

Enzymes

Question Paper 1

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Enzymes
Sub Topic	Enzymes
Booklet	Theory
Paper Type	Question Paper 1

Time Allowed : 64 minutes

Score : / 53

Percentage : /100

Grade Boundaries:

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

1 (a) Fig. 4.1 shows two ways in which enzymes interact with their substrates.

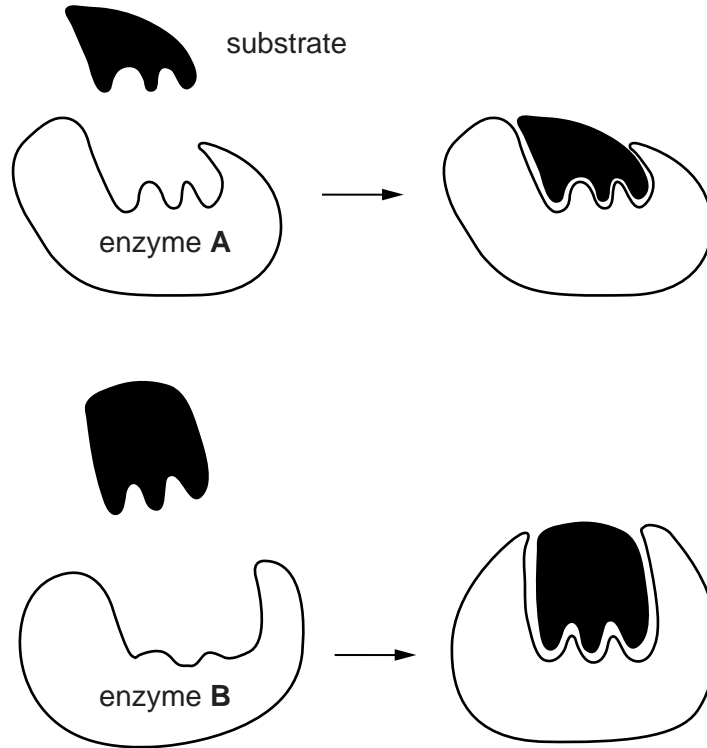


Fig. 4.1

Explain the difference between the two ways in which enzymes interact with their substrates as shown in Fig. 4.1.

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[3]

- (b) Carbonic anhydrase is an enzyme that is found in blood, liver and kidneys. Fig. 4.2 shows a molecular model of this enzyme.

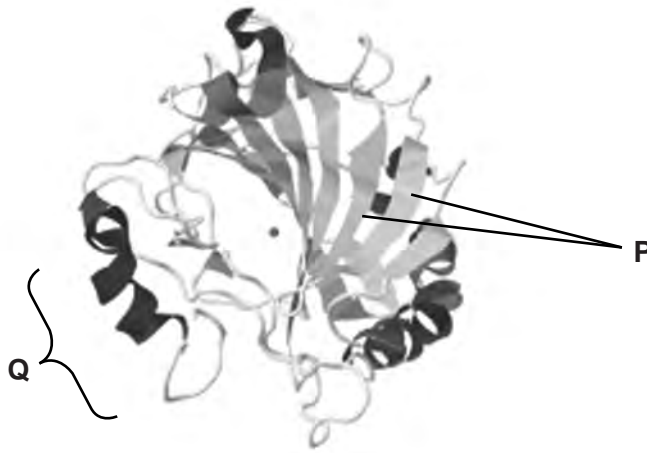


Fig. 4.2

- (i) With reference to Fig. 4.2 and the parts labelled P and Q, explain the term *secondary structure*.

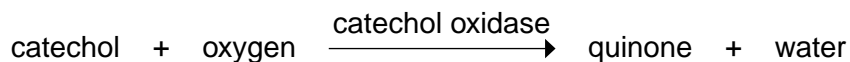
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- (ii) Describe the role of carbonic anhydrase in the blood.

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- 3 The enzyme, catechol oxidase, causes a brown colour to develop when slices of many fruits, such as apples, are exposed to air.

The enzyme catalyses the following reaction:



Quinone is then immediately further oxidized in air to a brown-coloured substance. Catechol and quinone are colourless.

A student investigated the rate of this reaction under different conditions.

- (a) State how the student could follow the progress of this reaction.

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In the first investigation, the student measured the initial rate of the reaction in varying concentrations of catechol. The results are shown in Fig. 4.1.

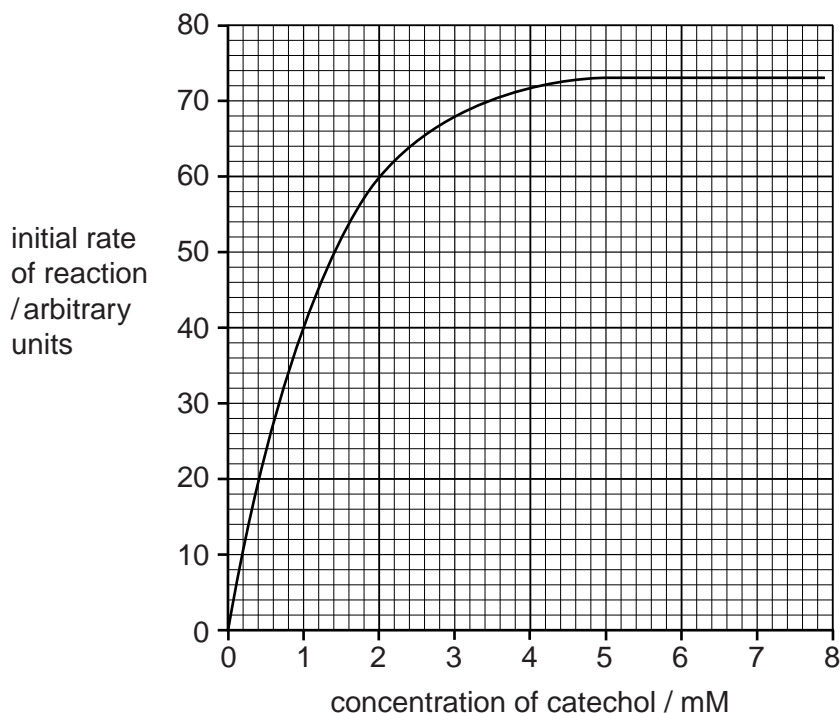


Fig. 4.1

(b) Explain the results shown in Fig. 4.1.

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(c) In a second investigation, the student repeated the experiment, but this time added a competitive inhibitor, para-hydroxybenzoic acid (PHBA), to each reaction mixture.

(i) Sketch on Fig. 4.1 the results that would be obtained for this second investigation. [2]

(ii) Explain the effect that PHBA will have on the action of phenoloxidase.

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(d) Lemon juice contains citric acid. Adding even a small amount of diluted lemon juice to apple slices slows the appearance of the brown colour.

Suggest an explanation for this observation.

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4 The enzyme sucrase catalyses the breakdown of the glycosidic bond in sucrose.

A student investigated the effect of increasing the concentration of sucrose on the rate of activity of sucrase.

Ten test-tubes were set up with each containing 5 cm³ of different concentrations of a sucrose solution. The test-tubes were placed in a water bath at 40 °C for ten minutes. A flask containing a sucrase solution was also put into the water bath.

After ten minutes, 1 cm³ of the sucrase solution was added to each test-tube. The reaction mixtures were kept at 40 °C for a further ten minutes.

After ten minutes, the temperature of the water bath was raised to boiling point. Benedict's solution was added to each test-tube. The time taken for a colour change was recorded and used to calculate rates of enzyme activity.

The results are shown in Fig. 4.1.

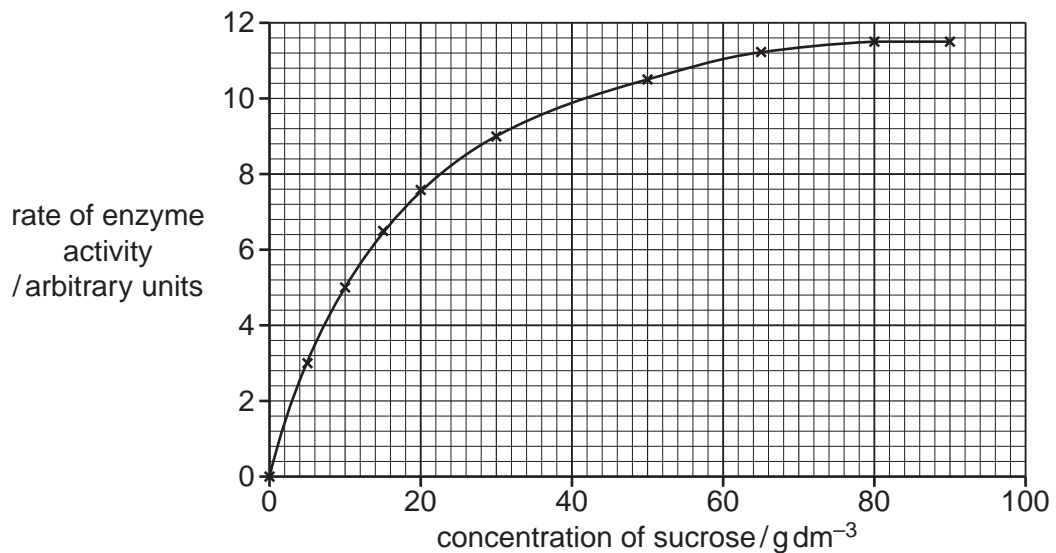


Fig. 4.1

(a) (i) Name the type of reaction catalysed by sucrase.

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(ii) Explain why the temperature of the water was raised to boiling point.

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- 5 Both sorghum and maize are important food crops in dry regions of the world, but sorghum is able to produce higher yields than maize in very dry conditions.

This is partly because sorghum plants have a smaller leaf area than maize, and also because sorghum leaves have rows of motor cells along the midrib of the upper surface of the leaf, allowing the leaves to roll up.

- (a) Explain how **these two** features adapt sorghum plants for growth in very dry conditions.

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- (b) Sorghum is a staple food in Africa, but the major storage protein that it contains, kaffirin, is not easily digested by protease enzymes. The main cause of this is cross-linking between kaffirin molecules.

The digestibility of the protein in five varieties of sorghum was measured when raw, and after cooking. Digestibility was measured as the percentage of the protein that would be broken down to amino acids during digestion.

The results are shown in Fig. 5.1.

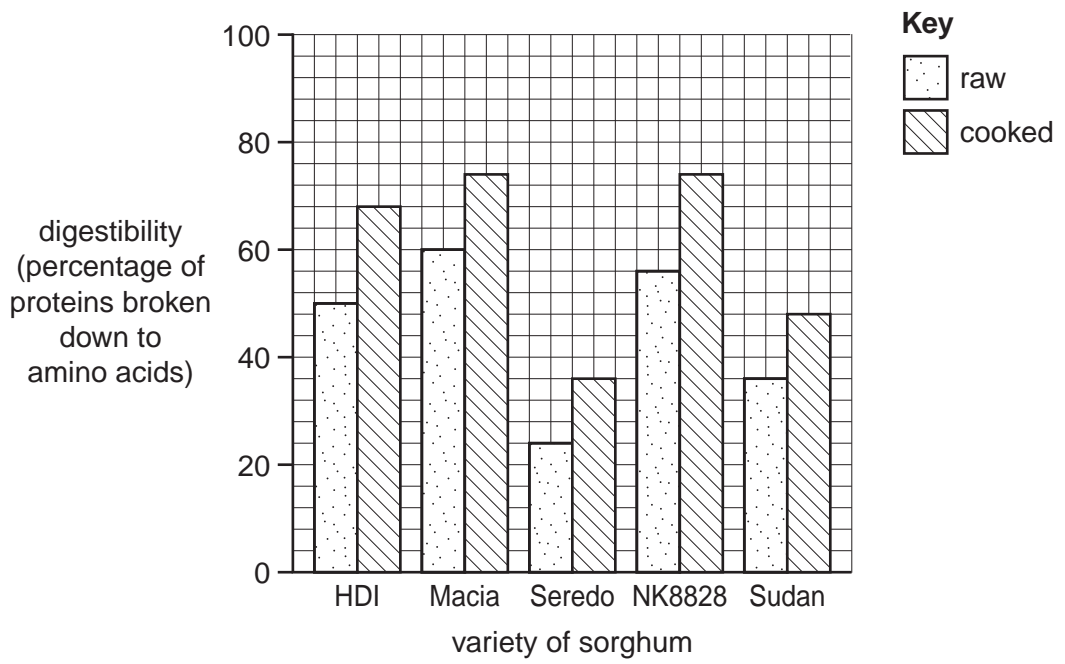


Fig. 5.1

With reference to Fig. 5.1

- (i)** compare the digestibility of raw and cooked sorghum protein

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- (ii)** using your knowledge of protein structure and enzyme activity, suggest reasons for the differences you have described in **(i)**.

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[Total: 8]