Enzymes – AS 9700 Biology Nov 2022

1. Nov/2022/Paper_11/No.12

A student was provided with two test-tubes, one containing 10 cm^3 of solution P and one containing 10 cm^3 of solution Q. When these solutions were mixed together and left for 24 hours, the concentration of P decreased but the concentration of Q remained the same.

The student wrote the following conclusions.

1 P may break down over time.

2 Q may be a biological catalyst.

3 P may be the substrate for Q.

Which conclusions could be supported by the information?

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

2. Nov/2022/Paper_11/No.13

Which statements are correct for the lock and key hypothesis **and** the induced fit hypothesis of enzyme action?

1 The substrate is the same shape as the active site.

2 The substrate is held in place in the active site by temporary bonds.

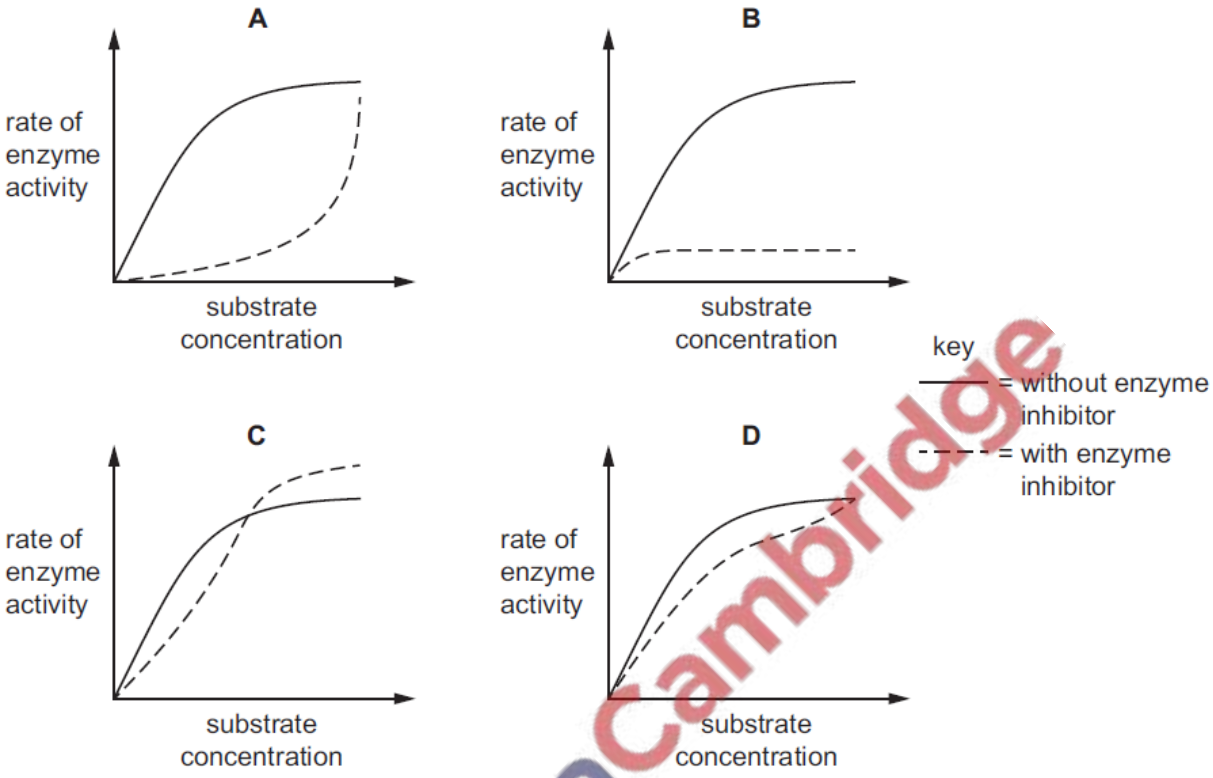
3 The enzyme and sometimes the substrate change shape slightly as the substrate molecule enters the enzyme.

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

3. Nov/2022/Paper_11/No.14

A student investigated the rate of enzyme activity with increasing substrate concentration. The experiment was repeated with the addition of a reversible non-competitive enzyme inhibitor. A graph was plotted to show the results.

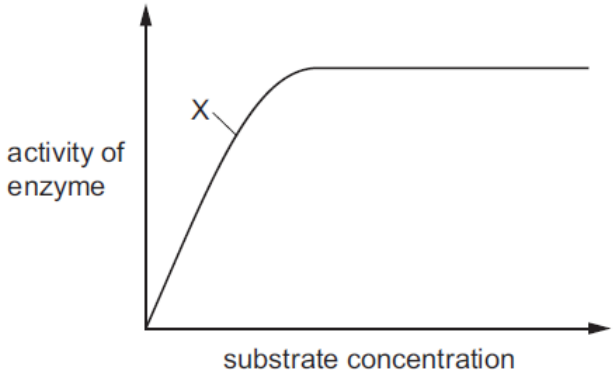
Which graph represents the results of the two experiments?



4. Nov/2022/Paper_12/No.13

A student investigated the effect of substrate concentration on the activity of an enzyme.

The graph shows the results of this investigation.



An increase in which factors could lead to a change in the activity of the enzyme at point X on the graph?

1 pH

2 substrate concentration

3 temperature

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

5. Nov/2022/Paper_12/No.14

The Michaelis–Menten constant, K_m, is the substrate concentration at which an enzyme works at half its maximum rate.

What is correct when the K_m value is low?

A The enzyme has a low affinity for the substrate and the quicker the reaction will proceed to its maximum rate.

B The enzyme has a low affinity for the substrate and the slower the reaction will proceed to its maximum rate.

C The enzyme has a high affinity for the substrate and the quicker the reaction will proceed to its maximum rate.

D The enzyme has a high affinity for the substrate and the slower the reaction will proceed to its maximum rate.

6. Nov/2022/Paper_13/No.13

Yeast contains the enzyme catalase which catalyses the breakdown of hydrogen peroxide (H_2O_2) as shown.

$$2H_2O_2 \xrightarrow{\text{catalase}} 2H_2O + O_2$$

Yeast was added to a solution of hydrogen peroxide and the total volume of oxygen released was recorded every 30 seconds for 2 minutes. All other variables were standardised.

The data is shown in the table.

time / s	total volume of O_2 / cm^3
30	157
60	251
90	283
120	285

What explains the pattern of the data?

A The rate of reaction increases as more enzyme–substrate complexes are formed.

B The rate of reaction increases as the enzyme reaches its maximum velocity (V_{max}).

C The volume of oxygen released decreases as the enzymes begin to denature.

D The volume of oxygen released decreases as more substrate is converted into product.

7. Nov/2022/Paper_11/No.14

The Michaelis–Menten constant, K_m, is a measure of the affinity of an enzyme for its substrate.

1 The higher the affinity, the lower the K_m.

2 The lower the affinity, the slower the reaction will be.

3 At K_m, half the active sites of the enzyme are occupied by the substrate.

Which statements about K_m are correct?

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

8. Nov/2022/Paper_11/No.1a(ii)

(a) Fig. 1.1 is a transmission electron micrograph showing a section of a human liver cell.

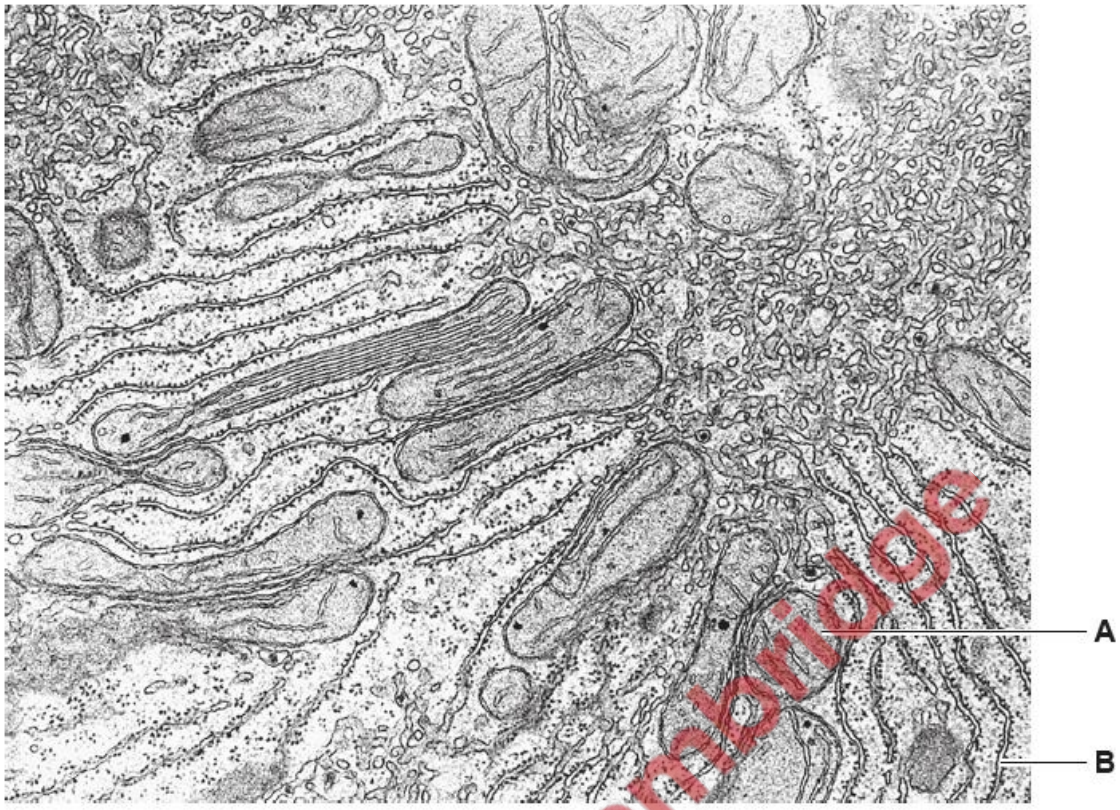


Fig. 1.1

(i) Name organelles **A** and **B** shown in Fig. 1.1.

A .....

B .....

[2]

(ii) In liver cells, enzymes are attached to the membrane of smooth endoplasmic reticulum.

With reference to the functions of smooth endoplasmic reticulum, suggest the advantages of having enzymes attached to the membrane rather than free in the lumen.

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..... [3]

9. Nov/2022/Paper_22/No.5(c)

(c) Hydrolytic enzymes, known as collagenases, are secreted by cells in an inactive form.

Cells also secrete inhibitors of collagenases. The activity of the enzymes and inhibitors is regulated so that the development and maintenance of the extracellular matrix is controlled.

(i) State **and** explain what the outcome will be for the composition of the extracellular matrix if collagenase inhibitor activity is needed.

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..... [2]

(ii) Synthetic inhibitors have been trialled as potential treatment for diseases caused by a lack of regulation of collagenase activity.

Research involves investigating the mechanism of action of an inhibitor.

State the effect that a **non-competitive** inhibitor will have on the maximum rate of reaction, V_{max}, and the Michaelis–Menten constant, K_m, of collagenase.

V_{max} .....

K_m .....

[2]