1. **True/False (2 marks):**
   a. The primary structure of a protein is determined by the sequence of amino acids.
   b. Hydrogen bonds are responsible for the tertiary structure of a protein.

2. **Fill in the Blank (4 marks):**
   Fill in the blanks with the appropriate terms related to protein structure:
   a. The _____ structure of a protein refers to the linear sequence of amino acids.
   b. _____ bonds are responsible for forming alpha-helices and beta-pleated sheets in the secondary structure.
   c. Interactions between R-groups, such as _____ bonds, contribute to the tertiary structure.
   d. Hemoglobin, a protein made of multiple polypeptide chains, exhibits _____ structure.

1. Explain the four levels of protein structure. Use hemoglobin as an example to describe how each level contributes to the protein's function.

2. A mutation in a protein replaces a hydrophobic amino acid with a hydrophilic one in the interior of the protein. Predict how this could affect the protein's structure and function, and explain your reasoning.

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4. Which component of a nucleotide determines whether it is DNA or RNA?
   - i. Phosphate group
   - ii. Deoxyribose or ribose sugar
   - iii. Nitrogenous base
   - iv. Hydrogen bonds

5. Which nitrogenous base is not found in RNA?
   - i. Adenine
   - ii. Guanine
   - iii. Thymine
   - iv. Cytosine

6. **True/False (2 marks):**
   a. DNA is double-stranded, while RNA is single-stranded.
   b. The sugar in DNA is ribose.

7. **Fill in the Blank (4 marks):**
   Fill in the blanks about nucleotide structure:
   a. The three components of a nucleotide are _____, _____, and _____.
   b. In DNA, adenine pairs with _____, and cytosine pairs with _____.

8. Compare and contrast the structural differences between DNA and RNA. Include at least two distinct features.
9. Describe the process of complementary base pairing during DNA replication. Include a diagram to show how the structure of the nucleotide contributes to its function.

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7. **True/False (2 marks):**
   a. Enzymes speed up reactions by increasing the activation energy.
   b. A substrate binds to the enzyme at its active site.

8. **Fill in the Blank (4 marks):**
   Fill in the blanks about enzyme function:
   a. Enzymes act as biological _____ by lowering the _____ energy of reactions.
   b. The _____ model describes the enzyme-substrate relationship as a perfect fit, while the _____ model suggests flexibility in binding.

9. Design an experiment to test how pH affects enzyme activity. Specify your hypothesis, independent and dependent variables, controlled variables, and the steps you would take. Provide a brief explanation of why pH affects enzyme activity.
10. A patient with a genetic mutation has an enzyme with an altered active site shape. Explain how this could affect enzyme-substrate binding and provide one potential treatment option to mitigate the problem.

Steroids

10. Steroids are a type of:

- i. Protein
- ii. Lipid
- iii. Carbohydrate
- iv. Nucleic acid

11. Which of the following is an example of a steroid?

- i. Hemoglobin
- ii. Glucose

- iii. Testosterone
- iv. Collagen

11. **Fill in the Blank (3 marks):**
    Fill in the blanks about steroid structure and function:
    a. Steroids are classified as _____ and have a structure composed of _____ fused rings.
    b. _____ is an example of a steroid hormone responsible for regulating male secondary sexual characteristics.
12. Describe the basic structure of a steroid and explain how it differs from a triglyceride.
13. A patient has abnormally high levels of cholesterol. Explain the role of cholesterol in the cell membrane and discuss one potential consequence of excessive cholesterol in the bloodstream.

Integration of Topics

13. **Application Question (6 marks):** Explain how the structure of a protein's active site allows it to interact with a substrate. Use the lock-and-key and induced fit models to illustrate your answer.
14. **Cross-Topic Question (7 marks):** DNA contains the instructions for protein synthesis, and enzymes are critical in this process. Explain the relationship between nucleotides, protein structure, and enzyme activity. Include examples to support your explanation.
15. **Data Analysis (6 marks):** A lab experiment measures the rate of an enzyme-catalyzed reaction at different temperatures. Analyze the given data table (temperature vs. reaction rate) and explain the trends in terms of protein structure and enzyme function.

Temperature (°C)	Reaction Rate (µmol/min)
10	1.2
20	2.8
30	4.6
40	5.9
50	4.8
60	2.3
