

APOLLO

Enzymes and metabolism

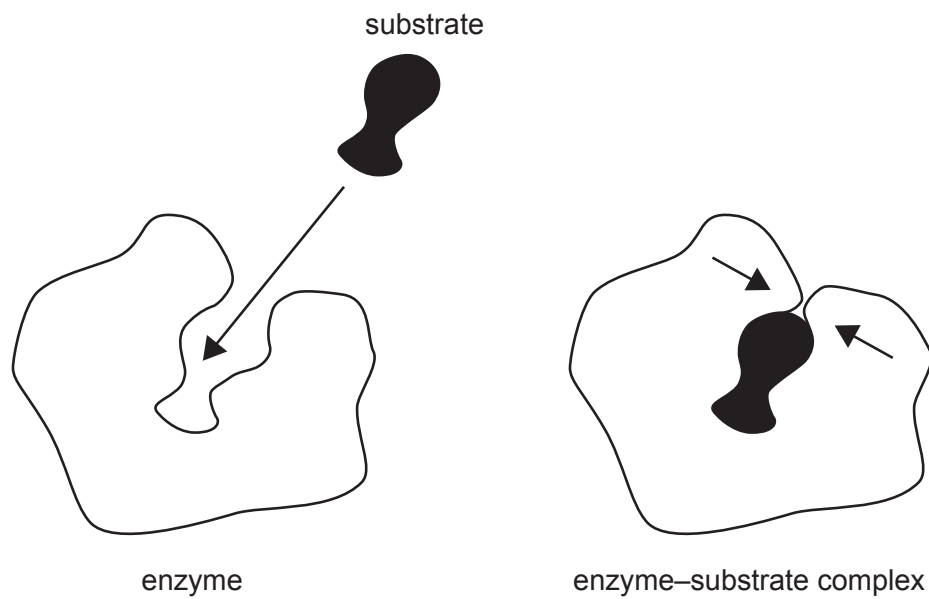
SL

Biology

First assessment 2025

7 questions | questions

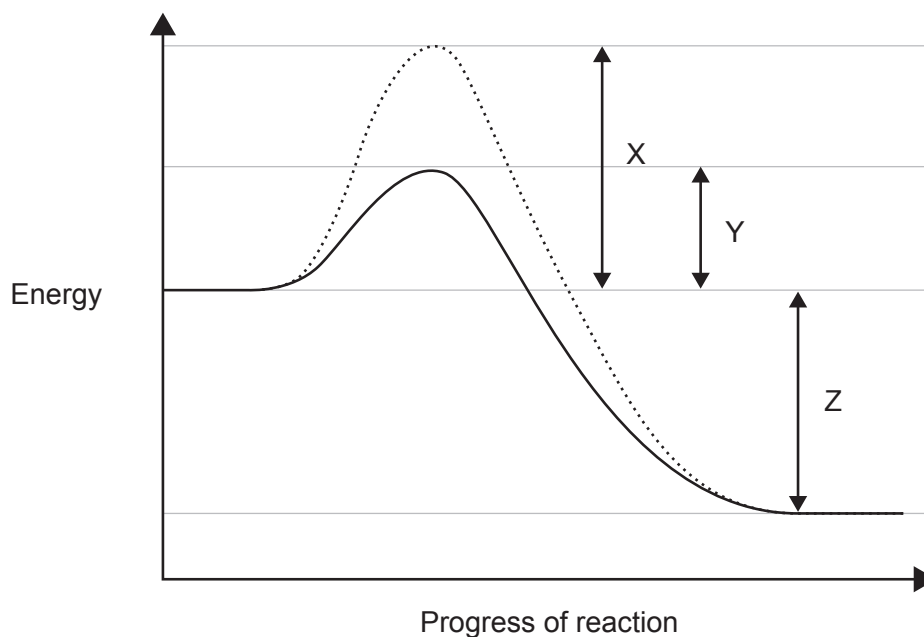
5. The diagram shows the formation of an enzyme–substrate complex.



What describes the process shown in the diagram?

- A. The lock and key hypothesis, as the substrate is complementary to the enzyme.
- B. The substrate permanently alters the shape of the enzyme's active site.
- C. The substrate and the active site have the same shape.
- D. The active site changes shape to accommodate the substrate in the induced-fit model.

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?

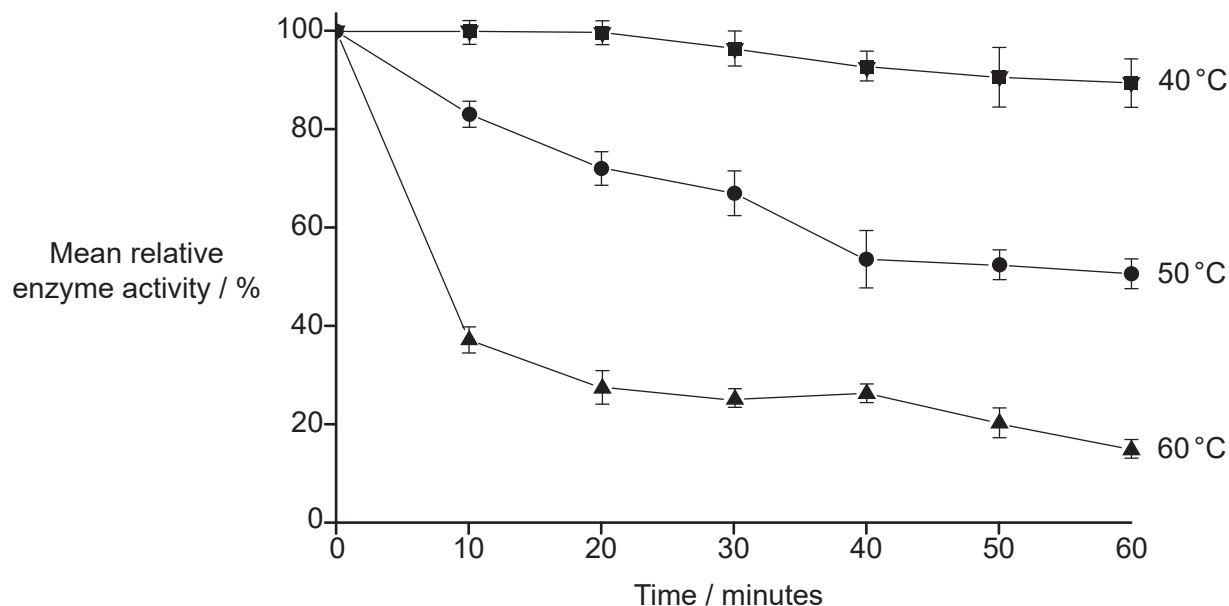
- A. X is the activation energy with an enzyme and Z is the net energy released from the reaction.
- B. X is the energy released from the reaction and Y is the activation energy with an enzyme.
- C. Y is the energy released with an enzyme and Z is the energy released when bonds are broken.
- D. Y is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

4. A scientist investigated the effect of storage temperature on the activity of an enzyme.

The scientist incubated three lipase solutions for one hour at three different storage temperatures (40 °C, 50 °C or 60 °C).

At every 10-minute interval, a sample of lipase solution was taken and immediately used to catalyse the digestion of a small volume of oil. The values were then compared to the results obtained at the optimum temperature for lipase (37 °C). Relative enzyme activity values were determined.

The graph shows the mean results of the investigation.



- (a) Identify the independent variable in this investigation.

[1]

.....

- (b) Identify **one** factor that needs to be controlled in this investigation.

[1]

.....

(This question continues on the following page)



(Question 4 continued)

- (c) Explain the relationship shown between storage temperature and relative enzyme activity.

.....

.....

.....

.....

- (d) Describe how the reliability of the results obtained in this investigation is indicated on the graph.

.....

.....

- (e) When oils are digested, fatty acids are produced. These reduce the pH of the reaction mixture. Explain how the rate of reaction could be measured in this investigation.

.....

.....

.....

.....



Disclaimer:

Content used in IB assessments is taken from authentic, third-party sources. The views expressed within them belong to their individual authors and/or publishers and do not necessarily reflect the views of the IB.

References:

1. PeterHermesFurian, 2017. *Onion epidermis with large cells under light microscope*. [image online] Available at: <https://www.gettyimages.co.uk/detail/photo/onion-epidermis-with-large-cells-under-light-royalty-free-image/655178448> [Accessed 29 April 2024]. Source adapted.
2. Reproduced from Gregory M. Preston et al., Appearance of Water Channels in *Xenopus* Oocytes Expressing Red Cell CHIP28 Protein, DOI: 10.1126/science.256.5055.385. 1992, AAAS.
3. Lezh, 2008. *Ixodid tick*. [image online] Available at: <https://www.gettyimages.co.uk/detail/photo/ixodid-tick-royalty-free-image/157332347> [Accessed 30 April 2024]. Source adapted.
4. Zheng, C., 2021. Study on enzymatic activity and lipase catalysis by lipase high-yield strain. Conf. Ser.: Earth Environ. Sci. 632 032016. <https://doi.org/10.1088/1755-1315/632/3/032016>. Source adapted.



Please **do not** write on this page.

Answers written on this page
will not be marked.



Please **do not** write on this page.

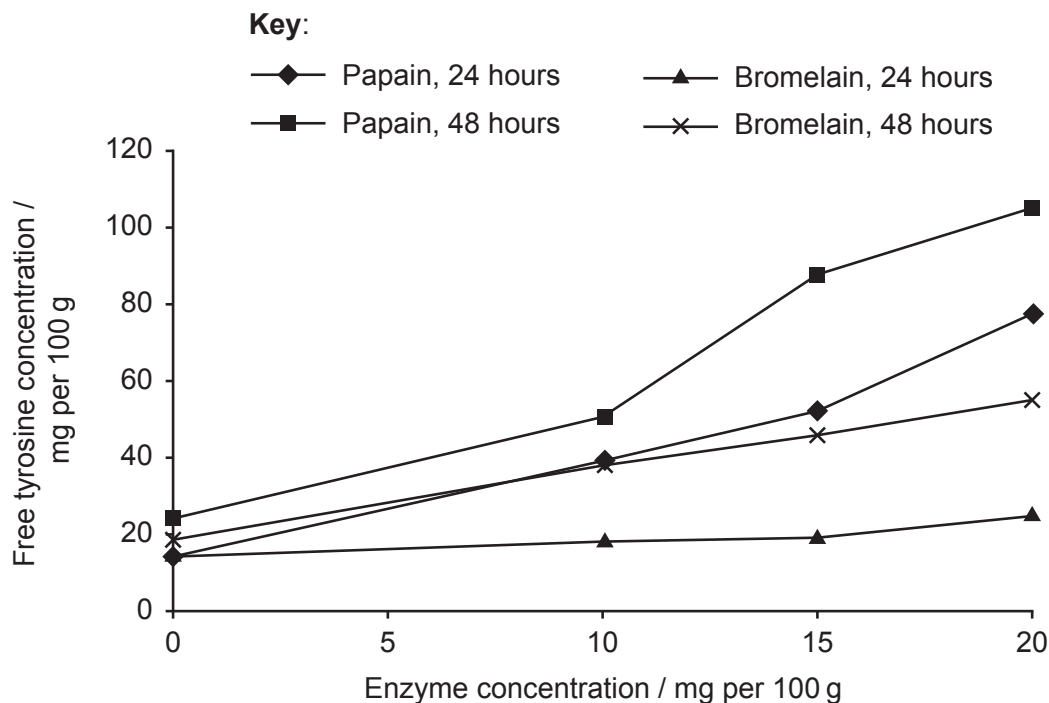
Answers written on this page
will not be marked.



4. Which are examples of anabolic and catabolic reactions?

	Anabolic reaction	Catabolic reaction
A.	hydrolysis of macromolecules into monomers	oxidation of substrates in respiration
B.	glycogen formation	hydrolysis of macromolecules into monomers
C.	oxidation of substrates in respiration	protein synthesis
D.	protein synthesis	glycogen formation

3. Protease enzymes break down (degrade) protein. The catalytic activity of the protease enzymes papain and bromelain on meat tenderization was evaluated by injecting the enzymes at different concentrations into beef. Meat tenderization was assessed by measuring the concentration of the amino acid tyrosine, which is released from proteins as they become degraded. The graph shows the effect of enzyme concentration after 24 and 48 hours.



- (a) State an independent variable in this experiment.

[1]

.....

.....

- (b) Outline the effect of increasing the papain concentration on the free tyrosine concentration.

[1]

.....

.....

(This question continues on the following page)



(Question 3 continued)

(c) Distinguish between the results for bromelain activity at 24 hours and at 48 hours. [2]

.....

.....

.....

.....

(d) Justify the use of the concentration of amino acids, such as tyrosine, to assess protease enzyme activity. [3]

.....

.....

.....

.....

.....

.....



Turn over

- 5.** 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.

7. What is a reason that Taq polymerase is a suitable enzyme for use in the polymerase chain reaction (PCR)?
- A. It can work at a wide range of pH.
 - B. It works at higher temperatures than most enzymes.
 - C. It can separate two strands of DNA.
 - D. It allows DNA to be replicated without the use of primers.