

AP Biology Practice Test: Chapter 6 - Introduction to Metabolism

Instructions: Answer all questions to the best of your ability. For the short answer questions, provide a complete response with clear explanations.

Short Answer Questions (1-5)

1. **Define metabolism and explain the difference between catabolic and anabolic pathways.**
 2. **What is ATP, and why is it considered the energy currency of the cell?**
 3. **Describe the role of enzymes in metabolic reactions. How do they affect activation energy?**
 4. **What are coenzymes and cofactors, and how do they assist enzymes in catalyzing reactions? Provide examples.**
 5. **Explain how temperature and pH can affect enzyme activity.**
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Multiple Choice Questions (6-20)

6. Which of the following statements about metabolism is true?
 - A) Metabolism refers only to the breakdown of molecules.
 - B) Metabolism involves only catabolic pathways.
 - C) Metabolism encompasses all the chemical reactions in an organism.
 - D) Metabolism is the process of photosynthesis.
7. Which type of reaction involves the release of energy?
 - A) Anabolic reactions
 - B) Catabolic reactions
 - C) Hydrolysis reactions
 - D) Both B and C
8. The energy required to start a chemical reaction is known as:
 - A) Free energy
 - B) Activation energy
 - C) Kinetic energy
 - D) Potential energy
9. What effect does increasing the concentration of substrate have on the rate of an enzyme-catalyzed reaction?
 - A) It decreases the reaction rate.
 - B) It has no effect.
 - C) It increases the reaction rate until a saturation point is reached.
 - D) It stops the reaction altogether.
10. Enzymes are:
 - A) Carbohydrates that catalyze reactions.
 - B) Lipids that store energy.

- C) Proteins that speed up reactions without being consumed.
 - D) Nucleic acids involved in energy transfer.
11. Which of the following is a characteristic of enzymes?
- A) They are consumed in the reaction.
 - B) They can work at any temperature or pH.
 - C) They lower the activation energy of a reaction.
 - D) They are specific for all substrates.
12. What is the primary role of ATP in cells?
- A) To store genetic information.
 - B) To serve as a structural component of cell membranes.
 - C) To act as an energy carrier.
 - D) To catalyze metabolic reactions.
13. A noncompetitive inhibitor:
- A) Binds to the active site of an enzyme.
 - B) Decreases the maximum rate of reaction.
 - C) Can be overcome by increasing substrate concentration.
 - D) Is not affected by the concentration of substrate.
14. In which process is glucose broken down to produce ATP?
- A) Photosynthesis
 - B) Cellular respiration
 - C) Fermentation
 - D) Both B and C
15. The term “feedback inhibition” refers to:
- A) The enhancement of metabolic pathways.
 - B) The regulation of enzyme activity by the end product of a pathway.
 - C) The process of substrate-level phosphorylation.
 - D) The conversion of ATP to ADP.
16. Which of the following statements about redox reactions is true?
- A) Reduction involves the loss of electrons.
 - B) Oxidation involves the gain of electrons.
 - C) Redox reactions always occur in pairs.
 - D) Both A and C.
17. Which of the following is NOT a factor that affects enzyme activity?
- A) Substrate concentration
 - B) Presence of inhibitors
 - C) Size of the enzyme
 - D) Temperature and pH
18. The energy stored in ATP is released when:
- A) A phosphate group is added.
 - B) A phosphate group is removed.
 - C) Glucose is broken down.
 - D) Oxygen is consumed.
19. In cellular respiration, the ultimate electron acceptor is:
- A) Glucose

- B) Oxygen
 - C) Carbon dioxide
 - D) Water
20. Which of the following is an example of an anabolic pathway?
- A) Glycolysis
 - B) Protein synthesis
 - C) Cellular respiration
 - D) Fermentation
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True/False Questions (21-30)

21. **True/False:** All enzymes are proteins.
22. **True/False:** Catabolic pathways consume energy to build complex molecules.
23. **True/False:** An enzyme's active site is specific for only one substrate.
24. **True/False:** Enzymes can be used repeatedly in reactions without being consumed.
25. **True/False:** A competitive inhibitor decreases the rate of reaction by binding to the enzyme's active site.
26. **True/False:** ATP is a stable molecule and can be stored for long periods without breaking down.
27. **True/False:** Metabolism includes both the breakdown and synthesis of molecules.
28. **True/False:** Increasing temperature always increases enzyme activity.
29. **True/False:** Coenzymes are often derived from vitamins.
30. **True/False:** Enzymes function best at a specific temperature and pH, and deviations can denature them.

ANSWERS

Answers to Short Answer Questions (1-5)

1. Define metabolism and explain the difference between catabolic and anabolic pathways.
 - Metabolism refers to the total of all chemical reactions that occur within an organism to maintain life. It is divided into two main pathways:
 - Catabolic pathways: These are metabolic processes that break down molecules into smaller units, releasing energy in the process (e.g., cellular respiration).
 - Anabolic pathways: These processes build larger molecules from smaller ones, requiring energy (e.g., protein synthesis).
2. What is ATP, and why is it considered the energy currency of the cell?
 - ATP (adenosine triphosphate) is a nucleotide that serves as a primary energy carrier in cells. It is considered the energy currency of the cell because it stores energy in its high-energy phosphate bonds. When ATP is hydrolyzed to ADP

(adenosine diphosphate) and an inorganic phosphate, energy is released, which can be used for various cellular processes.

3. Describe the role of enzymes in metabolic reactions. How do they affect activation energy?
 - Enzymes are biological catalysts that speed up metabolic reactions by lowering the activation energy required for the reaction to proceed. They bind to substrates at their active sites, facilitating the formation of the transition state, which accelerates the conversion of substrates to products.
 4. What are coenzymes and cofactors, and how do they assist enzymes in catalyzing reactions? Provide examples.
 - Cofactors are non-protein chemical compounds that assist enzymes in catalyzing reactions. They can be metal ions (e.g., Zn^{2+} , Mg^{2+}). Coenzymes are organic molecules that act as cofactors (e.g., NAD^+ , FAD , and vitamins). They often participate in the enzymatic reaction by providing functional groups or transferring electrons.
 5. Explain how temperature and pH can affect enzyme activity.
 - Enzyme activity is highly dependent on temperature and pH.
 - Temperature: Enzymes generally have an optimal temperature range. Increasing temperature can increase reaction rates to a point, but extreme heat can denature enzymes, rendering them inactive.
 - pH: Each enzyme has an optimal pH at which it is most active. Deviations from this optimal pH can reduce enzyme activity and may lead to denaturation.
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Answers to Multiple Choice Questions (6-20)

6. C) Metabolism encompasses all the chemical reactions in an organism.
 7. B) Catabolic reactions
 8. B) Activation energy
 9. C) It increases the reaction rate until a saturation point is reached.
 10. C) Proteins that speed up reactions without being consumed.
 11. C) They lower the activation energy of a reaction.
 12. C) To act as an energy carrier.
 13. D) Is not affected by the concentration of substrate.
 14. B) Cellular respiration
 15. B) The regulation of enzyme activity by the end product of a pathway.
 16. C) Redox reactions always occur in pairs.
 17. C) Size of the enzyme
 18. B) A phosphate group is removed.
 19. B) Oxygen
 20. B) Protein synthesis
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Answers to True/False Questions (21-30)

- 21. True: All enzymes are proteins.
- 22. False: Catabolic pathways release energy by breaking down molecules, while anabolic pathways consume energy to build complex molecules.
- 23. True: An enzyme's active site is specific for only one substrate.
- 24. True: Enzymes can be used repeatedly in reactions without being consumed.
- 25. True: A competitive inhibitor decreases the rate of reaction by binding to the enzyme's active site.
- 26. False: ATP is not a stable molecule for long-term storage; it is used quickly as an energy source.
- 27. True: Metabolism includes both the breakdown and synthesis of molecules.
- 28. False: Increasing temperature does not always increase enzyme activity; it can lead to denaturation at high temperatures.
- 29. True: Coenzymes are often derived from vitamins.
- 30. True: Enzymes function best at specific temperature and pH levels, and deviations can lead to denaturation.