

Enzymes

Question Paper 2

Level	A Level
Subject	Biology
Exam Board	OCR
Module	Foundations in Biology
Topic	Enzymes
Booklet	Question Paper 2

Time allowed: 49 minutes

Score: /36

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E
>69%	56%	50%	42%	34%	26%

Question 1

What is the correct definition of the term **coenzyme**?

- A. An inorganic ion that forms the centre of a globular protein.
- B. A molecule that binds to the enzyme, changing the shape of the active site, preventing an enzyme substrate complex from forming.
- C. A non-protein organic molecule, not permanently attached to an enzyme, but needed to allow the enzyme to function.
- D. A metal ion that attaches to the enzyme, changing the shape of the active site, increasing the likelihood of a reaction.

[1]

Question 2

Some inorganic ions have roles in enzyme-controlled reactions.

Which of the rows, **A** to **D**, in the table below is correct?

	Role of ion	
	Cofactor for amylase	Prosthetic group for carbonic anhydrase
A	Zn^{2+}	Cl^{-}
B	Zn^{+}	Cl^{-}
C	Cl^{2-}	Zn^{+}
D	Cl^{-}	Zn^{2+}

[1]

Question 3

Zinc ions are necessary for the enzyme carbonic anhydrase to work.

Which statement correctly describes the nature and function of zinc ions in their interaction with carbonic anhydrase?

- A inorganic ions and coenzymes
- B vitamins and prosthetic groups
- C inorganic ions and prosthetic groups
- D vitamins and coenzymes

[1]

Question 4

Enzymes are important molecules in living organisms.

(a) (i) A student decided to use the biuret test to detect the presence of enzyme in a solution.

Outline the procedure the student should follow in order to detect the presence of enzyme in a solution using the biuret test. [2]

(ii) State why the structure of enzyme molecules allows them to be detected **in solution** using the biuret test. [1]

(b) The student wished to determine the mass of enzyme in 250 cm^3 of an enzyme solution of unknown concentration.

To determine the concentration of this enzyme solution, the student first carried out the biuret test on three enzyme solutions of known concentration:

- solution 1 0.5 mg cm^{-3} of enzyme
- solution 2 1.0 mg cm^{-3} of enzyme
- solution 3 2.0 mg cm^{-3} of enzyme

After completing the biuret tests, the absorbance of light by each solution was measured using a colorimeter. The student plotted a graph of the results. The graph is shown in Fig. 3.1.

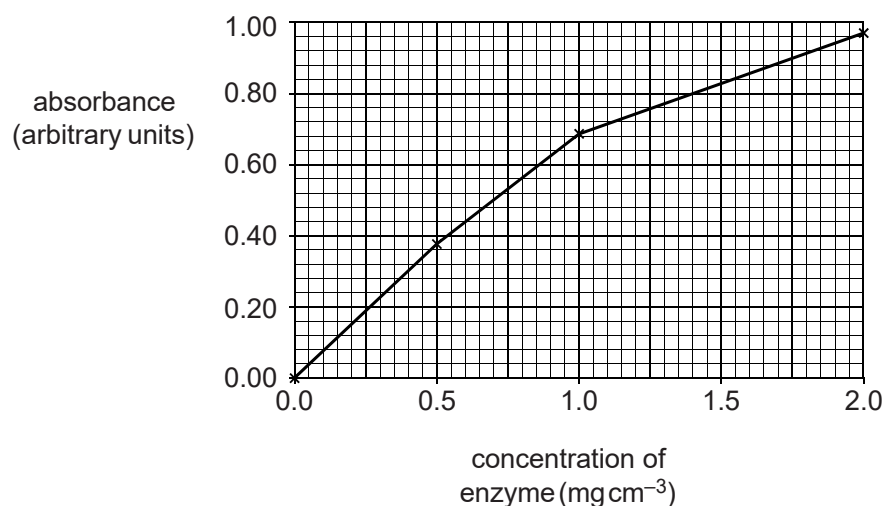


Fig. 3.1

- (i) The student then carried out the same procedure on the enzyme solution of unknown concentration.

The absorbance reading on the colorimeter was 0.8 arbitrary units.

Using the line drawn by the student in Fig. 3.1, determine the concentration of the enzyme solution.

Calculate the **mass** of enzyme, **in grams**, in 250 cm³ of the enzyme solution. Show your working. Give your answer to **two** decimal places.

[2]

- (ii) The student performed the calculation correctly. However, the teacher said that the value for the mass of enzyme given by the student was inaccurate.

Explain how the student's **method** could be improved to increase the accuracy of this value.

[2]

- (iii) Outline the practical procedures the student would have taken to generate the point on the graph at the origin (0.0, 0.00).

[2]

(c) Some enzymes work better in the presence of other molecules or ions.

Explain how these molecules or ions increase the activity of enzymes.

[5]

[Total: 14]

Question 5

Pepsin is an enzyme that digests protein foods in the mammalian stomach.

(a) Protein molecules are made from chains of amino acids.

(i) Name the covalent bond between two adjacent amino acids in a chain of amino acids.

[1]

(ii) Name the type of reaction involved in breaking this bond **and** describe what happens in this reaction.

[2]

(b) Describe how an enzyme, such as pepsin, breaks down a substrate.

[5]

(c) A student investigated how changing the pH affected the activity of pepsin.

- He used a blender to make a suspension of egg white (protein) in water.
- At the start of the investigation the suspension was cloudy.
- He prepared fixed concentrations of egg white suspension, acid and pepsin to add to each of six test-tubes.
- He removed 0.1 cm³ of the mixture from each test-tube and used universal indicator to measure the pH of each mixture.
- He incubated each test-tube in a water bath at 35 °C and timed how long it took for the egg white suspension in each tube to clear.
- He prepared a table in which he recorded his results (Table 1.1).

Tube	Volume of egg white suspension	Volume of acid added (cm ³)	Amount of pepsin added (cm ³)	Measured pH	Time for suspension to clear (m)
1	5	2.0	3.0	1	
2	5	1.5	3.0	2	
3	5	1.0	3.0	3	
4	5	0.5	3.0	4	
5	5	0.0	3.0	5	
6	5	2.0	0.0	1	

Table 1.1

- (i) Identify **three** errors the student made in the preparation of his **table** before he recorded his results. [3]
- (ii) Identify a change the student could make to his procedure that would increase the **validity** of the investigation. [1]
- (iii) State the term that best describes the purpose of **tube 6**. [1]
- (iv) Another student suggested that he should repeat the investigation at least twice.
How would this have improved the investigation? [2]

(d) Fig. 1.1 shows the effect of increasing the substrate concentration on the rate of activity of pepsin.

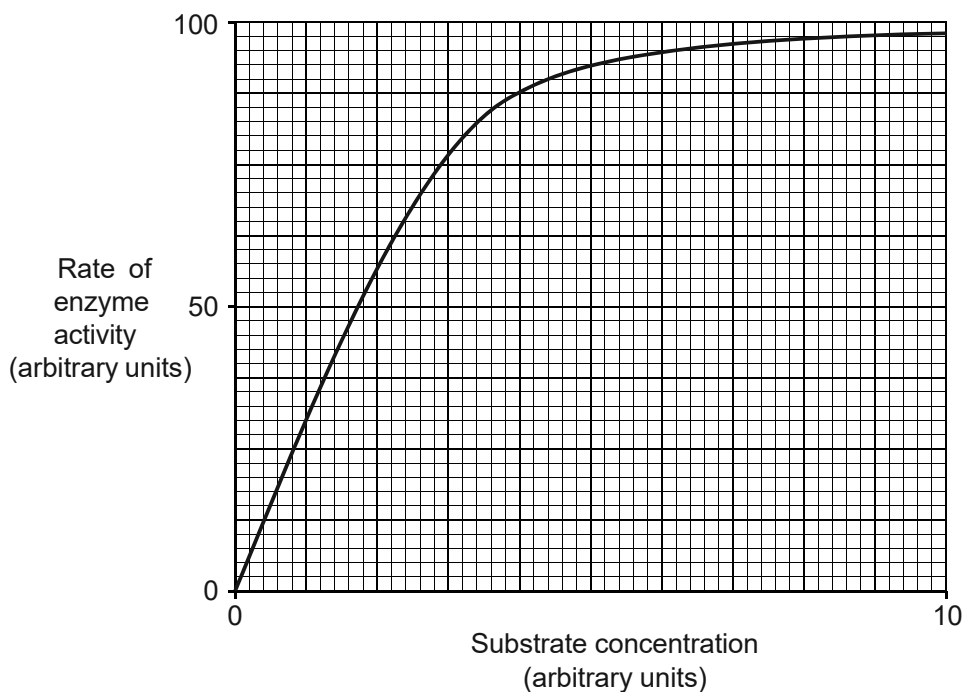


Fig. 1.1

(i) Pepstatin is a competitive inhibitor of pepsin.

On Fig. 1.1, draw a line to represent the effect of adding a fixed concentration of pepstatin on the rate of pepsin activity over the whole range of substrate concentrations. **[2]**

(ii) Pepstatin acts as a competitive inhibitor of pepsin.

What can you conclude about the structure of pepstatin? **[2]**

[Total: 19]