

3

Proteins

Subject Outline terms and phrases

primary, secondary, tertiary, quaternary, three-dimensional shape, enzyme, hormone, receptor molecule, antibody, substrate, induced-fit model, temperature, pH, inhibitors, activation energy

1. Define the following terms used to describe protein formation.

Primary structure: _____

Secondary structure: _____

Tertiary structure: _____

Quaternary structure: _____

2. Explain how the primary and secondary structure of a protein give rise to a unique tertiary structure.

3. Complete the following table for protein function.

Function	Examples
structural	
	antibodies
	hormones
energy storage	
catalyse reactions	

4. Explain how the three-dimensional structure of proteins plays an important role in their ability to recognise and bind to specific molecules.

5. 'Antibodies are specific to their antigens'

(a) Explain the statement above by referring to the molecular shapes of antigens and their corresponding antibodies.

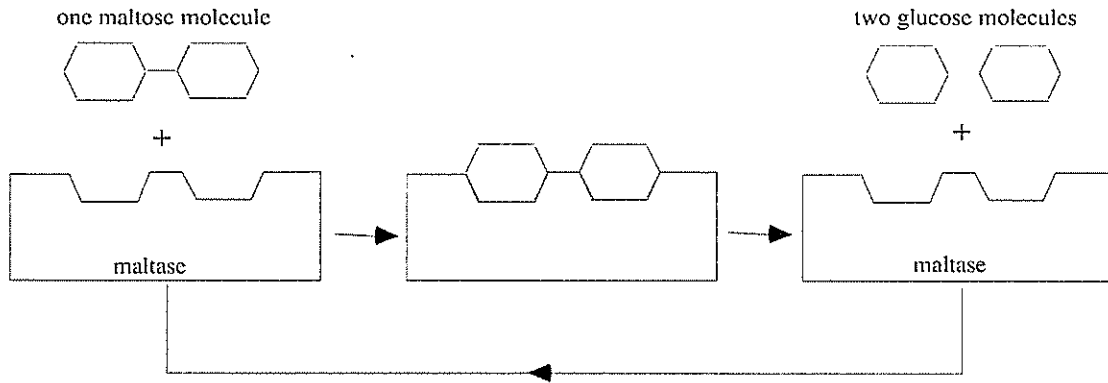
(b) Draw a clearly labelled diagram of an antibody and its antigen.

6. (a) What is the function of enzymes?

(b) What are enzymes made of and how do they differ from one another?

(c) Explain the difference between **intracellular** and **extracellular** enzymes.

7. (a) On the diagram below label the **substrate**, **enzyme**, **enzyme-substrate complex** and **product**. Indicate the position of the **active site**.



- (b) Use the example in the diagram above to explain why an enzyme is specific for its substrate.

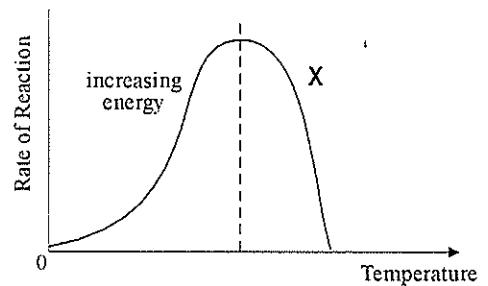
- (c) Describe the induced-fit model of enzyme-substrate binding. Illustrate your answer with a diagram.

8. On the pH scale below label the positions that correspond to **acidic**, **basic**, and **neutral**.



9. Refer to the graph at the right.

- (a) On the temperature axis, label the position of the optimum temperature for this enzyme.
- (b) Explain why the rate of reaction decreases in the region labelled X.

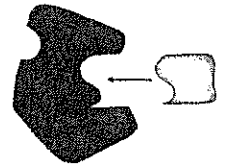


- (c) Besides temperature, state two environmental factors that affect the activity of enzymes.

Factor 1: _____

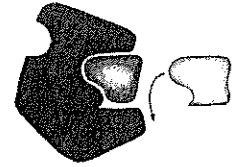
Factor 2: _____

10. (a) On the diagram at right label the enzyme, the substrate, the competitive inhibitor, and the non-competitive inhibitor.

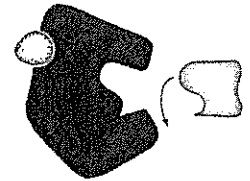


(b) Explain how (i) competitive and (ii) non-competitive inhibitors can affect the function of an enzyme.

(i) competitive inhibitors



(ii) non-competitive inhibitors



11. How do pH and temperature alter the binding of enzyme and substrate molecules?

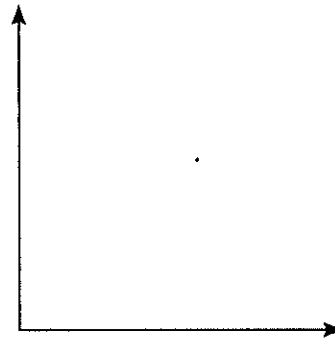
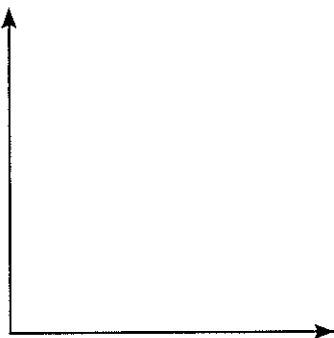
pH _____

temperature _____

12. Draw a graph to show how the rate of an enzyme-controlled reaction changes as the:

(a) concentration of reactants increases

(b) concentration of the enzyme increases



13. (a) What is meant by the term **activation energy**?

(b) What effect do enzymes have on the activation energy required for biological reactions?
