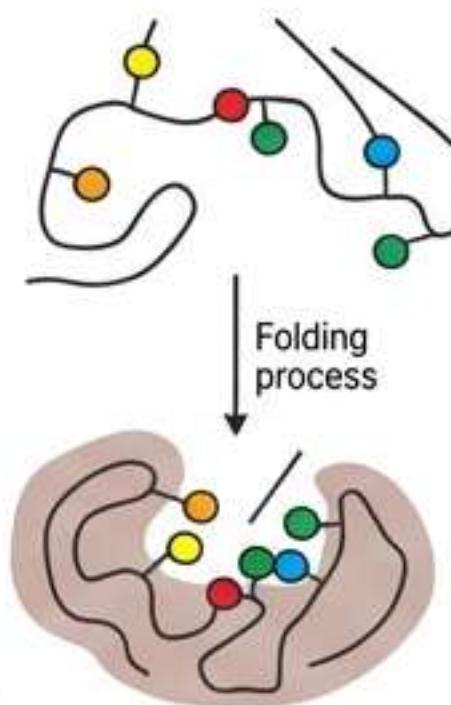


Question n° 1 | Enzymology Exam Review

Question: Enzymes (check the true statement):

- A. Are all globular proteins
- B. Are thermosensitive
- C. Consist only of a protein part
- D. Regulatory activity appears at the tertiary structure
- E. Catalytic function appears starting from the tertiary structure



Correct Answer: E

Explanation: Primary and secondary structures act as the scaffold. The **catalytic activity** emerges only when the protein folds into its **Tertiary Structure**, creating a specific 3D cleft known as the **Active Site**. This cleft brings distant amino acids together to bind the substrate.

Mnemonic: "Three for Tea" (Tertiary structure = Tea-time/Catalysis begins).

Question n° 3 | Enzymology Exam Review

Question: Regarding enzyme properties (check the true statement):

- A. Catalysis increases reaction speed by increasing activation energy
- B. An enzyme catalyzes multiple different reactions for one substrate
- C. An enzyme can act on several substrates of the same class
- D. All enzymes are proteins
- E. Optimal temperature varies from one enzyme to another

Correct Answer: C

Explanation: While enzymes are specific, many exhibit **Group Specificity**. They recognize a specific chemical bond or functional group (e.g., peptide bonds) rather than just one unique molecule, allowing them to process a class of similar substrates.

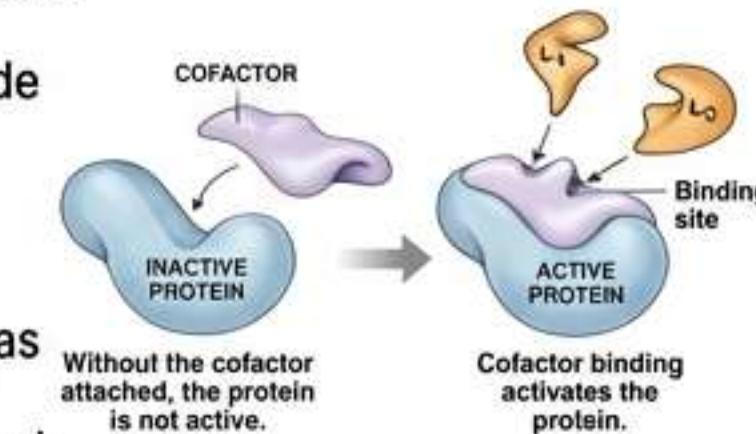
Substrate	Enzymes
Lipid	Lipase
Starch	Amylase
Protein	Protease

Mnemonic: "Master Key" (Opens multiple locks of the same brand/class).

Question n° 2 | Enzymology Exam Review

Question: Free Coenzymes (check the false statement):

- A. Form weak bonds with the enzyme
- B. Dissociate from the enzyme after each reaction
- C. Intervene in the reaction stoichiometrically
- D. Their concentration is of the same magnitude as the enzyme
- E. Answers A and C are correct



Correct Answer: D

Explanation: Free coenzymes (like NAD+) act as **co-substrates**. They bind, react, and leave to be recycled. Because they service many different enzymes in the cell, their concentration is generally **much higher** than that of any.

Mnemonic: "The Commuter" (Coenzymes travel between many enzymes; they don't live there).

Question n° 4 | Enzymology Exam Review

Question: Regarding factors influencing enzymatic reaction (check the false statement):

- A. Each enzyme has an optimal T and pH
- B. Extreme pH causes denaturation
- C. Irreversible inhibitors act by denaturing the enzyme
- D. Optimal T varies between enzymes
- E. Enzyme solubility is maximal at high salt concentrations

Correct Answer: E

Explanation: This describes "**Salting Out**." At very high salt concentrations, water molecules are occupied solvating the salt ions, leaving protein molecules to interact with each other and **precipitate** out of solution. Solubility decreases.



Mnemonic: "Salty Precipitate" (Too much salt pushes the enzyme out of solution).

Question n° 5 | Enzymology Exam Review

Question: For an enzyme obeying Michaelis kinetics (check the true statement):

- A. Zero order when V is proportional to $[S]$
- B. V_{max} is measured during pre-stationary phase
- C. K_m is the $[S]$ giving $2x V_{max}$
- D. K_{cat} indicates specificity
- E. A perfect enzyme has a high K_{cat} and a low K_m

Correct Answer: E

A "kinetically perfect" enzyme is limited only by diffusion. It requires High K_{cat} (rapid turnover of substrate to product) and Low K_m (high affinity to grab the substrate). It grabs tight and works fast.



Mnemonic: "Grab Fast, Work Fast" (Low K_m , High K_{cat}).

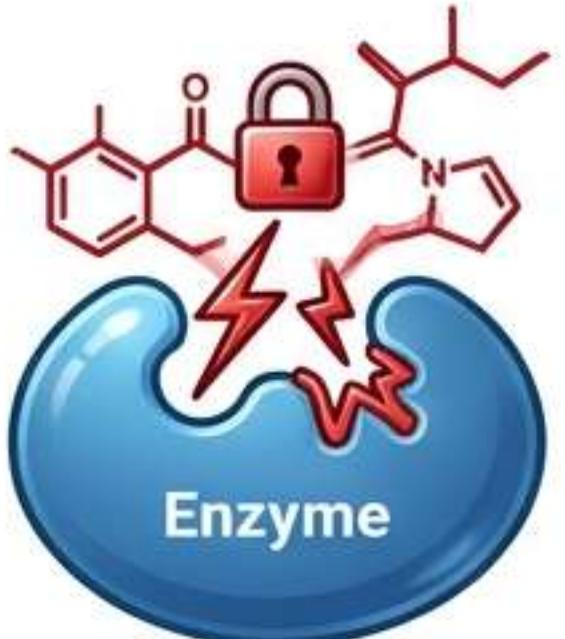
Question n° 7 | Enzymology Exam Review

Question: Regarding enzymatic inhibitors (check the false statement):

- A. Enzymatic inhibition is always reversible
- B. Irreversible inhibitors cause loss of catalytic properties
- C. Reversible inhibitors are: competitive, non-competitive, uncompetitive
- D. Non-competitive reduces the number of active enzyme molecules
- E. Competitive inhibition is overcome by increasing $[S]$

Correct Answer: A

Inhibition is **not always reversible**. Suicide inhibitors or heavy metals can form strong covalent bonds with the active site, permanently destroying the enzyme's catalytic capability.



Mnemonic: "Never say Always" (Some poisons are forever).

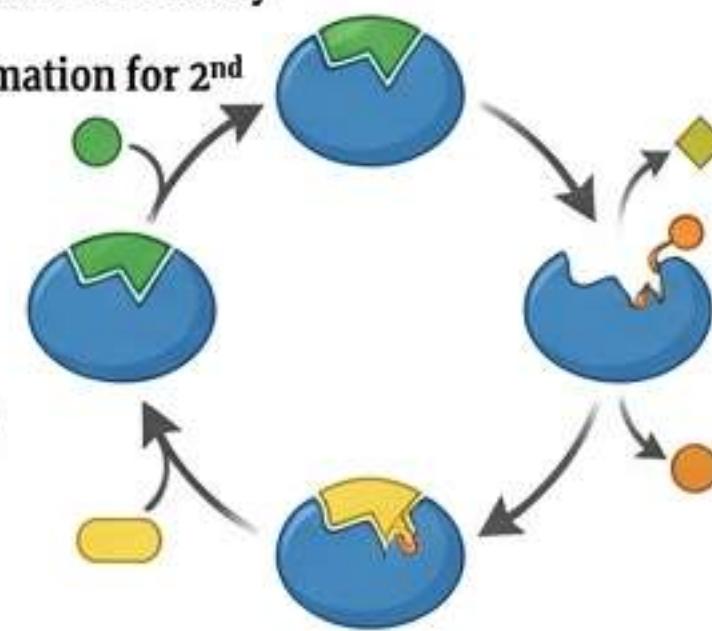
Question n° 6 | Enzymology Exam Review

Question: About 2-substrate kinetics (check the false statement):

- A. Sequential mechanism is simple transfer if both fix simultaneously
- B. In Random Bi-Bi, order is not imposed
- C. In Ordered Bi-Bi, 1st substrate binding alters conformation for 2nd
- D. In Ping-Pong reactions, the enzyme undergoes permanent modification
- E. Aspartate aminotransferase acts via Ping-Pong

Correct Answer: D

In a Ping-Pong (Double Displacement) mechanism, the enzyme is modified temporarily (e.g., accepting a group) to carry it to the second substrate. However, the enzyme must **regenerate** to its original form by the end. Permanent modification would mean it's not a catalyst.



Mnemonic: "Ping Pong Return" (The ball is passed, and the player resets).

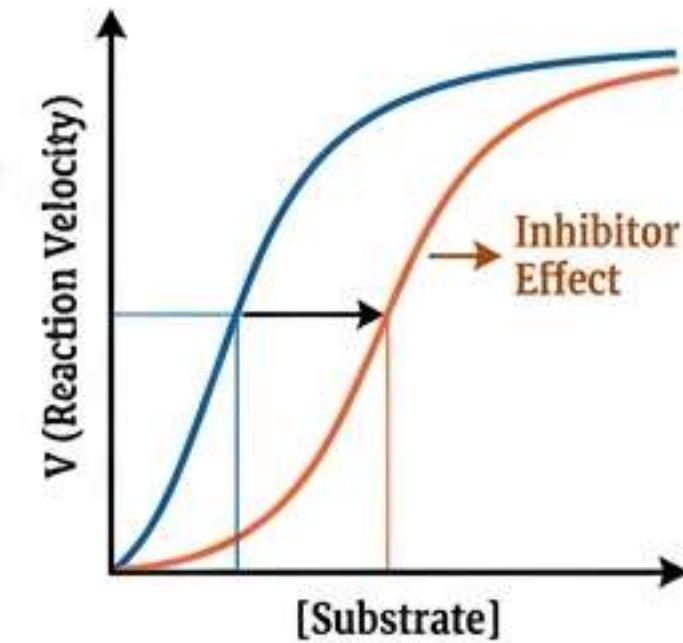
Question n° 8 | Enzymology Exam Review

Question: Regarding allosteric enzymes (check the false statement):

- A. Possess multiple active and allosteric sites
- B. Concerted model: transition happens simultaneously for all subunits
- C. T to R transition by substrate is positive homotropic effect
- D. Allosteric activators favor substrate binding
- E. Negative heterotropic effect is defined by fixation of allosteric inhibitor on allosteric site

Correct Answer: E

The Negative Heterotropic Effect is the consequence (reduced affinity/stabilizing the T-state), not just the act of fixation. It shifts the saturation curve to the right, making the enzyme less sensitive to the substrate.



Mnemonic: "Right is Resist" (Right shift = Enzyme resists binding).

Question n° 9 | Enzymology Exam Review

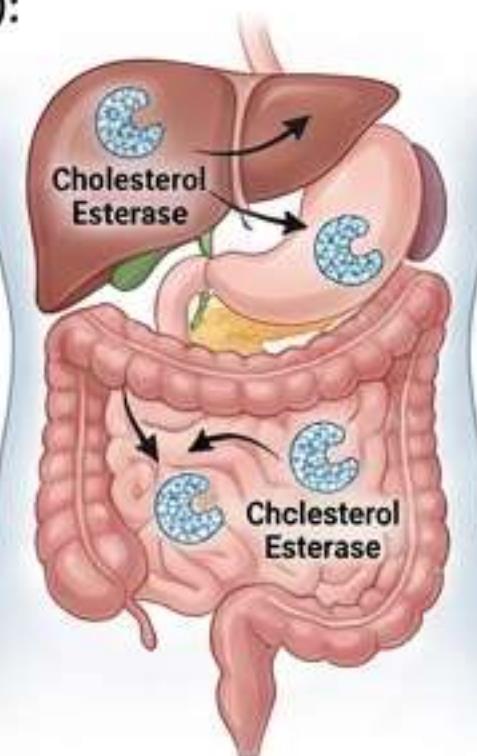
Question: Cholesterol Degradation (check the false statement):

- A. It is exclusively hepatic
- B. Results in bile acid formation
- C. Primary bile acids are cholyl-CoA and chenodeoxycholyl-CoA
- D. Cholesterol esterase allows hydrolysis of dietary cholesterol esters in intestinal lumen
- E. Cholesterol esterase hydrolyzes cholesterol esters brought to liver by lipoproteins

Correct Answer: D

Explanation: Statement D implies Cholesterol Esterase works only in the lumen. In reality, this enzyme is versatile: it works in the intestine for digestion AND in the liver (lysosomes) to process esters delivered by HDL/LDL particles.

Mnemonic: "Double Duty Esterase" (Digests food AND cleans blood lipids).



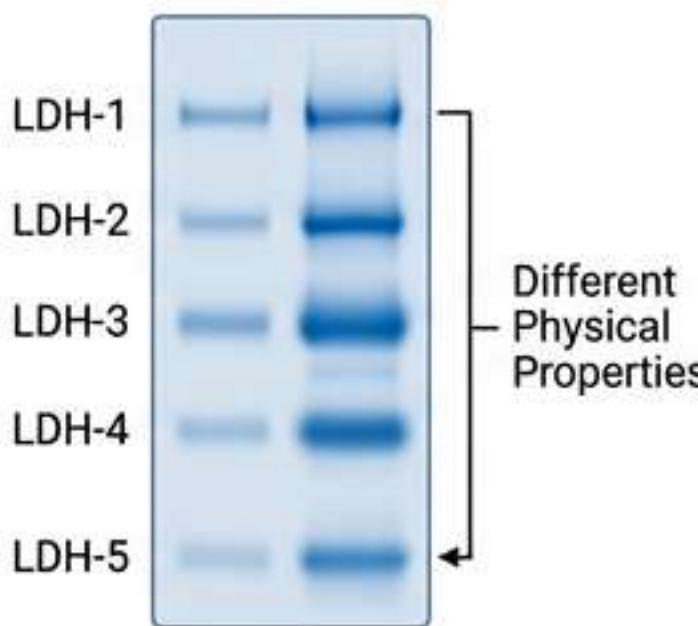
Question n° 11 | Enzymology Exam Review

Question: Isoenzymes are enzymes that possess:
(check the true answer):

- A. The same tissue origin
- B. A different substrate
- C. A different amino acid composition
- D. A different product
- E. The same amino acid composition

Correct Answer: C

Explanation: Isoenzymes catalyze the exact same reaction (Substrate → Product) but are encoded by different genes. This leads to different primary structures (amino acid sequences), resulting in unique physical properties.

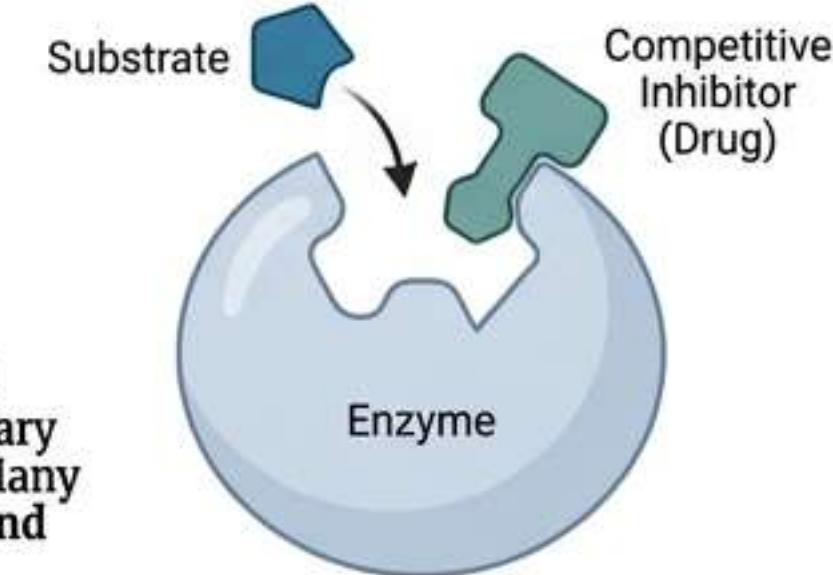


Mnemonic: "Different Genes, Same Jeans"
(Different origin/structure, same job).

Question n° 10 | Enzymology Exam Review

Question: About regulation of enzymatic activity
(check the true answer):

- A. Non-competitive inhibitor
- B. Competitive inhibitor
- C. Uncompetitive inhibitor
- D. Positive allosteric effector
- E. Enzyme activator



Correct Answer: B

Explanation: While allostery is the biological regulator, Competitive Inhibition is the primary mechanism for pharmacological regulation. Many drugs function by mimicking the substrate and competing for the active site.

Mnemonic: "The Imposter" (Competitive inhibitor pretends to be the substrate).

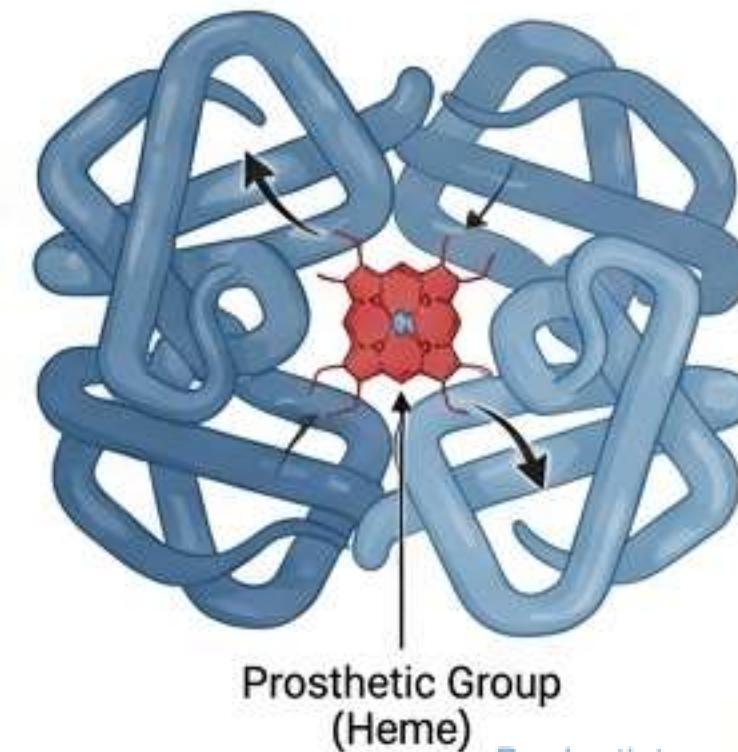
Question n° 12 | Enzymology Exam Review

Question: Linked Coenzymes (check the false answer):

- A. Form strong bonds with the enzyme
- B. Do not dissociate from the enzyme
- C. Intervene in the reaction stoichiometrically
- D. Their concentration is of the same magnitude as the enzyme
- E. Answers A and C are true

Correct Answer: B

Explanation: Prosthetic Groups (Linked Coenzymes) like Heme or FAD are tightly, often covalently, bound to the enzyme. They do not leave. They are regenerated *in situ* during the reaction cycle, unlike free co-substrates.



Mnemonic: "Permanent Resident" (Prosthetic groups never move out).

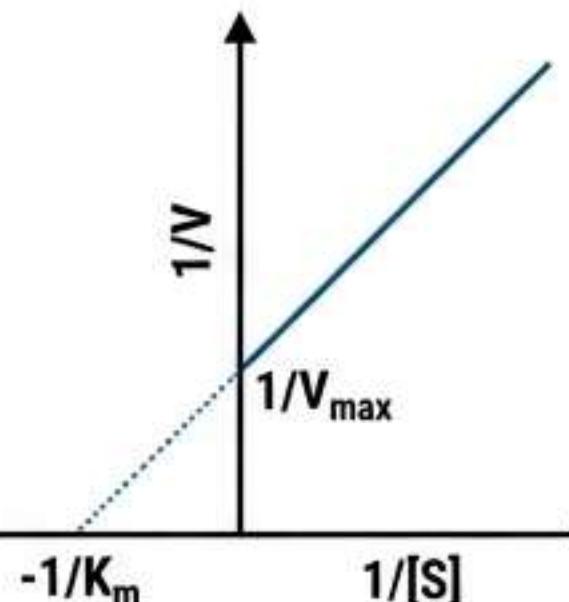
Question n° 13 | Enzymology Exam Review

Question: The Lineweaver-Burk graphical representation (check the true answer):

- A. Is a hyperbolic curve
- B. Crosses the Y-axis at $1/K_m$
- C. Crosses the X-axis at $1/V_{\max}$
- D. Has a slope of V_{\max}/K_m
- E. Illustrates the variation of $1/V$ on ordinates and $1/[S]$ on abscissas

Correct Answer: E

Explanation: The Lineweaver-Burk plot is a **linear transformation** of the Michaelis-Menten equation. By plotting the reciprocal of velocity ($1/V$) against the reciprocal of substrate ($1/[S]$), we turn the hyperbola into a straight line.



Mnemonic: "Double Flip" (Flip V and Flip S to get a straight line).

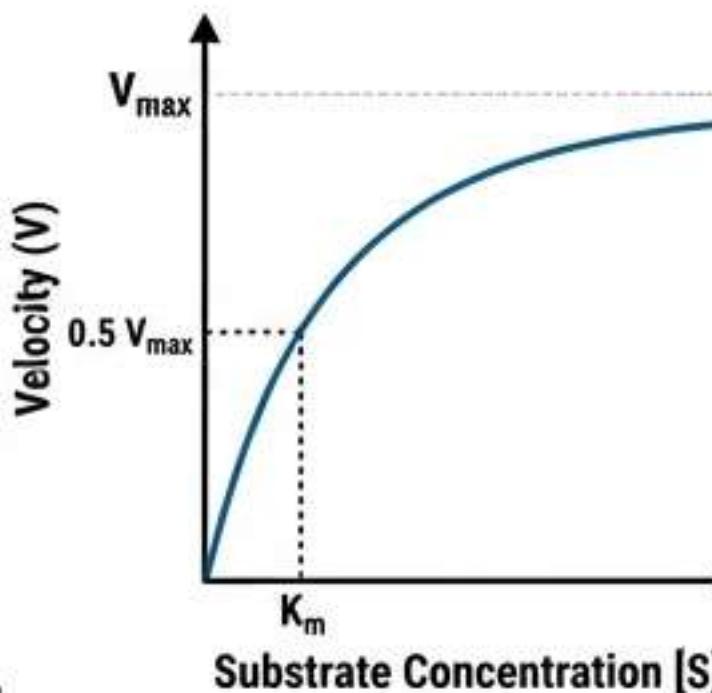
Question n° 16 | Enzymology Exam Review

Question: When $[S] = K_m$, the velocity is: (check the true answer):

- A. $0.1 V_{\max}$
- B. $0.2 V_{\max}$
- C. $0.5 V_{\max}$
- D. $0.8 V_{\max}$
- E. $2 V_{\max}$

Correct Answer: C

Explanation: This is the **operational definition** of K_m . K_m is the specific Substrate Concentration required to drive the reaction at exactly half its maximum speed ($V_{\max}/2$).



Mnemonic: "Meet me Halfway" (K_m is the location of half-speed).

Question n° 15 | Enzymology Exam Review

Question: The K_m (Michaelis constant) (check the false answer):

- A. Is the dissociation constant of the ES complex
- B. Decrease means affinity is increased
- C. Is the $[S]$ when enzyme is 50% saturated
- D. Increases in presence of competitive inhibitor
- E. Is equal to the ratio $[E][S]/[ES]$

Correct Answer: E

Explanation: The ratio $[E][S]/[ES]$ is the dissociation constant (K_S). K_m is a kinetic constant defined as $(k_1 + k_2) / k_1$. It includes the rate of product formation (k_2). It approximates affinity but is mathematically distinct.

$$K_m = \frac{k_{\text{breakdown}}}{k_{\text{formation}}}$$

Mnemonic: "K_m is Kinetic" (It's about motion/breakdown, not just binding).

Question n° 17 | Enzymology Exam Review

Question: The V_{\max} of the enzymatic reaction (check the true answer):

- A. Does not change in non-competitive inhibition
- B. Does not change in uncompetitive inhibition
- C. Increases with increasing substrate concentration
- D. Is the velocity when $K_m = [S]$
- E. Is the velocity when all enzyme is in ES complex form

Correct Answer: E

Explanation: V_{\max} represents **Saturation**. It is the theoretical limit reached when every single enzyme molecule is occupied as an Enzyme-Substrate complex (ES). Adding more substrate cannot increase the rate further.



Mnemonic: "Full House" (Every seat is taken).

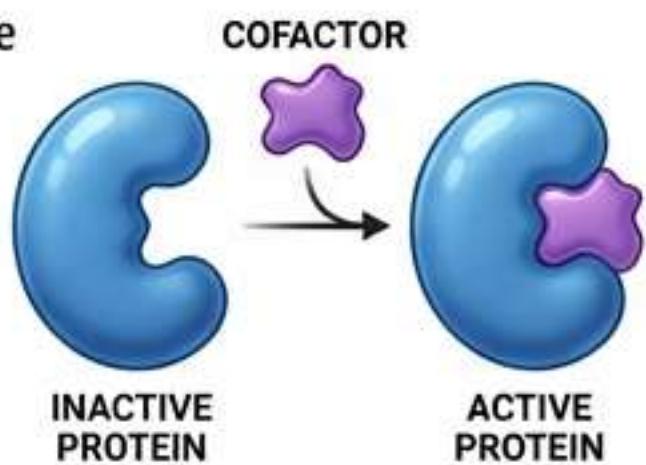
Question n° 18 | Enzymology Exam Review

Question: The enzyme (check the true answer):

- A. Is a chemical catalyst
- B. Decreases reaction speed
- C. Increases free energy of activation
- D. Is associated with a cofactor in the holoenzyme
- E. Presents multiple active sites on its surface

Correct Answer: D

Explanation: A functional enzyme system is called a Holoenzyme. It consists of the protein scaffold (Apoenzyme), which provides specificity, and the non-protein Cofactor (metal ion or coenzyme), which often performs the chemical work.



Mnemonic: "Holo = Whole" (Apo + Cofactor = The Whole Enchilada).

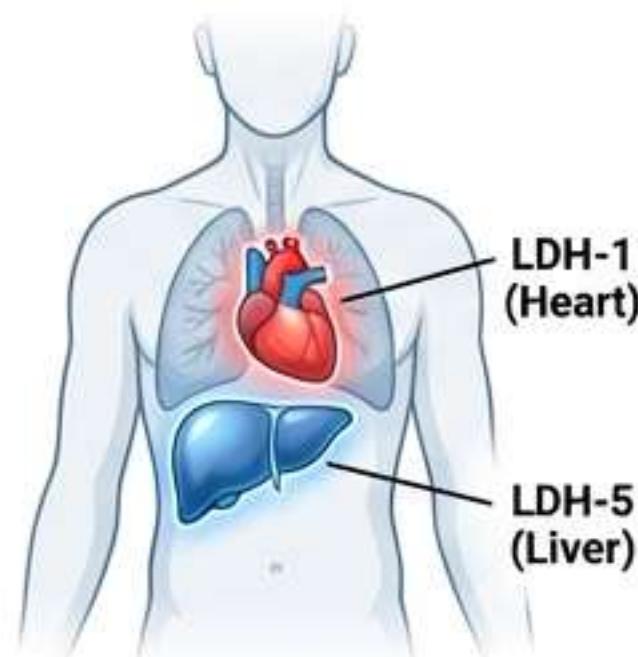
Question n° 20 | Enzymology Exam Review

Question: Isoenzymes (check the true answer):

- A. They act on different substrates
- B. They present tissue-dependent expression
- C. They catalyze different reactions

Correct Answer: B

Explanation: This property makes isoenzymes powerful diagnostic tools. Since LDH-1 is abundant in the heart and LDH-5 in the liver, finding LDH-1 in the blood specifically indicates heart tissue damage. The location defines the marker.



Mnemonic: "Tissue Tracker" (Isoenzymes tell you WHERE the damage is).

Question n° 19 | Enzymology Exam Review

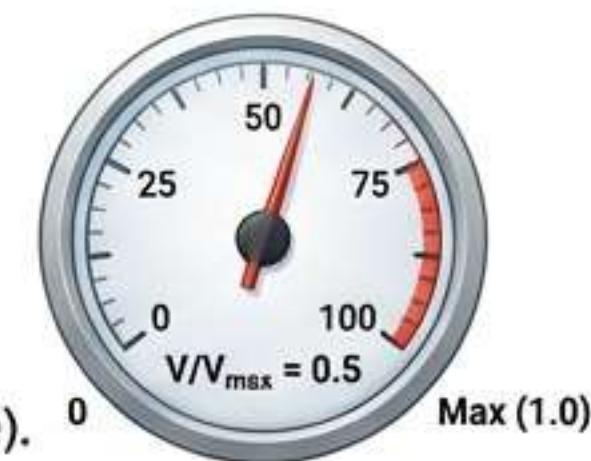
Question: Which proposition concerning enzymes is true?

- A. To be efficient, enzymes require a cofactor
- B. If $V/V_{max} < 1$, the enzyme is running at reduced speed
- C. Enzymes modify the equilibrium of reactions they catalyze

Correct Answer: B

Explanation: If the ratio V/V_{max} is less than 1, the enzyme is operating below its capacity (non-saturated). It implies substrate limitation. (Note: Enzymes never modify equilibrium constants, they only hasten the arrival at equilibrium).

Mnemonic: "Cruising Speed" (Not yet at full throttle).



Question n° 21 | Enzymology Exam Review

Question: Which proposition is false?

- A. Enzymes decrease activation energy
- B. Each enzyme catalyzes a single type of reaction
- C. Isoenzymes possess the same activity and physico-chemical properties

Correct Answer: C

Explanation: Isoenzymes are *different* proteins. Therefore, they must have different physico-chemical properties (Isoelectric point, Heat Stability) and kinetic properties (K_m , V_{max}). They are distinct molecules doing the same job.

	Isoenzyme A	Isoenzyme B
Property	Value	Value
Affinity	High	Low
Heat Stability	Stable	Labile

Mnemonic: "Identical Twins vs Fraternal Twins" (Isoenzymes are fraternal; different personalities).

Question n° 23 | Enzymology Exam Review

Question: Concerning coenzymes (check the false answer):

- A. They intervene obligatorily in an enzymatic reaction
- B. Co-substrates intervene in a catalytic manner
- C. They are organic molecules of non-protein nature

Correct Answer: B

Explanation: Co-substrates (like NAD⁺) intervene in a stoichiometric manner, not catalytic. They are consumed/transformed (NAD⁺ becomes NADH) and must be replaced. True catalysts are regenerated instantly by the reaction itself.



Mnemonic: "Batteries are Consumables" (Co-substrates get used up).

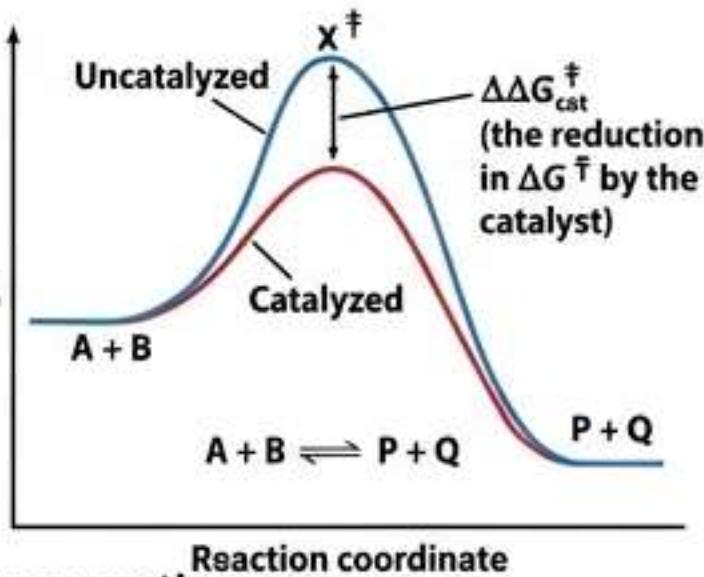
Question n° 26 | Enzymology Exam Review

Question: In thermodynamics, enzymes: (check the exact answer):

- A. Increase activation energy
- B. Lower activation energy
- C. Shift reaction equilibrium

Correct Answer: B

Explanation: Enzymes do not change the destination (Equilibrium); they only shorten the journey. They do this by stabilizing the Transition State, effectively lowering the Activation Energy barrier required to start the reaction.

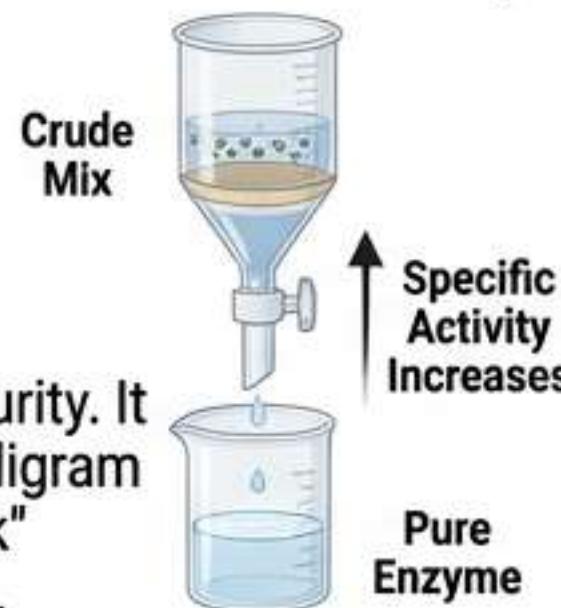


Mnemonic: "Tunnel through the Mountain" (Don't climb over, go through).

Question n° 25 | Enzymology Exam Review

Question: When measuring enzymatic activity (check the true answer):

- A. We must be in Order 1 (low [S])
- B. Temperature and pH have no influence
- E. Specific enzymatic activity is expressed in μmol/min/mg protein



Correct Answer: E

Explanation: Specific Activity is a measure of purity. It calculates the enzymatic "power" (Units) per milligram of total protein. As you purify a sample, the "junk" protein is removed, so the Specific Activity rises.

Mnemonic: "Power per Gram" (How strong is the pure stuff?).

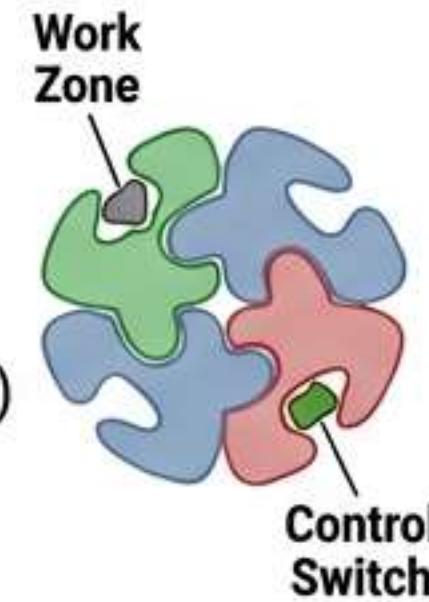
Question n° 27 | Enzymology Exam Review

Question: Concerning allosteric enzymes (check the false answer):

- A. Present a quaternary structure
- B. The active site is called the allosteric site
- C. Sigmoidal shape is characteristic of cooperativity

Correct Answer: B

Explanation: The defining feature of Allostery is the separation of function. The Active Site (catalysis) is physically distinct from the Allosteric Site (regulation). Signals at one site cause conformational changes at the other.



Mnemonic: "Two Doors" (Front door for work, back door for the boss).

Question n° 28 | Enzymology Exam Review

Question: During non-competitive inhibition: (check the exact answer):

- A. Inhibitor binds to active site
- C. V_{max} is decreased
- D. K_m is increased

Correct Answer: C

Explanation: Non-competitive inhibitors disable the enzyme whether substrate is bound or not. This effectively removes functional enzymes from the pool, lowering V_{max} . The remaining working enzymes have normal affinity, so K_m is unchanged.



Mnemonic: "Broken Machines" (Fewer working enzymes = Lower Max Speed).

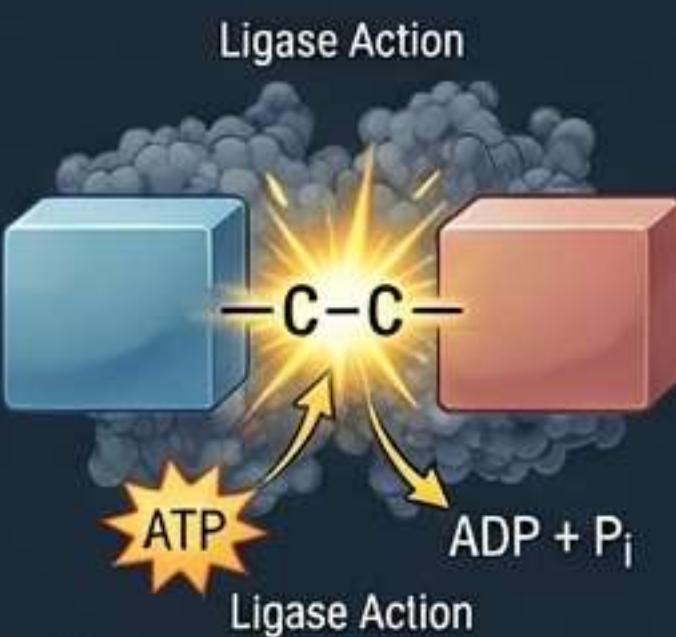
Question n° 32 | Enzymology Exam Review

Question: The bond C-C, C-S, C-O, or C-N is a characteristic of:

- A. Transferases
- B. Ligases

Correct Answer: B

Explanation: Ligases (Class 6) are the "builders." They catalyze the formation of new bonds between two large molecules, a process that is energetically expensive and typically requires the hydrolysis of ATP.



Mnemonic: "Ligase = Ligation" (To tie/bind together).

Question n° 29 | Enzymology Exam Review

Question: Competitive inhibitors: (check the exact answer):

- E. Have varied applications in therapeutics

Correct Answer: E

Explanation: Competitive Inhibitors are the basis of many modern drugs. Statins (cholesterol), ACE Inhibitors (blood pressure), and Methotrexate (cancer) all work by mimicking the natural substrate and blocking the enzyme's active site.



Mnemonic: "Fake Key" (The drug jams the lock).

Question n° 34 | Enzymology Exam Review

Question: The stationary phase corresponds to: (check the exact answer):

- C. The period during which [ES] is constant

Correct Answer: C

Explanation: This is the **Steady State Assumption**. After an initial burst, the formation of the Enzyme-Substrate complex equals its breakdown. The concentration [ES] remains constant as long as substrate is abundant.



Mnemonic: "Flow In = Flow Out" (Steady Level).

Question n° 36 | Enzymology Exam Review

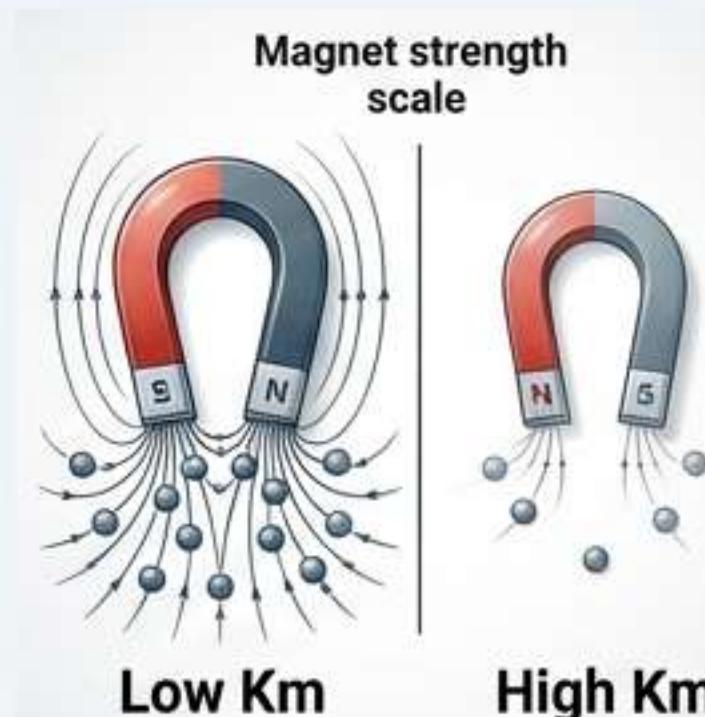
Question: The Michaelis constant (K_m):
(check the exact answer):

- A. Represents the affinity of the enzyme for its substrate

Correct Answer: A

Explanation: K_m is an inverse measure of affinity. A Low K_m means the enzyme is "sticky"—it needs very little substrate to work at half speed. A High K_m means low affinity—it needs a crowd of substrate to find one.

Mnemonic: "Low is Love" ($\text{Low } K_m = \text{High Affinity}$).



Question n° 43 | Enzymology Exam Review

Question: Every enzymatic protein
(correct propositions):

- A. Acts at very low concentration
- D. Does not affect the equilibrium of a reversible reaction

Correct Answer: A, D

Explanation: Enzymes are catalysts, meaning they are **not consumed**. A single enzyme molecule can process millions of substrate molecules per second. Therefore, they are effective at very low concentrations relative to the substrate.

Mnemonic: "The 1%" (A tiny amount does all the work).



Question n° 41 | Enzymology Exam Review

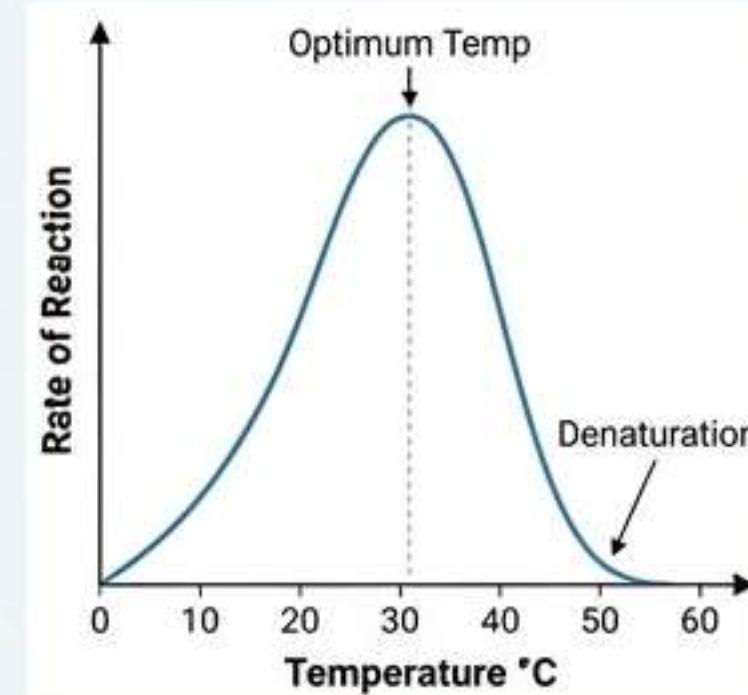
Question: An enzyme is characterized by
(correct propositions):

- A. Increases speed
- B. Decreases activation energy
- E. Acts at an optimal temperature dependent on its nature

Correct Answer: A, B, E

Explanation: This summarizes the **Biocatalyst Triad**: 1) Massive acceleration of rate, 2) Mechanism via lowering the energy barrier, and 3) Sensitivity to environment (Optimum Temperature) due to their protein nature.

Mnemonic: "Fast, Easy, Sensitive" (Speed, Energy, Environment).



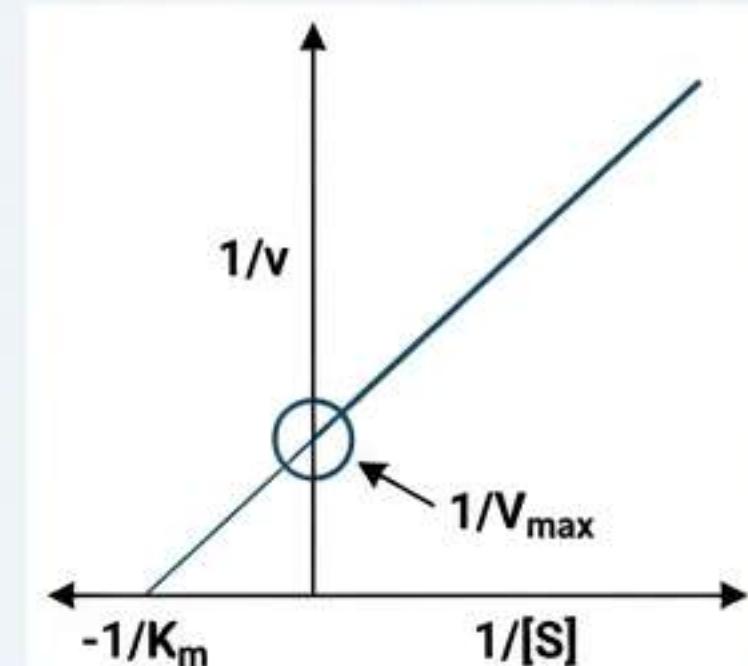
Question n° 45 | Enzymology Exam Review

Question: During a Michaelian reaction
(correct answers):

- B. V_{max} is a constant
- C. Y-intercept (Lineweaver-Burk) = $1/V_{max}$
- E. K_m is an index of affinity

Correct Answer: B, C, E

Explanation: On a Lineweaver-Burk plot, the Y-intercept is $1/V_{max}$. Since the enzyme amount is fixed, V_{max} is a constant ceiling. The closer the line intersects to zero (lower intercept), the higher the V_{max} .



Mnemonic: "Y-Max" (The Y-axis tells you the Max).

Question n° 49 | Enzymology Exam Review

Question: $V_i = 50\%$ of V_{max} when $[S] = 300 \mu M$. What is the value of K_m ? B. $300 \mu M$

Correct Answer: B

Explanation: This requires no math, only definition recall. K_m is defined as the substrate concentration $[S]$ where velocity is exactly half of max ($V_{max}/2$). Since V_i is 50%, the given $[S]$ IS the K_m .

If $V = V_{max}/2$, then $K_m = [S]$

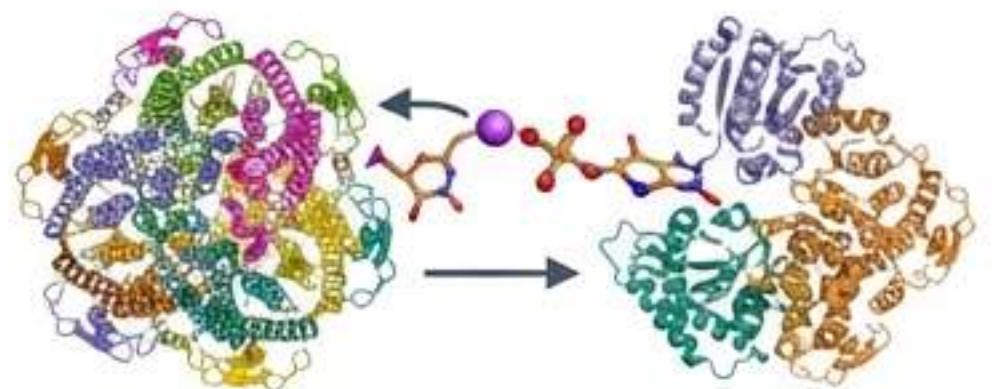
Mnemonic: "The 50/50 Rule" (At 50% speed, S equals Km).

Question n° 59 | Enzymology Exam Review

Question: Kinases are of class: D. 2

Correct Answer: D

Explanation: Kinases are a subclass of Transferases (Class 2). They transfer a phosphate group (usually from ATP) to an acceptor molecule. (Recall classes: 1=Oxido, 2=Transfer, 3=Hydro, 4=Lyase, 5=Iso, 6=Ligase).



Mnemonic: "OTHLIL - #2" (Oxido, Transfer, Hydro... Kinase moves things).

Question n° 53 | Enzymology Exam Review

Question: The enzymatic unit IU/L is: D. Quantity of enzyme catalyzing one micromole of substrate per minute

Correct Answer: D

Explanation: The International Unit (IU) is the medical standard for activity. It corresponds to the conversion of 1 μmol of substrate per minute. (Contrast with the SI unit Katal, which is moles per second).



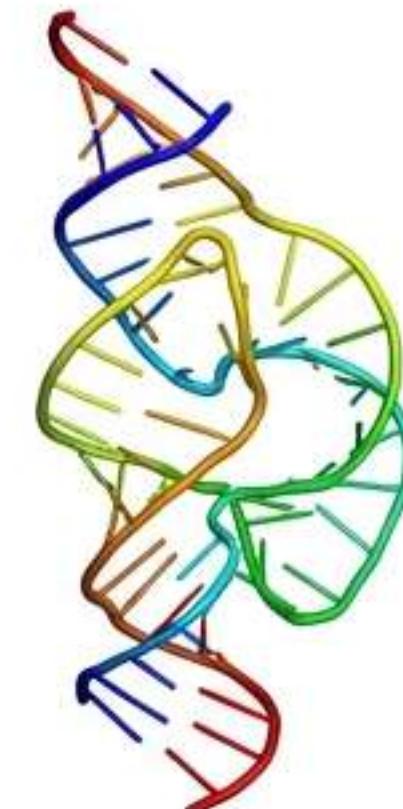
Mnemonic: "Micro-Minute" (The two M's of the IU).

Bonus Concept | Nucleic Acids

Question: Are all enzymes proteins?

Correct Answer: No (Ribozymes)

Explanation: While the vast majority of enzymes are proteins, Ribozymes are catalytic RNA molecules. They are crucial in removing introns from RNA (splicing) and in ribosome function, proving that nucleic acids can also fold into catalytic shapes.



Mnemonic: "RNA Rebel" (The exception to the protein rule). By dentiste web