (b) To make up a story is to invent it.

MCQ 2.11.22 **The plane wasn't allowed to take ____ because of bad weather conditions. (PMC MDCAT 2022)**

A	On	**B**	Up
C	Off	**D**	To

Solution: (c) An aircraft takes off.

MCQ 2.11.23 **Which one is correct? (PMC MDCAT 2022)**

A	I'm just passing away, Ali. Thought I might run into Ahmed here.	B	I'm just passing through, Ali. Thought I might run into Ahmed here.
C	I'm just passing on, Ali. Thought I might run Into Ahmed here.	D	I'm just passing along, Ali. Thought I might run into Ahmed here.

Solution: (b) To be passing through is to be going by on the way somewhere else.

MCQ 2.11.24 **Do you know how__ it is from Faisalabad to Islamabad? It's 470 km. (PMC MDCAT 2022)**

A	Many	B	Much
C	Far	D	Often

Solution: (c) Distance is asked after with how far.

MCQ 2.11.25 **We need to find ____ method to solve this problem. (PMC MDCAT 2022)**

A	Other	B	Another
C	Others	D	The other

Solution: (b) Another is one more of the same kind, and method is singular.

MCQ 2.11.26 **They had to put _ _ _ _ the meeting when the general director didn't turn _ _ _ _ . (PMC MDCAT 2022)**

A	on, off	B	up, off
C	off, on	D	off, up

Solution: (d) To put off is to postpone, and to turn up is to arrive.

MCQ 2.11.27 **The two machines _____ considerably. One has an electric motor, and the other one runs on oil. (PMC Practice 2021)**

A	Different	B	Differentiate
C	Differ	D	Difference

Solution: (c) Differ is the verb meaning to be unlike.

MCQ 2.11.28 **Choose the correct the sentence from the following options: (UHS MDCAT 2017)**

A	The room is comfortably balanced between the expensively decorated and the homely.	B	The room is comfortable balanced between the expensively decorated or the homely
C	The room is comfortably balanced between the expensive decorated and the homely.	D	The room is comfortably balanced among the expensively decorated and the home.

Solution: (a) Comfortably qualifies balanced, and between takes two things joined by and.

MCQ 2.11.29 **The delegates in Anatolia could transfer their activities to Istanbul, put Mustafa Kamal's ideas into practice and yet not longer stand in opposition to the Padishah. (UHS MDCAT 2017)**

A	In	B	To
C	Into	D	Not longer

Solution: (d) No longer is the idiom, not not longer.

MCQ 2.11.30 **The latter continued: "You see how is it- Ralston filled the place up with young men." (UHS MDCAT 2017)**

A	Latter	B	How is it
C	Up	D	With

Solution: (b) In an indirect question the subject comes before the verb: how it is.

MCQ 2.11.31 **A tree slid down the slope, leaned against and settled heavily to the ground. (UHS MDCAT 2017)**

A	Down	B	Leaned against
C	Heavily	D	To the ground

Solution: (d) The tree leaned against something; the phrase needs an object, so leaned against is the fault... the sentence is complete only at to the ground.

Topic 2.12 Sentence Inversion

Past MDCAT Questions

MCQ 2.12.1 **Choose the correctly structured sentence. (NUMS MDCAT 2025)**

A	Had he been there, he would see us.	B	Had he been there, he would had seen us.
C	Had he been there, he would have seen us.	D	Had he had been there, he would have seen us.

Solution: (c) Inverting had for if takes the third conditional, whose main clause is would have seen.

MCQ 2.12.2 **_____ so many people been out of work as today. Which part is the most appropriate to be filled in the blank? (UHS MDCAT 2023)**

A	More than ever before	B	Never before have
C	In the past, there never have	D	Formerly, there never were

Solution: (b) Never before at the head of the sentence inverts the auxiliary and the subject.

Topic 2.13 Active and Passive Voice

Past MDCAT Questions

MCQ 2.13.1 **She completed the task with great difficulty. Identify the CORRECT usage of passive voice. (KMU MDCAT 2025)**

A	The task was completed with great difficulty by her.	B	The task has been completed with great difficulty by her.
C	The task was been completed with great difficulty by her.	D	The task was being completed with great difficulty by her.

Solution: (a) The simple past active becomes the simple past passive: the task was completed by her.

MCQ 2.13.2 **The book was written by Rashid Khan. Identify the correct usage of voice. (SZABMU MDCAT 2025)**

A	Rashid Khan writes the book.	B	Rashid Khan wrote the book.
C	Rashid Khan written the book.	D	Rashid Khan has write the book.

Solution: (b) The passive past becomes the active past: Rashid Khan wrote the book.

MCQ 2.13.3 **Q.180 Fill in the blank with the correct word. The shepherd ploughed this mountain with cattle the first time it ..... ever ploughed. (UHS MDCAT 2023)**

A	was	B	was been
C	had	D	had been

Solution: (d) The passive of the past perfect is had been ploughed.

MCQ 2.13.4 **Identify the sentence, out of the following, that is error free: (UHS MDCAT 2023)**

A	I do not enjoy being laughed at by other people	B	I did not enjoy laughing by other people
C	I am not enjoying laughing by other people	D	I do not enjoying being laughed at by other people

Solution: (a) The idiom is to be laughed at, and after do not enjoy the verb takes the gerund being.

MCQ 2.13.5 **A few years ago, it _____ that human beings do not belong to this earth. (UHS MDCAT 2023)**

A	Found	B	Was found
C	Were found	D	Had found

Solution: (b) The finding was done to us, so the verb is passive: it was found.

MCQ 2.13.6 **A white ball _____ for the first time in the 1992 Cricket World Cup. (PMC MDCAT 2022)**

A	Used	B	Was used
C	Had used	D	Has been used

Solution: (b) The ball was used, so the verb is passive in the simple past.

Unit 3 Writing Skills

Topic 3.1 Proof-reading and Editing

Past MDCAT Questions

MCQ 3.1.1 **Fill in the correct articles: _____ female lion is called _____ lioness. She has no mane. (NUMS MDCAT 2025)**

A	A, the	B	The, a
C	The, the	D	A, a

Solution: (b) The species is spoken of in general with the definite article, and a lioness is one of many.

MCQ 3.1.2 **He circled _____ whole world on his ship and on _____ island he encountered _____ fierce giant. (NUMS MDCAT 2025)**

A	the, an, the	B	the, a, a
C	the, an, a	D	the, an, an

Solution: (c) The world is unique, an island begins with a vowel sound, and a giant is one of many.

MCQ 3.1.3 **Identify the ERROR in the sentence: The chef quickly prepared, delicious and it served a meal. (KMU MDCAT 2024)**

A	Punctuation	B	Style
C	Vocabulary	D	Word order

Solution: (a) The comma after prepared cuts the sentence in two and leaves it ungrammatical.

MCQ 3.1.4 **Q.186 Choose the sentence with the correct use of article. (UHS MDCAT 2023)**

A	Natasha can play a piano and a violin.	B	Natasha can play the piano and the violin.
C	Natasha can play the piano and a violin.	D	Natasha can play piano and violin.

Solution: (b) A musical instrument takes the definite article: play the piano, play the violin.

MCQ 3.1.5 **Spot the error out of the bracketed words. We try to speak (with) (one another) (but) (convey) nothing. (UHS MDCAT 2023)**

A	with	B	one another
C	convey	D	but

Solution: (a) One speaks to another, not with another, in this construction.

MCQ 3.1.6 **Adil insisted we all go out for _____ cup of coffee. (PMC MDCAT 2022)**

A	a	B	an
C	the	D	no article

Solution: (a) A cup begins with a consonant sound, so it takes a.

MCQ 3.1.7 **We are still a long way from ____ home. (PMC MDCAT 2022)**

A	a	B	an
C	the	D	no article

Solution: (d) Home in this sense takes no article.

MCQ 3.1.8 **There was _____ article about pollution in _____ paper. (PMC Practice 2021)**

A	A..an	B	An...the
C	A...the	D	A...a

Solution: (b) Article begins with a vowel sound, and the paper is a particular one.

MCQ 3.1.9 **We have _____ small house in _____ village in _____ Netherlands. (PMC Practice 2021)**

A	The...an...a	B	An...a...the
C	A...a....the	D	A...an...the

Solution: (c) A house and a village are each one of many; the Netherlands takes the definite article.

MCQ 3.1.10 **Twice, my father stopped to wipe the sweat from his eyes. (UHS MDCAT 2017)**

A	father stopped	B	wipe the
C	from	D	E) No error

Solution: (d) The sentence is correct as it stands.

Topic 3.2 Faulty Sentence Structure

Past MDCAT Questions

MCQ 3.2.1 **Identify the sentence that contains an ERROR in word order, style, or vocabulary: (KMU MDCAT 2024)**

A	He has a talent for solving complex problems.	B	She enjoys reading, writing, and to paint.
C	The quick brown fox jumps over the lazy dog.	D	They quickly adapted to the new environment.

Solution: (b) The list breaks its pattern: reading, writing and painting would keep it parallel.

MCQ 3.2.2 **Q.183 Choose the most suitable/appropriate sentence out of the following: (UHS MDCAT 2023)**

A	Penny did not let me to get my book.	B	Penny was not leaving me to get my book.
C	Penny did not let me get my book.	D	Penny had not left me get my book.

Solution: (c) Let is followed by the bare infinitive: let me get.

Topic 3.3 Subject-Verb Agreement

Past MDCAT Questions

Topic 2.14 Direct and Indirect Speech

Past MDCAT Questions

MCQ 2.14.1 **She said that she was happy. Which type of narration is used here? (PMC MDCAT 2022)**

A	Indirect	B	Direct
C	Simple	D	Complex

Solution: (a) The words are reported rather than quoted, so the narration is indirect.

MCQ 3.3.1 **Which of the following sentences has correct subject verb agreement? (UHS MDCAT 2025)**

A	The teacher give the students homework.	B	The teacher gives the students homework.
C	The teachers gives the student homework.	D	The teachers given the student homework.

Solution: (b) A singular subject takes the singular verb, so the teacher gives.

MCQ 3.3.2 **Each of the boys _____ ambitious to lead the team. (KMU MDCAT 2025)**

A	have	B	has
C	is	D	are

Solution: (c) Each is singular, so the verb is singular however many boys follow it.

MCQ 3.3.3 **It good players who bring good name to a country. (SZABMU MDCAT 2023)**

A	Was	B	Were
C	Is	D	Are

Solution: (c) The subject of the cleft sentence is it, which is singular.

MCQ 3.3.4 **Ethics important for a peaceful and loving society. (SZABMU MDCAT 2023)**

A	Have	B	Has
C	Are	D	Is

Solution: (d) Ethics as a subject of study is singular.

MCQ 3.3.5 **The soup _____ good (NUMS MDCAT 2023)**

A	Taste	B	Tastes
C	Is tasting	D	Has taste

Solution: (b) Soup is singular, and tastes here is a linking verb not used in the continuous.

MCQ 3.3.6 **A shoal of fish _____ killed by the fishermen. (UHS MDCAT 2023)**

A	Has been	B	Have
C	Had	D	Has

Solution: (a) The subject is shoal, which is singular, and the sense is passive: has been killed.

MCQ 3.3.7 **In winter, the days and nights is cold. Choose the part of the sentence that carries error: (UHS MDCAT 2023)**

A	In winter	B	The days
C	And nights	D	Is cold

Solution: (a) The subject days and nights is plural, so the verb should be are, not is.

MCQ 3.3.8 **The earth _____ to be moving. (PMC MDCAT 2022)**

A	Seem	B	Seemed
C	Seeming	D	Seems

Solution: (d) The earth is singular, so the verb takes its s.

MCQ 3.3.9 **A full description of car accidents _____ reported. (NUMS MDCAT 2022)**

A	Are	B	Have been
C	Was	D	Were

Solution: (c) The subject is description, which is singular.

MCQ 3.3.10 **Choose the correct option: (NUMS MDCAT 2022)**

A	Every one of the prisons are full.	B	Every one of the prisons had full.
C	Every one of the prisons have full.	D	Every one of the prisons is full.

Solution: (d) Every one is singular, so the verb is is however many prisons follow.

MCQ 3.3.11 **Knowledge and wisdom _____ no time for connection. (NUMS MDCAT 2022)**

A	Has	B	Have
C	Had	D	Are

Solution: (b) Two nouns joined by and make a plural subject.

MCQ 3.3.12 **Each of three boys _____ to ride. (NUMS MDCAT 2022)**

A	Loves	B	Love
C	Are loving	D	Have loved

Solution: (a) Each is singular, so the verb takes its s.

MCQ 3.3.13 **Some of the books on the table _____ to me. (PMC Practice 2021)**

A	Belong	B	Belonging
C	Belongs	D	Was belong

Solution: (a) Some of the books is plural, so the verb is belong.

MCQ 3.3.14 **My parents _____ near Lahore. (PMC Practice 2021)**

A	Living	B	Are living
C	Lives	D	Live

Solution: (d) Parents is plural, so the verb is live.

MCQ 3.3.15 **Sameer _____ in the park every day. (PMC Practice 2021)**

A	Run	B	Runs
C	Running	D	Walk

Solution: (b) Sameer is singular, so the verb takes its s.

MCQ 3.3.16 **None of them _____ able to solve this question. (PMC Practice 2021)**

A	Is	B	Were
C	Will	D	Would

Solution: (a) None is treated as singular here, so the verb is is.

MCQ 3.3.17 **Not only the parents but also their son _____ for interview. (PMC MDCAT 2020)**

A	Has called	B	Have called
C	Have been called	D	Has been called

Solution: (d) With not only but also the verb agrees with the nearer subject, son, which is singular and passive here.

MCQ 3.3.18 **In the following question, four alternative sentences are given. Choose the CORRECT option. (UHS MDCAT 2019)**

A	It is healthful to eat a variety of food.	B	It Were healthful to eat a variety of food.
C	It is healthful to ate a variety of food.	D	It were healthful to ate a variety of food.

Solution: (a) It is takes the singular present, and the infinitive after healthful is to eat.

Topic 3.4 Errors of Diction and Spelling

Past MDCAT Questions

MCQ 3.4.1 **The manager accepted the cashier's _____ for coming late. (UHS MDCAT 2025)**

A	expalanation	B	explaination
C	explanation	D	explantion

Solution: (c) The word is spelt explanation, with no i after the a.

MCQ 3.4.2 **Identify the sentence with no spelling error: (UHS MDCAT 2025)**

A	Imtiaz invited me on a dinner party at restaurant.	B	Imtiaz invited me on a dier party at restaurant.
C	Imtiaz invited me on a dinner party at restaurent.	D	Imtiaz invited me on a dinnar party at restaurent.

Solution: (a) Only the first spells both dinner and restaurant correctly.

MCQ 3.4.3 **Q.185 Which of the following sentences is correct? (UHS MDCAT 2023)**

A	How could Sarah perswad her mum to stay out later?	B	How could Sarah persuade her mum to stay out later?
C	How could Sarah persuad her mum to stay out later?	D	How could Sarah parsuade her mum to stay out later?

Solution: (b) The verb is spelt persuade.

MCQ 3.4.4 **Choose the correct spelling: (SZABMU MDCAT 2023)**

A	Renessance	B	Renaissance
C	Renaisance	D	Reniassance

Solution: (b) It is spelt renaissance.

MCQ 3.4.5 **Pick the word with correct spelling: (NUMS MDCAT 2023)**

A	Collique	B	Colleague
C	Collegue	D	Co-leageu

Solution: (b) It is spelt colleague.

MCQ 3.4.6 **Choose the correct spelling of the word: (PMC MDCAT 2022)**

A	Annehilate	B	Anihilate
C	Annihilate	D	Anehilate

Solution: (c) It is spelt annihilate.

MCQ 3.4.7 **Find the correctly spelt word: (PMC MDCAT 2022)**

A	Sovereign	B	Soveregn
C	Soverean	D	Soverein

Solution: (a) It is spelt sovereign.

MCQ 3.4.8 **Choose the word wrongly spelt. (PMC MDCAT 2022)**

A	Semester	B	Senesent
C	Sensory	D	Salacious

Solution: (b) The word is spelt senescent.

LOGICAL REASONING

Unit 1 Critical Thinking

Topic 1.1 Critical Thinking

Past MDCAT Questions

MCQ 1.1.1 **A mobile company is deciding whether to collect personal user data for improving advertisement. Which of the following is a moral argument against collecting the data? (KMU MDCAT 2025)**

A	Users may lose trust in the company, which could hurt profits.	B	It is wrong to collect data without users' clear and informed consent.
C	Competitors already collect more data, and we need to stay competitive.	D	More data means more accurate advertising, which boosts sales.

Solution: (b) Only the consent argument is about right and wrong; the others weigh profit and competition.

MCQ 1.1.2 **What is the primary difference between hypothesis and a theory? (SZABMU MDCAT 2025)**

A	A hypothesis is a proven fact, while a theory is an unproven data	B	A hypothesis is a specific prediction, while a theory is a broad explanation
C	A hypothesis is a qualitative statement, while a theory is quantitative statement	D	A hypothesis is a tentative explanation, while a theory is a well-substantiated explanation

Solution: (d) A hypothesis is a proposal still to be tested; a theory has already survived a great deal of testing.

MCQ 1.1.3 **Read the given passage and the following statements below. Then choose the option, basing your answer only on the information provided. The Early Medieval period (642-1219 CE) witnessed the spread of Islam in a region which is now known as Pakistan. During this period, Sufi missionaries played a pivotal role in converting a majority of the regional Buddhist population to Islam. Statements: I. Islam was spread in Pakistan region during the Early Medieval period. II. Sufi missionaries converted a lot of people to Islam during this time by force. III. It can be said that the Sufis were responsible for Pakistan ultimately become an Islamic country. (SZABMU MDCAT 2023)**

A	Only I is correct.	B	Only I and II are correct.
C	I, II and III all are correct.	D	Only I and III are correct.

Solution: (a) The passage says the Sufis converted people; it says nothing of force and draws no conclusion about the founding of the country.

MCQ 1.1.4 **Choose the word which is always associated with Electrical Energy. (PMC MDCAT 2022)**

A	Light	B	Cars
C	Power	D	Water

Solution: (a) Electrical energy is what a lamp turns into light; the others are not tied to it.

MCQ 1.1.5 **An autograph can not exist without? (PMC MDCAT 2022)**

A	Singer	B	Actor
C	Player	D	Pen

Solution: (d) An autograph is a signature, and it cannot be written without something to write with.

MCQ 1.1.6 **"Pick the word which is always associated with books: (PMC MDCAT 2022)**

A	Pages	B	Learning
C	Pictures	D	Eraser

Solution: (b) A book may or may not have pictures, but it is always for learning.

Unit 2 Letter and Symbol Series

Past MDCAT Questions

MCQ 2.1.1 **What will come next? 1, 4, 2, 5, 3, 6, 4, 7, ? (UHS MDCAT 2025)**

A	5	**B**	6
C	7	**D**	8

Solution: (a) The series runs in pairs, each pair three more than the last, so after 4 and 7 comes 5.

MCQ 2.1.2 **The virus spreads rapidly in the town. It infected the people - First day: 8, Second day: 1 Third day: 32. What will the number of people infected on the next day? (UHS MDCAT 2025)**

A	44 people	**B**	56 people
C	64 people	**D**	74 people

Solution: (c) The number doubles each day, so the day after 32 brings 64.

MCQ 2.1.3 **A medication dose starts at 100mg and halves each day. What will be the dose on day 4? (KMU MDCAT 2025)**

A	12.5mg	**B**	25mg
C	30mg	**D**	50mg

Solution: (a) The dose runs 100, 50, 25, then 12.5 on the fourth day.

MCQ 2.1.4 **Which number comes in the missing place? 200, 180, 162, 146, 132, _____ (KMU MDCAT 2025)**

A	118	**B**	120
C	122	**D**	126

Solution: (b) The steps shrink by two each time, so after falling 14 the next fall is 12, leaving 120.

MCQ 2.1.5 **Consider the sequence: 64, 32, 16, 8, ... What is the 10th term of this sequence? (KMU MDCAT 2025)**

A	2	**B**	4
C	1/4	**D**	1/8

Solution: (d) Each term is half the last, so the tenth is $64/2^9$, which is $1/8$.

MCQ 2.1.6 **Which number comes in the missing place? 1, 3, 7, 15, 31, _____ (SZABMU MDCAT 2025)**

A	61	**B**	63
C	65	**D**	67

Solution: (b) Each term is twice the last plus one, so after 31 comes 63.

MCQ 2.1.7 **Find out the missing term in the sequence: 15, 14, 12, 9, ? (KMU MDCAT 2024)**

A	5	**B**	6
C	7	**D**	8

Solution: (a) The steps are -1, -2, -3 and then -4, which takes 9 down to 5.

MCQ 2.1.8 **Observe the pattern and select the next term in the sequence: SSSSS, SSRSS, SRQRS, RQPQR (UHS MDCAT 2023)**

A	RQDQR	**B**	QRORQ
C	RQPOPQR	**D**	QPOPQ

Solution: (d) Each term steps one letter back on the outside and one more in the middle, so the next is QPOPQ.

Unit 3 Logical Deductions

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Past MDCAT Questions

MCQ 3.1.1 **All daffodils are plants. All plants are living things. Some living things are real. Conclusions: I. All daffodils are living things. II. Some living things are flowers. III. All daffodils are real. Which conclusions follow? (UHS MDCAT 2025)**

A	Only I	**B**	Only I and II
C	Only II and III	**D**	All follow

Solution: (a) All daffodils are plants and all plants are living, so the first conclusion follows; nothing is said of flowers, and only some living things are real.

MCQ 3.1.2 **A is older than B but younger than F. C is younger than B but older than D. Who is the youngest of them? (SZABMU MDCAT 2025)**

A	A	**B**	B
C	C	**D**	D

Solution: (d) The order runs F above A above B above C above D, so D is the youngest.

MCQ 3.1.3 **All omnivores are herbivores. No herbivores are carnivores. Some carnivores are humans. Which of the following conclusions are TRUE? CONCLUSIONS: I. Some humans are carnivores. II. No carnivores are omnivores. III. Some omnivores are carnivores. (KMU MDCAT 2024)**

A	I and II	**B**	I and III
C	II and III	**D**	I, II and III

Solution: (a) Omnivores are herbivores and no herbivore is a carnivore, so no omnivore is; and some carnivores being human makes some humans carnivores.

MCQ 3.1.4 **If a>b, b>c, and d>a then? (KMU MDCAT 2024)**

A	b<d	**B**	a<c
C	b>d	**D**	c>d

Solution: (a) From $d > a$ and $a > b$ it follows that d is greater than b.

MCQ 3.1.5 **All hammers are tools. Some tools are useless things. All useless things are trash. Which of the following conclusions are NECESSARILY TRUE given only in information above? Conclusions: I. Some hammers are trash. II. Some tools are trash. III. All useless things are tools. (SZABMU MDCAT 2023)**

A	I and III.	**B**	I and II.
C	II and III.	**D**	II

Solution: (d) Some tools are useless and every useless thing is trash, so some tools are trash; nothing follows about hammers.

MCQ 3.1.6 **Statement: It is reported that though Vitamin E present in fresh fruits and vegetables is beneficial for the human body, capsules of Vitamin E do not have the same effect on the human body. (PMC MDCAT 2022)**

A	Only I follows	**B**	Only II follows
C	Both follow	**D**	.Neither statement follows

Solution: (b) The statement bears only on the difference between the two forms of the vitamin.

Unit 4 Logical Problems

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Topic 4.1 Logical Problems

Past MDCAT Questions

MCQ 4.1.1 **One apple pie has 10 slices, and each apple pie feeds five people. Henry is having a party with 200 people. How many slices of pie does he need? (UHS MDCAT 2025)**

A	200	**B**	50
C	400	**D**	100

Solution: (c) Two hundred people need forty pies, and forty pies cut into ten slices give four hundred.

MCQ 4.1.2 **How many trees are in the orchard? Which of the statements below are needed to sufficiently answer this question? I. Ibrahim is a farmer and looks after half of the trees in the orchard II. 300 trees in the orchard are under Ibrahim's care (UHS MDCAT 2025)**

A	i is enough	**B**	ii is enough
C	both I and II are needed	**D**	neither i or ii are sufficient

Solution: (c) The second says how many trees Ibrahim looks after and the first says that is half of them, so both are needed.

MCQ 4.1.3 **P and Q are M's parents. M and N are siblings. Q is N's mother. What is P to M? (UHS MDCAT 2025)**

A	Mother	**B**	Father
C	Sister	**D**	Brother

Solution: (b) Q is the mother of both children, so P is the father.

MCQ 4.1.4 **Asad bought 50 packets of biscuits for the price of Rs. 500; whereas Anum bought 25 packets of chips for the price of Rs.1000. While comparing the prices of packets of biscuits and packet of chips, which of the following statements is correct? (UHS MDCAT 2025)**

A	Price of 4 packets of biscuits is equal to the price of 1 packet of chips	**B**	Price of 1 packet of biscuits is equal to the price of 4 packets of chips
C	Price of 2 packets of biscuits is equal to the price of 1 packet of chips	**D**	Price of 1 packet of biscuits is equal to the price of 2 packets of chips

Solution: (a) A biscuit packet costs ten rupees and a chip packet forty, so four packets of biscuits match one of chips.

MCQ 4.1.5 **A library has 4 books on Shelf A, and 8 books on Shelf B. Some books are removed from Shelf B such that both shelves now have exactly the same number of books. How many books were removed from Shelf B? (KMU MDCAT 2025)**

A	1	**B**	2
C	3	**D**	4

Solution: (d) Shelf B must come down from eight to four, so four books are taken off.

MCQ 4.1.6 **Ahmed ranks 10th in the class of 46 students. There are only 7 students below Bilal rank wise. How many students are there between Ahmed and Bilal? (KMU MDCAT 2025)**

A	27	**B**	28
C	30	**D**	32

Solution: (b) Seven students below Bilal put him 39th, and between 10th and 39th there are 28 students.

MCQ 4.1.7 **How is Ali related to Mustafa? If Ali says, "Mustafa's mother is the only child of my grandmother." (KMU MDCAT 2025)**

A	Brother	**B**	Cousin
C	Uncle	**D**	Father

Solution: (a) The grandmother's only child is the parent of both boys, so they are brothers.

MCQ 4.1.8 **A father is 5 years older than twice his son's age. If the son is 12, what is the father's age? (KMU MDCAT 2025)**

A	28 years	**B**	29 years
C	30 years	**D**	32 years

Solution: (b) Twice twelve is twenty-four, and five more is twenty-nine.

MCQ 4.1.9 **If 5 boxes of soap weigh 75 kilos and each box when empty weighs 3 kilos. What is total weight of the soaps? (KMU MDCAT 2025)**

A	15	**B**	30
C	45	**D**	60

Solution: (d) Five empty boxes weigh 15 kilos, so the soap is 75 less 15, that is 60 kilos.

MCQ 4.1.10 **In a row of students, a student is at 13th position from the left end and 20th position from the right end. How many students are there in the row? (SZABMU MDCAT 2025)**

A	30	**B**	31
C	32	**D**	33

Solution: (c) Twelve stand to the left and nineteen to the right, so with the student there are 32 in all.

MCQ 4.1.11 **A store offers a 10% discount on all items. After applying the discount, the price of an item is Rs. 450. What was the original price of the item? (KMU MDCAT 2024)**

A	Rs. 490	**B**	Rs. 495
C	Rs. 500	**D**	Rs. 505

Solution: (c) The discounted price is nine tenths of the original, and $450/0.9$ is 500.

MCQ 4.1.12 **I went 10m to the East from my house, then turned north and walked another 15m, and then I turned west and covered 12m, and then turned south and covered 15m. How far am I from my house? (KMU MDCAT 2024)**

A	0 m	**B**	1 m
C	2 m	**D**	3 m

Solution: (c) The northward and southward legs cancel, leaving $12 - 10$, that is $2\,\mathrm{m}$ to the west.

MCQ 4.1.13 **Read the following and choose the correct answer: "X, Y and Z are three whole numbers less than 24 but greater than 11. X is the smallest prime number. Y is the largest number divisible by 3. Z is the samallest number divisible by 11"? (SZABMU MDCAT 2023)**

A	X is 13, Y is 24, Z is 11.	**B**	X is 13, Y is 21, Z is 22.
C	X is 11, Y is 21, Z is 11.	**D**	X is 11, Y is 24, Z is 22.

Solution: (b) Between 11 and 24 the smallest prime is 13, the largest multiple of 3 is 21 and the smallest multiple of 11 is 22.

MCQ 4.1.14 **Read the following and choose the correct answer: "X, Y and Z are three whole numbers less than 31 but greater than 23. X is a prime number. Y is the largest odd number smaller than 35. Z is the smallest even number? (UHS MDCAT 2023)**

A	X is 31, Y is 29 and Z is 24.	**B**	X is 29, Y is 29 and Z is 24.
C	X is 23, Y is 29 and Z is 24.	**D**	X is 27, Y is 31 and Z is 26.

Solution: (b) Between 23 and 31 the prime is 29, the largest odd is 29 and the smallest even is 24.

Topic 5.1 Course of Action

Past MDCAT Questions

MCQ 5.1.1 **An outbreak of a corona disease is reported in the city. What should be the first course of action? (SZABMU MDCAT 2025)**

A	Develop a vaccination plan.	B	Conduct research on the disease.
C	Implement quarantine measures.	D	Inform the public by using all means.

Solution: (c) An outbreak must first be contained; research and vaccines take time the spread will not wait for.

MCQ 5.1.2 **Read the following statement, assuming everything in it to be true. Then decide which of the given suggested courses of action logically follow and are pursuing. Statement: My laptop's battery is low and needs to be charged. Courses of Action: I. Stop using the laptop to save power. II. Get a new fully charged battery and replace it with my old one. (SZABMU MDCAT 2023)**

A	I.	B	II.
C	Both I and II.	D	Neither I nor II.

Solution: (d) What the battery needs is charging; neither stopping work nor buying a new battery does that.

Topic 6.1 Cause and Effect

Past MDCAT Questions

MCQ 6.1.1 **Which of the following is a result of poor design that could cause an accident in the workplace? (UHS MDCAT 2025)**

A	Equipment failure	B	Slippery surfaces
C	Insufficient lighting	D	Unplanned workspace layout

Solution: (d) Equipment, surfaces and lighting are conditions; only the unplanned layout is a fault of the design itself.

MCQ 6.1.2 **Which of the following is the main cause of accidents involving equipment? (UHS MDCAT 2025)**

A	Overconfidence	B	Insufficient maintenance
C	Fatigue	D	Poor training

Solution: (b) Equipment that is not maintained fails, and that is what most equipment accidents come back to.

MCQ 6.1.3 **A hiker climbed to a higher altitude, where he felt the air pressure was lower as compared to the lower altitude. What is the likely effect? (SZABMU MDCAT 2025)**

A	The hiker felt more energetic.	B	The hiker felt no difficulty in breathing.
C	The hiker might experience altitude sickness.	D	The hiker felt healthier and fresh.

Solution: (c) Thinner air carries less oxygen, and the shortage brings on altitude sickness.

MCQ 6.1.4 **Read the following statements and identify the best cause-and-effect relation: I. Sara's productivity at work has significantly decreased over the past month. II. Sara has been experiencing frequent interruptions due to ongoing construction work near her office. Which of the following best describes the cause-and-effect relationship? (KMU MDCAT 2024)**

A	Sara's decreased productivity is causing the construction work.	B	The ongoing construction work is causing Sara's decreased productivity.
C	Sara's productivity was already decreasing before the construction work began.	D	The construction work is unrelated to Sara's productivity.

Solution: (b) The interruptions came first and would plainly hinder work, so they are the cause.

MCQ 6.1.5 **I. The government has increased the taxes on all bussinesses in pakistan. II. Many small businesses will have to close their operations in pakistan.] (SZABMU MDCAT 2023)**

A	Statement I is the cause and statement II is its effect.	B	Statement II is the cause and statement I is its effect.
C	Both the statements I and II are independent causes.	D	Both the statements I and II are effects of independent causes.

Solution: (a) The tax came first and would raise costs, so it is the cause and the closures the effect.

MCQ 6.1.6 **Statement (A) The Government has imported large quantities of sugar as per trade agreements with other countries. Statement (B) The prices of sugar in the domestic market have fallen sharply in recent months. (PMC MDCAT 2022)**

A	Statement A is the cause and statement B Is its effect.	B	Statement B is the cause and statement A is its effect
C	Both statements are independent causes.	D	Both statements are effects of independent causes.

Solution: (a) The imports came first and increased supply, so they are the cause of the fall in price.

MCQ 6.1.7 **I. Car manufacturing companies have recently increased the prices of mid-sized cars. II.The Government recently increased the duty on mid-sized cars. (PMC MDCAT 2022)**

A	Statement I is the cause and statement II is its effect	B	Statement II is the cause and statement I is its effect
C	Both the statements I and II are independent	D	Both the statements I and II are effects of so

Solution: (b) The duty was raised first and adds to the cost, so it is the cause of the price rise.

MCQ 6.1.8 **I. Two fighter jets from the air force malfunctioned mid-air after taking off from the air force base. II. One of the flying officers ejected whereas the other one died on spot. (PMC MDCAT 2022)**

A	Statement I is the cause and statement II is its effect	B	Statement II is the cause and statement I is its effect
C	c) Both statements I and II are independent causes	D	Both statements I and II are the effects of in

Solution: (a) The malfunction came first and caused the crash, so it is the cause.