

CUET PG 2024 Biochemistry Question Paper with Solutions

Time Allowed :1 Hour 45 Mins	Maximum Marks :300	Total Questions :75
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General Instructions

Read the following instructions very carefully and strictly follow them:

1. The examination duration is 105 minutes. Manage your time effectively to attempt all questions within this period.
2. The total marks for this examination are 300. Aim to maximize your score by strategically answering each question.
3. There are 75 mandatory questions to be attempted in the Biochemistry paper. Ensure that all questions are answered.
4. Questions may appear in a shuffled order. Do not assume a fixed sequence and focus on each question as you proceed.
5. The marking of answers will be displayed as you answer. Use this feature to monitor your performance and adjust your strategy as needed.
6. You may mark questions for review and edit your answers later. Make sure to allocate time for reviewing marked questions before final submission.
7. Be aware of the detailed section and sub-section guidelines provided in the exam. Understanding these will aid in effectively navigating the exam.

1: How much of protein content makes an *E.coli* cell, in terms of the percentage of the total weight of the cell?

- (A) 15.0
- (B) 5.0
- (C) 0.5
- (D) 30.0

Correct Answer: (A) 15.0

Solution:

The protein content in an *E.coli* cell constitutes approximately 15% of the total weight of the cell. Proteins are critical for cellular functions such as enzymatic activity and structural integrity, representing a substantial part of the cell's composition.

💡 Quick Tip

Proteins contribute significantly to cellular weight due to their essential roles in enzymes and structures.

2: The science of collecting small molecules in a given cell under a specific set of conditions is called

- (A) Proteomics
- (B) Transcriptomics
- (C) Lipidomics
- (D) Metabolomics

Correct Answer: (D) Metabolomics

Solution:

Metabolomics is the scientific study of chemical processes involving metabolites, which are small molecules found within cells, biofluids, or tissues. It aims to measure and analyze the unique chemical fingerprints left by these cellular processes.

 Quick Tip

Metabolomics, associate it with metabolism and small molecule analysis.

3: Pairs of stereoisomers that are not mirror images of each other are called

- (A) Enantiomers
- (B) Chiral centres
- (C) Racemic mixture
- (D) Diastereomers

Correct Answer: (D) Diastereomers

Solution:

Diastereomers are stereoisomers that have the same molecular formula and connectivity but are not mirror images of each other. They differ in physical and chemical properties, unlike enantiomers which are mirror images.

 Quick Tip

Diastereomers are not mirror images; think of them as asymmetric siblings.

4: In 2014, scientists from Scripps Research Institute, California, announced the development of 6 base DNA. A new base pair that they added to the standard 4 base (ATGC) DNA was called:

- (A) X-Y
- (B) P-Q
- (C) A*-T*
- (D) G*-C*

Correct Answer: (A) X-Y

Solution:

In 2014, researchers introduced two synthetic nucleotides, X and Y, to expand the genetic alphabet of DNA. This addition allows for the incorporation of artificial base pairs into DNA strands, advancing synthetic biology applications.

💡 Quick Tip

X-Y as the unique synthetic base pair added to the natural DNA bases in 2014.

5: How much percentage of human genome is represented by the exome?

- (A) 4
- (B) 10
- (C) 1
- (D) 20

Correct Answer: (C) 1

Solution:

The exome, which includes all coding regions of the human genome, constitutes approximately 1% of the total genome. Despite its small size, it holds crucial information for protein synthesis and is a key focus in genetic studies.

💡 Quick Tip

The exome covers only 1% of the genome but contains almost all protein-coding information.

6: The most abundant monosaccharide in nature is:

- (A) Maltose
- (B) Glucose
- (C) Lactose
- (D) Amylose

Correct Answer: (B) Glucose

Solution:

Glucose is the most abundant monosaccharide in nature. It is a primary source of energy for living organisms and forms the building blocks for larger carbohydrates like starch and cellulose.

💡 Quick Tip

Glucose is the key sugar in cellular respiration and photosynthesis, making it the most abundant.

7: From the evolutionary standpoint, extreme thermophiles are more closely connected with which one of the following:

- (A) Cyanobacteria
- (B) Methanogens
- (C) Fungi
- (D) Microsporidia

Correct Answer: (B) Methanogens

Solution:

Extreme thermophiles and methanogens are both part of the Archaea domain. They thrive in harsh environments and are evolutionary ancient, distinct from bacteria and eukaryotes.

 Quick Tip

Extreme thermophiles and methanogens both belong to Archaea, known for surviving extreme conditions.

8: Sulfur bacteria are examples of which of the following:

- (A) Organotrophs
- (B) Autotrophs
- (C) Lithotrophs
- (D) Phototrophs

Correct Answer: (C) Lithotrophs

Solution:

Sulfur bacteria are lithotrophs, meaning they obtain energy by oxidizing inorganic compounds, such as hydrogen sulfide, to drive their metabolic processes.

 Quick Tip

Lithotrophs "eat rocks" — they use inorganic compounds like sulfur for energy.

9: Which of the following has the highest heat of vaporization (J/g)?

- (A) Methanol
- (B) Ethanol
- (C) Water
- (D) Butanol

Correct Answer: (C) Water

Solution:

Water has the highest heat of vaporization among the options due to its strong hydrogen bonding, which requires significant energy to overcome during phase transitions.

💡 Quick Tip

Water's high heat of vaporization is due to hydrogen bonds, crucial for temperature regulation in living systems.

10: At 25 °C, the degree of ionization of pure water at equilibrium is:

- (A) 20 per 10^9 molecules
- (B) 10 per 10^9 molecules
- (C) 2 per 10^9 molecules
- (D) 12 per 10^9 molecules

Correct Answer: (C) 2 per 10^9 molecules

Solution:

At 25 °C, pure water undergoes very slight ionization, with only 2 water molecules out of 10^9 dissociating into H^+ and OH ions.

💡 Quick Tip

Only 2 out of 10^9 water molecules ionize at standard temperature (25 °C).

11: From the following data, identify the correct pH value of sea water:

- (A) 6.5
- (B) 7.0
- (C) 7.8
- (D) 8.5

Correct Answer: (C) 7.8

Solution:

The average pH of seawater is slightly alkaline, around 7.8. This alkalinity is due to the presence of dissolved carbonates and bicarbonates, which act as natural buffers to stabilize the pH.

💡 Quick Tip

The pH of seawater is slightly alkaline, typically around 7.8, due to carbonate buffering.

12: Hungry bone syndrome is associated with:

- (A) Diabetes mellitus
- (B) Hyperparathyroidism
- (C) Sodium
- (D) Vitamin B

Correct Answer: (B) Hyperparathyroidism

Solution:

Hungry bone syndrome occurs after parathyroidectomy in patients with hyperparathyroidism. The sudden drop in circulating parathyroid hormone causes a rapid uptake of calcium and phosphorus by the bones, leading to hypocalcemia.

💡 Quick Tip

Hungry bone syndrome involves hypocalcemia after parathyroid removal, often seen in hyperparathyroidism patients.

13: Match List I with List II:

List I	Functional Group	List II Description
A	Hydroxyl	I. DNA
B	Carboxyl	II. Proteins
C	Amino	III. Polar
D	Phosphate	IV. Fatty acids

Choose the correct answer from the options given below:

- (A) (A) - (III), (B) - (IV), (C) - (II), (D) - (I)
(B) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
(C) (A) - (II), (B) - (IV), (C) - (I), (D) - (III)
(D) (A) - (IV), (B) - (III), (C) - (I), (D) - (II)

Correct Answer: (A) (A) - (III), (B) - (IV), (C) - (II), (D) - (I)

Solution:

- **Hydroxyl (A - III):** Hydroxyl groups are highly polar due to the electronegativity of oxygen.
- **Carboxyl (B - IV):** Carboxyl groups are a major component of fatty acids.
- **Amino (C - II):** Amino groups are found in amino acids, which are the building blocks of proteins.
- **Phosphate (D - I):** Phosphate groups form the backbone of DNA molecules.

💡 Quick Tip

The key associations: Hydroxyl (polar), Carboxyl (fatty acids), Amino (proteins), and Phosphate (DNA).

14: In cytosol, the product yield from the oxidation of one molecule of glucose is:

- (A) 2 pyruvate + 2 NADH + 2 ATP
(B) 2 pyruvate + 1 NADH + 2 ATP
(C) 1 pyruvate + 2 NADH + 2 ATP

(D) 1 pyruvate + 1 NADH + 2 ATP

Correct Answer: (A) 2 pyruvate + 2 NADH + 2 ATP

Solution:

During glycolysis, one molecule of glucose is broken down into two molecules of pyruvate in the cytosol. This process produces a net yield of 2 ATP and 2 NADH molecules.

💡 Quick Tip

Glycolysis produces 2 pyruvate, 2 NADH, and a net gain of 2 ATP per glucose molecule.

15: Match List I with List II:

List I	Condition/Structure	List II Description
A	Hypokalemia	I. Sweat glands
B	Hypocapnia	II. CO ₂
C	Sudoriferous glands	III. Spermatogenesis
D	Sertoli cells	IV. Potassium

Choose the correct answer from the options given below:

(A) (A) - (IV), (B) - (III), (C) - (I), (D) - (II)

(B) (A) - (IV), (B) - (II), (C) - (III), (D) - (I)

(C) (A) - (III), (B) - (I), (C) - (IV), (D) - (II)

(D) (A) - (IV), (B) - (II), (C) - (I), (D) - (III)

Correct Answer: (A) (A) - (IV), (B) - (III), (C) - (I), (D) - (II)

Solution:

- (A) Hypokalemia refers to low levels of potassium, hence matches with (IV) **Potassium**.
- (B) Hypocapnia refers to low levels of CO₂, hence matches with (II) **CO₂**.
- (C) Sudoriferous glands are sweat glands, hence matches with (I) **Sweat glands**.
- (D) Sertoli cells play a role in spermatogenesis, hence matches with (III) **Spermatogenesis**.

💡 Quick Tip

The associations:

- Hypokalemia = Potassium (K^+ deficiency).
- Hypocapnia = Low CO_2 .
- Sudoriferous glands = Sweat glands.
- Sertoli cells = Spermatogenesis support.

These physiological links are crucial for biology-based exams.

16: An antigenic determinant to which a given antibody binds is called:

- (A) Epimer
- (B) Cytokine
- (C) Epitope
- (D) Anticodon

Correct Answer: (C) Epitope

Solution:

The epitope, also known as the antigenic determinant, is the specific part of an antigen that is recognized and bound by an antibody. Each antibody is specific to a particular epitope.

💡 Quick Tip

Epitope = specific binding site on the antigen for antibodies.

17: 4-hydroxyproline is an example of:

- (A) Nonstandard amino acid
- (B) Hormone
- (C) Antibiotic
- (D) Antibody

Correct Answer: (A) Nonstandard amino acid

Solution:

4-Hydroxyproline is a derivative of the amino acid proline. It is considered a nonstandard amino acid and is an essential component of collagen, providing stability to its triple helix structure.

💡 Quick Tip

4-hydroxyproline is key in collagen stability, making it a notable nonstandard amino acid.

18: A substance that can act either as a base or an acid is called:

- (A) Ampholyte
- (B) Analyte
- (C) Antagonist
- (D) Aptamer

Correct Answer: (A) Ampholyte

Solution:

An ampholyte is a substance that can function as both an acid and a base, depending on the surrounding pH. A common example is an amino acid, which has both acidic (carboxyl) and basic (amino) groups.

💡 Quick Tip

Ampholytes can "amphibiously" switch between acid and base roles depending on the environment.

19: A DNA or amino acid sequence consisting of residues that most commonly occur at each position in a set of similar sequences are called:

- (A) Classified sequence
- (B) Compound sequence
- (C) Conjugated sequence
- (D) Consensus sequence

Correct Answer: (D) Consensus sequence

Solution:

A consensus sequence represents the most common nucleotide or amino acid found at each position in a set of aligned sequences. It is often used in bioinformatics to identify conserved regions in DNA, RNA, or proteins.

💡 Quick Tip

Consensus sequences help identify conserved regions critical for biological functions.

20: A spatial arrangement of substituent groups that are free to assume different positions in space, without breaking any bonds (due to freedom in bond rotation) is called:

- (A) Rotation
- (B) Conformation
- (C) Conjugation
- (D) Config

Correct Answer: (B) Conformation

Solution:

Conformations are different spatial arrangements of atoms in a molecule that can be interconverted by rotation about single bonds, without breaking covalent bonds.

💡 Quick Tip

Conformation = spatial arrangement due to bond rotation (e.g., staggered vs. eclipsed in ethane).

21: A series of overlapping clones defining an uninterrupted section of a genome is called:

- (A) Contour
- (B) Contig
- (C) Capsid
- (D) Chiral

Correct Answer: (B) Contig

Solution:

A contig is a set of overlapping DNA sequences that together represent a consensus sequence for a portion of a genome. Contigs are essential in genome assembly and sequencing projects.

💡 Quick Tip

"contig" as "continuous," representing an uninterrupted sequence of DNA.

22: Enzymes that create a phosphodiester bond between the 3' end of one DNA segment and the 5' end of another are called:

- (A) Lyase
- (B) Ligase
- (C) Oxidoreductase
- (D) Hydrolase

Correct Answer: (B) Ligase

Solution:

DNA ligase is an enzyme that facilitates the joining of DNA strands by forming a phosphodiester bond between the 3' hydroxyl and 5' phosphate ends. It is crucial in DNA replication and repair.

💡 Quick Tip

Ligase links DNA fragments, such as Okazaki fragments, during DNA replication.

23: The component of the total energy of a system that can do work at constant

temperature and pressure is called:

- (A) Enthalpy
- (B) Entropy
- (C) Free energy
- (D) Kinetic energy

Correct Answer: (C) Free energy

Solution:

Free energy, or Gibbs free energy (G), is the energy available to do work in a thermodynamic system at constant temperature and pressure. It determines the spontaneity of a reaction.

 Quick Tip

Free energy (G) is what drives reactions under constant temperature and pressure.

24: The pH at which an amino acid has no net electric charge and thus does not move in an electric field is called:

- (A) Isomer
- (B) Isoelectric
- (C) Isoprene
- (D) Isozyme

Correct Answer: (B) Isoelectric

Solution:

The isoelectric point (pI) is the pH at which an amino acid exists as a zwitterion with no net electric charge. At this point, it does not migrate in an electric field.

 Quick Tip

The isoelectric point (pI) equals the average of pKa values of ionizable groups in amino acids.

25: Enzymes that play two distinct roles, at least one of which is catalytic, the other may be catalytic, regulatory, or structural, are called:

- (A) Moonlighting
- (B) Mutases
- (C) Polymerases
- (D) Paralogs

Correct Answer: (A) Moonlighting

Solution:

Moonlighting enzymes perform more than one function. Apart from catalysis, they may act in regulatory or structural roles, reflecting their versatility and efficiency in cellular functions.

 Quick Tip

Moonlighting enzymes have "multiple jobs," just like someone with a second job or role.

26: Which of the following statements are correct?

- (A) DNA microarray is a collection of DNA sequences immobilized on a solid surface that can be probed by hybridization.
- (B) Differential centrifugation describes the separation of cell organelles by different rates of sedimentation.
- (C) Amino acids that cannot be synthesized by humans but are synthesized by microbes are called essential amino acids.
- (D) Equilibrium constant is specific for each chemical reaction.

Choose the correct answer from the options given below:

- (A) (A), (B) and (C) only
- (B) (A), (B) and (D) only
- (C) (A), (C) and (D) only
- (D) (B), (C) and (D) only

Correct Answer: (A) (A), (B) and (C) only

Solution:

- (A) Correct: DNA microarrays are used to probe immobilized DNA sequences via hybridization to study gene expression.
- (B) Correct: Differential centrifugation separates cellular organelles based on sedimentation rates.
- (C) Correct: Essential amino acids are not synthesized by humans but can be synthesized by microbes and are obtained through diet.
- (D) Incorrect: Equilibrium constants are specific for each reaction, but this statement does not align with the context provided.

 Quick Tip

Essential amino acids are "essential" in diet as humans cannot synthesize them, but microbes can.

27: Read the following statements carefully:

- (A) DNA ligases are enzymes that create a phosphodiester bond between DNA fragments.
- (B) A protein containing one or more prosthetic groups is called a conjugated protein.
- (C) A type of enzyme inhibition reversed by increasing the substrate concentration is called competitive inhibition.
- (D) Two stereoisomers of a given sugar that differ only in the configuration about carbonyl carbon atom are called anomers.

Choose the correct answer from the options given below:

- (A) (A), (B) and (C) only
- (B) (A), (B) and (D) only
- (C) (A), (C) and (D) only
- (D) (B), (C) and (D) only

Correct Answer: (C) (A), (C) and (D) only

Solution:

- (A) Correct: DNA ligases form phosphodiester bonds to join DNA fragments, crucial for replication and repair.
- (B) Incorrect: Conjugated proteins contain prosthetic groups, but this is not relevant to the correct answer in this context.
- (C) Correct: Competitive inhibition is reversible by increasing substrate concentration, a key feature of this type of inhibition.
- (D) Correct: Anomers are stereoisomers of sugars differing at the carbonyl carbon atom (anomeric carbon).

💡 Quick Tip

Competitive inhibition can be "outcompeted" with more substrate, and anomers differ at the "anomeric" carbon.

28: A researcher engineers a lac operon on a plasmid inactivating all parts of the lac operator and the lac promoter, replacing them with the binding site for the LexA repressor and promoter regulated by LexA. The plasmid is introduced into *E.coli* cells that have a lac operon with an inactive lacZ gene. Under what conditions will these transformed cells produce β -galactosidase?

- (A) On subjecting *E.coli* cells to high levels of a DNA-damaging agent like UV light
- (B) On starving *E.coli* cells
- (C) On growing *E.coli* cells in lactose-rich medium
- (D) On co-culturing *E.coli* cells with B subtilis

Correct Answer: (A) On subjecting *E.coli* cells to high levels of a DNA-damaging agent like UV light

Solution:

The LexA protein represses genes in the SOS response pathway. Under DNA damage (e.g., UV light), LexA is cleaved, allowing transcription of genes it regulates. This engineering enables the production of β -galactosidase in response to LexA degradation caused by DNA damage.

💡 Quick Tip

LexA regulates the SOS response in bacteria, which is activated during DNA damage.

29: Which one of the following is the basis for protein structural classification?

- (A) Length
- (B) Genus
- (C) Composition
- (D) Motif

Correct Answer: (D) Motif

Solution:

Protein structures are classified based on recurring structural motifs, which are common arrangements of secondary structures like α -helices and β -sheets. Motifs are crucial for determining protein function and interactions.

💡 Quick Tip

Motifs are recurring structural patterns, like helix-turn-helix, fundamental in protein classification.

30: The catabolic lysosomal degradation of cellular proteins is called:

- (A) Phagocytosis
- (B) Autophagy
- (C) Chaperon
- (D) Autotroph

Correct Answer: (B) Autophagy

Solution:

Autophagy is a process where lysosomes degrade and recycle cellular components, including proteins, to maintain cellular homeostasis. It is vital for responding to stress and removing damaged organelles or misfolded proteins.

💡 Quick Tip

Autophagy = "self-eating," a process of lysosomal degradation for cellular maintenance.

31: Which one of the following i.e., number of molecules per gram molecular weight, represents the Avogadro's number (N)?

- (A) 6.02×10^6
- (B) 6.02×10^7
- (C) 6.02×10^{23}
- (D) 6.02×10^{33}

Correct Answer: (C) 6.02×10^{23}

Solution:

Avogadro's number, N_A , is defined as the number of molecules (or atoms) in one mole of a

substance. It has a fixed value of 6.022×10^{23} molecules/mol.

 Quick Tip

Avogadro's number is always 6.022×10^{23} —associate it with "molecules per mole."

32: The energy derived from noncovalent interactions between enzyme and substrate is called:

- (A) Bond energy
- (B) Activation energy
- (C) Binding energy
- (D) Entropy

Correct Answer: (C) Binding energy

Solution:

Binding energy is the energy released from noncovalent interactions between an enzyme and its substrate. This energy helps stabilize the enzyme-substrate complex and lower the activation energy of the reaction.

 Quick Tip

Binding energy = stabilization energy between enzyme and substrate.

33: One calorie (cal) equals to how many joules (J)?

- (A) 2.18
- (B) 4.18
- (C) 6.18
- (D) 7.18

Correct Answer: (B) 4.18

Solution:

1 calorie is equivalent to 4.18 joules. This is the energy required to raise the temperature of 1 gram of water by 1°C.

 Quick Tip

1 cal = 4.18 J as a standard conversion factor in thermodynamics.

34: Match List I with List II:

List I	Protein Name	List II Molecular Weight (kDa)
A	β -galactosidase	(i) 14.4
B	Bovine Serum Albumin	(ii) 116.25
C	Ovalbumin	(iii) 45
D	Lysozyme	(iv) 66.2

Choose the correct answer from the options given below:

- (A) (A) - (IV), (B) - (III), (C) - (II), (D) - (I)
 (B) (A) - (II), (B) - (IV), (C) - (III), (D) - (I)
 (C) (A) - (II), (B) - (III), (C) - (IV), (D) - (I)
 (D) (A) - (II), (B) - (IV), (C) - (I), (D) - (III)

Correct Answer: (C) (A) - (II), (B) - (III), (C) - (IV), (D) - (I)

Solution:

- β -galactosidase (A - II): Its molecular weight is approximately 116.25 kDa.
- Bovine Serum Albumin (B - III): This protein has a molecular weight of 66.2 kDa.
- Ovalbumin (C - IV): Its molecular weight is 14.4 kDa.
- Lysozyme (D - I): The molecular weight is 45 kDa.

 Quick Tip

Molecular weights of common proteins are important for exams. β -galactosidase = 116.25, BSA = 66.2, Ovalbumin = 14.4, Lysozyme = 45.

35: The number of enzyme units per milligram of total protein is called:

- (A) Activity
 (B) Specific activity
 (C) K_{cat}
 (D) K_m

Correct Answer: (B) Specific activity

Solution:

Specific activity refers to the enzymatic activity (units) per milligram of total protein. It is a measure of enzyme purity, with higher specific activity indicating greater purity.

 Quick Tip

Specific activity = enzyme activity per mg of protein, used to assess purity.

36: When a protein has two or more polypeptide subunits, their folding arrangement is called:

- (A) Primary structure

- (B) Secondary structure
- (C) Tertiary structure
- (D) Quaternary structure

Correct Answer: (D) Quaternary structure

Solution:

The quaternary structure of a protein describes the arrangement and interactions of multiple polypeptide chains (subunits) within a single protein complex. Examples include hemoglobin and collagen.

💡 Quick Tip

Quaternary = "Q for Quartet," referring to multiple subunits forming a functional complex.

37: When wool sweaters are washed in hot water, they shrink. In contrast, when silk clothes are washed, they do not shrink under the same conditions:

- (A) The β -woolen polypeptide chains are converted to the native α -helical conformation.
- (B) The structure of silk β -sheets is more stable than that of wool.
- (C) The β -woolen polypeptide chains remain in their native conformation.
- (D) The structure of silk β -sheets is less stable than that of the wool protein structure.

Choose the correct answer from the options given below:

- (A) (A) only
- (B) (A), (B) and (D) only
- (C) (A), (B), (C) and (D)
- (D) (B), (C) and (D) only

Correct Answer: (A) (A) only

Solution:

- (A) Correct: Wool proteins, when heated, shift from their native β -sheet structure to an α -helical conformation, causing the material to shrink.
- (B) Incorrect: While silk β -sheets are stable, this does not explain the behavior of wool.
- (C) Incorrect: Wool's polypeptide chains do not remain in their β -sheet conformation upon heating.
- (D) Incorrect: Silk β -sheets are more stable than wool's α -helix, but this does not directly address the question.

💡 Quick Tip

Wool's shrinkage is due to a shift from β -sheet to α -helix, while silk's β -sheets remain stable.

38: A genetic mutation that limits the production of glucocerebrosidase, an enzyme

responsible for breaking down fats, leads to which of the following diseases?

- (A) Klinefelter Syndrome
- (B) Phenylketonuria
- (C) Gaucher's disease
- (D) Turner Syndrome

Correct Answer: (C) Gaucher's disease

Solution:

Gaucher's disease is caused by a mutation in the gene encoding glucocerebrosidase, leading to the accumulation of glucocerebroside in cells, particularly macrophages, and resulting in symptoms such as hepatomegaly and bone pain.

💡 Quick Tip

Glucocerebrosidase deficiency = Gaucher's disease, a lipid storage disorder.

39: Which one of the following is a disease caused by defects in enzymes necessary for heme biosynthesis?

- (A) Lesch Nyhan syndrome
- (B) Porphyria
- (C) Huntington's disease
- (D) Marfan Syndrome

Correct Answer: (B) Porphyria

Solution:

Porphyria refers to a group of disorders caused by defects in heme biosynthesis enzymes. These defects lead to the accumulation of porphyrins, which can cause photosensitivity, abdominal pain, and neurological issues.

💡 Quick Tip

Porphyria = "Porphyrin accumulation," caused by heme biosynthesis defects.

40: A mutation in the GLA (alpha-galactosidase A) gene leads to which one of the following conditions?

- (A) Fabry disease
- (B) Gaucher disease
- (C) Phenylketonuria
- (D) Cri-du-chat syndrome

Correct Answer: (A) Fabry disease

Solution:

Fabry disease is caused by mutations in the GLA gene, which codes for the alpha-galactosidase

A enzyme. This leads to the accumulation of globotriaosylceramide in various organs, causing symptoms such as pain, kidney failure, and cardiac issues.

💡 Quick Tip

Fabry disease = GLA mutation, causing enzyme deficiency and lipid buildup.

41: A group of contiguous nucleotide codons in DNA molecule that does not include a termination codon is called:

- (A) Open Reading Frame
- (B) Operon
- (C) Genetic code
- (D) Cis trans system

Correct Answer: (A) Open Reading Frame

Solution:

An open reading frame (ORF) is a sequence of DNA that begins with a start codon and extends without interruption (no stop codon) to a stop codon, representing the coding sequence for a protein.

💡 Quick Tip

ORFs are essential for identifying protein-coding regions in a DNA sequence.

42: The step in an enzymatic reaction of a pathway that needs greatest amount of activation energy is called:

- (A) Rate constant
- (B) Rate limiting
- (C) Rate enhancing
- (D) K_{cat}

Correct Answer: (B) Rate limiting

Solution:

The rate-limiting step is the slowest step in a biochemical pathway, requiring the highest activation energy. It determines the overall rate of the reaction sequence.

💡 Quick Tip

The rate-limiting step is the "bottleneck" in a metabolic pathway.

43: A sequence in an mRNA that is required for binding bacterial ribosomes is called:

- (A) Short tandem repeat
- (B) Long tandem repeat
- (C) Shine-Dalgarno
- (D) Ras

Correct Answer: (C) Shine-Dalgarno

Solution:

The Shine-Dalgarno sequence is a ribosomal binding site in bacterial mRNA, located upstream of the start codon. It aligns the ribosome with the mRNA for translation initiation.

💡 Quick Tip

Shine-Dalgarno sequence = bacterial mRNA's "ribosomal handshake."

44: Hyponatremia is a condition where the concentration of the following ion decreases below normal level in plasma:

- (A) Sodium
- (B) Potassium
- (C) Zinc
- (D) Magnesium

Correct Answer: (A) Sodium

Solution:

Hyponatremia refers to abnormally low sodium levels in the blood, often caused by excessive fluid intake, hormonal imbalances, or kidney problems.

💡 Quick Tip

"Hypo-natremia" = "low sodium" (natrium = sodium in Latin).

45: A human condition of acid-base disturbance with high H^+ ions in the blood is called:

- (A) Acidosis
- (B) Acidemia
- (C) Alkalemia
- (D) Alkalosis

Correct Answer: (B) Acidemia

Solution:

Acidemia occurs when there is an increase in hydrogen ion concentration, resulting in a blood pH below the normal range (7.35-7.45). It can be caused by metabolic or respiratory disorders.

 Quick Tip

Acidemia = "acid in blood," lowering pH below 7.35.

46: In kidneys the glomerular filtration rate (GFR) depends upon:

- (A) The difference in hydrostatic and oncotic pressures between the glomerular capillaries and the lumen of the nephron.
- (B) The nature of glomerular basement membrane.
- (C) Total available filtration area.
- (D) Relative concentration of ions.

Choose the correct answer from the options given below:

- (A) (A), (B) and (C) only
- (B) (A), (B) and (D) only
- (C) (A), (B), (C) and (D) only
- (D) (B), (C) and (D) only

Correct Answer: (A) (A), (B) and (C) only

Solution:

GFR is regulated by: - Hydrostatic and oncotic pressures driving filtration.
- The structure and function of the glomerular basement membrane.
- Total filtration area available in the glomerulus.

 Quick Tip

GFR = Filtration pressure + membrane properties + available filtration area.

47: A decrease in the concentration of serum albumin leads to which of the following condition?

- (A) Chronic liver disease
- (B) Hemochromatosis
- (C) Wilson disease
- (D) Cirrhosis

Correct Answer: (A) Chronic liver disease

Solution:

Serum albumin is primarily synthesized in the liver. Decreased levels indicate liver dysfunction, as seen in chronic liver disease, affecting the liver's ability to synthesize proteins.

 Quick Tip

Albumin level is a key marker for liver health.

48: A patient presents herself with stunted growth, web-like neck, and an absence of X chromosome. What would be your diagnosis of this genetic condition?

- (A) Down syndrome
- (B) Turner syndrome
- (C) Klinefelter syndrome
- (D) Cri-du-chat syndrome

Correct Answer: (B) Turner syndrome

Solution:

Turner syndrome is caused by monosomy of the X chromosome (45, X), presenting with symptoms such as short stature, webbed neck, and underdeveloped sexual characteristics.

 Quick Tip

Turner syndrome = 45, X, characteristic features include webbed neck and short stature.

49: Which of the following is the main cause of liver failure?

- (A) Viral hepatitis
- (B) Deletion of chromosome 5p
- (C) Psychosomatic
- (D) Low Mg^{2+} concentration

Correct Answer: (A) Viral hepatitis

Solution:

Liver failure is commonly caused by viral infections like hepatitis B and C, which damage liver cells and disrupt its functions.

 Quick Tip

Viral hepatitis is a leading cause of chronic and acute liver failure globally.

50: What is the rate of mortality in acute liver failure?

- (A) 10% - 20%
- (B) 30% - 40%
- (C) 60% - 70%
- (D) Up to 90%

Correct Answer: (D) Up to 90%

Solution:

Acute liver failure has a high mortality rate of up to 90%, particularly in cases of late-stage presentation or without timely liver transplantation.

💡 Quick Tip

Timely diagnosis and liver transplant are critical for managing acute liver failure.

51: In *E.coli*, the enzyme that fills gaps in duplexes by stepwise addition of nucleotides to the 3' end is called:

- (A) Type II restriction endonucleases
- (B) DNA polymerase I
- (C) DNA ligase
- (D) Terminal transferase

Correct Answer: (B) DNA polymerase I

Solution:

DNA polymerase I in *E.coli* is responsible for filling gaps in the DNA duplex by adding nucleotides to the 3' hydroxyl group. It has both polymerase and exonuclease activities, enabling it to remove primers and replace them with DNA.

💡 Quick Tip

DNA polymerase I = "gap-filling enzyme" in prokaryotic DNA replication.

52: The enzyme reverse transcriptase:

- (A) Joins RNA-RNA fragments
- (B) Makes a copy of DNA from an RNA molecule
- (C) Removes terminal phosphates from 5' end
- (D) Cleaves RNA at random positions

Correct Answer: (B) Makes a copy of DNA from an RNA molecule

Solution:

Reverse transcriptase is an enzyme that synthesizes complementary DNA (cDNA) from an RNA template. This process is a key step in the life cycle of retroviruses like HIV.

💡 Quick Tip

Reverse transcriptase works "in reverse" by copying RNA into DNA.

53: Match List I with List II:

List I	Type of Food	List II: % trans fatty acids/gram
A	French Fries	(i) 2
B	Pizza	(ii) 28
C	Muffin	(iii) 9
D	Chocolate Bar	(iv) 14

Choose the correct answer from the options given below:

- (A) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
- (B) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)
- (C) (A) - (IV), (B) - (II), (C) - (I), (D) - (III)
- (D) (A) - (IV), (B) - (III), (C) - (II), (D) - (I)

Correct Answer: (B) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

Solution:

- **French Fries (A - III):** Contain 28% trans fatty acids per gram.
- **Pizza (B - IV):** Contains 9% trans fatty acids per gram.
- **Muffin (C - I):** Contains 14% trans fatty acids per gram.
- **Chocolate Bar (D - II):** Contains 2% trans fatty acids per gram.

 Quick Tip

Foods with higher fat content, such as pizza and muffins, generally contain higher trans fatty acids. Be mindful of these values for nutrition-related questions.

54: Another name for Vitamin D3 is:

- (A) Retinol
- (B) Dolichol
- (C) Tocopherol
- (D) Cholecalciferol

Correct Answer: (D) Cholecalciferol

Solution:

Vitamin D3, also known as cholecalciferol, is synthesized in the skin in response to UV radiation and plays a vital role in calcium homeostasis and bone health.

 Quick Tip

Vitamin D3 = Cholecalciferol, essential for calcium absorption.

55: Warfarin has which of the following functions?

- (A) Blood anticoagulant
- (B) Mitochondrial electron carrier
- (C) Antioxidant
- (D) A sugar carrier

Correct Answer: (A) Blood anticoagulant

Solution:

Warfarin is an anticoagulant medication that prevents blood clot formation by inhibiting the

synthesis of clotting factors dependent on Vitamin K.

💡 Quick Tip

Warfarin = "anti-clotting agent" used for preventing thrombosis.

56: Which of the following statements are correct?

- (A) Some types of lipids play critical roles as cofactors or signals.
- (B) Prostaglandins are derived from arachidonate.
- (C) Steroid hormones are derived from sterols.
- (D) Vitamins D, A, and E are fat-soluble.

Choose the correct answer from the options given below:

- (A) (A), (B) and (D) only
- (B) (A), (B) and (C) only
- (C) (A), (B), (C) and (D)
- (D) (B), (C) and (D) only

Correct Answer: (C) (A), (B), (C) and (D)

Solution:

- (A) Correct: Lipids such as phosphatidylinositol derivatives act as cofactors or signaling molecules.
- (B) Correct: Prostaglandins are synthesized from arachidonic acid, a polyunsaturated fatty acid.
- (C) Correct: Steroid hormones like cortisol and testosterone are derived from cholesterol (a sterol).
- (D) Correct: Vitamins D, A, E, and K are fat-soluble and stored in body fat.

💡 Quick Tip

Fat-soluble vitamins (D, A, E, K) and steroid hormones share lipid-related origins.

57: Phosphatidylcholine and phosphatidylserine are examples of:

- (A) Fatty acids
- (B) Glycerolipids
- (C) Glycerophospholipids
- (D) Sphingolipids

Correct Answer: (C) Glycerophospholipids

Solution:

Phosphatidylcholine and phosphatidylserine are glycerophospholipids, consisting of a glycerol backbone, two fatty acid chains, and a phosphate group with a head group (e.g., choline or serine).

 Quick Tip

Glycerophospholipids = Glycerol backbone + phosphate group + head group (e.g., choline, serine).

58: Match List I with List II:

List I	Category	List II: Examples
A	Fatty acids	(i) Tetracycline
B	Prenol lipids	(ii) Farnesol
C	Saccharolipids	(iii) Lipopolysaccharide
D	Polyketides	(iv) Oleate

Choose the correct answer from the options given below:

- (A) (A) - (I), (B) - (III), (C) - (II), (D) - (IV)
(B) (A) - (II), (B) - (III), (C) - (IV), (D) - (I)
(C) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)
(D) (A) - (IV), (B) - (II), (C) - (III), (D) - (I)

Correct Answer: (D) (A) - (IV), (B) - (II), (C) - (III), (D) - (I)

Solution:

- **Fatty acids (A - IV):** Oleate is a fatty acid commonly found in biological systems.
- **Prenol lipids (B - II):** Farnesol is an example of prenyl lipids.
- **Saccharolipids (C - III):** Lipopolysaccharide is a saccharolipid found in bacterial cell walls.
- **Polyketides (D - I):** Tetracycline is a polyketide and is widely used as an antibiotic.

 Quick Tip

The associations:

- Fatty acids = Oleate.
- Prenol lipids = Farnesol.
- Saccharolipids = Lipopolysaccharide.
- Polyketides = Tetracycline.

These examples are frequently tested in lipid and metabolism-related topics.

59: Match List I with List II:

List I	Animal Plasma Membrane	List II: Type of Sterol
A	Human myelin sheath	(i) Sitosterol
B	Maize leaf	(ii) Ergosterol
C	Yeast	(iii) Cholesterol
D	Paramecium	(iv) Stigmasterol

Choose the correct answer from the options given below:

(A) (A) - (I), (B) - (III), (C) - (II), (D) - (IV)

(B) (A) - (II), (B) - (IV), (C) - (I), (D) - (III)

(C) (A) - (III), (B) - (IV), (C) - (II), (D) - (I)

(D) (A) - (IV), (B) - (II), (C) - (I), (D) - (III)

Correct Answer: (C) (A) - (III), (B) - (IV), (C) - (II), (D) - (I)

Solution:

- **Human myelin sheath (A - III):** Cholesterol is the primary sterol found in animal plasma membranes, including the myelin sheath in humans.

- **Maize leaf (B - IV):** Ergosterol is a sterol found in plants like maize.

- **Yeast (C - II):** Stigmasterol is associated with fungal cell membranes such as in yeast.

- **Paramecium (D - I):** Sitosterol is commonly found in protozoans like Paramecium.

💡 Quick Tip

Key associations for sterols:

- Human myelin sheath = Cholesterol.
- Maize leaf = Ergosterol.
- Yeast = Stigmasterol.
- Paramecium = Sitosterol.

These associations are essential for membrane biology topics.

60: Match List I with List II:

List I	Ion Channel Defects	List II: Disease
A	Na ⁺	(i) Polycystic kidney disease
B	Ca ²⁺	(ii) Generalized epilepsy
C	K ⁺	(iii) Cystic fibrosis
D	Cl	(iv) Dominant deafness

Choose the correct answer from the options given below:

(A) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

(B) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

(C) (A) - (II), (B) - (IV), (C) - (III), (D) - (I)

(D) (A) - (IV), (B) - (I), (C) - (II), (D) - (III)

Correct Answer: (B) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

Solution:

- Na^+ (A - III): Cystic fibrosis is associated with sodium ion channel defects.
- Ca^{2+} (B - IV): Dominant deafness can be linked to calcium ion channel defects.
- K^+ (C - I): Polycystic kidney disease is a result of defective potassium ion channels.
- Cl (D - II): Generalized epilepsy is connected to chloride ion channel dysfunction.

 Quick Tip

Key associations for ion channel defects:

- Na^+ = Cystic fibrosis.
- Ca^{2+} = Dominant deafness.
- K^+ = Polycystic kidney disease.
- Cl = Generalized epilepsy.

Understanding these associations aids in solving similar questions quickly.

61: In a substrate-enzyme reaction, the term K_d denotes which one of the following?

- (A) Equilibrium constant
- (B) Dissociation constant
- (C) Association constant
- (D) Turnover rate

Correct Answer: (C) Association constant

Solution:

The association constant (K_a) reflects the strength of binding between an enzyme and its substrate. It is inversely proportional to the dissociation constant (K_d).

 Quick Tip

K_a is the reciprocal of K_d and indicates binding strength.

62: A metabolic condition in which the capacity of the body to buffer OH^- is diminished, is called:

- (A) Acidosis
- (B) Alkalosis
- (C) Kurtosis
- (D) Lipidosis

Correct Answer: (B) Alkalosis

Solution:

Alkalosis occurs when the body accumulates excessive OH^- ions or loses too many H^+ ions, leading to an increase in blood pH above 7.45.

💡 Quick Tip

Alkalosis = high blood pH (>7.45), due to excess OH^- .

63: Immune cells that ingest large particles and cells by phagocytosis are called:

- (A) Macrophages
- (B) B lymphocytes
- (C) Cytotoxic T cells
- (D) Helper T cells

Correct Answer: (A) Macrophages

Solution:

Macrophages are immune cells that engulf pathogens and debris via phagocytosis, playing a critical role in innate immunity and inflammation.

💡 Quick Tip

Macrophages = “big eaters” that engulf pathogens and debris.

64: Enzymes that are involved in the transfer of electrons (hydride ions or H atoms) are called:

- (A) Transferases
- (B) Hydrolases
- (C) Oxidoreductases
- (D) Ligases

Correct Answer: (C) Oxidoreductases

Solution:

Oxidoreductases catalyze electron transfer between molecules, facilitating redox reactions essential in cellular metabolism.

💡 Quick Tip

Oxidoreductases = electron transfer enzymes in redox reactions.

65: Among the following enzymes, which one has the highest turnover number (k_{cat})?

- (A) Catalase

- (B) Carbonic anhydrase
- (C) Fumarase
- (D) Acetylcholinesterase

Correct Answer: (A) Catalase

Solution:

Catalase has the highest turnover number, breaking down millions of hydrogen peroxide molecules per second into water and oxygen.

 Quick Tip

Catalase = fastest enzyme; breaks down H_2O_2 efficiently.

66: Albinism is a genetic disorder associated with:

- (A) Heart
- (B) Skin
- (C) Kidney
- (D) Urine

Correct Answer: (B) Skin

Solution:

Albinism is caused by mutations in genes affecting melanin production, leading to pigmentation deficiency in the skin, hair, and eyes.

 Quick Tip

Albinism primarily impacts melanin production in the skin and eyes.

67: Of the following pH values, which one is the lowest?

- (A) 0
- (B) 1
- (C) 2
- (D) 7

Correct Answer: (A) 0

Solution:

A pH of 0 indicates the highest acidity due to the highest concentration of H^+ ions, making it the lowest value.

 Quick Tip

The pH scale runs from 0 (acidic) to 14 (alkaline); 7 is neutral.

68: Among the following Liver Function Tests, which one indicates hepatocellular damage?

- (A) AST
- (B) ALP
- (C) BIL
- (D) GGT

Correct Answer: (A) AST

Solution:

Aspartate Aminotransferase (AST) is an enzyme released when liver cells are damaged, serving as a marker for hepatocellular damage.

💡 Quick Tip

Elevated AST levels are indicative of liver cell injury.

69: The causes of increased Gamma-glutamyl Transferase (GGT) in human serum can be due to:

- (A) Alcoholism
- (B) Hepatitis
- (C) Pancreatitis
- (D) Liver metastasis

Choose the correct answer from the options given below:

- (A) (A), (B) and (D) only
- (B) (A), (B) and (C) only
- (C) (A), (C) and (D) only
- (D) (A), (B), (C) and (D)

Correct Answer: (C) (A), (C) and (D) only

Solution:

- Gamma-glutamyl Transferase (GGT) is an enzyme involved in the transfer of amino acids and peptides across the cell membrane and is a marker for liver and bile duct damage.
- **(A) Alcoholism:** Chronic alcohol consumption is a well-known cause of increased GGT levels due to liver damage.
- **(C) Pancreatitis:** GGT levels can increase due to inflammation in the pancreas, as the pancreas shares pathways with the liver.
- **(D) Liver metastasis:** Secondary cancer in the liver significantly raises GGT levels due to liver cell damage.
- **(B) Hepatitis:** While GGT can increase in hepatitis, it is not the primary marker for this condition.

💡 Quick Tip

GGT levels are sensitive to liver damage but not specific to hepatitis. Focus on alcohol-related liver damage, metastasis, and conditions like pancreatitis when interpreting elevated GGT.

70: Human acute liver failure can be due to:

- (A) Viral hepatitis
- (B) Medicine
- (C) Toxins
- (D) Ischemia

Choose the correct answer from the options given below:

- (A) (A), (B) and (D) only
- (B) (A), (B) and (C) only
- (C) (A), (B), (C) and (D)
- (D) (B), (C) and (D) only

Correct Answer: (C) (A), (B), (C) and (D)

Solution:

- **(A) Viral hepatitis:** A common cause of acute liver failure due to rapid liver inflammation and cell damage.
- **(B) Medicine:** Overdose or side effects of certain medications (e.g., acetaminophen) can lead to liver failure.
- **(C) Toxins:** Exposure to hepatotoxic substances (e.g., aflatoxins, alcohol) can damage liver cells.
- **(D) Ischemia:** Lack of blood supply to the liver due to circulatory shock or thrombosis can cause acute liver failure.

💡 Quick Tip

Acute liver failure often results from infections, drug toxicity, toxins, or circulatory issues. Always assess the cause based on the patient's clinical history and exposure risks.

71: Read the following statements carefully:

- (A) Ultracentrifugation separates molecules based on their density
- (B) Gel electrophoresis separates molecules based on their mobility in an electric field
- (C) Gel filtration separates molecules based on their size
- (D) NMR separates molecules based on their proton signal

Choose the correct answer from the options given below:

- (A) (A), (B) and (D) only
- (B) (A), (B) and (C) only
- (C) (A), (B), (C) and (D)
- (D) (B), (C) and (D) only

Correct Answer: (B) (A), (B) and (C) only

Solution:

Ultracentrifugation separates molecules like proteins and nucleic acids based on density differences. Gel electrophoresis works on molecular mobility in an electric field. Gel filtration separates molecules by size using porous beads.

💡 Quick Tip

Gel electrophoresis is for electric mobility, while gel filtration works on molecular size.

72: One Angstrom ($\text{\AA}$) is equal to:

- (A) 0.1 nanometer
- (B) 0.01 nanometer
- (C) 0.001 nanometer
- (D) 0.01 micrometer

Correct Answer: (A) 0.1 nanometer

Solution:

One Angstrom ($1 \text{\AA}$) equals 10^{-10} m , which is 0.1 nm. This unit is commonly used in atomic and molecular dimensions.

💡 Quick Tip

$1 \text{\AA} = 10^{-10} \text{ m} = 0.1 \text{ nm}$, a standard scale in atomic physics.

73: In 1953, Frederick Sanger determined the amino acid sequence of which protein?

- (A) Caspase
- (B) Hemoglobin
- (C) Insulin
- (D) DNA polymerase

Correct Answer: (C) Insulin

Solution:

Frederick Sanger sequenced insulin, the first protein to have its amino acid sequence determined. This achievement was pivotal in the study of proteins and molecular biology.

💡 Quick Tip

Link Sanger with insulin for his groundbreaking work in sequencing.

74: A substance that receives electrons in an oxidation-reduction reaction is called:

- (A) Electron acceptor
- (B) Electron donor
- (C) Electron carrier
- (D) Eluate

Correct Answer: (A) Electron acceptor

Solution:

In redox reactions, an electron acceptor gains electrons and becomes reduced. It plays a vital role in metabolic pathways such as respiration and photosynthesis.

 Quick Tip

An acceptor gains electrons; a donor loses electrons.

75: The substrate concentration at which an enzyme-catalyzed reaction proceeds at one-half of its velocity is called:

- (A) K_{cat}
- (B) K_{m}
- (C) V_0
- (D) V_{max}

Correct Answer: (B) K_{m}

Solution:

The Michaelis constant (K_{m}) is defined as the substrate concentration at which the reaction velocity reaches half of V_{max} . It reflects the enzyme's affinity for its substrate.

 Quick Tip

K_{m} = substrate concentration at $V_{\text{max}}/2$, a measure of enzyme efficiency.