

APOLLO

Enzymes and metabolism

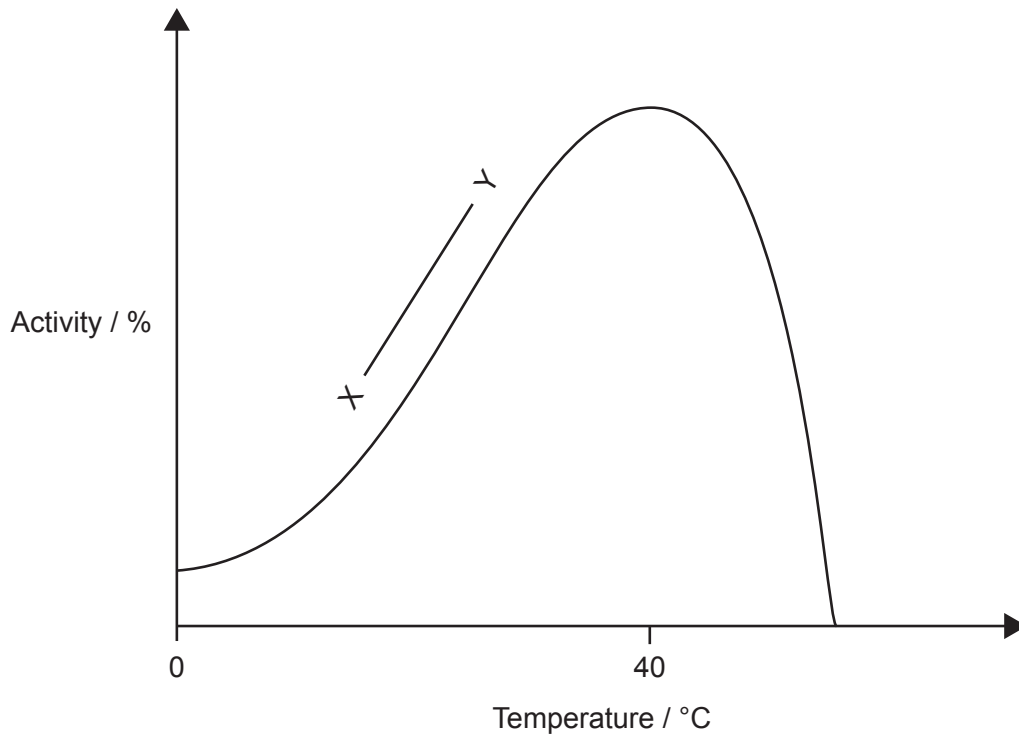
HL

Biology

First assessment 2025

11 questions | questions

5. The graph shows the activity of an enzyme as temperature increases.

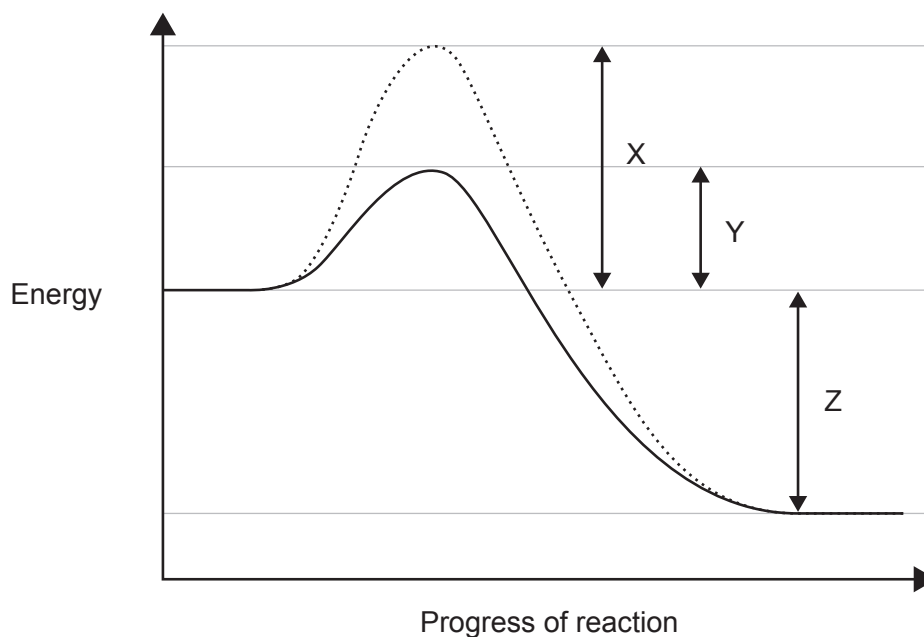


What explains the change in enzyme activity between X and Y?

- A. The enzyme is denaturing as the active site changes shape.
- B. Increased collisions occur as molecules are moving faster.
- C. Increased product concentration speeds up the reaction.
- D. An inhibitor has been added, reducing the number of active sites.

- 5.** Which process is an example of catabolism?
- A. Protein synthesis
 - B. Photosynthesis
 - C. Oxidation of substrates in respiration
 - D. Glycogen formation

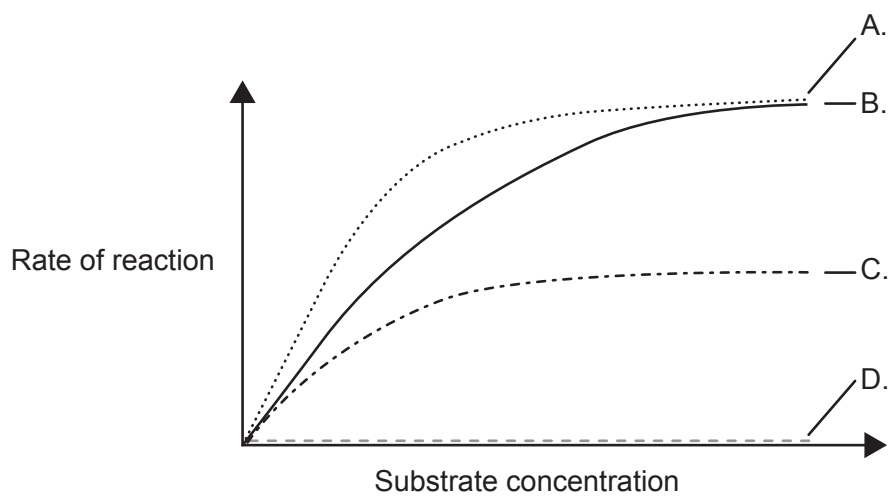
5. The graph shows energy changes during a reaction both with and without an enzyme present.



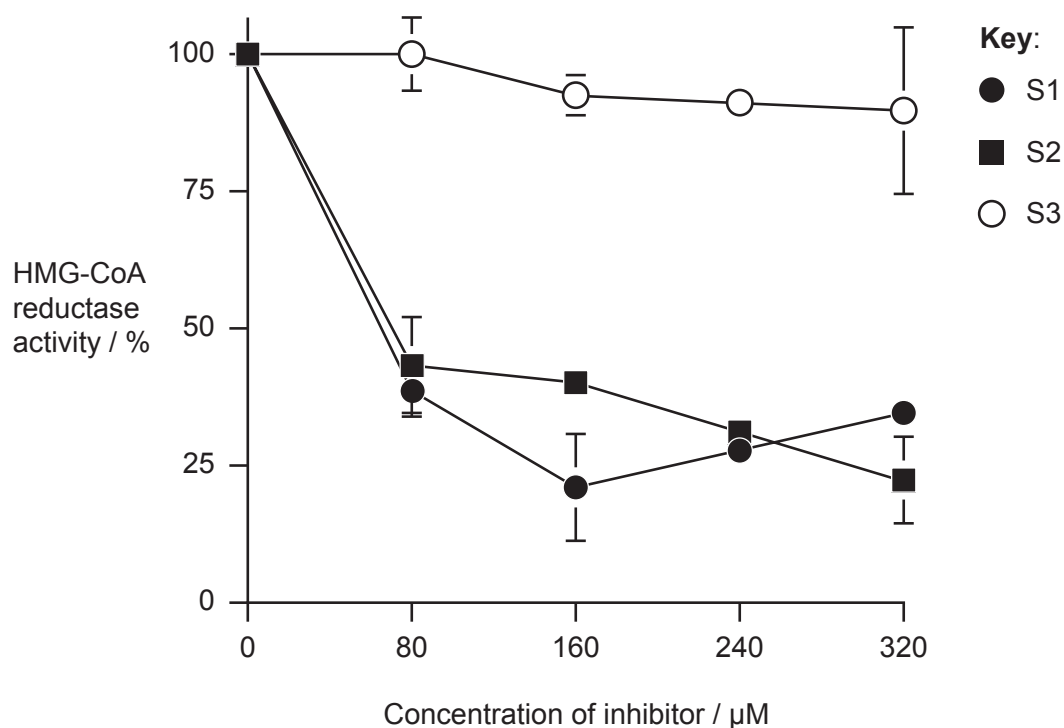
Which statement correctly identifies two of the regions labelled X, Y and Z in the graph?

- A. X is the activation energy with an enzyme and Z is the net energy released from the reaction.
- B. X is the energy released from the reaction and Y is the activation energy with an enzyme.
- C. Y is the energy released with an enzyme and Z is the energy released when bonds are broken.
- D. Y is the activation energy with an enzyme and Z is the net energy released.

6. The graph illustrates how enzyme-catalysed reactions can be affected by inhibitors. Which curve shows the effect of statins on the rate of cholesterol synthesis in the body?



3. The inhibitory effect of three different statins (S1, S2 and S3) on the activity of HMG-CoA reductase, an enzyme involved in cholesterol metabolism in the liver, was investigated.



- (a) (i) Identify an independent variable in this investigation.

[1]

.....

.....

- (ii) State **one** variable that needs to be controlled.

[1]

.....

.....

(This question continues on the following page)



(Question 3 continued)

- (b) Compare and contrast the effect of increasing concentrations of S1 and S2 on the mean activity of HMG-CoA reductase. [3]

- (c) Outline how the rate of reaction of HMG-CoA reductase can be calculated. [1]

- (d) Statins limit the synthesis of cholesterol by acting as competitive inhibitors. Distinguish between competitive and non-competitive inhibition. [1]

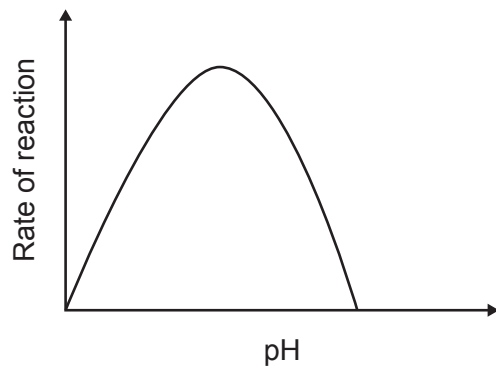
- (e) Describe the role of enzymes in **one named** process that prevents infections in the human body. [2]



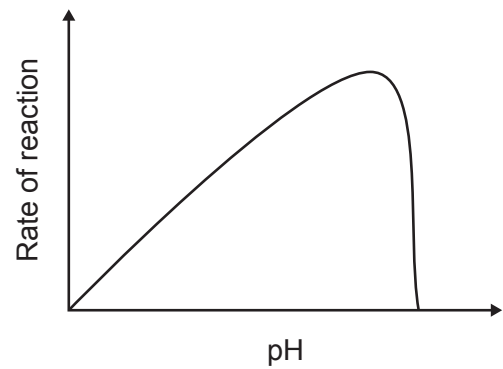
Turn over

5. Which graph shows the effect of pH on the rate of most enzyme-catalysed reactions?

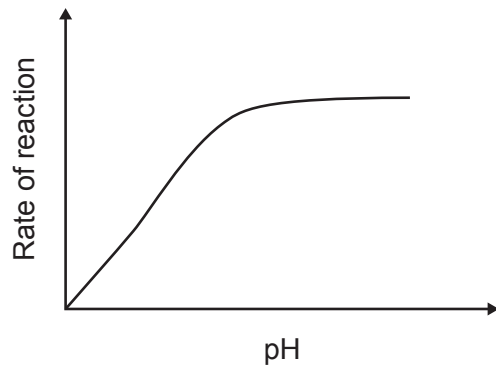
A.



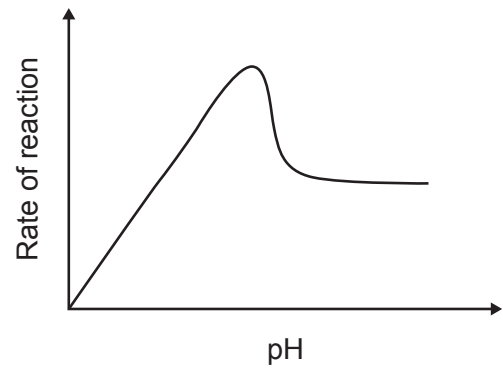
B.



C.



D.



6. A solution of laundry detergent containing enzymes was used to soak some blood-stained clothes in order to remove the stains. Each item of stained clothing was soaked in a solution of a different temperature. After one hour, the stains remaining on the clothes were measured on a colour intensity scale.

1	2	3	4	5
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lightest colour
(lowest intensity)



darkest colour
(highest intensity)

Temperature / °C	Colour intensity of stain
10	4
20	3
30	2
40	1
50	5

What is a valid explanation for these results?

- A. At 10 °C the enzymes denature.
- B. At 20 °C the shape of some enzyme active sites change.
- C. At 30 °C the enzyme and substrate molecules have the greatest kinetic energy.
- D. At 50 °C the chance of successful binding between enzyme and substrate is low.

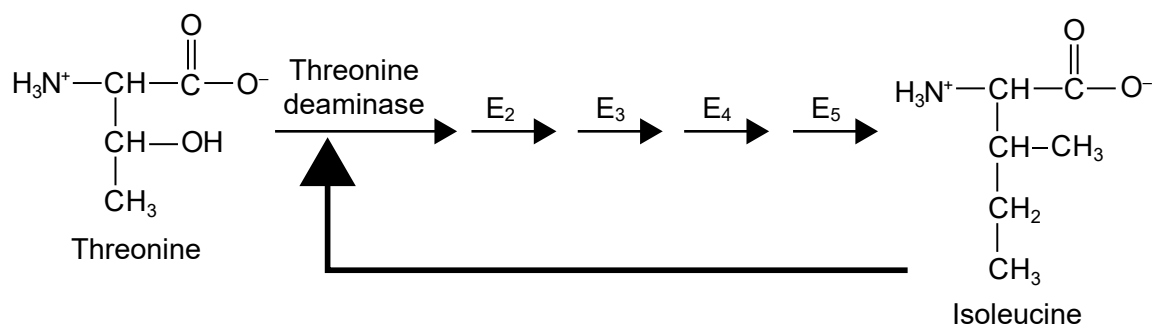
Section B

Answer **two** questions. One additional mark is available for the construction of your answers for each question. Answers must be written within the answer boxes provided.

9. The complementarity of shapes and chemical properties allows molecules to bind to each other.

- (a) Describe, with examples, the types of molecule within cell-to-cell signalling systems that are complementary to each other. [4]
- (b) Explain the possible causes of changes to enzyme active sites and the consequences of these changes. [7]
- (c) Outline how reversible changes to haemoglobin molecules increase the efficiency of oxygen transport within the human body. [4]

7. The diagram represents the metabolic pathway that converts threonine to isoleucine.



What is a feature of this pathway?

- A. The pathway is regulated by positive feedback.
- B. Isoleucine is a competitive inhibitor.
- C. Isoleucine is a substrate for threonine deaminase.
- D. Isoleucine is an allosteric inhibitor.

- 8.** What is a common feature of enzymes?
- A. They all react with substrates.
 - B. They all decrease the rate of reaction.
 - C. They are all secreted from cells in vesicles.
 - D. They all bind to the active site of their substrate.

Section B

Answer **two** questions. One additional mark is available for the construction of your answers for each question. Answers must be written within the answer boxes provided.

9. Various mechanisms can lead to inhibition in biological systems. A toxin is a substance capable of disrupting metabolic processes in organisms.
- (a) Describe how toxins such as DDT might concentrate in the bodies of birds. [4]
- (b) Toxins often act as inhibitors. Compare and contrast competitive and non-competitive enzyme inhibition. [7]
- (c) Rotenone is a naturally occurring toxin that blocks the electron transport chain in insects and fish. Outline the consequences of exposure to a toxin like rotenone for cell respiration. [4]