

# Enzymes

## Question Paper 2

<b>Level</b>	International A Level
<b>Subject</b>	Biology
<b>Exam Board</b>	CIE
<b>Topic</b>	Enzymes
<b>Sub Topic</b>	
<b>Booklet</b>	Multiple Choice
<b>Paper Type</b>	Question Paper 2

**Time Allowed :** 51 minutes

**Score :** / 42

**Percentage :** /100

**Grade Boundaries:**

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 Proteases are a group of enzymes that digest proteins.

Which statement about proteases is correct?

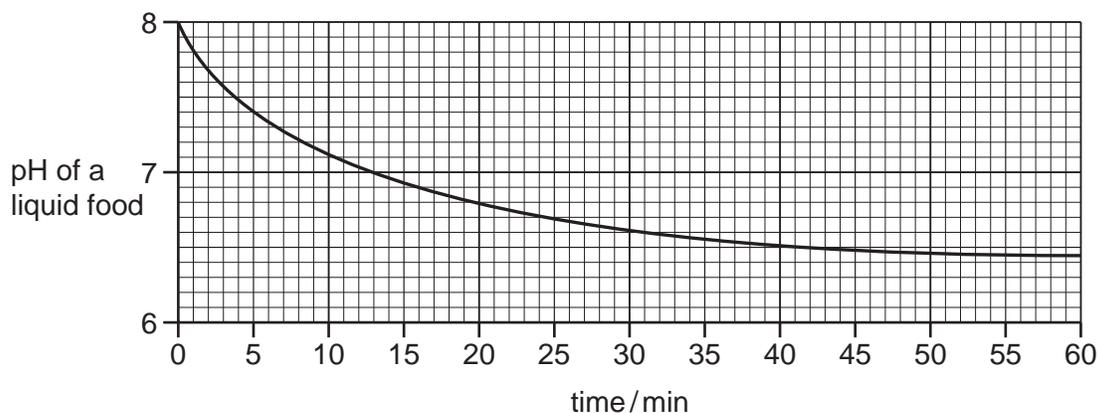
- A** A bacterial protease that is secreted from a disease-causing bacterium could act as an antigen and cause the production of an antibody.
- B** Bacterial proteases are important in the nitrogen cycle as they are able to catalyse the breakdown of the organic nitrogen molecules nucleotides and urea.
- C** Non-competitive inhibition of a protease that has an optimum pH of pH2 can be overcome by increasing the substrate concentration and increasing the pH.
- D** Water molecules are required when peptide bonds that link the monomers together are broken by the action of proteases in condensation reactions.

2 Which words from the table correctly complete the paragraph about enzymes?

When the pH of an environment is decreased below an enzyme's optimum pH, .....1..... bonds between adjacent .....2..... groups, holding the .....3..... structure, are disrupted.

	1	2	3
<b>A</b>	hydrogen and ionic	R	tertiary
<b>B</b>	hydrogen	hydroxyl	secondary
<b>C</b>	ionic and peptide	R	primary and tertiary
<b>D</b>	peptide	amine	primary

- 3 Lipase is a digestive enzyme produced by the pancreas that catalyses the hydrolysis of dietary lipids. The table shows how the pH of a liquid food containing a high proportion of lipids decreases over time.



Which statements are possible explanations of the results of the experiment between 50 and 60 minutes?

- 1 Enzyme concentration becomes the limiting factor.
- 2 Substrate concentration becomes the limiting factor.
- 3 All the enzyme active sites are saturated.
- 4 Denaturation of the enzyme by the products.
- 5 Products are acting as competitive inhibitors.

**A** 1, 2 and 3      **B** 1, 4 and 5      **C** 2, 3 and 4      **D** 2, 4 and 5

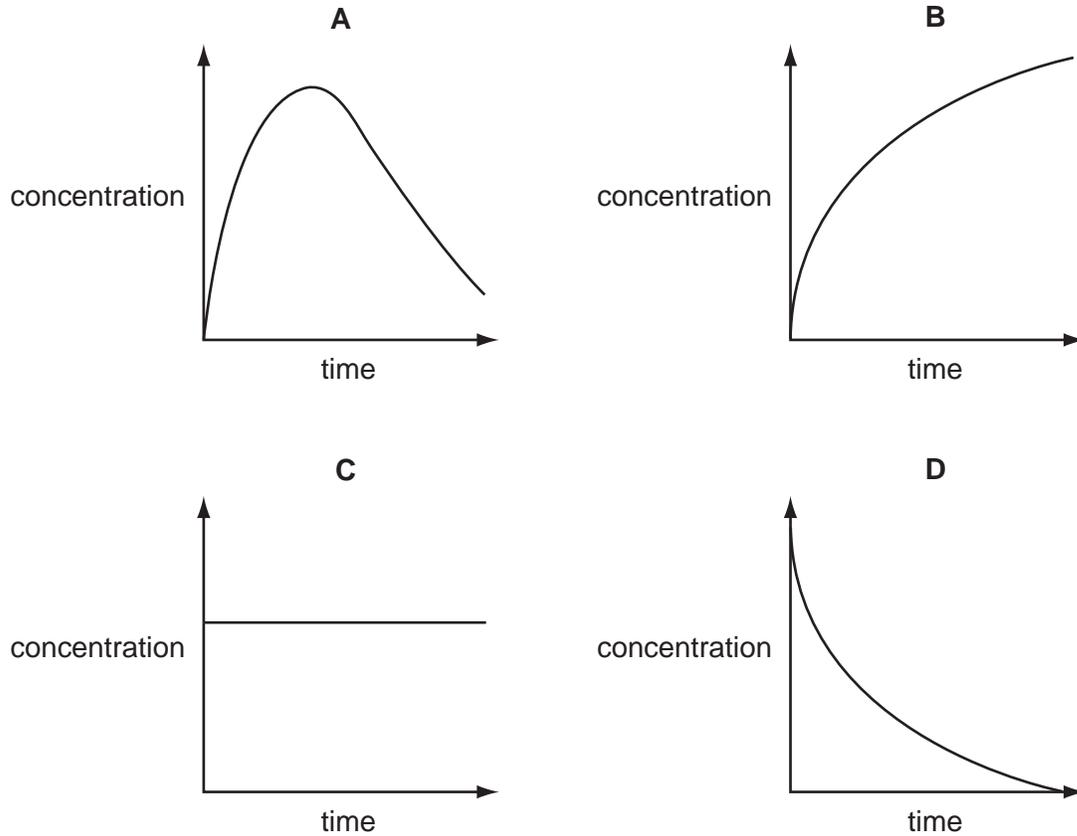
- 4 The AIDS virus produces a long polypeptide that is hydrolysed by a protease enzyme, producing several smaller peptides. This viral protease is the target of anti-AIDS drugs.

Which feature is essential for the success of these drugs?

- A** a complex structure that inhibits many types of viral enzyme
- B** a molecule containing a heavy metal atom that is a non-competitive inhibitor of enzymes
- C** a protein that can act as a competitive inhibitor of protease enzymes
- D** a specific structure that inhibits only viral protease

- 5 A quantity of an enzyme was added to a quantity of its substrate. The graphs show the changes in concentration of the enzyme, the substrate, the enzyme-substrate complex and the product over time.

Which graph shows the change in the concentration of the enzyme-substrate complex?



- 6 Which is correct for a competitive inhibitor of an enzyme?

<b>A</b>	inhibitor binds to a site on the enzyme other than the active site	the substrate concentration has no effect on the level of inhibition
<b>B</b>	inhibitor binds to the active site of the enzyme	increasing the substrate concentration decreases the effect of the inhibitor
<b>C</b>	inhibitor binds to the active site of the enzyme	the substrate concentration has no effect on the level of inhibition
<b>D</b>	inhibitor binds to the enzyme-substrate complex	increasing the substrate concentration decreases the effect of the inhibitor

7 Which two substances maintain the fluidity of the cell membranes?

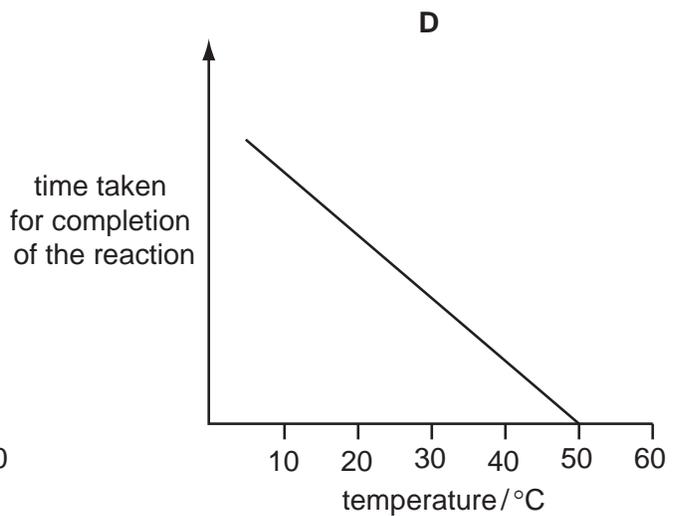
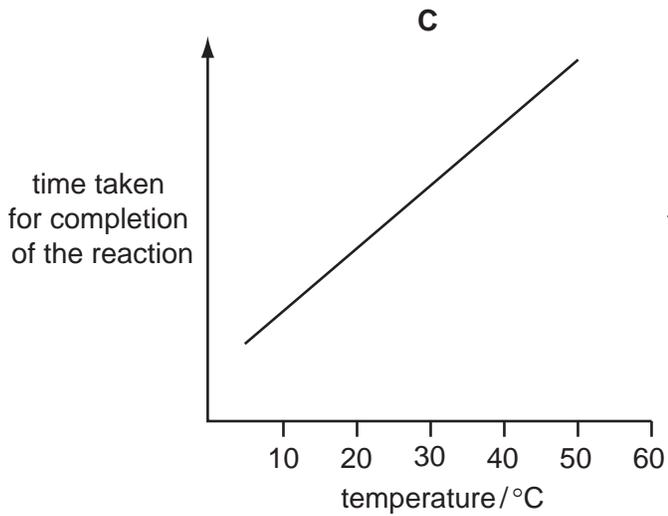
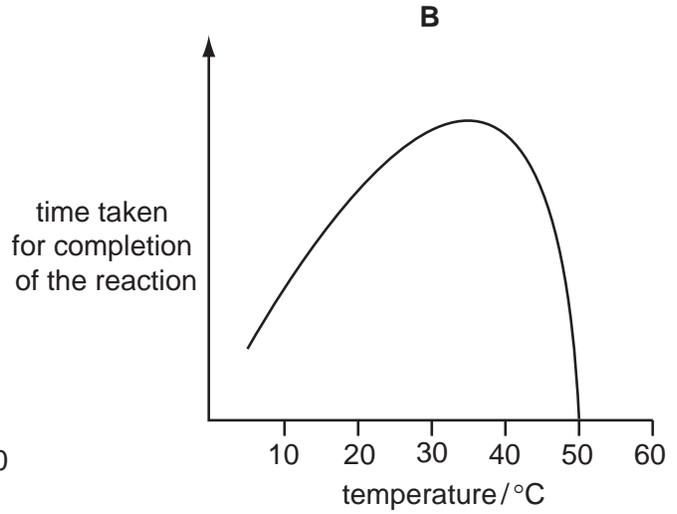
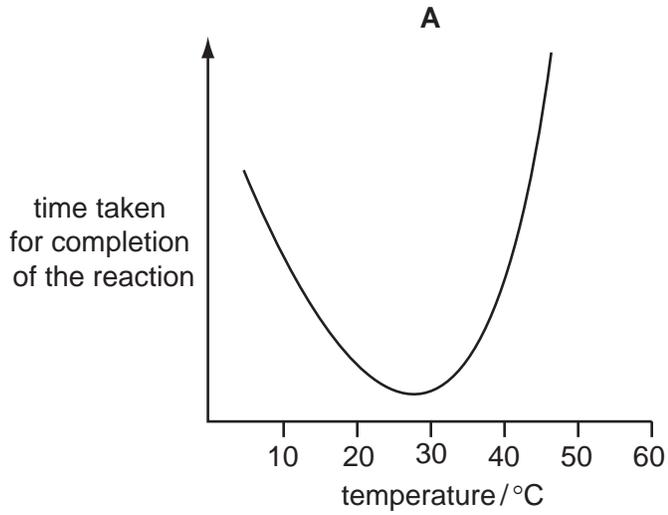
- A** cholesterol and glycolipid
- B** glycolipid and glycoprotein
- C** glycoprotein and phospholipid
- D** phospholipid and cholesterol

8 Which statements about competitive inhibitors of enzyme action are correct?

- 1 Increasing the concentration of the enzyme's substrate will reduce their effect.
  - 2 They bind to an enzyme at its active site.
  - 3 They reduce the activation energy required for a reaction to take place.
  - 4 They reduce the maximum rate of reaction.
- A** 1 and 2 only    **B** 1 and 3 only    **C** 2 and 3 only    **D** 2, 3 and 4 only

- 9 An enzyme is completely denatured at 50 °C. A fixed concentration of this enzyme is added to a fixed concentration of its substrate. The time taken for completion of the reaction is measured at different temperatures.

Which graph shows the results?



10 Which is correct for a non-competitive inhibitor of enzyme action?

- 1 Increasing the concentration of the enzyme's substrate will reduce its effect.
- 2 It reduces the activation energy required for a reaction to take place.
- 3 It reduces the maximum rate of reaction.

**A** 1 only      **B** 3 only      **C** 1 and 3 only      **D** 2 and 3 only

11 The enzyme lysozyme secreted from tear glands forms deposits on contact lenses.

Which ingredient would be effective in a contact lens cleaner for removing these deposits?

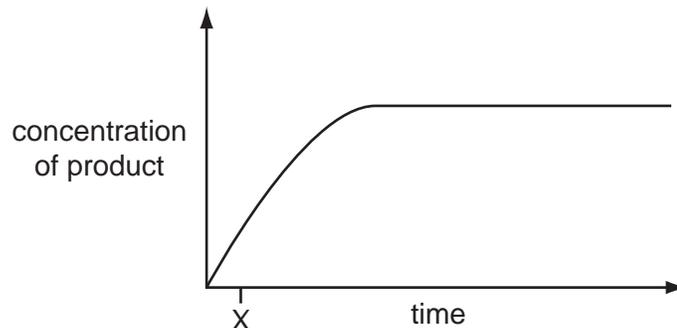
- A** ethanol
- B** lysosomes
- C** pH buffers
- D** proteases

12 Which is correct for competitive inhibitors of enzymes?

- 1 They occupy the active site of an enzyme.
- 2 They have exactly the same shape as the substrate.
- 3 They can be used to control the rate of enzyme activity.
- 4 They can bind to a site on an enzyme other than the active site.

**A** 1 only      **B** 1 and 3 only      **C** 1, 2 and 3 only      **D** 2, 3 and 4 only

- 13 The graph shows the course of an enzyme-catalysed reaction at 30 °C.



What is true at time X?

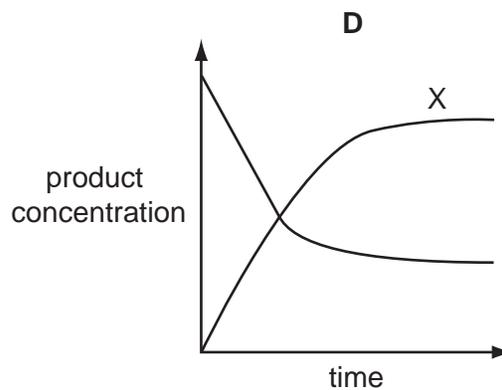
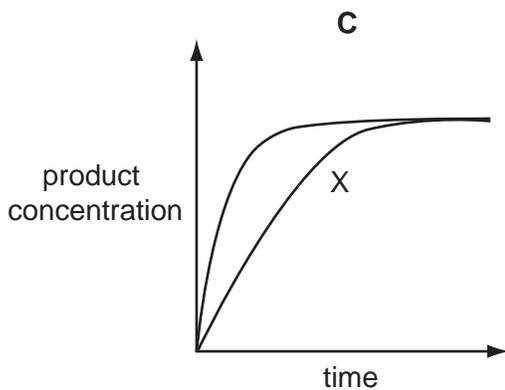
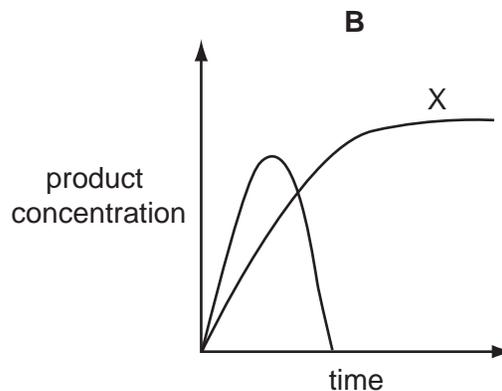
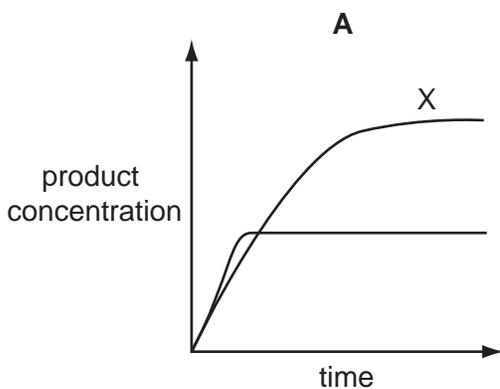
- A Most enzyme molecules will have free active sites.
  - B The number of available substrate molecules is high.
  - C The number of enzyme-substrate complexes is low.
  - D The rate remains the same if more enzyme is added.
- 14 Which of the bonds will be last to break as the temperature of an enzyme is increased?
- A covalent
  - B hydrogen
  - C hydrophobic interactions
  - D ionic
- 15 What is the effect of an enzyme in an enzyme-catalysed reaction?
- A decreases both the activation energy and the energy yield
  - B decreases the activation energy and has no effect on the energy yield
  - C increases both the activation energy and the energy yield
  - D increases the energy yield and decreases the activation energy

16 What is the role of enzymes in metabolism?

- A to catalyse the hydrolysis of large molecules only
- B to increase the number of collisions between molecules
- C to lower the activation energy required to start a reaction
- D to supply the activation energy required to start a reaction

17 Two enzyme experiments were carried out. The first, experiment X, was carried out at a constant temperature of 37 °C. During the second experiment the temperature was increased from 37 °C to 80 °C. All other factors were kept the same.

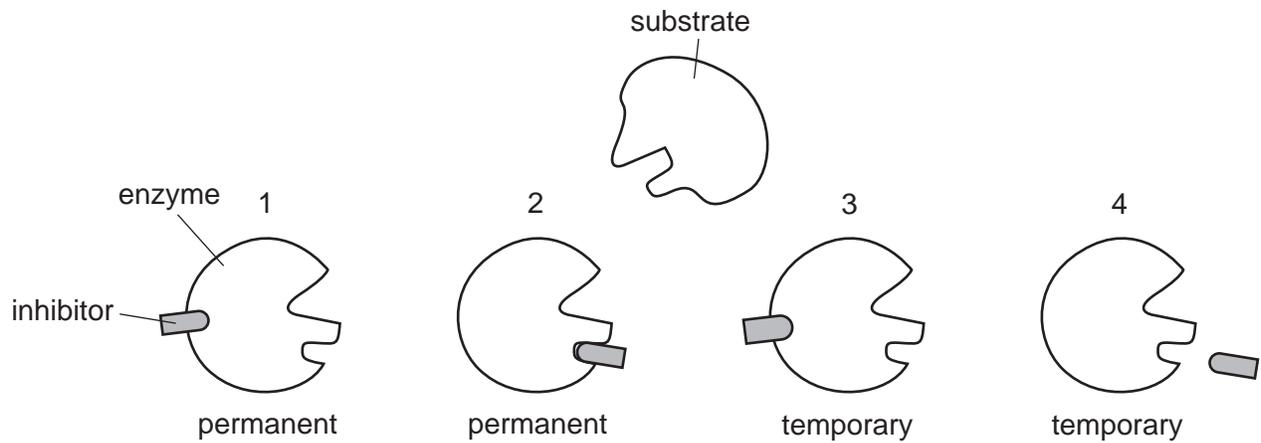
Which graph shows the results?



18 Which bonds are the last to break when an enzyme is heated?

- A disulfide
- B hydrogen
- C hydrophobic interactions
- D ionic

19 The diagrams show where an inhibitor becomes attached to an enzyme and whether this is permanent or temporary.



Which diagrams represent a non-competitive inhibitor?

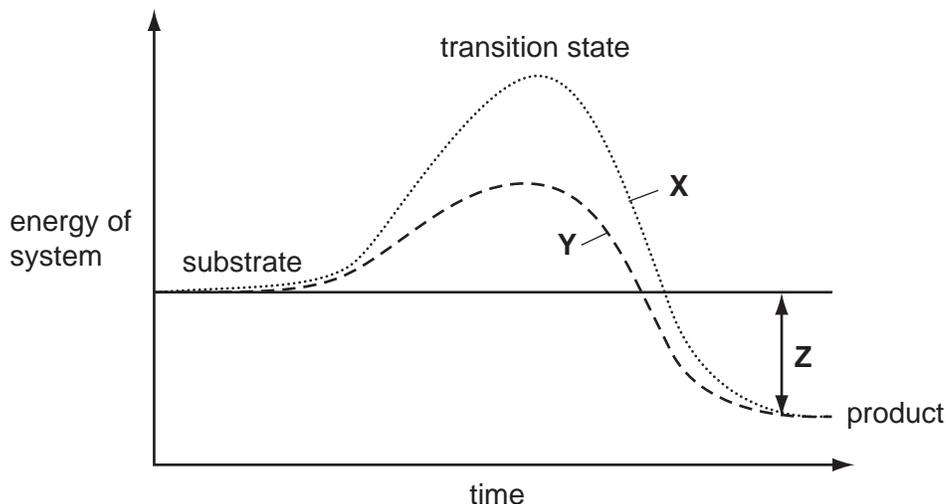
- A 1 and 2 only
- B 2 and 3 only
- C 3 and 4 only
- D 1, 2 and 3

20 Which statements about the effect of **all** enzyme inhibitors are correct?

- 1 alter the shape of the active site
- 2 denature the enzyme
- 3 reduce the rate of the enzyme catalysed reaction

- A 1, 2 and 3
- B 1 and 2 only
- C 1 and 3 only
- D 3 only

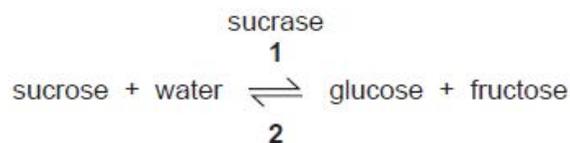
21 The graph shows the effect of an enzyme on a reaction.



Which combination identifies **X**, **Y** and **Z**?

	<b>X</b>	<b>Y</b>	<b>Z</b>
<b>A</b>	catalysed reaction	uncatalysed reaction	energy lost by product
<b>B</b>	catalysed reaction	uncatalysed reaction	total energy lost during reaction
<b>C</b>	uncatalysed reaction	catalysed reaction	energy gained by product
<b>D</b>	uncatalysed reaction	catalysed reaction	total energy change during reaction

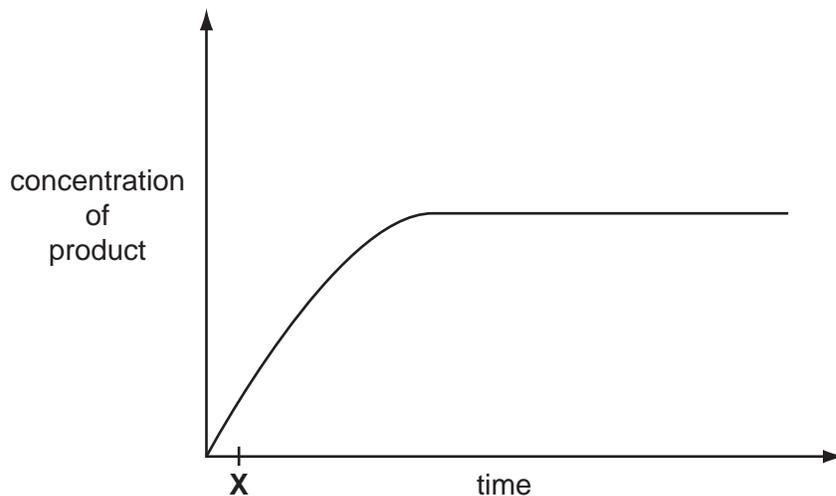
22 The equation shows a reversible reaction.



In this reaction, on which molecule does an active site occur and what types of reaction occur at **1** and **2**?

	active site present on	reaction at <b>1</b>	reaction at <b>2</b>
<b>A</b>	sucrase	condensation	hydrolysis
<b>B</b>	sucrase	hydrolysis	condensation
<b>C</b>	sucrose	condensation	hydrolysis
<b>D</b>	sucrose	hydrolysis	condensation

23 The graph shows the course of an enzyme-catalysed reaction at 30 °C.



What is true at time **X**?

- A** Most enzyme molecules will have free active sites.
- B** The number of available substrate molecules is high.
- C** The number of enzyme-substrate complexes is low.
- D** The rate remains the same if more enzyme is added.

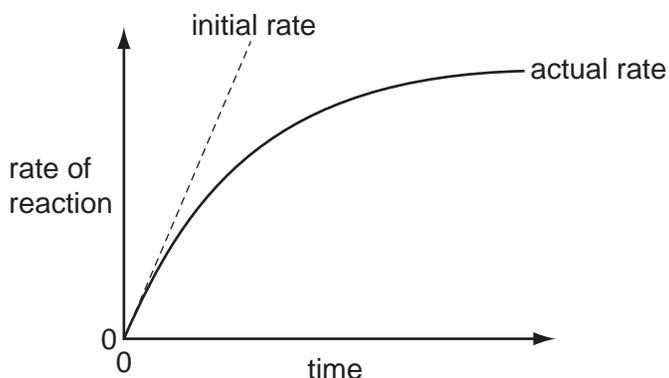
24 The rate of enzyme-catalysed reactions in human cells is regulated.

Which may be involved in such regulation?

- 1 a change in enzyme concentration
- 2 a change in substrate concentration
- 3 inhibition by the final product of the reaction

- A** 1 and 2 only    **B** 1 and 3 only    **C** 2 and 3 only    **D** 1, 2

- 25 A fixed volume of the enzyme catalase was added to a fixed volume of hydrogen peroxide solution. The diagram shows how the rate of the reaction changed over the course of the reaction.

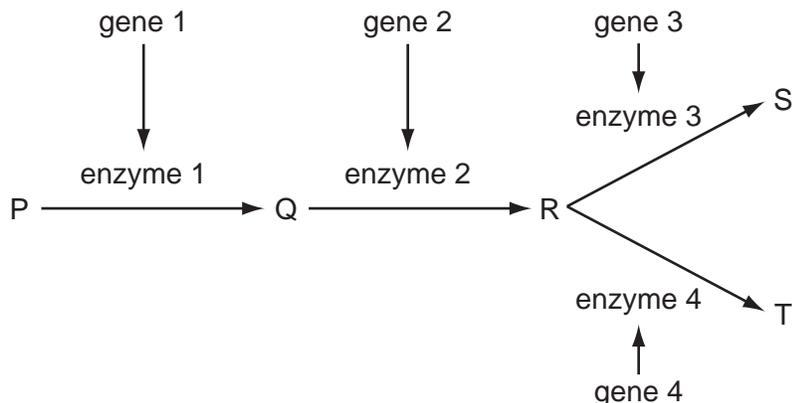


Why did the actual rate of reaction decrease over time?

- A The enzyme active sites become saturated.
  - B The enzymes were denatured.
  - C The product inhibited the reaction.
  - D The substrate molecules were used up.
- 26 Which levels of protein structure are always involved when competitive and non-competitive inhibitors bind to enzymes?

	competitive	non-competitive
A	primary, secondary and tertiary	secondary
B	quaternary and tertiary	quaternary and tertiary
C	secondary	primary and tertiary
D	tertiary	tertiary

- 27 S and T are products of a biochemical pathway. A different enzyme, coded for by different specific genes, catalyses each step in the pathway.



What is the possible outcome to the pathway if a mutation in gene 3 leads to an inactive enzyme?

- A There is a decrease in the activity of gene 1 and gene 2.
  - B There is an accumulation of product S.
  - C There is an increase in the rate of reaction of enzyme 4.
  - D There is an increase in the production of T.
- 28 HIV-1 protease is an enzyme produced by the HIV virus.

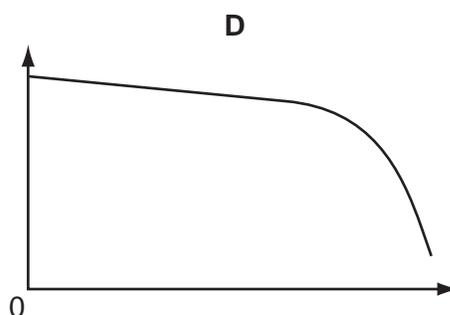
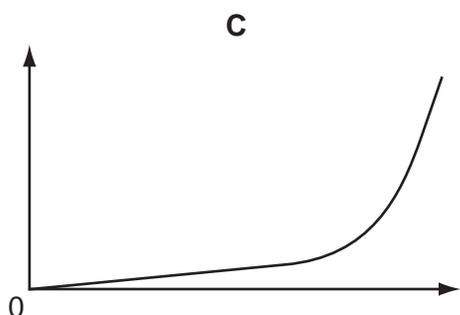
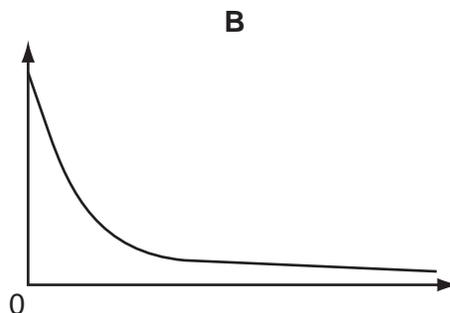
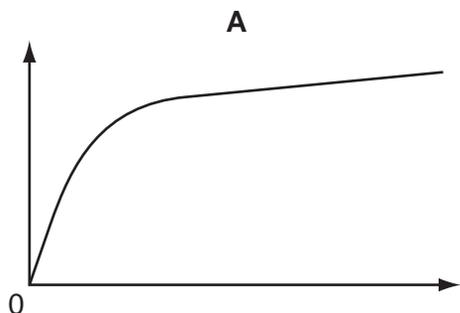
Two identical chains of 99 amino acids form the enzyme. In each chain, amino acids 25, 26 and 27 in the sequence form part of the active site.

Which orders of protein structure control the shape of the active site?

- A primary, secondary, tertiary and quaternary
- B primary, secondary and tertiary only
- C primary and quaternary only
- D quaternary only

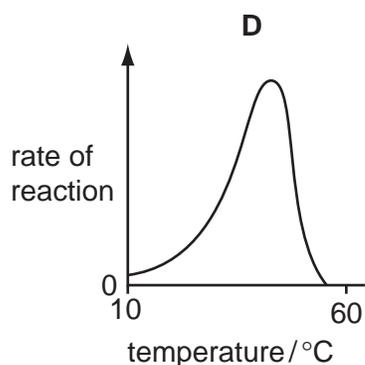
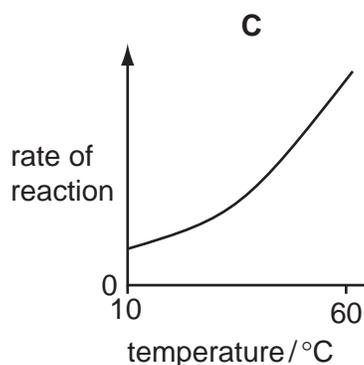
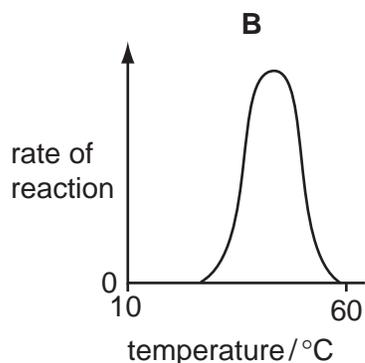
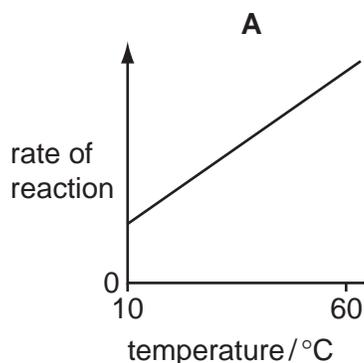
29 In an experiment,  $5 \text{ cm}^3$  of 1 % salivary amylase are added to  $100 \text{ cm}^3$  of different concentrations of starch.

Which graph shows the results of plotting the initial rate of reaction (y-axis) against the concentration of substrate (x-axis)?

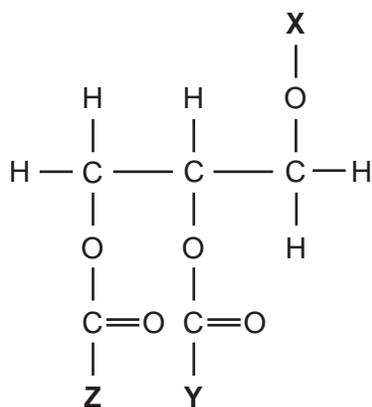


- 30 The rate of an enzyme controlled reaction was measured at temperatures within the range 10-60 °C.

Which curve represents the most usual relationship between temperature and enzyme activity?



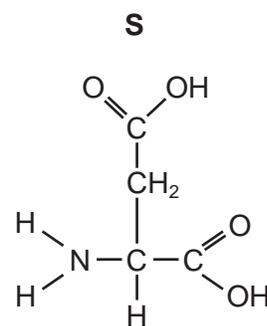
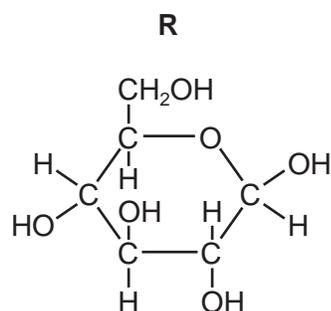
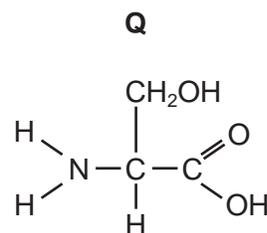
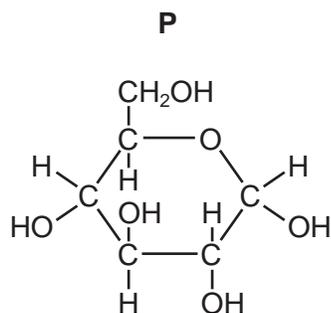
- 31 The diagram shows a phospholipid molecule.



What are **X**, **Y** and **Z**?

	<b>X</b>	<b>Y</b>	<b>Z</b>
<b>A</b>	hydrocarbon chain	hydrocarbon chain	phosphate-containing group
<b>B</b>	hydrocarbon chain	glycerol	phosphate-containing group
<b>C</b>	phosphate-containing group	hydrocarbon chain	hydrocarbon chain
<b>D</b>	phosphate-containing group	glycerol	hydrocarbon chain

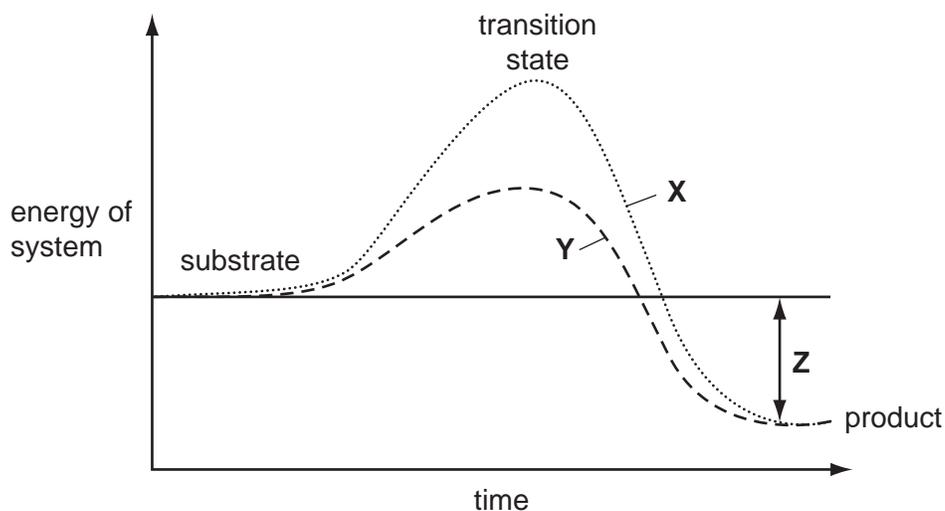
32 The diagrams show four different molecules.



Which shows the correct information about the molecule or molecules?

	contains a carboxyl group	forms 1,6 glycosidic bonds in glycogen	forms peptide bonds by condensation
<b>A</b>	P	P	P and Q
<b>B</b>	Q	R	P and R
<b>C</b>	R	R	R and Q
<b>D</b>	S	P	Q and S

33 The graph shows the effect of an enzyme on a reaction.

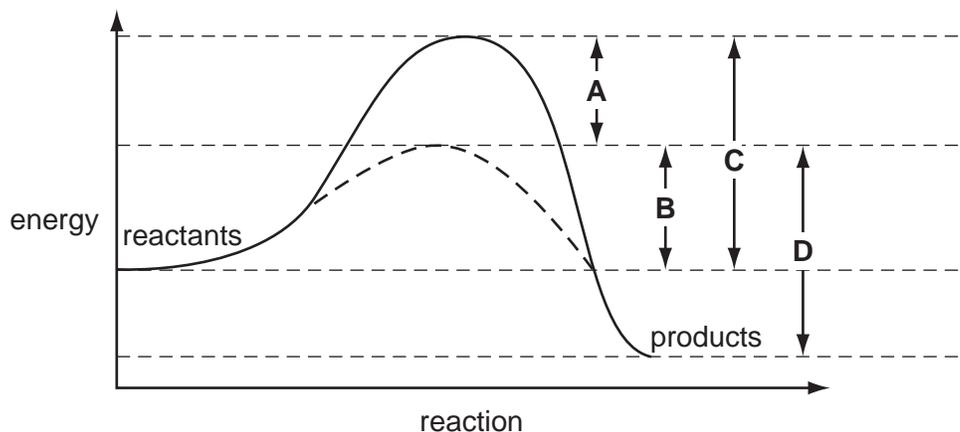


Which combination identifies **X**, **Y** and **Z**?

	<b>X</b>	<b>Y</b>	<b>Z</b>
<b>A</b>	catyalsed reaction	uncatylased reaction	activation energy
<b>B</b>	catyalsed reaction	uncatylased reaction	energy lost during reaction
<b>C</b>	uncatylased reaction	catyalsed reaction	energy gained by product
<b>D</b>	uncatylased reaction	catyalsed reaction	overall energy change

34 The graph shows the activation energy of an enzyme-catalysed reaction and the same reaction without a catalyst.

Which arrow shows the activation energy of the uncatylased reaction?

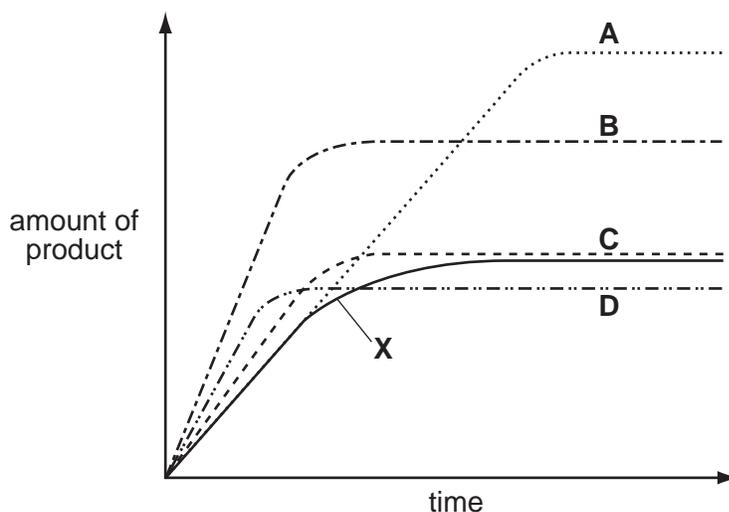


35 How does increasing substrate concentration affect the rate of an enzyme-catalysed reaction in the presence of a competitive inhibitor?

- A The rate of the reaction decreases.
- B The rate of the reaction decreases initially and then recovers.
- C The rate of the reaction increases.
- D The rate of the reaction is not affected.

36 The curve **X** shows the activity of an enzyme at 20 °C. Curves **A** to **D** show the effect of different conditions on the activity of the enzyme.

Which curve shows the effect of increasing the temperature by 10 °C and adding extra substrate?

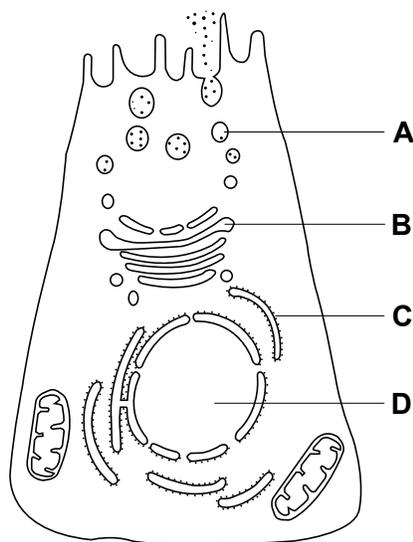


37 What is the effect of increasing substrate concentration on the degree of inhibition of an enzyme-controlled reaction?

	competitive inhibition	non-competitive inhibition
<b>A</b>	decreased	increased
<b>B</b>	decreased	no change
<b>C</b>	increased	decreased
<b>D</b>	no change	increased

38 The diagram is taken from an electron micrograph of a cell which secretes digestive enzymes.

Where are these enzymes made?

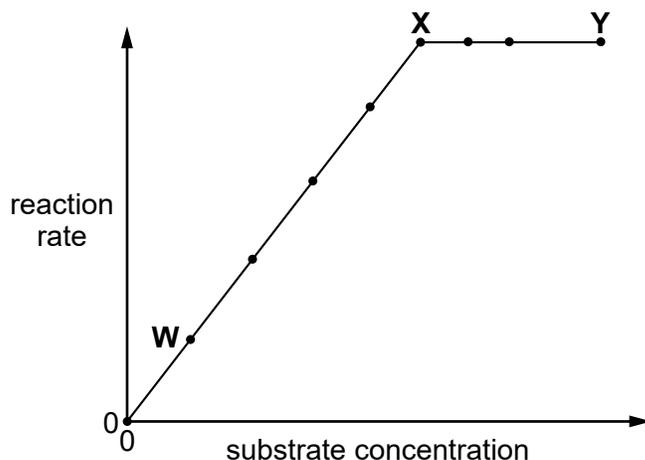


39 The enzyme lysozyme secreted from tear glands forms deposits on contact lenses.

Which ingredient would be effective in a contact lens cleaner for removing these deposits?

- A antibodies
- B lysosomes
- C pH buffers
- D proteases

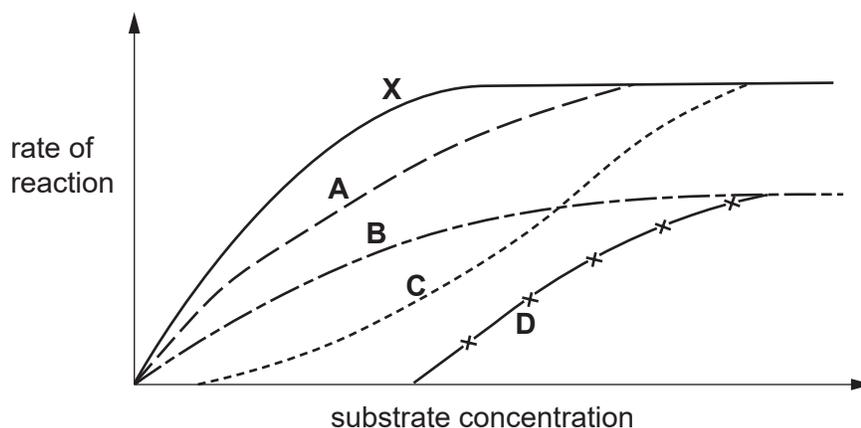
- 40 The graph shows the effect of substrate concentration on the rate of an enzyme-controlled reaction. The enzyme concentration is constant.



Which statement about the graph is correct?

- A Between **W** and **X**, the number of enzyme molecules is limiting.
  - B Between **X** and **Y**, the number of enzyme molecules is limiting.
  - C Between **X** and **Y**, the number of substrate molecules is limiting.
  - D Between **X** and **Y**, the product concentration remains the same.
- 41 In the graph, **X** represents the relationship between the initial rate of reaction of an enzyme and the concentration of its substrate under optimal conditions and without an inhibitor.

Which curve represents the result when the same experiment is carried out in the presence of a fixed, low concentration of a non-competitive inhibitor?



**42** Which bonds hold substrate molecules to the active site of an enzyme?

- A** disulphide
- B** glycosidic
- C** hydrogen
- D** peptide