1 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.

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..... **[2]**

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

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..... **[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 cm^3 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.

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3 .....

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[3]

(ii) Identify a change the student could make to his procedure that would increase the **validity** of the investigation.

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..... **[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?

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..... **[2]**

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

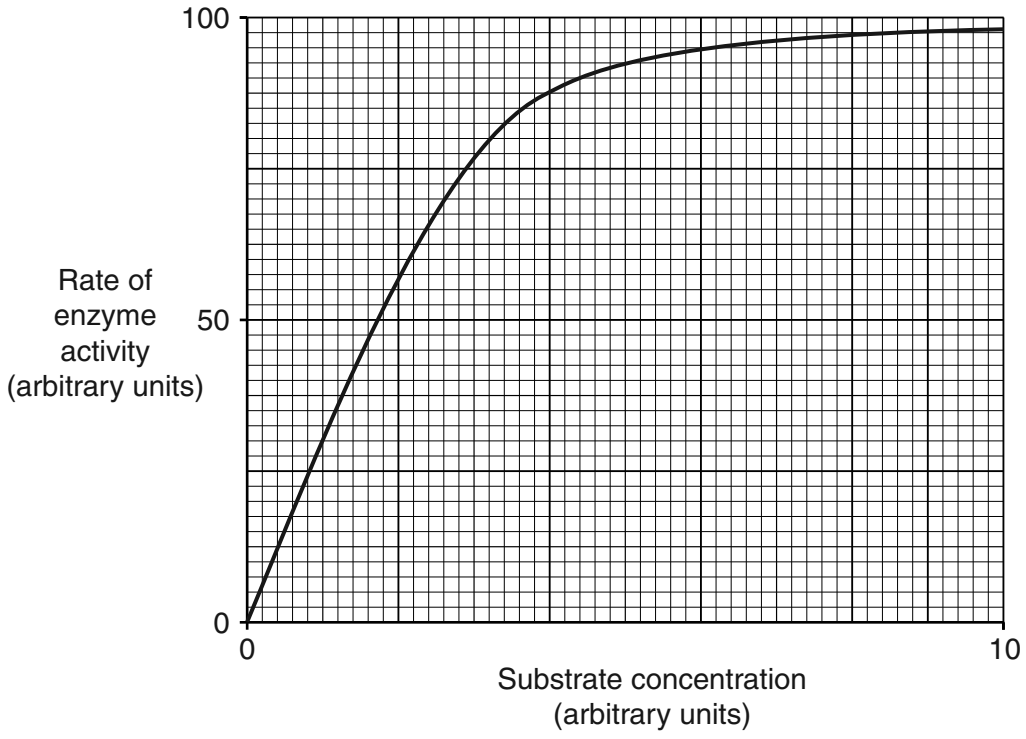


Fig. 1.1

(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.

..... *This should be answered on Fig. 1.1* .....**[2]**

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

What can you conclude about the structure of pepstatin?

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..... **[2]**

[Total: 19]

2 **(a)** An investigation was carried out into the effect on lung function on giving up smoking.

The investigators measured the maximum volume of air that could be exhaled in one second (FEV_1) in a group of people who had stopped smoking, and in a similar group of people who continued to smoke over a five year period.

The results are shown in Fig. 5.1.

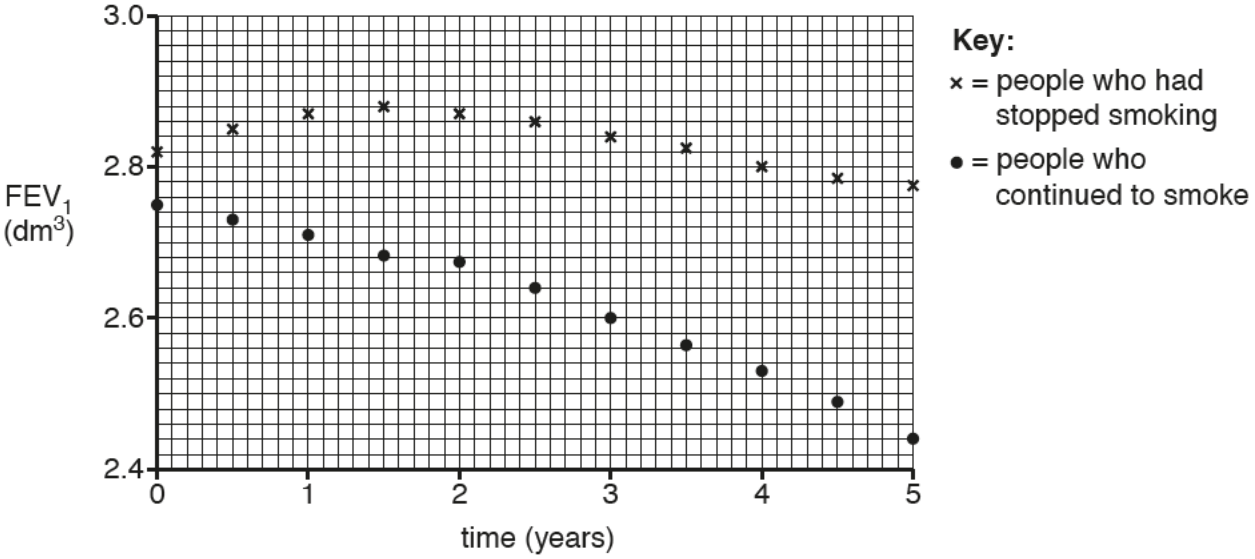


Fig. 5.1

(i) Using the information in Fig. 5.1, calculate the percentage decrease in the FEV_1 over the 5 year period for the group of people who **continued to smoke**.

Show your working. Give your answer to **one decimal place**.

Answer = ... % **[2]**

(ii) Describe the trends shown by the results in Fig. 5.1.

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..... **[4]**

(b) (i) One of the symptoms of smoking is the development of a smoker's cough.

Explain how smoking causes a smoker's cough **and** how the cough itself can lead to further problems in the lungs over a long period of time.



In your answer you should clearly distinguish between the development of the cough and the effects of prolonged coughing.

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(ii) Chronic obstructive pulmonary disease (COPD) is a combination of diseases that can result in coughing, breathing difficulties and fatigue.

Name **two** specific diseases that contribute to COPD.

1 .....

2 ..... **[2]**

(iii) One form of COPD develops because enzymes are released by phagocytes entering the alveoli. This enzyme action can break down elastin in the lining of the bronchioles and alveoli.

Use the example of elastin breakdown to explain the induced-fit hypothesis of enzyme action.

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..... **[5]**

[Total: 20]

3 In the search for new biofuels, research has been done into the digestion of wood waste by fungi.

The cellulase enzymes produced by the fungi break cellulose into sugars. These sugars can then be converted into ethanol, a biofuel.

Fig. 3.1 shows the stages in this digestion process.

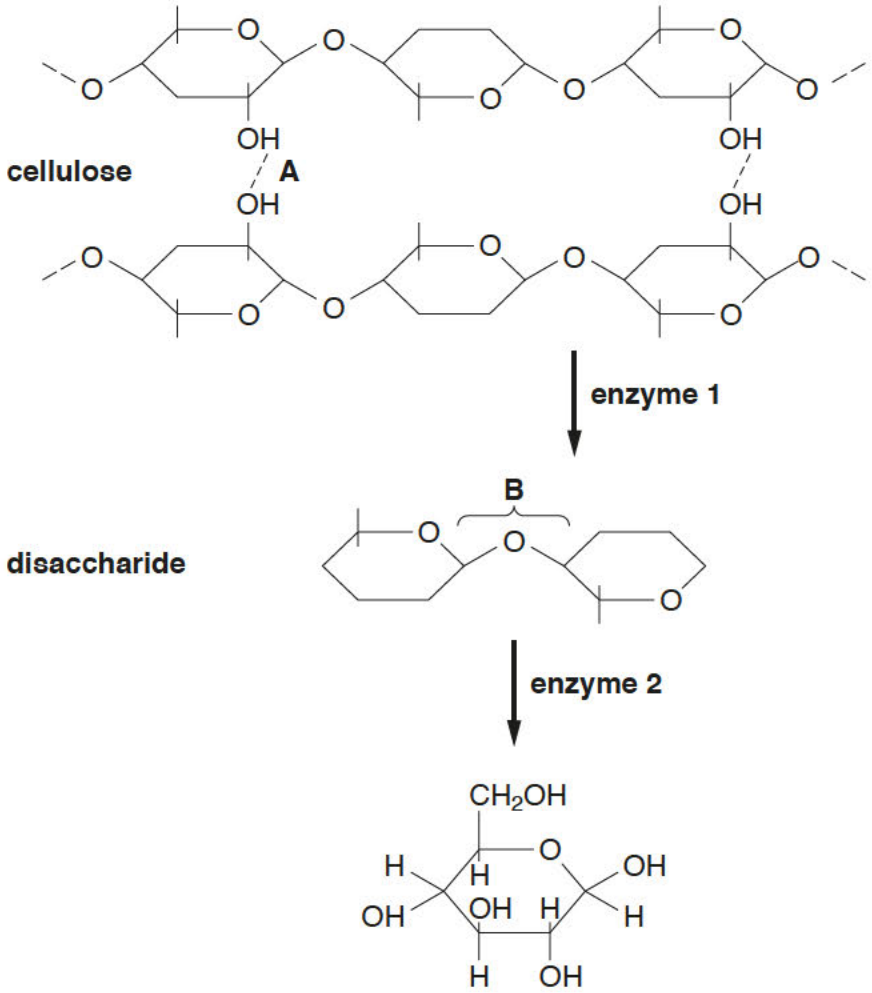


Fig. 3.1

(a) (i) Name bonds **A** and **B** shown in Fig. 3.1.

A .....

B ..... **[2]**

(ii) State how bond **B** is broken in the digestion of the disaccharide.

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..... **[1]**

(iii) Name the sugar that is the **final** product of this digestion process.

..... **[1]**

(b) Explain why **different** enzymes are involved in each stage of the digestion process.

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..... **[3]**

(c) Fig. 3.2 shows the effect of changing pH on the rate of activity of **enzyme 2**.

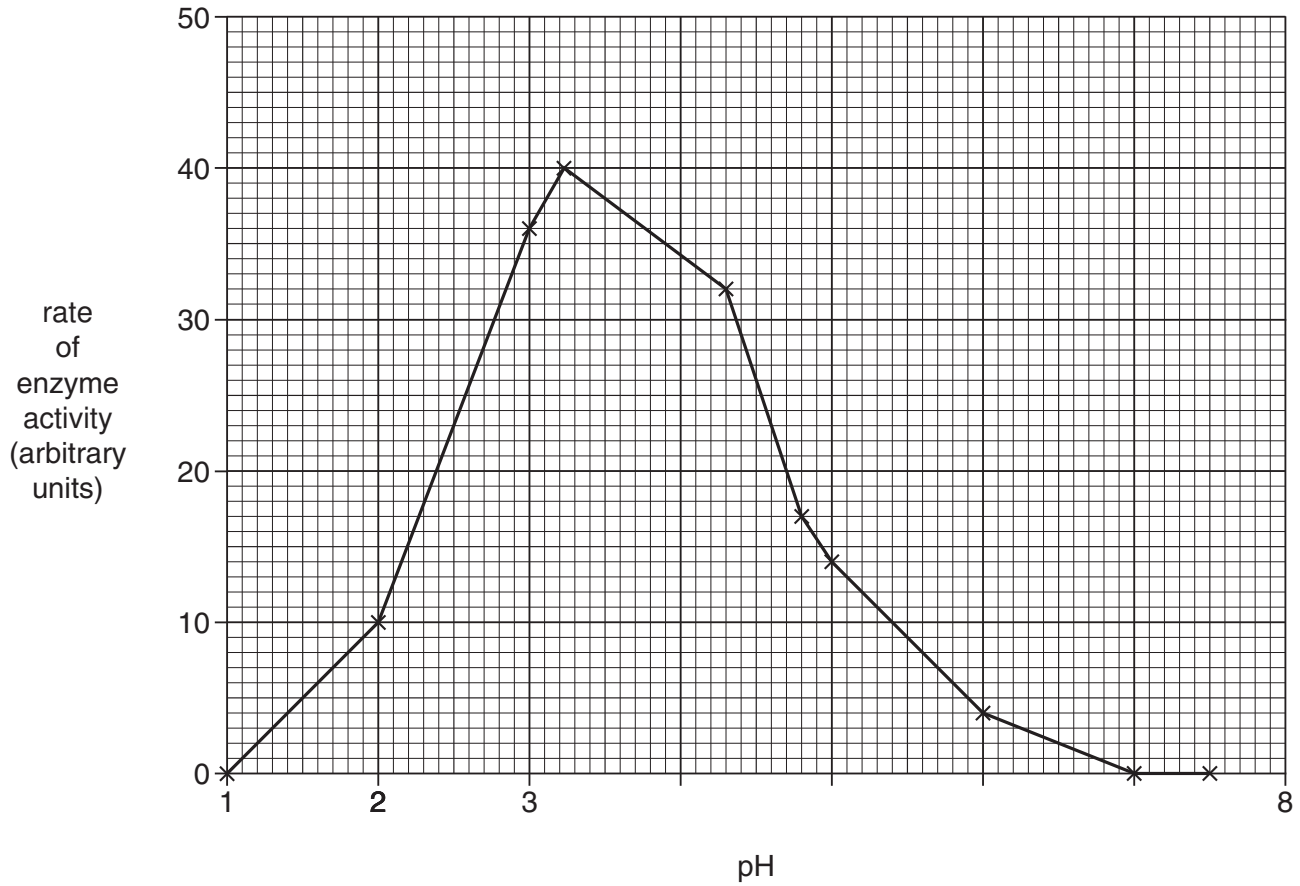


Fig. 3.2

(i) Explain why the activity of **enzyme 2** falls to zero at pH 7.

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..... **[3]**

(ii) State **two** factors that should have been controlled when investigating the effect of pH on the activity of **enzyme 2**.

1 .....

2 ..... **[2]**

(d) The activity of an enzyme can be measured by testing for the concentration of its product at regular intervals.

Describe how the concentration of a reducing sugar can be measured using a colorimeter.

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..... **[6]**

[Total: 18]