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CHEM • CHEMISTRY

19. Macromolecules / Biochemistry

Official PMDC Solved Past Paper Topical Booklet • High-Yield Examination Series

47 Solved Questions

2010 to 2024 Archive

Boards: BUMHS, DUHS, KMU, MDCAT, PMDC, SET

Weightage: 27% of MDCAT (54 MCQs)

Curated by Ibrahim for fellow bees. Every question in this chapter has been verified against official UHS, NUMS, SZABMU, DUHS, and KMU answer keys. Propolis cognitive autopsies are provided at the end of this booklet to explain core concepts and break down common distractor traps.

OFFICIAL SOLVED EDITION**Q1.**

SZABMU 2024

Based on function thyroxine can be classified as

- (A) Structural protein
- (B) Hormonal protein
- (C) Genetic protein
- (D) Transport protein

Q2.

KMU 2024

Protein present in haemoglobin has ____ structure.

- (A) Primary
- (B) Tertiary
- (C) Secondary
- (D) Quaternary

Q3.

KMU 2024

In competitive inhibition, the inhibitor

- (A) Competes with enzyme
- (B) Binds with substrate
- (C) Irreversibly binds with enzyme
- (D) Competes with substrate

Q4.

DUHS 2024

It transports oxygen from the lungs to every tissue of the body

- (A) Proteins
- (B) Hemoglobin
- (C) Hormones
- (D) Liquids

Q5.

DUHS 2024

Deficiency of ____ causes loss of weight, appetite, and taste: (out of syllabus)

- (A) P
- (B) Zn
- (C) Fe
- (D) K

Q6.

BUMHS 2024

Amino acids, which are not synthesized by human body are

- (A) Synthetic amino acids
- (B) Non-essential amino acids
- (C) Dietary amino acids
- (D) Essential amino acids

Q7.

BUMHS 2024

The polymer formed single type of monomer is called

- (A) Copolymer
- (B) Homopolymer
- (C) Terpolymer
- (D) Thermosetting polymer

Q8.

BUMHS 2024

The lipids which have ____ compound is called steroids

- (A) Tetracyclic
- (B) Phenanthrene
- (C) Benzene
- (D) Cyclopentane

Q9.

BUMHS 2024

Which of the following food product has lower energy per gram?

- (A) Glucose
- (B) Milk
- (C) ghee
- (D) Butter

Q10.

BUMHS 2024

The non-protein part of enzyme is called

- (A) Co-enzyme
- (B) Substrate
- (C) Apoenzyme
- (D) Activator

Q11.

UHS 2023

Competitive inhibitors stop an enzyme from working by:

- (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

Q12.

UHS 2023

After the digestion & before absorption the product of the protein is:

- (A) Only Amino Acid
- (B) Amino acid and small polypeptide
- (C) Only small polypeptide
- (D) Only ammonia

Q13.

SZABMU 2023

The two functional groups present in all amino acids are:

- (A) Carboxylic acid and amino
- (B) Amino and aldehyde
- (C) Ether and carboxylic acid
- (D) Aldehyde and carboxylic acid

Q14.

SZABMU 2023

Enzyme is a natural substance that:

- (A) Has no effect on the rate of chemical reaction
- (B) Increases the rate of chemical reaction
- (C) Decreases the rate of chemical reaction
- (D) Stops the chemical reaction

Q15.

KMU 2023

The inhibition in which or inhibitor does not combine directly with the enzyme but binds to the enzyme substrate complex is called:

- (A) Reversible inhibition
- (B) Competitive inhibition
- (C) Uncompetitive inhibition
- (D) Non-competitive inhibition

Q16.

KMU 2023

Trypsinogen can be activated by the action of:

- (A) HCl
- (B) Enterokinase
- (C) Glucokinase
- (D) Amylase

Q17.

DUHS 2023

Enzyme show optimum activity between 37°C to 50°C. it however works

- (A) Below 37°C
- (B) Above 50°C
- (C) It loses activity permanently below 37°C
- (D) It loses activity permanently above 50°C

Q18.

DUHS 2023

Which of the following is an Amino acid?

- (A) Palmitic acid
- (B) Aspartic acid
- (C) Benzoic acid
- (D) Aniline

Q19.

BUMHS 2023

Protein content of human milk is about:

- (A) 1.4 %
- (B) 3.4 %
- (C) 2.4 %
- (D) 4.4 %

Q20.

BUMHS 2023

For every reaction occurring in human body there is at least one type of:

- (A) Protein
- (B) Enzyme
- (C) Amino acid
- (D) Vitamin

Q21.

UHS 2022

When food reaches stomach, the action of which of the following come to an end due to acidic pH?

- (A) Amylase
- (B) Lipase
- (C) Maltase
- (D) Hydrolase

Q22.

UHS 2022

Which of the following proteins acts as carrier of Cu in blood plasma?

- (A) Ceruloplasmin
- (B) Haemoglobin
- (C) Glycoprotein
- (D) Histone

Q23.

SZABMU 2022

Based on function, thyroxin can be classified as

- (A) Transport protein
- (B) Structural protein
- (C) Hormonal protein
- (D) Genetic protein

Q24.

SZABMU 2022

Enzyme is a natural substance that

- (A) Has no effect on the rate of chemical reaction
- (B) Decreases the rate of chemical reaction
- (C) Increases the rate of chemical reaction
- (D) Stops the chemical reaction

Q25.

KMU 2022

The linear arrangement of amino acid units in proteins is called:

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

Q26.

DUHS 2022

Nylon "6,6" is a:

- (A) Condensation polymer of hexandioic acid & 1,6 diaminohexane
- (B) Addition polymer
- (C) It is an ester
- (D) Condensation polymer

Q27.

DUHS 2022

In protein amino acid molecule are linked by:

- (A) Peptide linkage
- (B) Glycosidic linkage
- (C) Glucoacidic linkage
- (D) Ethane linkage

Q28.

BUMHS 2022

Which enzyme is used for the treatment of blood cancer in children?

- (A) Thrombin
- (B) LDH-1
- (C) L-asparaginase
- (D) Zymase

Q29.

BUMHS 2022

The main structural feature of proteins is:

- (A) Ester linkage
- (B) Glycoside linkage
- (C) Ether linkage
- (D) Peptide linkage

Q30.

PMDC 2021

Protein is a polymer of ____?

- (A) Glucose
- (B) Nitrogenous base
- (C) Amino acids
- (D) Nitrogen atoms

Q31.

PMDC 2021

Globulins protein upon hydrolysis yield amino acids or their derivatives, so they belong to which type of protein

- (A) Compound proteins
- (B) Simple proteins
- (C) Derived proteins
- (D) Conjugated proteins

Q32.

PMDC 2021

Regular coiling and twisting of polypeptide chain caused by H-bonding in between NH and CO occurs ____

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

Q33.

PMDC 2021

The substances which reduce the activity of enzyme action are called ____?

- (A) Activators
- (B) Promoters
- (C) Reducers
- (D) Inhibitors

Q34.

PMDC 2020

Based on the physico-chemical properties, proteins may be classified into the following types:

- (A) Simple proteins
- (B) Compound proteins
- (C) Derived proteins
- (D) All of the above

Q35.

PMDC 2020

Based on function, thyroxine can be classified as:

- (A) Structural protein
- (B) Transport protein
- (C) Hormonal protein
- (D) Genetic protein

Q36.

PMDC 2020

L-Asparaginase enzymes has been used for the treatment of:

- (A) Jaundice
- (B) Rickets
- (C) Blood cancer
- (D) Heat disease

Q37.

SET 2019

The proteins which give an amino acid and non-protein group on hydrolysis are known as:

- (A) Derived protein
- (B) Conjugated protein
- (C) Albumins
- (D) Conjugated simple protein

Q38.

KMU 2019

The enzyme which is found in saliva, accelerates the conversion of starch into sugar is;

- (A) Ptyalin
- (B) Pepsin
- (C) Thrombin
- (D) Fumarase

Q39.

MDCAT 2019

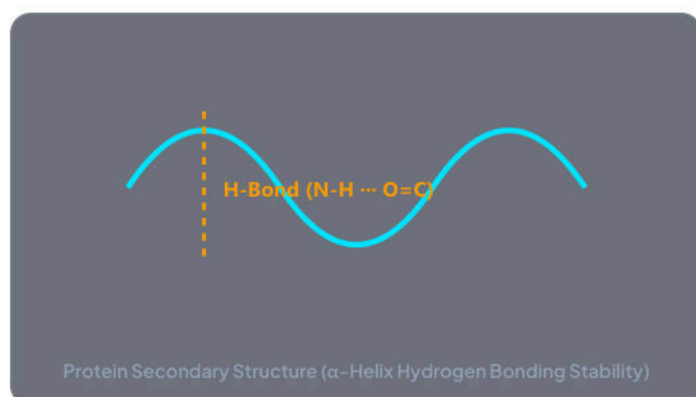
Which of the following bond is responsible for joining the amino acids in proteins?

- (A) Peptide Bond
- (B) Metallic Bond
- (C) Di sulfide bond
- (D) Ionic Bond

Q40.

MDCAT 2018

The stability in the following structure is due to the

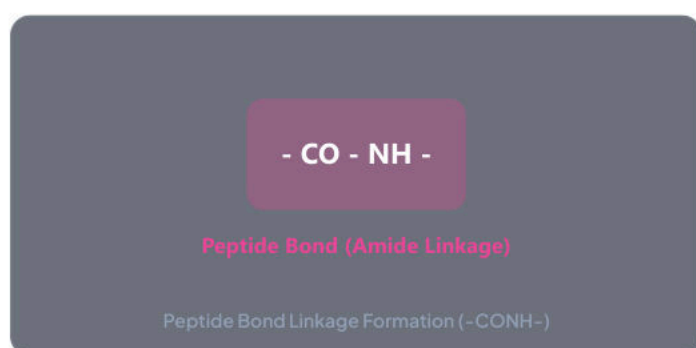


- (A) Hydrogen bonding between NH group of one peptide with another peptide
- (B) Disulfide bridges
- (C) Weak vander Waal's forces
- (D) Presence of unpaired electron in the structure

Q41.

MDCAT 2018

Amino acids react with each other such that -COOH group of one amino acid reacts with the another amino acid to give a condensed structure as shown below. What is the name of circled part of this structure?



- (A) Ester linkage
- (B) Azide linkage
- (C) Peptide linkage
- (D) Carbide linkage

Q42.

MDCAT 2018

Role of a catalyst in a chemical reaction is to

- (A) Decrease rate of a reaction
- (B) Increase rate of a reaction
- (C) Decrease yield of a reaction
- (D) Increase yield of product

Q43.

MDCAT 2017

Phosphoprotein comes under the type of proteins

- (A) Simple protein
- (B) Conjugated
- (C) Derived protein
- (D) Both A & B

Q44.

MDCAT 2012

Macromolecules are described as large molecules built up from small repeating units called

- (A) Monomers
- (B) Metamers
- (C) Isomers
- (D) Tautomers

Q45.

MDCAT 2011

A polymer in which the number of amino acid residue is greater than 100 or the molecular mass is greater than 10,000 is called

- (A) Polypeptide
- (B) Tripeptide
- (C) Dipeptide
- (D) Protein

Q46.

MDCAT 2010

Collagen and albumin are:

- (A) Simple proteins
- (B) Derived proteins
- (C) Polyamide
- (D) Polysaccharide

Q47.

MDCAT 2010

Glucose is converted into ethanol by the enzyme present in the yeast:

- (A) Zymase
- (B) Urease
- (C) Invertase
- (D) Sucrase

RAPID 5-COLUMN ANSWER KEY

Official PMDC verified answer keys for 19. Macromolecules / Biochemistry.

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Q#	KEY	BOARD	Q#	KEY	BOARD	Q#	KEY	BOARD	Q#	KEY	BOARD	Q#	KEY	BOARD
1	B	SZABMU 2024	11	C	UHS 2023	21	A	UHS 2022	31	B	PMDC 2021	41	C	MDCAT 2018
2	D	KMU 2024	12	B	UHS 2023	22	A	UHS 2022	32	C	PMDC 2021	42	B	MDCAT 2018
3	D	KMU 2024	13	A	SZABMU 2023	23	C	SZABMU 2022	33	D	PMDC 2021	43	B	MDCAT 2017
4	B	DUHS 2024	14	B	SZABMU 2023	24	C	SZABMU 2022	34	D	PMDC 2020	44	A	MDCAT 2012
5	A	DUHS 2024	15	C	KMU 2023	25	A	KMU 2022	35	C	PMDC 2020	45	D	MDCAT 2011
6	D	BUMHS 2024	16	B	KMU 2023	26	A	DUHS 2022	36	C	PMDC 2020	46	A	MDCAT 2010
7	B	BUMHS 2024	17	D	DUHS 2023	27	A	DUHS 2022	37	B	SET 2019	47	A	MDCAT 2010
8	A	BUMHS 2024	18	B	DUHS 2023	28	C	BUMHS 2022	38	A	KMU 2019			
9	A	BUMHS 2024	19	C	BUMHS 2023	29	D	BUMHS 2022	39	A	MDCAT 2019			
10	A	BUMHS 2024	20	B	BUMHS 2023	30	C	PMDC 2021	40	A	MDCAT 2018			

TOTAL MCQS	CORRECT	INCORRECT	BLANK	ACCURACY
47	-----	-----	-----	----- %

Scan the booklet QR code to enter answers in
BeambePrep Grind Mode for automated error autopsies.

PROPOLIS COGNITIVE ERROR AUTOPSIES

Step-by-step conceptual derivations, formula working, and distractor autopsies for every question.

Question #1 Key: (B)

SZABMU 2024

Based on function thyroxine can be classified as

CORE CONCEPT AND DERIVATION

Thyroxine is an amino acid derivative acting as a systemic chemical messenger.

Formula:

N/A

Solution:

- Thyroxine (T₄) is secreted into the blood by the thyroid gland to regulate basal metabolic rate.
- Because its physiological role is entirely regulatory and acts at distant target tissues, it is functionally classified as a **hormonal protein** (or hormonal derivative).

Why other options are incorrect:

It is not used to build tissues (structural), it doesn't ferry other molecules in the blood (transport), and it is not a histone involved in DNA packing (genetic).

Question #2 Key: (D)

KMU 2024

Protein present in haemoglobin has _____ structure.

CORE CONCEPT AND DERIVATION

Proteins that consist of multiple distinct polypeptide subunits aggregated together exhibit the highest level of protein structure.

Formula:

$\alpha_2\beta_2$

Solution:

- Hemoglobin is composed of four individual polypeptide chains (two α -globins and two β -globins in adults).
- These four separate subunits bind together via non-covalent interactions to form a single functional, multimeric protein complex.
- This aggregation of multiple independent polypeptide chains constitutes a **quaternary structure**.

Why other options are incorrect:

While hemoglobin contains primary, secondary, and tertiary structures within its individual subunits, the overarching functional structure of the complete, native protein is quaternary.

Question #3 Key: (D)

KMU 2024

In competitive inhibition, the inhibitor

CORE CONCEPT AND DERIVATION

In competitive inhibition, the inhibitor possesses a molecular geometry and charge distribution closely resembling the natural substrate.

Solution:

- Because of structural similarity, the inhibitor **competes with the substrate** for occupancy of the enzyme's catalytic active site.
- When the inhibitor occupies the active site, the actual substrate is prevented from binding, forming an Enzyme-Inhibitor (EI) complex.
- Competitive inhibition is reversible and can be overcome by increasing substrate concentration ($[S]$), which increases K_m while keeping V_{max} unchanged.
- Therefore, the inhibitor **competes with substrate**.

Why other options are incorrect:

- A (Competes with enzyme):** Incorrect; the inhibitor binds to the enzyme rather than competing against it.
- B (Binds with substrate):** The inhibitor interacts directly with the enzyme's active site, not with the substrate.
- C (Irreversibly binds with enzyme):** Competitive inhibition is reversible via mass action; irreversible inhibitors bind permanently via covalent bonds (e.g., nerve gases, cyanide).

Question #4 Key: (B)

DUHS 2024

It transports oxygen from the lungs to every tissue of the body

CORE CONCEPT AND DERIVATION

Red blood cells utilize specialized metalloproteins to reversibly bind and transport respiratory gases.

Formula:

$Hb + 4O_2 \rightleftharpoons Hb(O_2)_4$

Solution:

- The erythrocytes (red blood cells) are packed with a specialized iron-containing protein called **hemoglobin**.
- Hemoglobin binds oxygen tightly in the high-oxygen environment of the lungs and releases it in the lower-oxygen environment of peripheral tissues.

Why other options are incorrect:

While hemoglobin is a protein, "Proteins" is far too broad of an answer. Hormones regulate physiology, and liquids (like blood plasma) carry only a negligible amount of dissolved oxygen compared to hemoglobin.

Question #5 Key: (A)

DUHS 2024

Deficiency of _____ causes loss of weight, appetite, and taste: (out of syllabus)

CORE CONCEPT AND DERIVATION

Trace minerals and macronutrients play crucial roles in physiological homeostasis. Phosphorus (P) is vital for ATP, bone structure, and cellular signaling.

Formula:

N/A

Solution:

- According to the provided explanatory notes for this specific exam, a deficiency of Phosphorus (P) is linked to a cluster of symptoms including loss of weight, appetite, and taste.
- Note: In clinical medicine, Zinc (Zn) deficiency is most classically famous for causing loss of taste (ageusia) and appetite. However, strictly following the provided board curriculum/key, Phosphorus is the indicated answer.

Why other options are incorrect:

Iron (Fe) deficiency causes anemia (fatigue, pale skin). Potassium (K) deficiency causes muscle weakness and fatigue. Zinc (Zn) causes skin rashes and diarrhea according to the provided text.

Question #6 Key: (D)

BUMHS 2024

Amino acids, which are not synthesized by human body are

CORE CONCEPT AND DERIVATION

Nutritional classification of amino acids is based on the body's intrinsic biochemical ability to synthesize them from intermediate metabolites.

Formula:

N/A

Solution:

- The human body requires 20 standard amino acids to build proteins.
- The body can manufacture 11 of them internally (non-essential).
- The remaining 9 amino acids cannot be synthesized by human metabolic pathways. Because it is "essential" that they are obtained through the diet, they are called **essential amino acids** (e.g., valine, histidine, leucine).

Why other options are incorrect:

Non-essential amino acids are synthesized by the body. 'Dietary' is a generic term, and 'synthetic' implies artificially created in a lab rather than naturally derived from food.

Question #7 Key: (B)

BUMHS 2024

The polymer formed single type of monomer is called

CORE CONCEPT AND DERIVATION

Polymers are classified by the homogeneity of their repeating monomeric units.

Formula:



Solution:

- When a polymer chain consists entirely of copies of exactly one type of monomer, it is referred to as a **homopolymer** (homo- meaning 'same').
- Examples include polyethylene (only ethene monomers) or starch (only glucose monomers).

Why other options are incorrect:

A copolymer consists of two different types of monomers (like Nylon-6,6). A terpolymer consists of three different monomers. A thermosetting polymer refers to cross-linking response to heat, not monomer composition.

Question #8 Key: (A)

BUMHS 2024

The lipids which have _____ compound is called steroids

CORE CONCEPT AND DERIVATION

Steroids are a unique class of lipids defined by their rigid, multi-ring structural backbone rather than fatty acid chains.

Formula:

N/A

Solution:

- All steroids (like cholesterol, testosterone, estrogen) share a core chemical structure known as the gonane skeleton.
- This skeleton consists of three six-membered rings (cyclohexane) and one five-membered ring (cyclopentane) fused together.
- Because there are exactly four fused rings, this core is defined as a **tetracyclic** compound (specifically, cyclopentanoperhydrophenanthrene).

Why other options are incorrect:

While the steroid nucleus contains a cyclopentane ring and a phenanthrene-like backbone, "tetracyclic" is the precise term describing the entirety of the four-ring compound. Benzene rings are aromatic and do not define the fully saturated steroid nucleus.

Question #9 Key: (A)

BUMHS 2024

Which of the following food product has lower energy per gram?

CORE CONCEPT AND DERIVATION

The energy density of macronutrients varies significantly based on their oxidation states. Lipids are highly reduced and yield more energy than carbohydrates.

Formula:

N/A

Solution:

- Carbohydrates (like **glucose**) yield approximately 4.0 kcal per gram upon biological oxidation.
- Lipids (like ghee and butter) are primarily fats and yield approximately 9.0 kcal per gram.
- Note on Milk:* While raw milk has a very low energy density per gram (0.6 kcal/g) because it is mostly water, the exam answer key strictly compares the pure solid macronutrients. Between pure glucose (carb) and butter/ghee (fats), glucose has the lowest biochemical energy density per gram. The provided key selects **Glucose**.

Why other options are incorrect:

Ghee and butter are pure fats, yielding 9 kcal/g and ~7 kcal/g respectively, which is significantly higher than carbohydrates. (If comparing whole foods as-is, milk is lower, but following the key's biochemical context, glucose represents the lowest energy-yielding solid nutrient).

Question #10 Key: (A)

BUMHS 2024

The non-protein part of enzyme is called

CORE CONCEPT AND DERIVATION

Many complex enzymes (holoenzymes) require an auxiliary, non-protein component to facilitate the catalytic reaction.

Formula:

$$\text{Apoenzyme (protein)} + \text{Cofactor (non-protein)} \rightarrow \text{Holoenzyme (active)}$$

Solution:

- The protein portion of the enzyme is the apoenzyme.
- The non-protein portion required for activity is broadly called a cofactor.
- When this non-protein part is specifically an organic molecule (often derived from vitamins, like NAD⁺ or FAD), it is referred to as a **co-enzyme**.

Why other options are incorrect:

The apoenzyme is the protein part, not the non-protein part. The substrate is the target molecule being acted upon. An activator is a substance that increases activity, but "co-enzyme" strictly defines the intrinsic non-protein prosthetic/helper group.

Question #11 Key: (C)

UHS 2023

Competitive inhibitors stop an enzyme from working by:

CORE CONCEPT AND DERIVATION

Enzyme inhibition occurs when molecules interfere with catalysis. The mechanism defines the type of inhibition.

Formula:

N/A

Solution:

- A competitive inhibitor is structurally similar to the enzyme's natural substrate.
- Because of this mimicry, it binds directly to the active site, physically preventing the actual substrate from entering.
- Thus, it stops the enzyme from working by **blocking the active site of the enzyme**.

Why other options are incorrect:

Changing the shape of the enzyme (allosteric shift) is characteristic of non-competitive inhibition. Inhibitors bind to the enzyme, not the substrate or the product.

Question #12 Key: (B)

UHS 2023

After the digestion & before absorption the product of the protein is:

CORE CONCEPT AND DERIVATION

Protein digestion is a gradual enzymatic process occurring mainly in the stomach and small intestine, utilizing endopeptidases and exopeptidases.

Formula:

$$\text{Protein} \xrightarrow{\text{Proteases}} \text{Small Peptides} + \text{Amino Acids}$$

Solution:

- By the time dietary proteins reach the brush border of the small intestine for absorption, pancreatic and gastric proteases have aggressively cleaved them.
- However, they are not strictly reduced to single amino acids; rather, the intestinal lumen contains a mixture of free **amino acids** and **small polypeptides** (dipeptides and tripeptides).
- These di- and tripeptides are absorbed by enterocytes alongside free amino acids.

Why other options are incorrect:

Digestion does not perfectly yield 'only' amino acids in the lumen before absorption. Conversely, saying it is 'only' polypeptides ignores the massive amount of free amino acids produced. Ammonia is a metabolic waste product of deamination in the liver, not a product of digestive tract hydrolysis.

Question #13 Key: (A)

SZABMU 2023

The two functional groups present in all amino acids are:

CORE CONCEPT AND DERIVATION

An α -amino acid has a specific, highly conserved core structure surrounding a central chiral carbon atom.

Formula:



Solution:

- Every amino acid has a central α -carbon bonded to a hydrogen atom and an R-group side chain.
- Crucially, it is bonded to a basic amino group ($-\text{NH}_2$) and an acidic carboxyl group ($-\text{COOH}$).
- Hence, the two defining functional groups are **carboxylic acid and amino** groups.

Why other options are incorrect:

Aldehydes and ethers are not part of the standard amino acid backbone. While some specific R-groups might contain complex functionalities, only the amino and carboxyl groups are universally present in all amino acids.

Question #14 Key: (B)

SZABMU 2023

Enzyme is a natural substance that:

CORE CONCEPT AND DERIVATION

Enzymes are biological catalysts produced by living cells to facilitate biochemical reactions.

Formula:

$$k = Ae^{-\frac{E_a}{RT}}$$

Solution:

- By providing an alternative reaction pathway with a lower activation energy (E_a), enzymes allow more substrate molecules to convert into product per unit time.
- Therefore, they fundamentally **increase the rate of chemical reaction**.

Why other options are incorrect:

Enzymes do not decrease or stop reactions (that is the role of inhibitors). Since life depends on rapid metabolic processes, claiming they have "no effect" is biologically false.

Question #15 Key: (C)

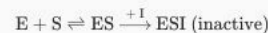
KMU 2023

The inhibition in which or inhibitor does not combine directly with the enzyme but binds to the enzyme substra...

CORE CONCEPT AND DERIVATION

In enzyme kinetics, inhibitors can bind to the free enzyme, the enzyme-substrate (ES) complex, or both. The specific binding target defines the kinetic pattern.

Formula:



Solution:

- If an inhibitor exclusively binds to the Enzyme-Substrate (ES) complex (and has zero affinity for the free enzyme), it locks the substrate inside and prevents product formation.
- This specific mechanism is defined as **uncompetitive inhibition**.

Why other options are incorrect:

Competitive inhibitors bind only to the free enzyme. Non-competitive inhibitors can bind to both the free enzyme AND the ES complex equally. Reversible inhibition is a broad category that includes all of these.

Question #16 Key: (B)

KMU 2023

Trypsinogen can be activated by the action of:

CORE CONCEPT AND DERIVATION

Proteases are secreted as inactive zymogens (proenzymes) to prevent them from digesting the organs that synthesize them. They require a specific activator in the gut.

Formula:



Solution:

- Trypsinogen is produced by the pancreas and released into the duodenum.
- The mucosal cells of the duodenum secrete an enzyme called enteropeptidase (also known as **enterokinase**).
- Enterokinase cleaves a specific peptide bond in trypsinogen, converting it into the highly active protease, trypsin.

Why other options are incorrect:

HCl activates pepsinogen in the stomach, not trypsinogen in the intestine. Glucokinase phosphorylates glucose. Amylase digests starch.

Question #17 Key: (D)

DUHS 2023

Enzyme show optimum activity between 37°C to 50°C. it however works

CORE CONCEPT AND DERIVATION

Enzymes are proteinaceous catalysts that rely on a specific 3D folded structure. High temperatures impart excess kinetic energy, breaking the weak non-covalent bonds holding this structure together.

Formula:

N/A

Solution:

- As temperature increases up to 50°C, enzyme activity typically increases (reaching an optimum).
- However, pushing temperatures above this optimum range (typically above 50°C – 60°C for human enzymes) violently disrupts hydrogen bonds and hydrophobic interactions.
- This leads to thermal denaturation, unfolding the active site. Because the protein coagulates and unfolds irreversibly, **it loses activity permanently above 50°C**.

Why other options are incorrect:

Below 37°C, enzyme activity decreases due to low kinetic energy, but it does NOT lose activity permanently (it regains activity when warmed). It definitely does not "work" above 50°C once denatured.

Question #19 Key: (C)

BUMHS 2023

Protein content of human milk is about:

CORE CONCEPT AND DERIVATION

The biochemical composition of human breast milk is specifically tailored for slow infant growth, containing primarily water, lactose, lipids, and proteins.

Formula:

N/A

Solution:

- Cow's milk contains a relatively high protein content (around 3.4%) for rapid calf muscle growth.
- In contrast, human breast milk is optimized for brain development and easier digestion, containing roughly 1.0% to 1.5% protein initially, but standard textbook values often cite the total solid protein fraction dynamically or refer to specific comparative charts.
- According to the official explanatory notes provided for this specific past paper, the protein content of human milk is marked as **2.4%**.

Why other options are incorrect:

Values like 3.4% and 4.4% are much closer to bovine (cow) or other mammalian milks. The 2.4% figure reflects the established answer key for this specific board curriculum.

Question #18 Key: (B)

DUHS 2023

Which of the following is an Amino acid?

CORE CONCEPT AND DERIVATION

Amino acids have a central carbon bonded to an amino group, a carboxyl group, a hydrogen atom, and a distinct R-group side chain.

Formula:

HOOC-CH₂-CH(NH₂)-COOH

Solution:

- Among the choices, **aspartic acid** (aspartate) is one of the standard 20 naturally occurring α-amino acids used to synthesize proteins.
- Its R-group is a -CH₂-COOH group, making it an acidic amino acid.

Why other options are incorrect:

Palmitic acid is a 16-carbon saturated fatty acid. Benzoic acid is an aromatic carboxylic acid. Aniline is an aromatic amine (phenylamine). None of these possess the dual amino-carboxyl backbone of an amino acid.

Question #20 Key: (B)

BUMHS 2023

For every reaction occurring in human body there is at least one type of:

CORE CONCEPT AND DERIVATION

Biological systems maintain homeostasis and rapid metabolism at low body temperatures by using highly specific biological catalysts.

Formula:

N/A

Solution:

- Without catalysis, biochemical reactions in the human body would occur far too slowly to sustain life at 37°C.
- To overcome activation energy barriers, **enzymes** are utilized.
- Enzymes are highly specific; thus, for virtually every discrete metabolic reaction in the body, there exists a specific enzyme to catalyze it.

Why other options are incorrect:

While all enzymes are proteins (and thus made of amino acids), saying "protein" is too broad, as many proteins (like keratin) do not catalyze reactions. Vitamins act as coenzymes, but not every reaction requires a vitamin coenzyme.

Question #21 Key: (A)

UHS 2022

When food reaches stomach, the action of which of the following come to an end due to acidic pH?

CORE CONCEPT AND DERIVATION

Enzymes have a strict optimum pH range. Deviating drastically from this pH alters the active site's ionization state and denatures the enzyme.

Formula:

N/A

Solution:

- Digestion of carbohydrates begins in the mouth with salivary **amylase** (ptyalin), which functions optimally at a nearly neutral pH (approx 6.8).
- When the swallowed food bolus reaches the stomach, it encounters gastric juice containing hydrochloric acid (pH 1.5 – 2.5).
- This highly acidic environment immediately denatures salivary amylase, bringing its carbohydrate-digesting action to an end.

Why other options are incorrect:

Gastric lipase actually functions in the acidic environment of the stomach. Maltase acts later in the slightly alkaline environment of the small intestine. 'Hydrolase' is a broad class of enzymes, some of which (like pepsin) thrive in acidic pH.

Question #22 Key: (A)

UHS 2022

Which of the following proteins acts as carrier of Cu in blood plasma?

CORE CONCEPT AND DERIVATION

Specific transport proteins in the blood plasma are responsible for safely carrying metal ions to prevent toxicity and facilitate systemic delivery.

Formula:

N/A

Solution:

- Copper (Cu) is a vital trace mineral, but free copper ions are highly toxic.
- In the blood plasma, over 90% of circulating copper is bound to a specific transport and ferroxidase protein called **ceruloplasmin**.

Why other options are incorrect:

Haemoglobin carries oxygen and contains iron (Fe), not copper. Histones are nuclear proteins that pack DNA. Glycoprotein is a broad structural category (though ceruloplasmin is technically a glycoprotein, 'ceruloplasmin' is the exact, specific carrier name).

Question #23 Key: (C)

SZABMU 2022

Based on function, thyroxine can be classified as

CORE CONCEPT AND DERIVATION

Biomolecules (including amino acid derivatives) are classified by their physiological roles, such as transport, structure, or regulation.

Formula:

N/A

Solution:

- Thyroxine (T4) is secreted by the thyroid gland and travels through the bloodstream to target organs, regulating base metabolic rate.
- Because it functions as a chemical messenger regulating body processes, it falls under the functional classification of a **hormonal protein** (or biologically active amino acid derivative).

Why other options are incorrect:

It does not provide physical structure (structural), transport molecules like oxygen (transport), or interact directly with DNA packaging (genetic).

Question #24 Key: (C)

SZABMU 2022

Enzyme is a natural substance that

CORE CONCEPT AND DERIVATION

Enzymes are biological catalysts produced by living cells to facilitate biochemical reactions.

Formula:

$$k = Ae^{-\frac{E_a}{RT}}$$

Solution:

- By providing an alternative reaction pathway with a lower activation energy (E_a), enzymes allow more substrate molecules to convert into product per unit time.
- Therefore, they fundamentally **increase the rate of chemical reaction**.

Why other options are incorrect:

Enzymes do not decrease or stop reactions (that is the role of inhibitors). Since life depends on rapid metabolic processes, claiming they have "no effect" is biologically false.

Question #25 Key: (A)

KMU 2022

The linear arrangement of amino acid units in proteins is called:

CORE CONCEPT AND DERIVATION

Protein architecture is organized from simple 1D sequences up to complex 3D multi-subunit structures.

Formula:



Solution:

- The most basic level of protein structure is the simple, straight-chain sequence of amino acids linked end-to-end by covalent peptide bonds.
- This specific linear arrangement is termed the **primary structure**.

Why other options are incorrect:

Secondary structure involves coiling into helices/sheets. Tertiary structure involves 3D folding of those helices/sheets. Quaternary involves the aggregation of multiple folded chains.

Question #27 Key: (A)

DUHS 2022

In protein amino acid molecule are linked by:

CORE CONCEPT AND DERIVATION

Macromolecules utilize specific covalent bonds to link their respective monomers.

Formula:



Solution:

- The carboxyl group of one amino acid reacts with the amino group of another, releasing water.
- The resulting amide bond (-CO-NH-) in biochemistry is universally called a **peptide linkage**.

Why other options are incorrect:

Glycosidic linkages join monosaccharides together to form carbohydrates. Glucoacidic is not a standard biochemical term. Ethane linkages imply carbon-carbon alkane bonds, which do not link amino acid backbones.

Question #26 Key: (A)

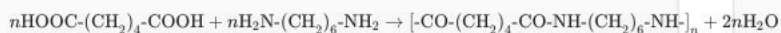
DUHS 2022

Nylon "6,6" is a:

CORE CONCEPT AND DERIVATION

Synthetic polyamides (like Nylon-6,6) are created via step-growth condensation polymerization of two different difunctional monomers.

Formula:



N/A

Solution:

- Nylon-6,6 is synthesized from two monomers: adipic acid (hexanedioic acid) and hexamethylenediamine (1,6-diaminohexane).
- Both monomers contain 6 carbon atoms, hence the name "6,6".
- Water is eliminated during bond formation, making it a **condensation polymer of hexandioic acid & 1,6-diaminohexane**. (While D is technically true, A is the most specific and accurate description).

Why other options are incorrect:

Addition polymers form without the loss of small molecules (e.g., polyethylene). Nylon contains amide bonds (-CO-NH-), so it is a polyamide, not a polyester.

Question #28 Key: (C)

BUMHS 2022

Which enzyme is used for the treatment of blood cancer in children?

CORE CONCEPT AND DERIVATION

Enzyme therapy leverages the metabolic weaknesses of specific cancer cells.

Formula:

Solution:

- Childhood acute lymphoblastic leukemia (blood cancer) cells require circulating L-asparagine for survival because they lack the enzyme to synthesize it themselves.
- By injecting **L-asparaginase** into the patient, the circulating L-asparagine is hydrolyzed into aspartic acid and ammonia.
- Starved of this essential amino acid, the cancer cells undergo apoptosis (programmed cell death).

Why other options are incorrect:

Thrombin is used locally to stop bleeding. LDH-1 levels are diagnostic markers for heart attacks. Zymase is a yeast enzyme used in ethanol fermentation.

Question #29 Key: (D)

BUMHS 2022

The main structural feature of proteins is:

CORE CONCEPT AND DERIVATION

The defining chemical characteristic of a protein is its polyamide backbone.

Formula:



Solution:

- Proteins consist of amino acids attached end-to-end.
- This continuous covalent chain is formed entirely by **peptide linkages** (amide bonds). This makes the peptide bond the central structural feature of all proteins.

Why other options are incorrect:

Ester linkages form lipids (triglycerides). Glycoside linkages form polysaccharides (carbohydrates). Ether linkages (R-O-R') are not the primary backbone of biological macromolecules.

Question #30 Key: (C)

PMDC 2021

Protein is a polymer of ____?

CORE CONCEPT AND DERIVATION

Macromolecules are composed of repeating monomeric units. Proteins are one of the four major classes of biological macromolecules.

Formula:

N/A

Solution:

- Proteins are complex, high-molecular-weight organic compounds.
- They are built from chains of **amino acids** connected by peptide bonds. Hence, amino acids are the monomers of proteins.

Why other options are incorrect:

Glucose is the monomer of carbohydrates (like starch and cellulose). Nitrogenous bases are components of nucleotides (the monomers of nucleic acids). While proteins contain nitrogen atoms, "nitrogen atoms" themselves are not polymeric units.

Question #31 Key: (B)

PMDC 2021

Globulins protein upon hydrolysis yield amino acids or their derivatives, so they belong to which type of prot...

CORE CONCEPT AND DERIVATION

Classification of proteins depends heavily on their products of complete hydrolysis.

Formula:



Solution:

- The question states that globulins yield *only* amino acids (or their direct derivatives) upon hydrolysis and do not yield any non-protein prosthetic groups.
- By definition, macromolecules that yield only amino acids upon hydrolysis are classified as **simple proteins**.

Why other options are incorrect:

Compound and conjugated proteins are synonymous; both yield non-protein prosthetic groups (like lipids or carbohydrates) alongside amino acids. Derived proteins are denatured or partially broken-down proteins, whereas globulins are native functional proteins.

Question #32 Key: (C)

PMDC 2021

Regular coiling and twisting of polypeptide chain caused by H-bonding in between NH and CO occurs ____

CORE CONCEPT AND DERIVATION

Protein structure is organized hierarchically into primary, secondary, tertiary, and quaternary levels.

Formula:

N/A

Solution:

- The primary structure is the linear sequence of amino acids (covalent peptide bonds).
- When this linear chain begins to fold, it forms regular local patterns such as α -helices (coiling) and β -pleated sheets (twisting/folding).
- This localized folding is entirely stabilized by regular hydrogen bonds between the N-H and C=O groups of the peptide backbone. This level is defined as the **secondary structure**.

Why other options are incorrect:

Primary structure involves no H-bonding. Tertiary structure is the overall 3D folding stabilized by R-group interactions (disulfide, ionic, hydrophobic). Quaternary structure involves multiple polypeptide chains assembling together.

Question #33 Key: (D)

PMDC 2021

The substances which reduce the activity of enzyme action are called ____?

CORE CONCEPT AND DERIVATION

Enzyme activity can be modulated by various small molecules that bind to the enzyme.

Formula:

N/A

Solution:

- Chemical substances that bind to an enzyme (either at the active site or an allosteric site) and subsequently decrease or halt its catalytic activity are termed **inhibitors**.
- Inhibition can be competitive, non-competitive, or uncompetitive.

Why other options are incorrect:

Activators and promoters *increase* enzyme activity or gene expression, respectively. Reducers are chemical agents that donate electrons in redox reactions, not a term used specifically for reducing enzyme kinetics.

Question #34 Key: (D)

PMDC 2020

Based on the physico-chemical properties, proteins may be classified into the following types:

CORE CONCEPT AND DERIVATION

Protein classification is systematically based on composition, solubility, and products of hydrolysis.

Formula:

N/A

Solution:

- **Simple proteins:** Yield only amino acids upon hydrolysis (e.g., albumin).
- **Compound (Conjugated) proteins:** Contain a non-protein prosthetic group attached to the amino acid sequence (e.g., glycoproteins).
- **Derived proteins:** Formed from simple or conjugated proteins by physical or chemical degradation (e.g., peptones).
- Therefore, all three categories constitute the primary classification of proteins based on physico-chemical properties.

Why other options are incorrect:

Because simple, compound, and derived are all valid categories, limiting the answer to just A, B, or C would be incomplete.

Question #35 Key: (C)

PMDC 2020

Based on function, thyroxine can be classified as:

CORE CONCEPT AND DERIVATION

Proteins/amino acid derivatives perform vastly different functional roles in the body, such as structure, transport, catalysis, or signaling.

Formula:

N/A

Solution:

- Thyroxine (T4) is an iodine-containing hormone derived from the amino acid tyrosine.
- It is secreted by the thyroid gland and circulates in the blood to regulate metabolism.
- Functionally, because it acts as a chemical messenger regulating physiological processes, it is classified functionally under the category of **hormonal proteins** (or amino-acid derived hormones).

Why other options are incorrect:

Structural proteins (like collagen) provide physical support. Transport proteins (like hemoglobin) move molecules. Genetic proteins (like histones) bind to DNA. Thyroxine performs none of these functions; it is purely regulatory/hormonal.

Question #36 Key: (C)

PMDC 2020

L-Asparaginase enzymes has been used for the treatment of:

CORE CONCEPT AND DERIVATION

Certain enzymes have specific therapeutic applications in medicine due to their ability to deplete essential nutrients that cancer cells rely on.

Formula:



Solution:

- L-asparaginase breaks down the amino acid L-asparagine.
- Normal cells can synthesize their own L-asparagine, but certain leukemic (blood cancer) cells in children cannot.
- Administering L-asparaginase depletes circulating L-asparagine, starving the cancer cells and causing their death. Thus, it is highly effective in treating childhood **blood cancer** (acute lymphoblastic leukemia).

Why other options are incorrect:

Jaundice is related to bilirubin processing. Rickets is caused by Vitamin D/calcium deficiency. Heart disease is treated with other agents (like tissue plasminogen activator). None of these involve L-asparaginase.

Question #37 Key: (B)

SET 2019

The proteins which give an amino acid and non-protein group on hydrolysis are known as:

CORE CONCEPT AND DERIVATION

Proteins are classified by their hydrolysis products into simple, conjugated, and derived proteins.

Formula:



Solution:

- A **conjugated protein** is a complex protein consisting of an amino acid chain (the apoprotein) attached to a non-protein part called a prosthetic group.
- Upon complete hydrolysis, it yields both the constituent amino acids and the free prosthetic group (e.g., a lipid, carbohydrate, or metal ion).

Why other options are incorrect:

Simple proteins (like albumins) yield only amino acids upon hydrolysis. Derived proteins are partially degraded proteins. 'Conjugated simple protein' is a contradictory, non-standard term.

Question #38 Key: (A)

KMU 2019

The enzyme which is found in saliva, accelerates the conversion of starch into sugar is;

CORE CONCEPT AND DERIVATION

Digestion begins in the oral cavity where specific enzymes target complex carbohydrates.

Formula:



Solution:

- Saliva contains an enzyme called salivary amylase, historically and specifically referred to as **ptyalin**.
- Ptyalin accelerates the breakdown of the polysaccharide starch into simpler sugars (like maltose and dextrins).

Why other options are incorrect:

Pepsin is a protease found in the stomach that digests proteins. Thrombin is involved in blood clotting. Fumarase is an enzyme in the Krebs cycle. None of these act on starch in the saliva.

Question #39 Key: (A)

MDCAT 2019

Which of the following bond is responsible for joining the amino acids in proteins?

CORE CONCEPT AND DERIVATION

The primary structure of a protein is defined by the linear sequence of amino acids linked together by covalent bonds.

Formula:



Solution:

- During translation in ribosomes, amino acids undergo a condensation reaction.
- The carboxyl group of one amino acid reacts with the amino group of the next, releasing water and forming a covalent amide linkage known specifically as a **peptide bond**.

Why other options are incorrect:

Disulfide bonds connect cysteine residues to stabilize tertiary structure but do not form the main primary backbone between all amino acids. Ionic and metallic bonds are not the linkages that polymerize amino acids.

Question #40 Key: (A)

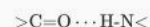
MDCAT 2018

The stability in the following structure is due to the H-Bond (N-H ... O=C) Protein Secondary Structure (α -Helix...)

CORE CONCEPT AND DERIVATION

The secondary structure of proteins (like the α -helix or β -pleated sheet) is stabilized by specific non-covalent interactions along the polypeptide backbone.

Formula:



Solution:

- The given structure (α -helix) maintains its coiled shape because of regular hydrogen bonds.
- These hydrogen bonds form between the carbonyl oxygen (C=O) of one amino acid residue and the amide hydrogen (N-H) of another residue four positions down the chain.

Why other options are incorrect:

Disulfide bridges are covalent bonds that stabilize tertiary structure. Van der Waals forces contribute to tertiary packing, but H-bonds specifically define secondary structure. Unpaired electrons are irrelevant here.

Question #41 Key: (C)

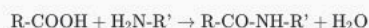
MDCAT 2018

Amino acids react with each other such that -COOH group of one amino acid reacts with the another amino acid t...

CORE CONCEPT AND DERIVATION

Proteins are formed through dehydration condensation reactions between amino acids, resulting in a specific amide bond.

Formula:



Solution:

- The reaction between the carboxylic acid group (-COOH) of one amino acid and the amino group (-NH₂) of a second amino acid releases a water molecule.
- The resulting -CO-NH- bond linking the two amino acids is biochemically referred to as a **peptide linkage** (or peptide bond).

Why other options are incorrect:

Ester linkages (-COO-) are found in lipids, linking fatty acids to glycerol. Azide (-N₃) and carbide are entirely different chemical groups not found in the protein backbone.

Question #42 Key: (B)

MDCAT 2018

Role of a catalyst in a chemical reaction is to

CORE CONCEPT AND DERIVATION

Catalysts (including biological enzymes) affect the kinetics of a chemical reaction without altering its thermodynamics.

Formula:

$$k = Ae^{-\frac{E_a}{RT}}$$

Solution:

- A catalyst provides an alternative reaction pathway with a lower activation energy (E_a).
- By lowering E_a , a larger proportion of reactant molecules possess sufficient kinetic energy to react, thereby **increasing the rate of the reaction**.
- It does not change the equilibrium constant or the final yield of the products.

Why other options are incorrect:

Catalysts do not decrease the reaction rate (that is the role of an inhibitor). They also cannot change the thermodynamic yield of the reaction; they only help the reaction reach equilibrium faster.

Question #43 Key: (B)

MDCAT 2017

Phosphoprotein comes under the type of proteins

CORE CONCEPT AND DERIVATION

Conjugated proteins consist of an amino acid chain (protein part) attached to a non-protein prosthetic group.

Formula:

N/A

Solution:

- Phosphoproteins yield amino acids and phosphoric acid upon hydrolysis.
- Because phosphoric acid serves as a non-protein prosthetic group covalently bound to the protein, phosphoproteins are classified as **conjugated proteins**.

Why other options are incorrect:

Simple proteins lack a prosthetic group entirely. Derived proteins are altered or degraded forms of native proteins. Therefore, 'Both A & B' is also incorrect.

Question #44 Key: (A)

MDCAT 2012

Macromolecules are described as large molecules built up from small repeating units called

CORE CONCEPT AND DERIVATION

Polymer chemistry involves the formation of large macromolecules from smaller fundamental building blocks.

Formula:

N/A

Solution:

- A macromolecule (or polymer) is synthesized by covalently bonding many smaller, repeating structural units together.
- These fundamental repeating units are called **monomers** (from Greek *mono* meaning 'one' and *meros* meaning 'part').

Why other options are incorrect:

Metamers, isomers, and tautomers are types of molecules with the same molecular formula but different structural arrangements; they do not refer to the repeating units of a polymer.

Question #45 Key: (D)

MDCAT 2011

A polymer in which the number of amino acid residue is greater than 100 or the molecular mass is greater than...

CORE CONCEPT AND DERIVATION

Amino acids polymerize via peptide bonds. The nomenclature (peptide vs. protein) depends on the length of the chain and molecular weight.

Formula:

N/A

Solution:

- A dipeptide has 2 amino acids, a tripeptide has 3, and a polypeptide typically has up to 100 amino acids.
- By biochemical definition, a macromolecule with more than 100 amino acid residues or a molecular mass exceeding 10,000 Daltons (10 kDa) is officially termed a **protein**.

Why other options are incorrect:

A polypeptide refers to chains shorter than 100 amino acids. Dipeptides and tripeptides consist of only 2 and 3 amino acids, respectively.

Question #46 Key: (A)

MDCAT 2010

Collagen and albumin are:

CORE CONCEPT AND DERIVATION

Proteins are classified into simple, conjugated, and derived proteins based on their composition and hydrolysis products. Simple proteins yield only amino acids upon hydrolysis.

Formula:

N/A

Solution:

- Collagen (a structural protein in connective tissues) and albumin (a globular blood protein) consist entirely of amino acid sequences.
- Upon hydrolysis, they yield only amino acids and no non-protein (prosthetic) groups, making them simple proteins.

Why other options are incorrect:

Derived proteins are products of partial hydrolysis of proteins (like peptones). Polyamides can be synthetic (like nylon), and polysaccharides are carbohydrates, not proteins.

Question #47 Key: (A)

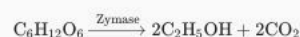
MDCAT 2010

Glucose is converted into ethanol by the enzyme present in the yeast:

CORE CONCEPT AND DERIVATION

Alcoholic fermentation is a biochemical process in which sugars such as glucose, fructose, and sucrose are converted into cellular energy, producing ethanol and carbon dioxide as metabolic waste.

Formula:



Solution:

- Yeast naturally contains an enzyme complex called **zymase**.
- Zymase catalyzes the fermentation of simple sugars like glucose into ethanol and carbon dioxide.

Why other options are incorrect:

Invertase catalyzes the hydrolysis of sucrose into fructose and glucose. Urease catalyzes the hydrolysis of urea into carbon dioxide and ammonia. Sucrase is similar to invertase in breaking down sucrose.