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Biology Grade 11 — Chapter 3

Enzymes

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Independent practice MCQs from the supplied Class 11 Biology notes pack. Total: 50 questions.

A. Important / Main Topics

1. Which of the following best defines an enzyme?

(A) A biological polymer that catalyzes biochemical reactions
(B) A lipid that speeds up reactions
(C) A carbohydrate that provides energy
(D) A nucleic acid that stores genetic information

Correct Answer: A

Explanation: The notes define enzymes as biological polymers that catalyze biochemical reactions.

2. What is the sum of all chemical reactions going on in a cell known as?

(A) Catabolism
(B) Metabolism
(C) Anabolism
(D) Hydrolysis

Correct Answer: B

Explanation: The sum of all chemical reactions going on in a cell is known as metabolism.

3. Where is the catalytic activity of an enzyme located?

(A) In the entire enzyme molecule
(B) In the cofactor
(C) In the active site
(D) In the substrate

Correct Answer: C

Explanation: In the active site — this correctly answers the question.

4. How many amino acids typically make up an active site?

(A) 1–2
(B) 15–20
(C) 20–50
(D) 3–12

Correct Answer: D

Explanation: The active site consists of 3–12 amino acids which may be scattered in the polypeptide but are brought together by folding.

5. Which type of cofactor is permanently attached to the enzyme and does not detach after the reaction?

(A) Prosthetic group
(B) Coenzyme
(C) Inorganic ion
(D) Activator

Correct Answer: A

Explanation: A prosthetic group is a covalently bonded part of an enzyme which is permanently attached and does not detach after the completion of the reaction.

6. What is the inactive protein part of an enzyme called when its cofactor is not attached?

(A) Holoenzyme
(B) Apoenzyme

(C) Cofactor
(D) Substrate

Correct Answer: B

Explanation: If the cofactor is not available, the remaining protein part of the enzyme becomes catalytically inactive and is called apoenzyme.

7. Which model of enzyme action compares the enzyme to a lock and the substrate to a key?

(A) Induced fit model
(B) Fluid mosaic model
(C) Lock and key model
(D) Chemiosmotic model

Correct Answer: C

Explanation: Emil Fischer proposed the lock and key model (1894), where the enzyme is a lock and the substrate is a key that fits precisely into the active site.

8. What is the energy required to break existing bonds and begin a reaction called?

(A) Free energy
(B) Kinetic energy
(C) Potential energy
(D) Energy of activation

Correct Answer: D

Explanation: The energy of activation is defined as the energy required to break the existing bonds and begin the reaction.

9. At what temperature do most human enzymes show maximum activity?

(A) 37–38°C
(B) 0–10°C
(C) 20–25°C
(D) 70°C or higher

Correct Answer: A

Explanation: 37–38°C — this correctly answers the question.

10. Which enzyme works best in a highly acidic environment (pH 2)?

(A) Trypsin
(B) Pepsin
(C) Papain
(D) Amylase

Correct Answer: B

Explanation: Pepsin functions most effectively at an optimum pH of 2, as found in the stomach.

11. In competitive inhibition, where does the inhibitor bind?

(A) Allosteric site
(B) Cofactor
(C) Active site
(D) Substrate

Correct Answer: C

Explanation: A competitive inhibitor is structurally similar to the substrate and competes with it for binding to the active site.

12. Which of the following is an example of an irreversible non-competitive inhibitor?

(A) Malonate
(B) Sulphonamide
(C) Substrate analog
(D) Cyanide

Correct Answer: D

Explanation: Cyanides are potent poisons that irreversibly inhibit cytochrome oxidase by combining with the iron in the prosthetic group.

13. What is the term for the process where the end product of a pathway inhibits an enzyme earlier in the pathway?

(A) Feedback inhibition
(B) Competitive inhibition
(C) Positive feedback
(D) Allosteric activation

Correct Answer: A

Explanation: Feedback inhibition — this correctly answers the question.

14. Which class of enzymes catalyzes oxidation-reduction reactions?

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

Correct Answer: B

Explanation: Oxidoreductases — this correctly answers the question.

15. Which class of enzymes joins two molecules together using energy from ATP?

(A) Lyases
(B) Isomerases
(C) Ligases
(D) Hydrolases

Correct Answer: C

Explanation: Ligases (synthetases) bring about the joining together of two molecules, with energy derived from the hydrolysis of ATP.

16. A certain enzyme requires Mg^{2}□ ions to function. These ions are only attached when the substrate binds. What type of cofactor is Mg^{2}□?

(A) Prosthetic group
(B) Coenzyme
(C) Apoenzyme
(D) Inorganic ion (activator)

Correct Answer: D

Explanation: Inorganic cofactors like Mg^{2}□ are detachable and are only attached to the enzyme when the substrate binds. They are also called activators.

17. How does an enzyme speed up a chemical reaction?

(A) By lowering the energy of activation
(B) By increasing the overall free energy change (Δ G)
(C) By increasing the temperature of the reaction
(D) By changing the equilibrium of the reaction

Correct Answer: A

Explanation: By lowering the energy of activation — this correctly answers the question.

18. Why is an enzyme denatured at very high temperatures?

(A) The peptide bonds break, destroying the primary structure.
(B) The secondary and tertiary structures are disrupted, and the active site loses its shape.
(C) The enzyme becomes more active.
(D) The substrate is destroyed.

Correct Answer: B

Explanation: The secondary and tertiary structures are disrupted, and the active site loses its shape. — this correctly answers the question.

19. How does a non-competitive inhibitor affect the Vmax and K_m of an enzyme?

(A) Vmax remains unchanged, K_m increases
(B) Both Vmax and K_m increase
(C) Vmax decreases, K_m remains unchanged
(D) Both Vmax and K_m decrease

Correct Answer: C

Explanation: Non-competitive inhibitors bind to the allosteric site, decreasing the maximum rate (Vmax) without affecting the affinity of the enzyme for the substrate (K_m).

20. In a metabolic pathway, the amino acid aspartate is converted to threonine through five enzymatic reactions. When threonine is in excess, it binds to an allosteric site on enzyme 1 and inhibits it. What is this an example of?

(A) Competitive inhibition
(B) Irreversible inhibition
(C) Enzyme activation
(D) Feedback inhibition

Correct Answer: D

Explanation: This is a classic example of feedback inhibition, where the end product (threonine) inhibits an earlier enzyme in its own biosynthetic pathway.

21. Which class of enzymes breaks large complex organic molecules into smaller ones by adding water?

(A) Hydrolases
(B) Lyases
(C) Ligases
(D) Transferases

Correct Answer: A

Explanation: Hydrolases — this correctly answers the question.

22. If a competitive inhibitor is present, how can its effect be overcome?

(A) By increasing the concentration of the inhibitor
(B) By increasing the concentration of the substrate
(C) By decreasing the temperature
(D) By adding a non-competitive inhibitor

Correct Answer: B

Explanation: Because the inhibitor and substrate compete for the active site, increasing the substrate concentration increases the chance of substrate binding, overcoming the inhibition.

23. What is the role of the enzyme complex pyruvate dehydrogenase?

(A) It catalyzes the conversion of glucose to pyruvate.
(B) It catalyzes the Krebs cycle.
(C) It catalyzes the oxidation, decarboxylation, and addition of coenzyme A to pyruvate.
(D) It breaks down ATP.

Correct Answer: C

Explanation: It catalyzes the oxidation, decarboxylation, and addition of coenzyme A to pyruvate. — this correctly answers the question.

24. Which of the following is an example of an enzyme that exhibits absolute specificity?

(A) Lipase
(B) Hexokinase
(C) Carbonic anhydrase
(D) Urease

Correct Answer: D

Explanation: Absolute specificity means the enzyme can catalyze only one substrate and essentially no others. Urease acts only on urea.

25. Which model of enzyme action proposes that the active site is flexible and molds itself around the substrate?

(A) Induced fit model
(B) Lock and key model
(C) Fluid mosaic model
(D) Chemiosmotic model

Correct Answer: A

Explanation: Koshland's induced fit model (1959) proposes that the active site is flexible and is modified as the substrate interacts, allowing the enzyme to perform its catalytic function effectively.

B. Less Important / Secondary Topics

26. Which of the following environmental factors affects the rate of enzyme action by influencing the charges on amino acid side chains?

(A) pH
(B) Temperature
(C) Substrate concentration
(D) Enzyme concentration

Correct Answer: A

Explanation: PH — this correctly answers the question.

27. Why are enzymes from thermophilic bacteria used in biological washing powders?

(A) They work best at low temperatures.
(B) They are stable and active at high temperatures.
(C) They are cheaper to produce.
(D) They break down stains without water.

Correct Answer: B

Explanation: Thermophilic bacteria have enzymes with optimum temperatures of 70°C or higher, making them sui.

28. What happens to an enzyme when it is cooled to near or below freezing point?

(A) It is permanently denatured.
(B) Its active site is destroyed.
(C) It is inactivated but not denatured, and regains activity when warmed.
(D) It catalyzes reactions faster.

Correct Answer: C

Explanation: Low temperatures inactivate enzymes, but they are not denatured. They will regain their catalytic influence when higher temperatures are restored.

29. Which of the following is a coenzyme?

(A) Zn^{2}□
(B) Iron-containing porphyrin ring
(C) Pepsinogen
(D) NAD□

Correct Answer: D

Explanation: Coenzymes are organic cofactors, often derivatives of vitamins. NAD□ is a common coenzyme involved in redox reactions.

30. What type of enzyme catalyzes the transfer of a phosphate group from ATP to glucose?

(A) Transferase
(B) Oxidoreductase
(C) Hydrolase
(D) Lyase

Correct Answer: A

Explanation: Hexokinase is a transferase that transfers a phosphate group from ATP to glucose. Transferases catalyze the transfer of specific functional groups from one substrate to another.

31. How is the enzyme pepsinogen converted to its active form, pepsin?

(A) By adding a phosphate group
(B) By exposure to HCl, which removes an additional polypeptide fragment
(C) By cooling the enzyme
(D) By adding a coenzyme

Correct Answer: B

Explanation: Pepsinogen is secreted in an inactive form with an extra polypeptide fragment. Exposure to HCl in the stomach removes this fragment, converting it to active pepsin.

32. Which of the following statements about enzyme concentration is correct, assuming substrate is not limiting?

(A) Increasing enzyme concentration decreases the reaction rate.
(B) Enzyme concentration has no effect on the reaction rate.
(C) Increasing enzyme concentration increases the reaction rate proportionally.
(D) The reaction rate reaches a maximum when the enzyme concentration is zero.

Correct Answer: C

Explanation: When substrate is not limiting, increasing enzyme concentration increases the reaction rate proportionally, as more active sites are available.

33. In an enzyme-catalyzed reaction, what is the Michaelis constant (K_m) a measure of?

(A) Maximum reaction rate
(B) Enzyme concentration
(C) Activation energy
(D) Enzyme affinity for the substrate

Correct Answer: D

Explanation: K_m is the substrate concentration at which the reaction rate is half of Vmax. A low K_m indicates high affinity, and a high K_m indicates low affinity.

34. Which of the following enzymes acts upon proteins?

(A) Protease
(B) Lipase
(C) Amylase
(D) Nuclease

Correct Answer: A

Explanation: Protease — this correctly answers the question.

35. Which diagnostic enzyme is used to assess liver function?

(A) Creatine Phosphokinase
(B) Gamma-glutamyl Transpeptidase
(C) Lipase
(D) Aldolase

Correct Answer: B

Explanation: Gamma-glutamyl Transpeptidase is used in assessing liver function. Other diagnostic enzymes have different uses (e.g., lipase for pancreas damage).

36. A researcher discovers a new inhibitor that binds to an enzyme's allosteric site. Adding more substrate does not overcome the inhibition. What type of inhibitor is this?

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

Correct Answer: C

Explanation: Non-competitive inhibitors bind to the allosteric site, and their effect cannot be overcome by increasing substrate concentration because they do not compete for the active site.

37. Why does an enzyme's activity decrease at a pH above or below its optimum?

(A) The substrate is destroyed.
(B) The enzyme becomes more specific.
(C) The activation energy increases.
(D) The enzyme is denatured due to changes in ionization of amino acid side chains.

Correct Answer: D

Explanation: The enzyme is denatured due to changes in ionization of amino acid side chains. — this correctly answers the question.

38. An enzyme is found to have a Vmax of 100 units and a K_m of 5 mM. In the presence of a competitive inhibitor, what happens to Vmax and K_m?

(A) Vmax remains unchanged, K_m increases
(B) Vmax decreases, K_m remains unchanged
(C) Vmax increases, K_m decreases
(D) Both Vmax and K_m decrease

Correct Answer: A

Explanation: Competitive inhibitors increase the apparent K_m (decreasing affinity) but do not affect the Vmax, because at high substrate concentrations the inhibitor can be outcompeted.

39. A patient is poisoned with cyanide. Which enzyme is most directly inhibited, and what is the consequence?

(A) Pepsin; digestion stops.
(B) Cytochrome oxidase; cellular respiration stops.
(C) Amylase; starch breakdown stops.
(D) ATP synthase; ATP synthesis increases.

Correct Answer: B

Explanation: Cyanide inhibits cytochrome oxidase, an essential enzyme in the electron transport chain, by binding to iron in the prosthetic group. This halts cellular respiration and can be fatal.

40. Which of the following best explains why the induced fit model is more widely accepted than the lock and key model?

(A) It explains why enzymes are highly specific.
(B) It shows that enzymes are rigid structures.
(C) It accounts for the flexibility of enzymes and their ability to act on related substrates.
(D) It requires no energy of activation.

Correct Answer: C

Explanation: The induced fit model explains that the active site is flexible and can mold itself to fit related substrates, allowing the enzyme to catalyze related reactions, which the rigid lock and key model cannot explain.

41. In a cell, the enzyme hexokinase transfers a phosphate from ATP to glucose. Which class of enzyme is hexokinase?

(A) Hydrolase
(B) Oxidoreductase
(C) Isomerase
(D) Transferase

Correct Answer: D

Explanation: Hexokinase is a transferase, specifically a phosphotransferase, that catalyzes the transfer of a phosphate group from ATP to glucose.

42. Which of the following describes the role of a coenzyme in an enzymatic reaction?

(A) It is a detachable organic cofactor, often derived from vitamins, that participates in catalysis.
(B) It serves as a permanent structural component.
(C) It is a metallic ion that activates the enzyme.
(D) It is the substrate of the reaction.

Correct Answer: A

Explanation: Coenzymes are organic cofactors that are detachable and often derived from vitamins (e.g., NAD□, FAD). They participate in catalytic processes by carrying chemical groups.

43. What is the effect of a non-competitive inhibitor on the active site of an enzyme?

(A) It directly blocks the active site.
(B) It binds to an allosteric site, causing a conformational change that distorts the active site.
(C) It binds to the active site but is not catalyzed.
(D) It permanently destroys the substrate.

Correct Answer: B

Explanation: Non-competitive inhibitors bind to a site other than the active site (allosteric site), causing a change in the enzyme's shape that prevents the substrate from being converted to product.

44. A mutation changes the amino acid sequence of an enzyme's active site. What is the most likely consequence?

(A) The enzyme becomes more efficient.
(B) The enzyme becomes a structural protein.
(C) The enzyme may lose its ability to bind its specific substrate.
(D) The enzyme's activation energy increases.

Correct Answer: C

Explanation: The shape of the active site is determined by its amino acid sequence. A mutation that changes this sequence can alter the active site's shape, preventing the specific substrate from binding.

45. How does the enzyme catalase protect cells from oxidative damage?

(A) It produces hydrogen peroxide.
(B) It breaks down ATP.
(C) It synthesizes proteins.
(D) It breaks down hydrogen peroxide into water and oxygen.

Correct Answer: D

Explanation: Catalase is an enzyme that breaks down hydrogen peroxide (H□O□), a toxic molecule, into water and oxygen, protecting cells from oxidative damage.

46. Which of the following statements about the effect of substrate concentration on enzyme activity is true?

(A) The reaction rate increases until all active sites are saturated, reaching Vmax.
(B) The reaction rate increases indefinitely with substrate concentration.
(C) The reaction rate decreases as substrate concentration increases.
(D) Substrate concentration has no effect on the reaction rate.

Correct Answer: A

Explanation: As substrate concentration increases, the reaction rate increases until all enzyme active sites are occupied (saturated), at which point the rate reaches a maximum (Vmax).

47. Why does the enzyme activity of human enzymes decrease drastically at 60°C?

(A) Substrate molecules move too fast.
(B) The enzyme is denatured due to the disruption of hydrogen bonds.
(C) The enzyme becomes more specific.
(D) The pH changes.

Correct Answer: B

Explanation: At high temperatures (above the optimum 37–38°C), the secondary and tertiary structures of the enzyme are disrupted. Hydrogen bonds break, causing denaturation and loss of active site shape.

48. A competitive inhibitor is added to an enzyme-catalyzed reaction. If the inhibitor concentration is very high, what happens to the K_m?

(A) K_m decreases.
(B) K_m remains unchanged.
(C) K_m increases.
(D) K_m becomes zero.

Correct Answer: C

Explanation: A competitive inhibitor increases the apparent K_m because a higher substrate concentration is required to achieve half-maximal velocity in the presence of the inhibitor.

49. Which class of enzyme catalyzes the intra-molecular rearrangement of atoms to form an isomer?

(A) Lyase
(B) Ligase
(C) Hydrolase
(D) Isomerase

Correct Answer: D

Explanation: Isomerases bring about intra-molecular rearrangement of atoms in molecules, forming one isomer from another (e.g., phosphohexose isomerase).

50. A patient has damage to the pancreas. Which diagnostic enzyme is likely to be elevated in their blood?

(A) Lipase
(B) Creatine Phosphokinase
(C) Lactic Dehydrogenase
(D) Aldolase

Correct Answer: A

Explanation: Lipase is used to diagnose damage to the pancreas. (Creatine phosphokinase is for muscle damage, LDH for heart/liver, and aldolase for muscle/prostate).