

**BIO · BIOLOGY**

03. Enzymes

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

79 Solved Questions

2014 to 2024 Archive

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

Weightage: 34% of MDCAT (68 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.**

KMU 2024

The enzymes enable the conversion of substrates into products by: **[KMU-2024]**

- (A) Changing equilibrium in the direction of the substrate
- (B) Increasing the activation energy
- (C) Increasing the substrate concentration
- (D) Lowering the activation energy

Q2.

SZABMU 2024

A covalently bonded inorganic ion to protein part of enzyme is termed as: **[SZABMU-2024]**

- (A) Coenzyme
- (B) Holoenzyme
- (C) Apoenzyme
- (D) Prosthetic group

Q3.

NUMS 2024

Activation of all the following enzymes need a regulatory molecule except: **[NUMS-2024]**

- (A) Pepsinogen
- (B) Trypsinogen
- (C) Erypsin
- (D) Chymotrypsinogen

Q4.

SZABMU 2024

Which property of enzyme is helpful to carry out metabolic activities at room temperature? **[SZABMU-2024-Reconduct]**

- (A) Not sensitivity to pH
- (B) Does not change the speed of reaction
- (C) Highly specific
- (D) Required in large quantities

Q5.

UHS 2024

Induced fit model of enzyme activity suggests that an enzyme: **[UHS-2024]**

- (A) Cannot modify its active sites
- (B) Can bind to a single substrate
- (C) Can catalyze related reaction
- (D) Usually belong to non-regulatory enzyme

Q6.

KMU 2024

What happens to the enzyme after an enzyme-catalyzed reaction? **[KMU-2024]**

- (A) Reduced to inactive form
- (B) Becomes inert
- (C) Changes into substrate
- (D) Used for another reaction

Q7.

SZABMU 2024

The Lock and Key Model (1894) was modified by:
[SZABMU-2024]

- (A) Emil Fischer
- (B) Koshland
- (C) Kuhne
- (D) Camillo Golgi

Q8.

NUMS 2024

An enzyme is capable of acting on a wide range of related substrates. Which of the following is a property of this enzyme? [NUMS-2024]

- (A) Inflexible active site
- (B) Regulatory enzyme
- (C) Non-regulatory enzyme
- (D) Highly specific enzyme

Q9.

SZABMU 2024

All of the following are the postulates of lock and key model, except: [SZABMU-2024-Reconduct]

- (A) Active site has a rigid structure
- (B) Enzymes are non-regulatory
- (C) One specific key can only open specific lock
- (D) Substrate combines with an enzyme to induce change in enzyme structure

Q10.

UHS 2024

Which of the following statement is incorrect regarding rate of enzymatic action? [UHS-2024]

- (A) Increase in enzyme concentration increases the rate
- (B) Increase in enzyme concentration reduces the rate
- (C) All enzymes work at their maximum rate at optimum
- (D) All enzymes work at their maximum rate at optimum pH temperature

Q11.

KMU 2024

Catalase can be activated at pH: [KMU-2024]

- (A) 1
- (B) 3
- (C) 5
- (D) 7

Q12.

KMU 2024

Optimum pH for pancreatic lipase is: [KMU-2024]

- (A) 2
- (B) 4
- (C) 6
- (D) 8

Q13.

KMU 2024

Enzymatic activity can be inhibited by: [KMU-2024]

- (A) Heavy metal ions
- (B) Methane
- (C) Mutase
- (D) Noble gases

Q14.

KMU 2024

A competitive inhibitor: [KMU-2024]

- (A) Accelerates the chemical reaction
- (B) Competes with the enzyme
- (C) Is irreversible
- (D) Is reversible

Q15.

SZABMU 2024

Cyanides attached to enzymes by forming a covalent bond. These come under category of: [SZABMU-2024]

- (A) Reversible inhibitors
- (B) Irreversible inhibitors
- (C) Non-competitive inhibitors
- (D) Competitive inhibitors

Q16.

KMU 2024

Which enzyme is secreted in the active form? [KMU-2024]

- (A) Amylase
- (B) Trypsin
- (C) Pepsin
- (D) Chymotrypsin

Q17.

NUMS 2024

Ions of heavy metal are harmful for living organisms because of their ability to: [NUMS-2024]

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

Q18.

NUMS 2024

Enzyme catalase protects the plant cell from: [NUMS-2024]

- (A) Dehydration
- (B) Photorespiration
- (C) Toxic effect of alcohol metabolism
- (D) Protein loss

Q19.

UHS 2023

NAD is an important? [UHS-2023]

- (A) Enzyme
- (B) Vitamin
- (C) Coenzyme
- (D) Hormone

Q20.

SZABMU 2023

Non protein but inorganic detachable co-factor is called: [SZABMU-2023]

- (A) Prosthetic group
- (B) Co-enzyme
- (C) Activator
- (D) Apoenzyme

Q21.

KMU 2023

All of the following are related to enzymes except: [ETEA-2023]

- (A) Remain unchanged after reaction
- (B) Speed up reaction
- (C) Increase the activation energy
- (D) Possess the active site

Q22.

KMU 2023

The coenzyme NAD is made up of: [ETEA-2023 Retake]

- (A) Vitamins
- (B) Sugar
- (C) Amino acids
- (D) Nucleotides

Q23.

KMU 2023

What alters the shape of enzyme and makes them functional: [ETEA-2023 Retake]

- (A) Cofactor
- (B) Other enzymes
- (C) Proteins
- (D) Both A and C

Q24.

KMU 2023

Enzymes are: [ETEA-2023 Retake]

- (A) Can be lipids or proteins
- (B) Lipids
- (C) Proteins
- (D) Carbohydrates

Q25.

KMU 2023

What is 'flavin adenine dinucleotide'? [ETEA-2023 Retake]

- (A) Coenzyme
- (B) Enzyme
- (C) Catalyst
- (D) Cofactor

Q26.

UHS 2023

The active sites of enzymes are composed of? [UHS-2023]

- (A) Few nucleosides
- (B) Few nucleotides
- (C) Few amino acids
- (D) Few saccharides

Q27.

SZABMU 2023

Lock and Key Model for enzyme action proposed by Emil Fischer suggests that: [SZABMU-2023]

- (A) Enzymes can modify their active sites
- (B) Enzymes are unbiased for the substrate
- (C) An enzyme can catalyze variety of reactions
- (D) Enzymes are restricted to one reaction type

Q28.

SZABMU 2023

Enzymes work by lowering the ____ of the reactions they catalyze: [SZABMU-2023]

- (A) Activation energy
- (B) Potential energy
- (C) Heat energy
- (D) Kinetic energy

Q29.

SZABMU 2023

Select a regulatory enzyme: [SZABMU-2023]

- (A) Maltase
- (B) Sucrase
- (C) Urease
- (D) Hexokinase

Q30.

KMU 2023

Which one of the following factors does not affect the rate of enzyme action? [ETEA-2023]

- (A) Enzyme concentration
- (B) Water concentration
- (C) Substrate concentration
- (D) Temperature

Q31.

KMU 2023

Enzymes present in mammals work best at: **[ETEA-2023]**

- (A) 20°C
- (B) 30°C
- (C) 40°C
- (D) 50°C

Q32.

KMU 2023

The optimal pH of lipase (pancreas) is: **[ETEA-2023]**

- (A) 4.0 - 5.0
- (B) 1.5 - 1.6
- (C) 8.0
- (D) 6.1 - 6.8

Q33.

NUMS 2023

Most enzymes work best at the following temperature: **[NUMS-2023]**

- (A) 30°C
- (B) 40°C
- (C) 50°C
- (D) 20°C

Q34.

NUMS 2023

In term of enzyme action, 'maximum temperature' refers to a temperature at which: **[NUMS-2023]**

- (A) Enzymes start to denature
- (B) Enzymes start to re-nature
- (C) Enzymes work best
- (D) Enzymes are reactivated

Q35.

KMU 2023

Adding substrates will not make a difference to the enzyme catalyzed reaction: **[ETEA-2023 Retake]**

- (A) When few enzyme molecules are left unsaturated
- (B) When the substrate cools down
- (C) When the substrate heats up
- (D) When many enzyme molecules remain unsaturated

Q36.

UHS 2023

Competitive inhibitors are ____ **[UHS-2023]**

- (A) Homologous to substrate
- (B) Analogous to substrate
- (C) Smaller than substrate
- (D) Larger than substrate

Q37.

NUMS 2023

____ reduce the enzyme productivity by blocking the substrate entering into the active site due to similar shapes. **[NUMS-2023]**

- (A) Competitive inhibitors
- (B) Non-competitive inhibitors
- (C) Co-enzymes
- (D) Activators

Q38.

NUMS 2023

Non-competitive inhibitors react with enzymes at: **[NUMS-2023]**

- (A) Allosteric site
- (B) Active site
- (C) Passive site
- (D) Regulatory site

Q39.

KMU 2023

An example of competitive inhibitor molecule is: **[ETEA-2023]**

- (A) Insecticide
- (B) Sulphonamide
- (C) Cyanide
- (D) Metal ions

Q40.

KMU 2023

The inhibition, in which the inhibitor does not combine directly with the enzyme but binds to the enzyme substrate complex is called: **[ETEA-2023]**

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

Q41.

KMU 2023

Which of the following is an example of hydrolase? **[ETEA-2023 Retake]**

- (A) Transmethylase
- (B) Oxygenase
- (C) Phosphatase
- (D) Peroxidase

Q42.

KMU 2022

Enzymes are ____ in nature. **[ETEA-2022]**

- (A) Proteins
- (B) Carbohydrates
- (C) Vitamins
- (D) Lipids

Q43.

UHS 2022

Zinc ion is attached to the active site of the enzyme carboxypeptidase. The zinc ion functions as: [UHS-2022]

- (A) An inhibitor molecule
- (B) A coenzyme molecule
- (C) An activator
- (D) Controller of allosteric site

Q44.

SZABMU 2022

The catalytic activity of an enzyme is restricted to its small portion: [SZABMU-2022]

- (A) Regulation site
- (B) Allosteric site
- (C) Active site
- (D) Passive site

Q45.

BUMHS 2022

The catalytic site of enzyme is made up of how many amino acids? [BUMHS-2022]

- (A) 50-100
- (B) 3-12
- (C) 100-1000
- (D) 30-50

Q46.

UHS 2022

Enzymes lower the activation energy by stabilizing the transition state of a metabolic reaction due to: [UHS-2022]

- (A) Distorting the molecules in the allosteric site
- (B) Changing conditions within the active site
- (C) Changing conditions within the protein framework
- (D) Rearranging the fatty acids in active site

Q47.

SZABMU 2022

Enzymes work by lowering the ____ of the reactions they catalyze. [SZABMU-2022]

- (A) Kinetic energy
- (B) Heat energy
- (C) Activation energy
- (D) Potential energy

Q48.

DUHS 2022

When substrate combines the active site of an enzyme it induces a conformational changes that enable enzyme to perform: [DUHS-2022]

- (A) Catalytic function
- (B) Meiosis
- (C) Metabolism
- (D) Analytic function

Q49.

NUMS 2022

Considering enzyme action, 'minimum temperature' is the term used when: [NUMS-2022]

- (A) Enzyme work at their best
- (B) Enzymes start denaturing
- (C) Inactive enzyme getting reactivated
- (D) Enzyme become hyperactive

Q50.

NUMS 2022

Which enzyme works in alkaline pH? [NUMS-2022]

- (A) Pepsin
- (B) Pancreatic lipase
- (C) Sucrase
- (D) Enterokinase

Q51.

SZABMU 2022

The maximum enzymatic activity of trypsin is shown at: [SZABMU-2022]

- (A) pH 2
- (B) pH 6
- (C) pH 8
- (D) pH 4

Q52.

SZABMU 2022

In term of enzyme action maximum temperature refers to a temperature at which: [SZABMU-2022]

- (A) Enzymes start to denature
- (B) Enzymes work best
- (C) Enzymes are reactivated
- (D) Enzymes start to re-nature

Q53.

BUMHS 2022

Optimum pH for digestive enzymes of stomach is: [BUMHS-2022]

- (A) Slightly acidic
- (B) Highly alkaline
- (C) Highly acidic
- (D) Slightly alkaline

Q54.

DUHS 2022

Enzymes are generally inactivated rapidly by exposure to UV light and also α, β rays because it alters the: [DUHS-2022]

- (A) Quantity of enzyme
- (B) Shape of enzymes
- (C) pH of enzyme
- (D) Nature of enzyme

Q55.

UHS 2022

Competitive inhibitors compete with: [UHS-2022]

- (A) Enzyme
- (B) Substrate
- (C) Coenzyme
- (D) Product

Q56.

UHS 2022

Non-competitive inhibitor molecules have: [UHS-2022]

- (A) A similar structure to the normal substrate molecule
- (B) A quite different structure from the substrate molecule
- (C) A different conformation but fit into the active site
- (D) A similar conformation but does not fit into the active site

Q57.

SZABMU 2022

_____ reduces the enzyme productivity by blocking the substrate from entering into the active site due to similar shapes. [SZABMU-2022]

- (A) Non-Competitive inhibitors
- (B) Activators
- (C) Competitive inhibitors
- (D) Co-enzymes

Q58.

PMDC 2020

Enzymes work by lowering the _____ of the reactions they catalyze. [PMC-2020]

- (A) Kinetic energy
- (B) Activation energy
- (C) Heat energy
- (D) Potential energy

Q59.

PMDC 2020

Lock and key model for enzyme action proposed by Emil Fischer suggests that: [PMC-2020]

- (A) Enzyme can catalyze variety of reactions
- (B) Enzymes can modify their active sites
- (C) Enzymes are unbiased for substrate
- (D) Enzymes are restricted to one reaction type

Q60.

MDCAT 2019

According to _____ model, the active site of enzyme is modified as the substrate interacts with enzyme.

[MDCAT-2019]

- (A) Lock and key
- (B) Fluid mosaic
- (C) Induced fit
- (D) Emil Fischer

Q61.

SZABMU 2019

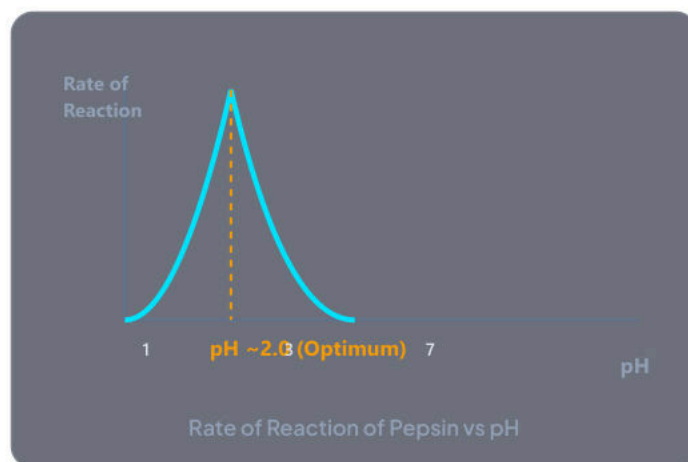
With the increase of enzyme concentration in a reaction, more _____ is/are available for the substrate. [AJK-2019]

- (A) Binding sites
- (B) Activation energy
- (C) Active sites
- (D) Products

Q62.

MDCAT 2019

Which one of the following graphs shows how the rate of reaction of pepsin is affected by pH? [MDCAT-2019]



- (A) Bell-shaped curve peaking at neutral pH (~7.0)
- (B) Linear increase peaking at alkaline pH (~12.0)
- (C) Flat horizontal line showing constant activity across all pH levels
- (D) Bell-shaped curve peaking at highly acidic pH (~2.0)

Q63.

SZABMU 2019

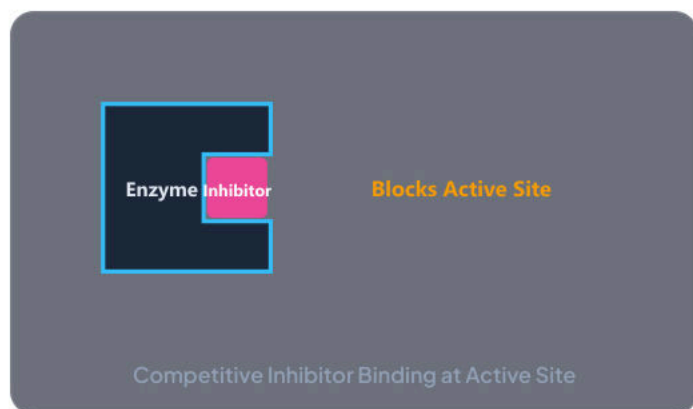
Which type of bonds is mostly affected in an enzyme molecule when there are pH fluctuations? [AJK-2019]

- (A) Hydrogen bonds
- (B) Disulphide bonds
- (C) Ionic bonds
- (D) Peptide bonds

Q64.

MDCAT 2019

This figure represents ____ inhibitor. [MDCAT-2019]



- (A) Competitive
- (B) Irreversible
- (C) Non-competitive
- (D) Isosteric

Q65.

MDCAT 2019

What is common in both competitive and non-competitive inhibition? [MDCAT-2019]

- (A) Non-Reversible inhibition
- (B) Reversible inhibition
- (C) Feedback inhibition
- (D) Irreversible inhibition

Q66.

MDCAT 2019

A student of chemical engineering mistakenly engulfed the toxic compound 'A' which was a potent inhibitor of certain enzyme. He was immediately brought to hospital where the doctor injected intravenously substrate 'B' to minimize the toxic effect of compound 'A'. His life was saved from serious damages. The treatment method shows that compound 'A' was a ____ inhibitors. [MDCAT-2019]

- (A) Irreversible
- (B) Competitive reversible
- (C) Temperature sensitive
- (D) Non-competitive reversible

Q67.

KMU 2019

Phosphatases belong to which group of the following? [ETEA-2019]

- (A) Ligase
- (B) Hydrolases
- (C) Lyases
- (D) None of the above

Q68.

MDCAT 2018

A non-protein part essential for proper and essential functioning of enzyme is called: [MDCAT-2018]

- (A) Extra factor
- (B) Co-factor
- (C) Efficient co-factor
- (D) Additional factor

Q69.

MDCAT 2018

The temperature that promotes the maximum activity of enzyme is referred as: [MDCAT-2018]

- (A) Fixed temperature
- (B) Optimum temperature
- (C) Active temperature
- (D) Controlled temperature

Q70.

MDCAT 2018

If molecule can bind to another site of the enzyme rather than the true active site, it is referred as [MDCAT-2018]

- (A) Competitive inhibitors
- (B) Non-allosteric inhibition
- (C) Irreversible inhibition
- (D) Non-competitive inhibitors

Q71.

MDCAT 2017

All enzymes are ____ [MDCAT-2017]

- (A) Fibrous proteins
- (B) Globular proteins
- (C) Low molecular weight proteins
- (D) Lipoproteins

Q72.

MDCAT 2017

The reactants on which enzyme work are: [MDCAT-2017]

- (A) Metabolites
- (B) Catabolites
- (C) Substrates
- (D) Products

Q73.

MDCAT 2017

What is true about enzymes? [MDCAT-2017]

- (A) Fibrous proteins
- (B) Non-specific
- (C) No effect on end product
- (D) Use in reaction

Q74.

MDCAT 2017

Which of the following comprises of inorganic ions?
[MDCAT-2017]

- (A) Apoenzyme
- (B) Coenzymes
- (C) Prosthetic group
- (D) Activators

Q75.

MDCAT 2017

Modified form of Lock and Key model was proposed by: [MDCAT-2017]

- (A) Fischer
- (B) Rosalind Franklin
- (C) Koshland
- (D) Watson

Q76.

MDCAT 2017

Which of the following type of inhibitor can be neutralized by adding more substrate into reaction?
[MDCAT-2017]

- (A) Irreversible non-competitive
- (B) Reversible inhibitor
- (C) Irreversible competitive
- (D) Irreversible inhibitor

Q77.

MDCAT 2014

A co-factor tightly bound to the enzyme on the permanent basis is called: [MDCAT-2014]

- (A) Activator
- (B) Prosthetic group
- (C) Apo-enzyme
- (D) Coenzyme

Q78.

MDCAT 2014

Which one of the following is the optimum pH of pancreatic lipase enzyme? [MDCAT-2014]

- (A) 9.70
- (B) 8.00
- (C) 7.60
- (D) 9.00

Q79.

MDCAT 2014

The competitive inhibitors have structural similarity with: [MDCAT-2014]

- (A) Binding site
- (B) Active site
- (C) Coenzyme
- (D) Substrate

RAPID 5-COLUMN ANSWER KEY

Official PMDC verified answer keys for 03. Enzymes.

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Q#	KEY	BOARD	Q#	KEY	BOARD	Q#	KEY	BOARD	Q#	KEY	BOARD	Q#	KEY	BOARD
1	D	KMU 2024	17	D	NUMS 2024	33	B	NUMS 2023	49	C	NUMS 2022	65	B	MDCAT 2019
2	D	SZABMU 2024	18	C	NUMS 2024	34	A	NUMS 2023	50	B	NUMS 2022	66	B	MDCAT 2019
3	C	NUMS 2024	19	C	UHS 2023	35	A	KMU 2023	51	C	SZABMU 2022	67	B	KMU 2019
4	C	SZABMU 2024	20	C	SZABMU 2023	36	A	UHS 2023	52	A	SZABMU 2022	68	B	MDCAT 2018
5	C	UHS 2024	21	C	KMU 2023	37	A	NUMS 2023	53	C	BUMHS 2022	69	B	MDCAT 2018
6	D	KMU 2024	22	D	KMU 2023	38	A	NUMS 2023	54	D	DUHS 2022	70	D	MDCAT 2018
7	B	SZABMU 2024	23	A	KMU 2023	39	B	KMU 2023	55	B	UHS 2022	71	B	MDCAT 2017
8	C	NUMS 2024	24	C	KMU 2023	40	D	KMU 2023	56	B	UHS 2022	72	C	MDCAT 2017
9	D	SZABMU 2024	25	A	KMU 2023	41	C	KMU 2023	57	C	SZABMU 2022	73	C	MDCAT 2017
10	B	UHS 2024	26	C	UHS 2023	42	A	KMU 2022	58	B	PMDC 2020	74	D	MDCAT 2017
11	D	KMU 2024	27	D	SZABMU 2023	43	C	UHS 2022	59	D	PMDC 2020	75	C	MDCAT 2017
12	D	KMU 2024	28	A	SZABMU 2023	44	C	SZABMU 2022	60	C	MDCAT 2019	76	B	MDCAT 2017
13	A	KMU 2024	29	D	SZABMU 2023	45	B	BUMHS 2022	61	C	SZABMU 2019	77	B	MDCAT 2014
14	D	KMU 2024	30	B	KMU 2023	46	B	UHS 2022	62	D	MDCAT 2019	78	D	MDCAT 2014
15	B	SZABMU 2024	31	C	KMU 2023	47	C	SZABMU 2022	63	C	SZABMU 2019	79	D	MDCAT 2014
16	A	KMU 2024	32	C	KMU 2023	48	A	DUHS 2022	64	A	MDCAT 2019			

TOTAL
MCQS

79

CORRECT

INCORRECT

BLANK

ACCURACY

%

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: (D)

KMU 2024

The enzymes enable the conversion of substrates into products by: [KMU-2024]

CORE CONCEPT AND DERIVATION

A catalyst speeds up a chemical reaction without altering the thermodynamics or being consumed in the process.

Solution:

- Chemical reactions require an initial burst of energy to destabilize current bonds so new ones can form (the transition state).
- Enzymes function entirely by providing an alternative reaction pathway that requires much less initial energy.
- By **lowering the activation energy**, a significantly larger fraction of molecules have enough energy to react, vastly accelerating the conversion of substrates into products.

Why other options are incorrect:

Enzymes NEVER change the chemical equilibrium; they only reach it faster. Increasing activation energy would slow the reaction down. Enzymes cannot magically conjure or increase substrate concentration.

Question #2 Key: (D)

SZABMU 2024

A covalently bonded inorganic ion to protein part of enzyme is termed as: [SZABMU-2024]

CORE CONCEPT AND DERIVATION

Cofactors are classified based on their permanence on the enzyme. The strength of their chemical bonds dictates their classification.

Solution:

- When a non-protein component (whether organic or an inorganic ion) binds to the apoenzyme via strong, permanent **covalent bonds**, it becomes a fixed structural component of the enzyme.
- This tightly, permanently bound helper is defined strictly as a **Prosthetic group**.

Why other options are incorrect:

A coenzyme is loosely and temporarily attached. An apoenzyme is just the naked protein without the cofactor. The holoenzyme is the entire active complex (protein + cofactor combined), not the term for the bound ion itself.

Question #3 Key: (C)

NUMS 2024

Activation of all the following enzymes need a regulatory molecule except: [NUMS-2024]

CORE CONCEPT AND DERIVATION

Many powerful digestive proteases are synthesized as inactive precursors (zymogens) to prevent them from destroying the cells that created them. They require a regulatory molecule to cleave and activate them.

Solution:

- Pepsinogen (activated by HCl), Trypsinogen (activated by enterokinase), and Chymotrypsinogen (activated by trypsin) are all inactive zymogens (indicated by the '-ogen' suffix).
- Erypsin**, however, is a collective term for a mixture of specific peptidases found in intestinal juice that are already active and do not require a separate regulatory molecule to unmask their active sites.

Why other options are incorrect:

Pepsinogen, trypsinogen, and chymotrypsinogen are classic examples of enzymes that are absolutely dependent on regulatory cleavage for activation.

Question #4 Key: (C)

SZABMU 2024

Which property of enzyme is helpful to carry out metabolic activities at room temperature? [SZABMU-2024-Recond...]

CORE CONCEPT AND DERIVATION

Enzymes allow complex, life-sustaining chemical reactions to occur rapidly at the mild temperatures found in living organisms, rather than requiring extreme heat.

Solution:

- An enzyme's ability to lower activation energy at room temperature is deeply tied to its structure.
- Because enzymes are **highly specific** to their substrates, their active sites form incredibly precise, multi-point chemical interactions (hydrogen bonds, ionic forces) with the substrate.
- This highly specific physical embrace places immense stress on the exact bonds that need breaking, allowing the reaction to proceed efficiently without needing the brute force of high environmental heat.

Why other options are incorrect:

Enzymes ARE highly sensitive to pH. They DO drastically change the speed of a reaction. They are required in very small quantities because they are reusable. Therefore, by elimination, high specificity is the only biologically true statement provided.

Question #5 Key: (C)

UHS 2024

Induced fit model of enzyme activity suggests that an enzyme:
[UHS-2024]

CORE CONCEPT AND DERIVATION

The Induced Fit model, unlike the rigid Lock and Key model, introduces structural flexibility to the active site.

Solution:

- Because the active site can physically mold and adapt its shape upon binding, it is not restricted to one single, perfectly identical molecule.
- This flexibility allows the enzyme to accommodate and **catalyze reactions for a class of structurally related substrates** (e.g., hexokinase can phosphorylate different six-carbon sugars).

Why other options are incorrect:

Option A is the exact opposite of the Induced Fit model (which is built on modifying the active site). Option B describes the absolute rigidity of the Lock and Key model. Regulatory enzymes actually heavily rely on induced fit mechanics.

Question #6 Key: (D)

KMU 2024

What happens to the enzyme after an enzyme-catalyzed reaction?
[KMU-2024]

CORE CONCEPT AND DERIVATION

A fundamental property of any catalyst, biological or inorganic, is that it is not consumed by the reaction it facilitates.

Solution:

- During catalysis, the enzyme temporarily binds to the substrate to form an ES complex.
- Once the bonds are rearranged, the product is released.
- The enzyme itself remains structurally and chemically unchanged, meaning it is instantly ready and **used for another reaction**. This reusability is why enzymes are only needed in very small concentrations in the body.

Why other options are incorrect:

Enzymes do not become inert or inactive simply by performing their job. They certainly do not magically transform into their own substrates.

Question #7 Key: (B)

SZABMU 2024

The Lock and Key Model (1894) was modified by: [SZABMU-2024]

CORE CONCEPT AND DERIVATION

Scientific models evolve as new evidence emerges. The extreme rigidity of the 1894 enzyme model could not explain broad specificities or allosteric regulation.

Solution:

- Emil Fischer proposed the original Lock and Key model in 1894.
- Decades later, in 1959, Daniel **Koshland** recognized that enzymes were dynamic proteins, not rigid locks.
- He proposed a modification known as the 'Induced Fit Model', stating that the active site is flexible and molds itself around the substrate.

Why other options are incorrect:

Emil Fischer created the original, unmodified model. Kuhne coined the term 'enzyme'. Camillo Golgi discovered the Golgi apparatus in cells, entirely unrelated to enzyme kinetic models.

Question #8 Key: (C)

NUMS 2024

An enzyme is capable of acting on a wide range of related substrates. Which of the following is a property of ...

CORE CONCEPT AND DERIVATION

Enzyme specificity ranges from absolute specificity (acting on only one substrate) to group/relative specificity (acting on structurally related substrates).

Solution:

- **Non-regulatory enzymes:** Many non-regulatory enzymes (such as general digestive enzymes like chymotrypsin, pepsin, and lipases) possess flexible active sites that accommodate a **wide range of structurally related substrates** (e.g., cleaving different peptide or ester bonds).
- **Regulatory (Allosteric) enzymes:** These act as critical rate-limiting pacemakers of metabolic pathways. They must be **highly specific** for their substrate and regulatory effectors to prevent uncontrolled metabolic flux.
- An enzyme acting on a broad range of related substrates conforms to the **Induced Fit Model** (flexible active site) and functions as a **Non-regulatory enzyme**.

Why other options are incorrect:

- **A (Inflexible active site):** An inflexible active site (Lock and Key model) would confer rigid, absolute specificity to only one exact molecule, not a wide range.
- **B (Regulatory enzyme):** Regulatory enzymes are highly specialized and strictly specific for precise metabolic control.
- **D (Highly specific enzyme):** Directly contradicts the question stem stating the enzyme acts on a "wide range of related substrates".

Question #9 Key: (D)

SZABMU 2024

All of the following are the postulates of lock and key model, except: [SZABMU-2024-Reconduct]

CORE CONCEPT AND DERIVATION

The Lock and Key model is defined by absolute rigidity. Any mention of flexibility belongs to a different model.

Solution:

- Postulates of Lock and Key: The active site is rigid (Option A). It fits only one specific substrate perfectly (Option C). Because of this rigidity, it cannot undergo complex allosteric regulation well (Option B).
- However, Option D states the substrate **induces a change in the enzyme structure**. This is the exact, defining postulate of Koshland's *Induced Fit Model*, not Fischer's Lock and Key model.

Why other options are incorrect:

Options A, B, and C correctly describe the limitations and framework of the historical Lock and Key model. Option D is the only clear exception.

Question #10 Key: (B)

UHS 2024

Which of the following statement is incorrect regarding rate of enzymatic action? [UHS-2024]

CORE CONCEPT AND DERIVATION

Enzyme kinetics relies on collision theory. More enzymes mean more available active sites for substrates to collide with.

Solution:

- If substrate concentration is abundant, adding more enzyme molecules directly increases the number of available active sites.
- This leads to a higher frequency of successful collisions, linearly increasing the reaction rate.
- Therefore, the statement that an **increase in enzyme concentration reduces the rate** is fundamentally backwards and mathematically **incorrect**.

Why other options are incorrect:

Option A is a true statement. Options C and D are true; peak performance (maximum rate) is achieved when environmental factors (pH and temperature) are exactly at their optimal levels.

Question #11 Key: (D)

KMU 2024

*Catalase can be activated at pH: [KMU-2024]***CORE CONCEPT AND DERIVATION**

Catalase is a vital protective enzyme found universally in the peroxisomes of nearly all aerobic living cells to neutralize toxic hydrogen peroxide.

Solution:

- Because catalase operates inside the general intracellular environment of the cell (which is kept near physiological neutrality), its structure is optimized for this environment.
- Therefore, catalase functions optimally at a neutral **pH of approximately 7.0** (specifically around 7.6).

Why other options are incorrect:

A pH of 1 or 3 is extremely acidic (similar to stomach acid) and would instantly denature the intracellular catalase protein. pH 5 is also too acidic for peak catalase efficiency.

Question #12 Key: (D)

KMU 2024

*Optimum pH for pancreatic lipase is: [KMU-2024]***CORE CONCEPT AND DERIVATION**

The digestive system is compartmentalized. The stomach is acidic, but the small intestine must be alkaline to protect the tissue and activate a new set of enzymes.

Solution:

- The pancreas secretes lipase into the duodenum (small intestine) to digest fats.
- The pancreas also secretes heavy concentrations of bicarbonate to neutralize incoming stomach acid, raising the intestinal pH to an alkaline level.
- As an evolutionary result, pancreatic lipase operates best in a basic medium, specifically at a pH of roughly **8.0** (to 9.0).

Why other options are incorrect:

pH 2 is optimal for stomach enzymes (pepsin). pH 4 and 6 are acidic and would result in poor efficiency or denaturation of pancreatic enzymes.

Question #13 Key: (A)

KMU 2024

*Enzymatic activity can be inhibited by: [KMU-2024]***CORE CONCEPT AND DERIVATION**

Certain external chemicals can act as severe, irreversible poisons to biological systems by violently attacking the fragile tertiary structure of proteins.

Solution:

- **Heavy metal ions** (such as Mercury Hg^{2+} , Lead Pb^{2+} , and Silver Ag^+) are highly toxic inhibitors.
- They forcefully bind to the reactive sulfhydryl ($-\text{SH}$) groups of the amino acid cysteine within the enzyme.
- This physically breaks the crucial disulfide bridges that hold the enzyme together, causing catastrophic and irreversible denaturation.

Why other options are incorrect:

Methane and noble gases are largely inert in biological systems and do not break protein bonds. Mutase is a class of isomerase enzymes, not an inhibitor.

Question #14 Key: (D)

KMU 2024

*A competitive inhibitor: [KMU-2024]***CORE CONCEPT AND DERIVATION**

Competitive inhibition relies on molecular mimicry. Because the bonds formed are temporary, the system can be manipulated by changing concentrations.

Solution:

- Competitive inhibitors mimic the substrate and bind to the active site using weak, non-covalent interactions (like hydrogen bonds).
- Because these bonds are weak, the inhibitor frequently attaches and detaches.
- If the normal substrate concentration is heavily increased, it will outcompete the inhibitor for the active site, proving that the inhibition **is reversible**.

Why other options are incorrect:

Inhibitors decelerate, not accelerate, reactions. It competes with the *substrate* (for access to the enzyme), it does not compete with the enzyme itself. By definition, true competitive inhibitors are reversible (unlike heavy metals).

Question #15 Key: (B)

SZABMU 2024

Cyanides attached to enzymes by forming a covalent bond. These come under category of: [SZABMU-2024]

CORE CONCEPT AND DERIVATION

The permanence of an enzyme inhibitor is dictated entirely by the strength of the chemical bond it forms with the protein.

Solution:

- Covalent bonds are extremely strong, permanent chemical links.
- When poisons like Cyanide form covalent bonds with vital enzymes (like cytochrome c oxidase in the electron transport chain), the enzyme cannot break the bond to free itself.
- Because the enzyme's catalytic ability is permanently destroyed and cannot be rescued by adding more substrate, this is strictly classified as an **irreversible inhibitor**.

Why other options are incorrect:

Reversible inhibitors use weak bonds (ionic/hydrogen). While cyanide's mechanism can be non-competitive in terms of location, the specific mention of the 'covalent bond' in the prompt dictates the structural category of 'irreversible'.

Question #16 Key: (A)

KMU 2024

Which enzyme is secreted in the active form? [KMU-2024]

CORE CONCEPT AND DERIVATION

Cells that produce protein-digesting enzymes must protect themselves from being digested by their own secretions. Enzymes that digest safe materials don't need this protection.

Solution:

- Proteases (like trypsin, pepsin, and chymotrypsin) are highly dangerous to the cells that produce them because cells are made of proteins. Thus, they are secreted as inactive zymogens (-ogens).
- **Amylase**, however, digests starch (carbohydrates). Since the salivary glands and pancreas are not made of starch, amylase poses no threat to the internal cellular machinery.
- Therefore, amylase can be safely secreted completely in its **active form**.

Why other options are incorrect:

Trypsin, Pepsin, and Chymotrypsin are all proteases secreted as inactive trypsinogen, pepsinogen, and chymotrypsinogen, respectively.

Question #17 Key: (D)

NUMS 2024

Ions of heavy metal are harmful for living organisms because of their ability to: [NUMS-2024]

CORE CONCEPT AND DERIVATION

Heavy metals are profound cellular poisons because they target the fundamental architectural pillars of proteins.

Solution:

- The 3D folding of many critical enzymes is maintained by strong covalent disulfide bridges between cysteine amino acids.
- Heavy metal ions (like Hg^{2+} , Pb^{2+}) have an immense chemical affinity for the sulfur in these sulfhydryl (-SH) groups.
- When they bind to the sulfur, they physically rip apart the disulfide bridges, causing the protein to unfold. This ability to violently **destabilize proteins** leads to rapid cell death.

Why other options are incorrect:

While heavy metals can indirectly affect all metabolism by destroying the enzymes involved, their direct, primary chemical mechanism of toxicity is the irreversible denaturation and destabilization of proteins, not specifically attacking fats, nucleic acids, or carbohydrates.

Question #18 Key: (C)

NUMS 2024

Enzyme catalase protects the plant cell from: [NUMS-2024]

CORE CONCEPT AND DERIVATION

Peroxisomal enzyme activity in cellular detoxification.

Solution: Catalase breaks down toxic hydrogen peroxide (H_2O_2) generated during oxidative reactions (including organic metabolite breakdown) into harmless water and oxygen, protecting the cell from oxidative damage.

Question #19 Key: (C)

UHS 2023

*NAD is an important? [UHS-2023]***CORE CONCEPT AND DERIVATION**

In cellular respiration, enzymes require organic helper molecules to transfer electrons safely between metabolic pathways.

Solution:

- NAD (Nicotinamide Adenine Dinucleotide) is an organic, non-protein molecule derived from Vitamin B3 (niacin).
- It binds loosely and temporarily to redox enzymes (dehydrogenases) to accept and donate electrons (as NADH).
- Because it is an organic, detachable helper molecule, it is officially classified as a **Coenzyme**.

Why other options are incorrect:

NAD is not a protein, so it cannot be an enzyme. It is derived from a vitamin, but it is not the vitamin itself. It does not act as a hormone (signaling molecule) in the endocrine system.

Question #20 Key: (C)

SZABMU 2023

Non protein but inorganic detachable co-factor is called: [SZABMU-2023]

CORE CONCEPT AND DERIVATION

Co-factors are classified by two distinct properties: their chemical composition (organic vs. inorganic) and how tightly they bind to the enzyme (detachable vs. permanent).

Solution:

- If a co-factor is **inorganic** (usually a metal ion like Mg^{2+} or Zn^{2+}) and **detaches** easily after the reaction, it is explicitly defined as an **Activator**.

Why other options are incorrect:

A Co-enzyme is detachable but is strictly organic (like NAD). A Prosthetic group is permanent/covalently bonded (can be organic or inorganic). The apoenzyme is the protein part itself.

Question #21 Key: (C)

KMU 2023

*All of the following are related to enzymes except: [ETEA-2023]***CORE CONCEPT AND DERIVATION**

Enzymes are biological catalysts. Their entire thermodynamic function is to make reactions easier to achieve, not harder.

Solution:

- Enzymes speed up chemical reactions.
- They possess an active site where the substrate binds.
- They remain structurally unchanged at the end of the reaction, ready to be used again.
- However, they function strictly by **lowering** the activation energy barrier. They **NEVER increase the activation energy**.

Why other options are incorrect:

Remaining unchanged, speeding up the reaction, and possessing an active site are all fundamental, factual properties of enzymes. Increasing activation energy is the exact opposite of what a catalyst does.

Question #22 Key: (D)

KMU 2023

*The coenzyme NAD is made up of: [ETEA-2023 Retake]***CORE CONCEPT AND DERIVATION**

To understand the function of a coenzyme, we must look at its underlying biochemical structure and its full chemical name.

Solution:

- NAD stands for Nicotinamide Adenine **Dinucleotide**.
- As the name implies, it is structurally composed of two distinct **nucleotides** joined together by their phosphate groups.
- One nucleotide contains an adenine base, and the other contains nicotinamide.

Why other options are incorrect:

While NAD is functionally derived from a vitamin (niacin), its physical structural building blocks are nucleotides. It is not made of amino acids (proteins) or simple sugars alone.

Question #23 Key: (A)

KMU 2023

What alters the shape of enzyme and makes them functional:
[ETEA-2023 Retake]

CORE CONCEPT AND DERIVATION

Many enzymes are synthesized in an incomplete, non-functional state (apoenzyme) and require an external trigger to complete their specific 3D active site.

Solution:

- Apoenzymes are inactive on their own.
- When a specific **cofactor** (like a metal ion or coenzyme) binds to the apoenzyme, it physically alters the protein's conformational shape.
- This shape change properly aligns the active site, converting the useless apoenzyme into a fully functional, active holoenzyme.

Why other options are incorrect:

While some enzymes (kinases) can activate other enzymes via phosphorylation, the universal structural requirement that completes an enzyme's shape to make it a holoenzyme is a cofactor.

Question #24 Key: (C)

KMU 2023

Enzymes are: [ETEA-2023 Retake]

CORE CONCEPT AND DERIVATION

Biological macromolecules are divided into four main classes: carbohydrates, lipids, proteins, and nucleic acids. Catalytic molecules fall into a specific class.

Solution:

- Virtually all metabolic and digestive enzymes in living organisms are composed of long chains of amino acids folded into complex 3D structures.
- Therefore, by definition, enzymes are universally classified as **Proteins**.
- (Note: While RNA ribozymes exist, historically in basic biology curricula, the foundational rule is 'All enzymes are proteins').

Why other options are incorrect:

Lipids (fats) and carbohydrates (sugars) serve mainly as structural components or energy storage; they lack the complex chemical versatility required to form a catalytic active site.

Question #25 Key: (A)

KMU 2023

What is 'flavin adenine dinucleotide'? [ETEA-2023 Retake]

CORE CONCEPT AND DERIVATION

Flavin Adenine Dinucleotide (FAD) is a crucial electron carrier utilized primarily in the Krebs cycle during cellular respiration.

Solution:

- FAD is an organic, non-protein helper molecule.
- It works closely with specific oxidoreductase enzymes to accept electrons (becoming FADH_2) and then transport them to the electron transport chain.
- Because it is a detachable, organic molecule derived from a vitamin (riboflavin), its exact biochemical classification is a **Coenzyme**.

Why other options are incorrect:

FAD is not a protein, so it cannot be an enzyme. While it is technically a sub-type of cofactor, 'coenzyme' is the most accurate and specific classification for organic dinucleotides like FAD and NAD.

Question #26 Key: (C)

UHS 2023

The active sites of enzymes are composed of? [UHS-2023]

CORE CONCEPT AND DERIVATION

Despite an enzyme being a massive protein structure containing hundreds of monomers, the business end of the molecule is remarkably small.

Solution:

- Since enzymes are proteins, their foundational building blocks are amino acids.
- The active site is a tiny, highly specific geometric pocket on the enzyme's surface.
- It is composed of a strictly arranged configuration of just a **few amino acids** (typically 3 to 12 residues) whose R-groups perfectly interact with the substrate.

Why other options are incorrect:

Nucleotides/nucleosides form DNA and RNA. Saccharides form carbohydrates. Only amino acids form the active sites of protein enzymes.

Question #27 Key: (D)

SZABMU 2023

Lock and Key Model for enzyme action proposed by Emil Fischer suggests that: [SZABMU-2023]

CORE CONCEPT AND DERIVATION

The foundational premise of Emil Fischer's 1894 model is extreme structural rigidity. A physical lock cannot change its shape to accommodate different keys.

Solution:

- The Lock and Key model dictates that the active site is a rigid, pre-formed structure that exactly matches only one specific substrate.
- Because it can physically only bind to one specific chemical, the enzyme is completely **restricted to one reaction type**.

Why other options are incorrect:

Modifying active sites is the hallmark of Koshland's Induced Fit model. Catalyzing a variety of reactions or being 'unbiased' directly violates the strict specificity of the Lock and Key concept.

Question #28 Key: (A)

SZABMU 2023

Enzymes work by lowering the ____ of the reactions they catalyze: [SZABMU-2023]

CORE CONCEPT AND DERIVATION

For molecules to react, they must collide with enough force to disrupt existing electron clouds and reach an unstable transition state.

Solution:

- The minimum amount of energy required to achieve this transition state is the **activation energy**.
- Enzymes act as physical templates, binding substrates in the perfect orientation and putting stress on their bonds.
- This incredibly efficient process severely lowers the activation energy required, allowing the reaction to proceed rapidly at physiological temperatures.

Why other options are incorrect:

Enzymes do not reduce the innate kinetic or potential energy of the molecules, nor do they cool the reaction down (heat energy). They exclusively target the energy barrier of the transition state.

Question #29 Key: (D)

SZABMU 2023

Select a regulatory enzyme: [SZABMU-2023]

CORE CONCEPT AND DERIVATION

Metabolic pathways are tightly controlled by specific rate-limiting enzymes that can be turned on or off via allosteric regulation, preventing the over-accumulation of products.

Solution:

- **Hexokinase** is the crucial first enzyme in the glycolysis pathway.
- It phosphorylates glucose to trap it inside the cell.
- It is highly regulated via feedback inhibition (inhibited by its own product, glucose-6-phosphate), making it a classic textbook example of a regulatory (allosteric) enzyme.

Why other options are incorrect:

Maltase, sucrase, and urease are simple digestive/hydrolytic enzymes. They generally operate continuously based solely on substrate availability and lack the complex allosteric regulatory sites found in pathway gatekeepers like hexokinase.

Question #30 Key: (B)

KMU 2023

Which one of the following factors does not affect the rate of enzyme action? [ETEA-2023]

CORE CONCEPT AND DERIVATION

Enzyme kinetics are governed by factors that directly alter the frequency of collisions between the active site and the substrate, or the physical integrity of the protein itself.

Solution:

- Temperature affects collision kinetic energy and denaturation.
- Enzyme and substrate concentrations dictate how many active sites are available and filled.
- **Water concentration** (in standard physiological environments) acts merely as a ubiquitous solvent. While severe dehydration stops life, mild fluctuations in water concentration do not directly or fundamentally alter the kinetic curve of enzyme action like the other targeted factors do.

Why other options are incorrect:

Temperature, enzyme concentration, substrate concentration, and pH are the four universally taught primary factors that directly dictate and alter the rate of enzymatic reactions.

Question #31 Key: (C)

KMU 2023

Enzymes present in mammals work best at: [ETEA-2023]

CORE CONCEPT AND DERIVATION

Enzymes evolve to function optimally at the internal body temperature of the organism they belong to.

Solution:

- Mammals are endothermic (warm-blooded) and generally maintain a core body temperature around 37°C.
- Enzymes in mammalian bodies have an optimum temperature range closely matching this, typically between 37°C and 40°C.
- Since 37°C is not an option, 40°C represents the closest upper limit of optimal physiological activity before significant denaturation begins.

Why other options are incorrect:

20°C and 30°C are too cold for peak mammalian enzyme kinetics. 50°C is too hot and would cause rapid thermal denaturation of mammalian proteins.

Question #32 Key: (C)

KMU 2023

The optimal pH of lipase (pancreas) is: [ETEA-2023]

CORE CONCEPT AND DERIVATION

Enzymes secreted into the digestive tract are optimized for the specific pH of their target compartment.

Solution:

- Pancreatic lipase is secreted by the pancreas into the duodenum (small intestine) to digest dietary lipids.
- The environment of the small intestine is neutralized by bicarbonate secretions, creating an alkaline medium.
- Therefore, the optimal pH for pancreatic lipase is highly alkaline, specifically around **8.0** (and can range up to 9.0).

Why other options are incorrect:

1.5 - 1.6 is highly acidic (optimal for stomach pepsin). 4.0 - 5.0 is mildly acidic. 6.1 - 6.8 is nearly neutral (optimal for salivary amylase). Pancreatic enzymes require a basic environment.

Question #33 Key: (B)

NUMS 2023

Most enzymes work best at the following temperature: [NUMS-2023]

CORE CONCEPT AND DERIVATION

The rate of an enzyme-catalyzed reaction increases with heat due to higher kinetic energy, up to a strict limit where the protein structure breaks down.

Solution:

- For most human/mammalian enzymes, reaction rates peak just before the onset of thermal denaturation.
- This optimal kinetic peak occurs around 37°C to 40°C.
- At 40°C, molecular collisions are maximized while the 3D protein structure remains largely intact.

Why other options are incorrect:

50°C destroys (denatures) most human enzymes. 20°C and 30°C do not provide enough kinetic energy for the reaction to reach its maximum possible rate.

Question #34 Key: (A)

NUMS 2023

In term of enzyme action, 'maximum temperature' refers to a temperature at which: [NUMS-2023]

CORE CONCEPT AND DERIVATION

Enzyme activity is governed by three cardinal temperatures: Minimum, Optimum, and Maximum temperatures.

Solution:

- **Optimum Temperature:** The temperature at which an enzyme exhibits its maximum catalytic activity (works best, typically ~37°C in humans).
- **Maximum Temperature:** The upper critical temperature at which **enzymes start to denature** and lose their functional tertiary/quaternary structure due to heat-induced disruption of hydrogen and ionic bonds.
- **Minimum Temperature:** The lowest temperature at which enzyme activity is detectable.
- Therefore, 'maximum temperature' specifically refers to the point where **enzymes start to denature**.

Why other options are incorrect:

- **B & D (Re-nature / Reactivated):** Heat denaturation is generally irreversible for globular enzymes.
- **C (Enzymes work best):** This defines the *Optimum Temperature*, not the Maximum Temperature.

Question #35 Key: (A)

KMU 2023

Adding substrates will not make a difference to the enzyme catalyzed reaction: [ETEA-2023 Retake]

CORE CONCEPT AND DERIVATION

Enzyme kinetics follows a saturation curve. The reaction rate is limited by the physical number of active sites available.

Solution:

- Initially, adding substrate speeds up the reaction because there are plenty of empty enzymes.
- However, once all active sites are occupied (saturated), the enzyme is working at its maximum velocity (V_{max}).
- When very **few enzyme molecules are left unsaturated**, the system is essentially at full capacity. Adding more substrate at this point will not yield any significant increase in the reaction rate because there are no available active sites to process it.

Why other options are incorrect:

If 'many' enzymes are unsaturated (Option D), adding substrate will make a huge difference. Heating or cooling the substrate changes kinetic energy, but doesn't directly address the specific chemical concept of enzyme saturation limits.

Question #36 Key: (A)

UHS 2023

Competitive inhibitors are ____ [UHS-2023]

CORE CONCEPT AND DERIVATION

To successfully block an active site, a competitive inhibitor must physically mimic the normal substrate.

Solution:

- In biochemical terminology, molecules that share a deeply similar structural framework and functional group arrangement are often termed structural analogs or structural **homologues**.
- Because they are structurally homologous to the true substrate, competitive inhibitors can wedge themselves perfectly into the highly specific geometry of the active site.

Why other options are incorrect:

'Analogous' generally implies a similar function but a different structure (which would fail to fit the active site). Size alone (simply being larger or smaller) is irrelevant; the precise 3D shape must match the substrate.

Question #37 Key: (A)

NUMS 2023

_____ reduce the enzyme productivity by blocking the substrate entering into the active site due to similar sha...

CORE CONCEPT AND DERIVATION

Enzyme inhibition can occur via a direct physical blockade of the catalytic site.

Solution:

- Competitive inhibitors** possess a 3D molecular geometry that is remarkably similar to the natural substrate.
- Due to this structural mimicry, they compete for and bind directly to the active site.
- This acts as a physical plug, strictly blocking the true substrate from entering and consequently reducing overall enzyme productivity.

Why other options are incorrect:

Non-competitive inhibitors bind elsewhere (allosteric sites) and change the enzyme's shape, rather than directly blocking the entrance. Co-enzymes and activators are essential helpers that increase, not reduce, productivity.

Question #38 Key: (A)

NUMS 2023

Non-competitive inhibitors react with enzymes at: [NUMS-2023]

CORE CONCEPT AND DERIVATION

Inhibitors that do not mimic the substrate must find an alternative location on the enzyme to exert their effect.

Solution:

- Non-competitive inhibitors bind to a secondary, distinct pocket on the enzyme's surface.
- This secondary site is universally referred to in biochemistry as an **Allosteric site** (from Greek *allo* meaning 'other' and *steric* meaning 'shape/space').
- Binding here triggers a global conformational shift that warps the active site, destroying its ability to bind the substrate.

Why other options are incorrect:

Competitive inhibitors bind to the active site. While an allosteric site acts as a 'regulatory site', the term 'Allosteric site' is the specific, universally accepted terminology for the binding location of non-competitive inhibitors in standard curricula.

Question #39 Key: (B)

KMU 2023

An example of competitive inhibitor molecule is: [ETEA-2023]

CORE CONCEPT AND DERIVATION

Many clinical drugs are designed as competitive inhibitors to specifically target and starve bacterial metabolic pathways.

Solution:

- **Sulphonamides** (sulfa drugs) are a classic textbook example of competitive inhibition.
- They are structurally very similar to para-aminobenzoic acid (PABA), a natural substrate bacteria use to synthesize folic acid.
- The drug competitively binds to the bacterial enzyme instead of PABA, halting folic acid synthesis and killing the bacteria.

Why other options are incorrect:

Cyanide is an irreversible, non-competitive inhibitor that binds strongly to cytochrome c oxidase. Insecticides (like organophosphates) and heavy metal ions generally form strong covalent bonds, acting as irreversible/non-competitive poisons.

Question #40 Key: (D)

KMU 2023

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

CORE CONCEPT AND DERIVATION

Inhibitors are classified by exactly when and where they bind to the enzyme during the catalytic cycle.

Solution:

- If an inhibitor only recognizes and binds to the enzyme after the substrate has already attached (forming the Enzyme-Substrate or ES complex), it traps the substrate inside.
- This highly specific mechanism is strictly defined as **Uncompetitive inhibition**.
- It prevents the ES complex from converting into products and cannot be overcome by adding more substrate.

Why other options are incorrect:

Competitive inhibitors bind the free enzyme. Non-competitive inhibitors can bind both the free enzyme and the ES complex. Binding exclusively to the ES complex is the hallmark of uncompetitive inhibition.

Question #41 Key: (C)

KMU 2023

Which of the following is an example of hydrolase? [ETEA-2023 Retake]

CORE CONCEPT AND DERIVATION

Hydrolases are a major class of enzymes that use water molecules to break chemical bonds (hydrolysis).

Solution:

- A **Phosphatase** is an enzyme that removes a phosphate group from its substrate.
- It accomplishes this cleavage by introducing a molecule of water (H_2O) across the bond, effectively hydrolyzing it.
- Therefore, it securely belongs to the hydrolase category.

Why other options are incorrect:

Transmethylases transfer methyl groups (transferases). Oxygenases and peroxidases facilitate oxidation-reduction reactions (oxidoreductases). None of these rely on water to cleave bonds like hydrolases do.

Question #42 Key: (A)

KMU 2022

Enzymes are ____ in nature. [ETEA-2022]

CORE CONCEPT AND DERIVATION

Enzymes are biological macromolecules constructed from specific monomeric subunits that allow them to fold into highly complex, active structures.

Solution:

- Almost all known biological enzymes are proteinaceous in nature (with the rare exception of ribozymes, which are RNA).
- They are composed of long chains of amino acids that fold into a tertiary or quaternary structure, which creates the functional active site.

Why other options are incorrect:

Carbohydrates, lipids, and vitamins do not form the structural backbone of enzymes. (Vitamins often act as precursors to coenzymes, but are not the enzyme itself).

Question #43 Key: (C)

UHS 2022

Zinc ion is attached to the active site of the enzyme carboxypeptidase. The zinc ion functions as: [UHS-2022]

CORE CONCEPT AND DERIVATION

Many enzymes require non-protein helper molecules for their catalytic activity. When this helper is an inorganic metal ion, it has a specific designation.

Solution:

- A detachable inorganic co-factor is known as an **activator**.
- Metal ions like Zn^{2+} , Mg^{2+} , and Fe^{2+} often act as activators by temporarily binding to the enzyme and helping to draw electrons away from the substrate, facilitating the reaction.

Why other options are incorrect:

Coenzymes are organic molecules (like vitamins). Inhibitors decrease enzyme activity, whereas zinc is required for carboxypeptidase to function. It binds to the active site to aid catalysis, not an allosteric regulatory site.

Question #44 Key: (C)

SZABMU 2022

The catalytic activity of an enzyme is restricted to its small portion: [SZABMU-2022]

CORE CONCEPT AND DERIVATION

Although an enzyme is a massive macromolecule made of hundreds of amino acids, only a tiny fraction of its surface is actually involved in the chemical reaction.

Solution:

- This highly restricted, specific region is called the **active site**.
- The active site is a uniquely shaped cleft or crevice composed of a small number of specific amino acids (usually 3 to 12) where the substrate binds and is converted into a product.

Why other options are incorrect:

The allosteric/regulation site is used for turning the enzyme on or off via effector molecules, not for the main catalytic conversion of the substrate. 'Passive site' is not a recognized biological term.

Question #45 Key: (B)

BUMHS 2022

The catalytic site of enzyme is made up of how many amino acids? [BUMHS-2022]

CORE CONCEPT AND DERIVATION

The bulk of an enzyme's protein structure exists primarily to maintain the exact 3D framework required for a tiny functional region.

Solution:

- The active/catalytic site is a very small region on the surface of the enzyme.
- Different amino acids are specifically arranged into this site, but their total number is surprisingly small—typically varying from only **3 to 12 amino acids**.
- The rest of the hundreds of amino acids merely provide the structural scaffolding to keep those 3–12 amino acids in the exact right spatial orientation.

Why other options are incorrect:

Numbers like 50–100 or 100–1000 refer to the entire length of the polypeptide chain that forms the whole enzyme, not the minute active site.

Question #46 Key: (B)

UHS 2022

Enzymes lower the activation energy by stabilizing the transition state of a metabolic reaction due to: [UHS-2022]

CORE CONCEPT AND DERIVATION

Activation energy is lowered when an enzyme makes it physically and chemically easier for substrates to reach the unstable transition state.

Solution:

- When a substrate binds to the active site, the enzyme subtly alters the microenvironment.
- By **changing conditions within the active site** (such as altering the local pH, adjusting charge distribution, or putting mechanical stress on specific bonds), the enzyme stabilizes the transition state, requiring less energy for the reaction to proceed.

Why other options are incorrect:

Changes in the general protein framework or allosteric site are related to regulation, not the direct catalytic mechanism. Active sites are composed of amino acids, not fatty acids.

Question #47 Key: (C)

SZABMU 2022

Enzymes work by lowering the _____ of the reactions they catalyze. [SZABMU-2022]

CORE CONCEPT AND DERIVATION

Every chemical reaction, even highly exergonic ones, requires an initial input of energy to break existing chemical bonds before new ones can form.

Solution:

- This required initial energy is called **activation energy**.
- Enzymes function uniquely as biological catalysts by significantly lowering this activation energy barrier.
- Because the barrier is lower, the reaction can occur much faster at the mild temperatures found in living organisms.

Why other options are incorrect:

Enzymes do not alter the overall kinetic or potential energy of the system, nor do they cool the reaction by lowering heat energy.

Question #48 Key: (A)

DUHS 2022

When substrate combines the active site of an enzyme it induces a conformational changes that enable enzyme to...

CORE CONCEPT AND DERIVATION

The active site of an enzyme is functionally divided into a binding site and a catalytic site. The Induced Fit model explains how these two cooperate.

Solution:

- First, the substrate attaches securely to the binding site.
- This binding physically induces a conformational (shape) change in the overall active site.
- This shift perfectly aligns the specific amino acid residues of the catalytic site against the substrate's chemical bonds, inducing the enzyme to perform its **catalytic function** (breaking or forming bonds).

Why other options are incorrect:

Meiosis is cellular division. Metabolism is a broad term for all cellular reactions. 'Analytic function' is a made-up term in this context. The direct result of the conformational shift is catalysis.

Question #49 Key: (C)

NUMS 2022

Considering enzyme action, 'minimum temperature' is the term used when: [NUMS-2022]

CORE CONCEPT AND DERIVATION

At incredibly low temperatures (near freezing), molecular kinetic energy is so low that substrates rarely collide with enzymes. The enzyme is functionally inactive, but importantly, its physical structure is intact (not denatured).

Solution:

- When heat is slowly reapplied, kinetic energy returns.
- The '**minimum temperature**' is defined as the lowest possible amount of thermal energy required to jumpstart the collisions and **reactivate** a temperature-inactivated enzyme.
- As temperature rises past this minimum, activity increases until it reaches the optimum.

Why other options are incorrect:

'Working at best' is the optimum temperature. 'Denaturing' happens at the maximum/extreme high temperature. Low temperatures never make an enzyme hyperactive.

Question #50 Key: (B)

NUMS 2022

Which enzyme works in alkaline pH? [NUMS-2022]

CORE CONCEPT AND DERIVATION

The digestive tract has different pH zones to compartmentalize digestion. The stomach is acidic, while the small intestine is highly basic.

Solution:

- **Pancreatic lipase** is secreted by the pancreas directly into the duodenum of the small intestine.
- The small intestine's environment is heavily buffered with bicarbonate to achieve a pH of around 9.0.
- Therefore, pancreatic lipase has evolved to function perfectly in this highly alkaline medium.

Why other options are incorrect:

Pepsin works in the stomach's extreme acid (pH 2). Sucrase works in a mildly acidic environment (pH 4.5). Enterokinase is also intestinal but Pancreatic Lipase is the classic textbook example of a high alkaline optimum enzyme (pH 9).

Question #51 Key: (C)

SZABMU 2022

The maximum enzymatic activity of trypsin is shown at: [SZABMU-2022]

CORE CONCEPT AND DERIVATION

Trypsin is a proteolytic enzyme that continues the digestion of proteins after they leave the acidic stomach.

Solution:

- Trypsin is released by the pancreas into the small intestine.
- Because the acidic chyme from the stomach is neutralized by basic pancreatic juices, the small intestine has a pH of approximately 7.8 to 8.7.
- Consequently, trypsin reaches its maximum catalytic activity at an alkaline **pH of 8**.

Why other options are incorrect:

A pH of 2 is highly acidic (optimal for pepsin). pH 4 and 6 are too acidic for small intestine enzymes and would denature trypsin.

Question #52 Key: (A)

SZABMU 2022

In term of enzyme action maximum temperature refers to a temperature at which: [SZABMU-2022]

CORE CONCEPT AND DERIVATION

Kinetic thermal limits in enzymatic reactions.

Solution: In enzyme kinetics, the peak of the temperature curve represents the point of maximum molecular collisions where **enzymes work best**, immediately prior to thermal denaturation.

Question #53 Key: (C)

BUMHS 2022

Optimum pH for digestive enzymes of stomach is: [BUMHS-2022]

CORE CONCEPT AND DERIVATION

The stomach is a unique digestive compartment designed to aggressively break down tough food particles and kill incoming pathogens.

Solution:

- The parietal cells of the stomach lining secrete concentrated Hydrochloric Acid (HCl).
- This drops the stomach's pH down to a drastically low level of approximately 2.0.
- Therefore, the chief digestive enzyme of the stomach, pepsin, requires a **highly acidic** optimum pH to function effectively.

Why other options are incorrect:

A slightly acidic pH (like 6) is found in the mouth (saliva). Alkaline conditions exist in the small intestine. Only the stomach maintains a highly acidic environment.

Question #54 Key: (D)

DUHS 2022

Enzymes are generally inactivated rapidly by exposure to UV light and also [Formula], [Formula] rays because ...

CORE CONCEPT AND DERIVATION

High-energy radiation disrupts protein folding and tertiary stability.

Solution: Ionizing radiation disrupts internal hydrogen and disulfide bonds maintaining the tertiary structure of enzymes. This irreversibly denatures the protein, fundamentally altering the **nature of the enzyme** and permanently halting catalysis.

Question #55 Key: (B)

UHS 2022

Competitive inhibitors compete with: [UHS-2022]

CORE CONCEPT AND DERIVATION

The active site of an enzyme is a highly specific physical space designed for one type of molecule. If two similar molecules are present, a chemical tug-of-war ensues.

Solution:

- A competitive inhibitor is structurally analogous (has a very similar shape) to the normal substrate.
- Because of this similarity, both molecules attempt to bind to the exact same physical location (the active site).
- Therefore, the competitive inhibitor is directly competing with the **substrate** for access to the enzyme.

Why other options are incorrect:

It does not compete with the enzyme (it binds TO the enzyme). It does not compete with the product or coenzyme, as they occupy entirely different roles or phases of the reaction.

Question #56 Key: (B)

UHS 2022

Non-competitive inhibitor molecules have: [UHS-2022]

CORE CONCEPT AND DERIVATION

The physical shape of an inhibitor dictates where it will bind on the enzyme, determining its entire mechanism of action.

Solution:

- Because non-competitive inhibitors do not bind to the active site, they do not need to mimic the substrate's shape.
- Instead, they bind to a completely separate allosteric site on the enzyme's surface.
- Therefore, they possess a **quite different structure from the substrate molecule**.

Why other options are incorrect:

Having a similar structure is the defining trait of a competitive inhibitor, which allows it to fit into the active site.

Question #57 Key: (C)

SZABMU 2022

_____ reduces the enzyme productivity by blocking the substrate from entering into the active site due to simi...

CORE CONCEPT AND DERIVATION

When two molecules share a very similar geometric structure, they can both fit into the same enzymatic binding pocket.

Solution:

- **Competitive inhibitors** are structural imposters of the normal substrate.
- By perfectly mimicking the substrate's shape, they successfully wedge themselves into the active site.
- This creates a physical roadblock, preventing the true substrate from entering and bringing enzyme productivity to a halt.

Why other options are incorrect:

Non-competitive inhibitors do not have similar shapes and bind elsewhere. Activators and co-enzymes INCREASE enzyme productivity, they do not reduce it.

Question #58 Key: (B)

PMDC 2020

Enzymes work by lowering the _____ of the reactions they catalyze. [PMC-2020]

CORE CONCEPT AND DERIVATION

For a chemical reaction to occur, the reactants must overcome an initial energy barrier before they can be converted into products.

Solution:

- This initial energy hurdle is known as the activation energy.
- Enzymes stabilize the transition state of the reaction, providing an alternative pathway that requires significantly less activation energy.
- By doing so, a much larger proportion of molecules have enough energy to react at biological temperatures.

Why other options are incorrect:

Enzymes do not alter the overall kinetic, heat, or potential energy of the reactants or products; they specifically lower the energy required to reach the transition state.

Question #59 Key: (D)

PMDC 2020

Lock and key model for enzyme action proposed by Emil Fischer suggests that: [PMC-2020]

CORE CONCEPT AND DERIVATION

The Lock and Key model implies absolute rigidity and absolute specificity.

Solution:

- Proposed by Emil Fischer in 1894, this model states that an enzyme's active site perfectly matches the shape of only one specific substrate, much like a specific key fits only one lock.
- Because of this rigid and highly specific physical match, the enzyme is entirely restricted to catalyzing one single, specific type of reaction.

Why other options are incorrect:

The ability to modify active sites belongs to the Induced Fit model. Catalyzing a variety of reactions contradicts the core premise of absolute specificity in the Lock and Key model.

Question #60 Key: (C)

MDCAT 2019

According to _____ model, the active site of enzyme is modified as the substrate interacts with enzyme. [MDCAT-...]

CORE CONCEPT AND DERIVATION

The interaction between an enzyme and its substrate is dynamic, not rigid. The enzyme's active site undergoes conformational changes upon substrate binding.

Solution:

- The **Induced Fit model**, proposed by Daniel Koshland in 1959, suggests that the active site is flexible.
- When a substrate combines with the enzyme, it induces a conformational change in the enzyme's structure.
- This change aligns the catalytic groups perfectly to perform the reaction efficiently.

Why other options are incorrect:

The Lock and Key model (proposed by Emil Fischer) assumes a rigidly shaped active site that never changes. The Fluid Mosaic model describes cell membranes, not enzymes.

Question #61 Key: (C)

SZABMU 2019

With the increase of enzyme concentration in a reaction, more _____ is/are available for the substrate. [AJK-20...]

CORE CONCEPT AND DERIVATION

The rate of an enzyme-catalyzed reaction is directly proportional to the enzyme concentration, provided the substrate concentration is unlimited.

Solution:

- Every enzyme molecule contains an active site where catalysis occurs.
- Therefore, increasing the number of enzyme molecules directly increases the number of available **active sites**.
- More active sites mean more substrates can be processed simultaneously, increasing the reaction rate.

Why other options are incorrect:

While binding sites are part of the active site, 'active sites' is the more comprehensive and standard biological answer. Enzyme concentration does not change the activation energy barrier itself, nor does it magically create products without substrate conversion.

Question #62 Key: (D)

MDCAT 2019

Which one of the following graphs shows how the rate of reaction of pepsin is affected by pH? [MDCAT-2019] pH...

CORE CONCEPT AND DERIVATION

Pepsin is a powerful gastric protease secreted in the stomach, operating optimally in highly acidic conditions.

Solution:

- Gastric hydrochloric acid (HCl) maintains a stomach pH of ~1.5 to 2.0.
- Pepsin's enzymatic activity peaks sharply around **pH 2.0**, represented by the bell curve in Option D.

Question #63 Key: (C)

SZABMU 2019

Which type of bonds is mostly affected in an enzyme molecule when there are pH fluctuations? [AJK-2019]

CORE CONCEPT AND DERIVATION

An enzyme's active site contains specific amino acid residues with basic or acidic side chains (R-groups). Their charges depend entirely on the surrounding hydrogen ion concentration (pH).

Solution:

- Changes in pH add or remove H^+ ions from the environment.
- This dramatically alters the ionization state of the amino acid R-groups (e.g., turning a negatively charged group neutral).
- Because these charges are disrupted, the electrostatic attractions—specifically the **ionic bonds**—that hold the tertiary structure of the active site together are broken.

Why other options are incorrect:

Hydrogen bonds are primarily broken by extreme changes in high heat (temperature). Peptide bonds (primary structure) and disulfide bonds (strong covalent bonds) are extremely stable and require harsh chemical treatments or specific proteases to break, not just mild pH fluctuations.

Question #64 Key: (A)

MDCAT 2019

This figure represents _____ inhibitor. [MDCAT-2019] Inhibitor Enzyme Blocks Active Site Competitive Inhibitor...

CORE CONCEPT AND DERIVATION

Competitive inhibitors structurally resemble the enzyme's substrate and bind directly to the **active site**, preventing substrate binding.

Solution:

- The diagram explicitly shows the inhibitor molecule binding at and blocking the enzyme's **active site**.
- This is the hallmark mechanism of **Competitive Inhibition** (Option A).

Question #65 Key: (B)

MDCAT 2019

What is common in both competitive and non-competitive inhibition? [MDCAT-2019]

CORE CONCEPT AND DERIVATION

Enzyme inhibitors are broadly classified into two main categories based on whether their effects are permanent (covalent) or temporary (weak bonds).

Solution:

- Both competitive (blocking the active site) and non-competitive (binding to an allosteric site) inhibitors are primary examples of **reversible inhibition**.
- They attach to the enzyme using weak, non-covalent interactions (like hydrogen or ionic bonds).
- Because these bonds are weak, the inhibitor can eventually detach, allowing the enzyme to regain its full catalytic function.

Why other options are incorrect:

Irreversible/non-reversible inhibition involves permanent destruction of the enzyme via strong covalent bonds (like poisons or heavy metals). Feedback inhibition is a specific metabolic pathway mechanism, not a structural classification shared universally by all competitive/non-competitive inhibitors.

Question #66 Key: (B)

MDCAT 2019

A student of chemical engineering mistakenly engulfed the toxic compound 'A' which was a potent inhibitor of c...

CORE CONCEPT AND DERIVATION

The defining clinical feature of competitive inhibition is that it can be overcome by flooding the system with excess natural substrate.

Solution:

- The toxic compound 'A' was blocking the active sites of a vital enzyme.
- By injecting a massive dose of normal substrate 'B', the doctors drastically shifted the concentration ratio.
- The abundant substrate 'B' out-competed the toxic inhibitor 'A' for the active sites, allowing the enzyme to resume its life-saving function.
- This proves the toxin formed weak bonds and fought for the active site, meaning it was a **competitive reversible** inhibitor.

Why other options are incorrect:

If it were irreversible, the enzyme would be permanently dead, and adding substrate would do nothing. If it were non-competitive, it would be bound elsewhere changing the active site shape, and flooding substrate into a broken active site would also fail.

Question #67 Key: (B)

KMU 2019

Phosphatases belong to which group of the following? [ETEA-2019]

CORE CONCEPT AND DERIVATION

Enzymes are universally classified into six main classes based on the specific type of chemical reaction they catalyze.

Solution:

- Phosphatases are enzymes that catalyze the removal of a phosphate group from a molecule.
- They achieve this cleavage by using a molecule of water to break the chemical bond (a process known as hydrolysis).
- Therefore, phosphatases are strictly categorized under the broader enzyme class of **Hydrolases**.

Why other options are incorrect:

Ligases join two molecules together (often using ATP). Lyases break chemical bonds without using water. Since they use water to break bonds, they must be hydrolases.

Question #68 Key: (B)

MDCAT 2018

A non-protein part essential for proper and essential functioning of enzyme is called: [MDCAT-2018]

CORE CONCEPT AND DERIVATION

While all enzymes are proteins, many require an additional non-amino acid component to become fully catalytically active.

Solution:

- This essential non-protein component is universally termed a **co-factor**.
- Co-factors usually act as a bridge between the enzyme and its substrate, or directly participate in the chemical reaction (e.g., electron transfer).

Why other options are incorrect:

'Extra factor', 'Efficient co-factor', and 'Additional factor' are completely fabricated distractor terms that have no meaning in biochemistry.

Question #69 **Key: (B)**

MDCAT 2018

The temperature that promotes the maximum activity of enzyme is referred as: [MDCAT-2018]

CORE CONCEPT AND DERIVATION

As temperature increases, molecular collisions increase, speeding up the reaction rate—but only up to a specific threshold before the protein denatures.

Solution:

- The precise temperature at which an enzyme works at its absolute maximum efficiency is called its **optimum temperature**.
- For most enzymes in the human body, this temperature is around 37°C (normal body temperature).
- Beyond this point, the intense thermal kinetic energy breaks the delicate hydrogen bonds maintaining the enzyme's 3D shape, leading to rapid denaturation.

Why other options are incorrect:

'Fixed', 'Active', and 'Controlled' temperatures are not the standard scientific terms used in biochemistry to describe the peak of an enzyme's activity curve.

Question #70 **Key: (D)**

MDCAT 2018

If molecule can bind to another site of the enzyme rather than the true active site, it is referred as [MDCAT-...]

CORE CONCEPT AND DERIVATION

Inhibition can occur without directly blocking the active site if the enzyme possesses secondary regulatory binding pockets.

Solution:

- When an inhibitor binds to a distinct, alternate location on the enzyme (an allosteric site), it alters the global 3D structure of the protein.
- This remote structural distortion ruins the shape of the active site so the substrate can no longer fit.
- Because it does not compete for the active site itself, it is accurately termed a **non-competitive inhibitor**.

Why other options are incorrect:

Competitive inhibitors strictly bind to the true active site. Irreversible inhibitors can bind anywhere but the defining feature here is the location (allosteric), not the permanence of the bond.

Question #71 **Key: (B)**

MDCAT 2017

All enzymes are ____ [MDCAT-2017]

CORE CONCEPT AND DERIVATION

Enzymes are highly folded, complex molecules that act as biological catalysts to speed up chemical reactions within the body.

Solution:

- Enzymes are composed of hundreds of amino acids joined together by peptide bonds.
- They fold and coil upon themselves to form a specific three-dimensional, spherical shape known as a globular structure.
- This globular shape is essential because it forms the highly specific active site required for substrate binding.

Why other options are incorrect:

Enzymes are not fibrous proteins (which are structural, like keratin or collagen) or lipoproteins, and they generally have very high molecular weights due to their long polypeptide chains.

Question #72 **Key: (C)**

MDCAT 2017

The reactants on which enzyme work are: [MDCAT-2017]

CORE CONCEPT AND DERIVATION

In enzymatic reactions, the initial molecules that undergo transformation are specifically termed in biochemistry to distinguish them from generic chemical reactants.

Solution:

- A molecule that is directly acted upon by an enzyme is defined as a substrate.
- When substrates bind to enzymes, they undergo an enzyme-induced chemical change and are converted into the final products.

Why other options are incorrect:

Products are the result of the reaction, not the starting material. Metabolites and catabolites are general terms for molecules involved in or resulting from metabolic processes, but 'substrate' is the precise term for the reactant of an enzyme.

Question #73 Key: (C)

MDCAT 2017

*What is true about enzymes? [MDCAT-2017]***CORE CONCEPT AND DERIVATION**

Enzymes function solely to lower activation energy and accelerate the rate at which equilibrium is reached. They do not alter the thermodynamics or the final nature of the reaction products.

Solution:

- Enzymes are biocatalysts that speed up biochemical reactions.
- Because they only alter the reaction pathway (lowering the activation energy), their presence does not affect the inherent chemical properties or the nature of the end product(s).

Why other options are incorrect:

Enzymes are globular (not fibrous), highly specific to their substrates (not non-specific), and remain entirely unchanged at the end of the reaction (they are not 'used up').

Question #74 Key: (D)

MDCAT 2017

*Which of the following comprises of inorganic ions? [MDCAT-2017]***CORE CONCEPT AND DERIVATION**

Enzyme co-factors are divided into organic and inorganic categories. Inorganic co-factors are typically metal ions necessary for catalysis.

Solution:

- Activators are strictly inorganic ions (such as Mg^{2+} , Fe^{2+} , Cu^{2+} , Zn^{2+}) that temporarily bind to the enzyme to enhance its activity.
- They act as a 'bridge' between the enzyme and the substrate.

Why other options are incorrect:

Coenzymes are organic molecules. Prosthetic groups are covalently bonded (can be organic or inorganic, but 'activator' specifically defines the detachable inorganic ion class). The apoenzyme is the protein part.

Question #75 Key: (C)

MDCAT 2017

*Modified form of Lock and Key model was proposed by: [MDCAT-2017]***CORE CONCEPT AND DERIVATION**

The rigidity of the early Lock and Key model failed to explain how some enzymes catalyze reactions for multiple related substrates or exhibit allosteric regulation.

Solution:

- To resolve this, Daniel **Koshland** proposed a modified version known as the Induced Fit model in 1959.
- He postulated that the active site continuously molds itself to the substrate as it binds, maximizing catalytic efficiency.

Why other options are incorrect:

Emil Fischer proposed the original, rigid Lock and Key model. Watson and Rosalind Franklin are famous for their work on the structure of DNA, not enzyme kinetics.

Question #76 Key: (B)

MDCAT 2017

*Which of the following type of inhibitor can be neutralized by adding more substrate into reaction? [MDCAT-201...]***CORE CONCEPT AND DERIVATION**

The effect of competitive inhibitors relies purely on a statistical game of chance regarding which molecule collides with the active site first.

Solution:

- A competitive reversible inhibitor weakly binds to the active site without permanently damaging it.
- Because it is a numbers game, if you drastically increase the concentration of the true substrate, the substrate molecules vastly outnumber the inhibitors.
- The sheer probability of a true substrate colliding with the active site becomes so high that the effect of the inhibitor is completely **neutralized**.
- (Note: The provided options historically list "Reversible inhibitor" as the correct choice for this competitive mechanism).

Why other options are incorrect:

Any irreversible inhibitor (competitive or non-competitive) forms permanent covalent bonds that destroy the enzyme; adding more substrate cannot save a destroyed active site.

Question #77 Key: (B)

MDCAT 2014

A co-factor tightly bound to the enzyme on the permanent basis is called: [MDCAT-2014]

CORE CONCEPT AND DERIVATION

Co-factors are non-protein components required for enzyme activity. They are classified based on their chemical nature and how tightly they bind to the apoenzyme.

Solution:

- If the non-protein part is covalently and permanently bonded to the enzyme's protein structure, it is defined as a **prosthetic group**.
- This tight binding ensures the group is always present to assist in the enzyme's specific biochemical reaction.

Why other options are incorrect:

A coenzyme is loosely attached and organic. An activator is loosely attached and inorganic. An apoenzyme is the protein portion of the enzyme itself without its cofactor.

Question #78 Key: (D)

MDCAT 2014

Which one of the following is the optimum pH of pancreatic lipase enzyme? [MDCAT-2014]

CORE CONCEPT AND DERIVATION

Enzymes have evolved to work optimally at the specific pH of their natural environment in the body.

Solution:

- Pancreatic lipase is secreted by the pancreas into the small intestine to digest fats.
- The environment of the small intestine is highly basic (alkaline) due to bicarbonate secretions.
- Therefore, the optimum pH for pancreatic lipase is perfectly adapted to this alkaline medium, which is exactly **9.00**.

Why other options are incorrect:

7.60 is the optimum for catalase, and 9.70 is the optimum for arginase. An optimum of 8.00 is slightly too low for pancreatic lipase's peak efficiency based on standard biological tables.

Question #79 Key: (D)

MDCAT 2014

The competitive inhibitors have structural similarity with: [MDCAT-2014]

CORE CONCEPT AND DERIVATION

Enzyme inhibition occurs when a foreign molecule prevents the normal substrate from binding. The mechanism depends on the inhibitor's physical shape.

Solution:

- A competitive inhibitor is a chemical imposter.
- It possesses a remarkably close **structural similarity to the normal substrate**.
- Because of this mimicry, it fits perfectly into the active site, physically blocking the true substrate from entering and stopping the reaction.

Why other options are incorrect:

The inhibitor mimics the substrate, not the active site itself (it fits into the active site). It does not resemble a coenzyme or the broader binding site.