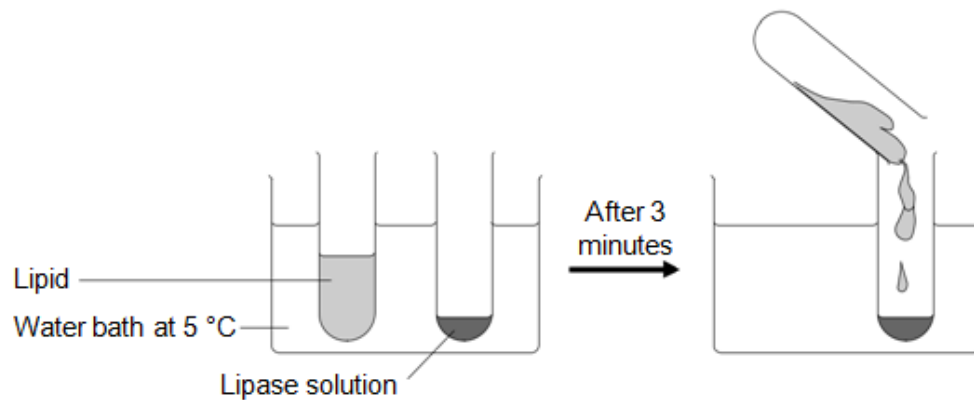


Enzyme and Digestion 4

Q:1 A group of students investigated the effect of temperature on the action of the enzyme lipase.

The students:

- ☐ put 1 cm³ of lipase solution into a test tube
- ☐ put 5 cm³ of lipid into a different test tube
- ☐ put both tubes in a water bath at 5 °C for 3 minutes
- ☐ mixed the lipid with the lipase solution.



Every five minutes the students tested a sample of the mixture for lipid, until no lipid remained.

The students repeated the experiment at different temperatures.

(a) To make their investigation fair the students needed to control some variables.

Give one variable the students controlled in their investigation.

(1 mark)

(b) The tubes of lipase solution and lipid were kept separately in the water bath for 3 minutes before mixing. Why?

Tick (☑) one box.

So that the lipase broke down the lipid quickly

So that the lipase and the lipid reached the right temperature

To give enough time for the lipase to break down the lipid

To give enough time for the water bath to heat up

(1 mark)

The table shows the students' results.

Temperature in °C	Time taken until no lipid remained in minutes
5	40
20	15
35	5
50	30
95	lipid still there after 120 minutes

(c) Describe the effect on the breakdown of the lipid of increasing the temperature from 5 °C to 50 °C.

(2 marks)

(d) Suggest two ways in which the students could have improved their investigation.

Use information from the students' method and the results table to help you.

1 _____

2 _____

(2 marks)

(e) (i) The lipase did not break down the lipid at 95 °C.

Why?

(1 mark)

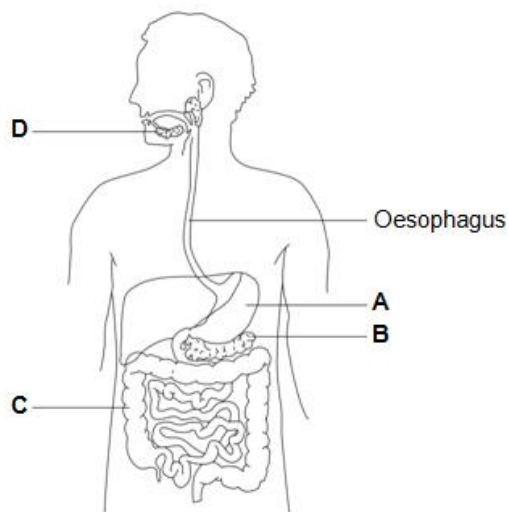
(e) (ii) At 35 °C the lipase broke down the lipid after 5 minutes. What new substances will be in the tube?

Draw a ring around one answer.

amino acids fatty acids and glycerol sugars

(1 mark)

Q:2 The diagram shows the human digestive system.



(a) Heartburn is a burning feeling caused when acid enters the oesophagus. The acid comes from the stomach.

(a) (i) Which letter on the diagram shows the stomach?



(1 mark)

(a) (ii) Name the acid the stomach produces.

(1 mark)

(a) (iii) Medicines taken to treat heartburn contain chemicals that neutralise excess stomach acid.

What type of chemical will neutralise stomach acid?

(1 mark)

(b) Use words from the box and your own knowledge to describe how carbohydrates are digested.

amylase starch sugars

(5 marks)

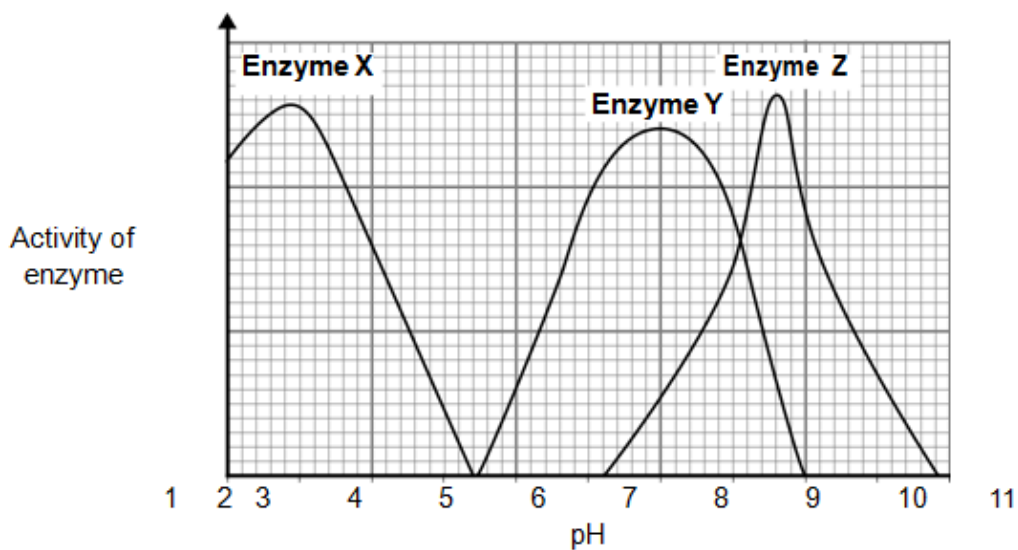
(c) Where in the body are the products of digestion absorbed?

(1 mark)

Q:3 (a) The graph shows the effect of pH on the activities of three enzymes, X, Y and Z.

These enzymes help to digest food in the human digestive system.

Each enzyme is produced by a different part of the digestive system.



(a) (i) What is the optimum (best) pH for the action of enzyme Z?

(1 mark)

(a) (ii) The stomach makes a substance that gives the correct pH for enzyme action in the human stomach.

Name this substance.

(1 mark)

(a) (iii) Which enzyme, X, Y or Z, will work best in the human stomach?

(1 mark)

(b) In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Different parts of the human digestive system help to break down molecules of fat so that they can be absorbed into the body.

Describe how.

To gain full marks you should refer to:

- the enzyme and where the enzyme is produced
- the products of digestion
- any other chemicals involved.

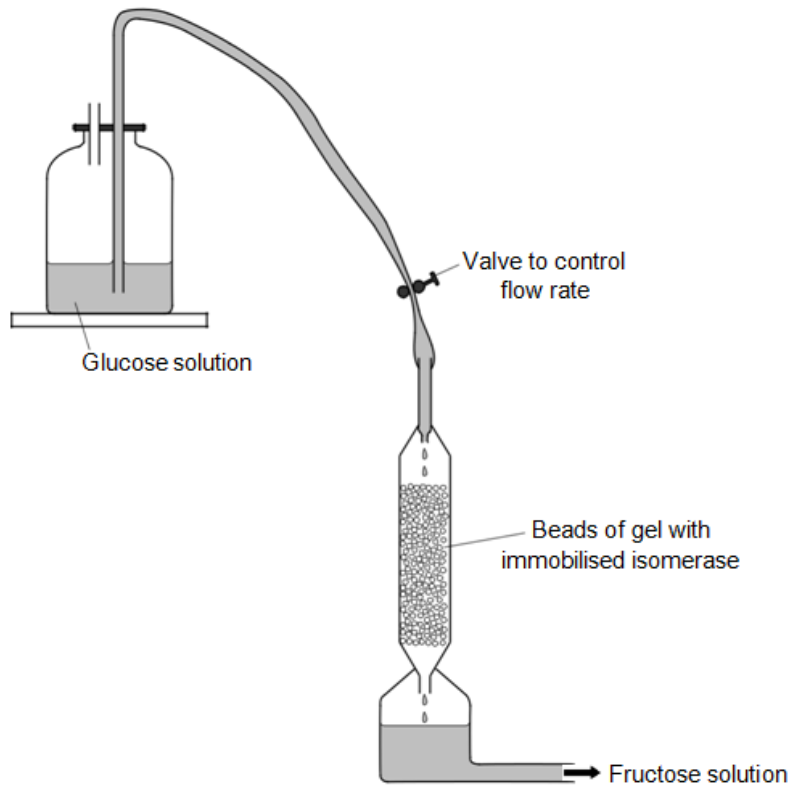
(6 marks)

Q:4 Isomerase is an enzyme which can change glucose into fructose. Fructose is often used instead of glucose in products like slimming foods.

In industry, isomerase is often 'immobilised' within beads of gel. The beads are placed in a glass column.

The isomerase stays attached to the beads and a solution of glucose is allowed to flow between the beads in the column.

The diagram shows how immobilised isomerase is used.



(a) An alternative method of changing glucose into fructose would be to mix a solution of the isomerase with the glucose solution in a large container.

Suggest two advantages of using isomerase immobilised in a column of beads.

- 1 _____

- 2 _____

(2 marks)

(b) A manufacturer investigated the effect of using different flow rates of glucose solution on the rate of fructose production.

The table shows the results.

Flow rate in dm^3 per minute	Rate of fructose production in mg per minute
1	150
2	325
3	480
4	608
5	650
6	650
7	650

The manufacturer decides to use a flow rate of 5 dm^3 per minute.

Suggest why the manufacturer chose this flow rate.

(2 marks)

(c) Fructose is a much sweeter sugar than glucose.

Explain why manufacturers of slimming foods may wish to use fructose as a sweetener instead of glucose.

(2 marks)

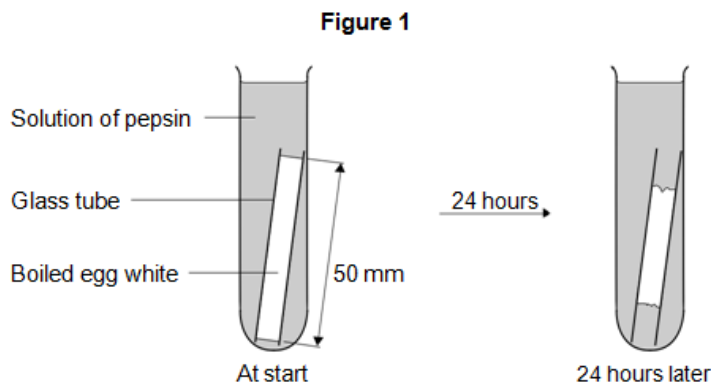
Q:5 Some students investigated the effect of pH on the digestion of boiled egg white by an enzyme called pepsin. Egg white contains protein.

The students:

- put a glass tube containing boiled egg white into a test tube
- added a solution containing pepsin at pH 7
- set up six more tubes with solutions of pepsin at different pH values
- left the test tubes for 24 hours at room temperature.

Figure 1 shows one of the test tubes, at the start and at the end of the 24 hours.

Figure 1



(a) (i) Name the product of protein digestion.

[1 mark]

(a) (ii) What type of enzyme digests protein?

Tick (☑) one box.

Amylase

lipase

protease

[1 mark]

(b) The egg white in each tube was 50 mm long at the start of the investigation.

Table 1 shows the students' results.

Table 1

pH	Length in mm of boiled egg white after 24 hours
1	38
2	20
3	34
4	45
5	50
6	50
7	50

(b) (i) At which pH did the pepsin work best?

pH

[1 mark]

(b) (ii) The answer you gave in part (b)(i) may not be the exact pH at which pepsin works best.

What could the students do to find a more accurate value for this pH?

[2 mark]

(b) (iii) There was no change in the length of the egg white from pH 5 to pH 7. Explain why.

[2 mark]

(c) Pepsin is made by the stomach.

Name the acid made by the stomach which allows pepsin to work well.

[1 mark]

Q:6 Enzymes are used in many industrial processes.

(a) Draw a ring around the correct answer to complete each sentence.

(a) (i) An enzyme is

an antibody.

a catalyst.

a mineral.

[1 mark]

(a) (ii) In industry, enzymes are used so that reactions work well at

all pH values.

higher pressures.

lower temperatures.

[1 mark]

(a) (iii) In industry, the enzyme carbohydrase is used to change starch into

amino acids.

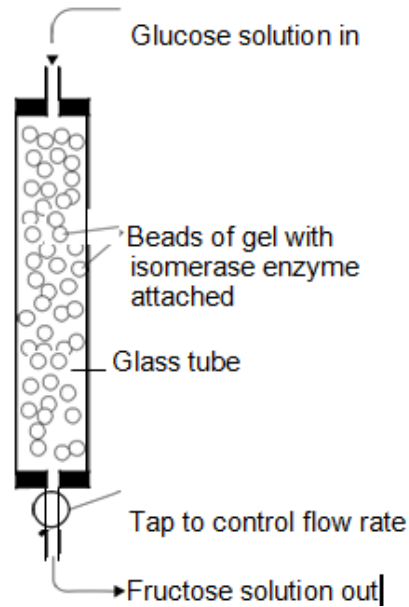
fatty acids.

sugar.

[1 mark]

(b) The enzyme isomerase changes glucose into fructose. In industry, the enzyme isomerase is attached to beads of gel in a glass tube, as shown in Figure 5.

Figure 5



Give two advantages of using an enzyme attached to beads of gel.

Tick (☑) two boxes.

- The enzyme would be denatured.
- The enzyme can easily be used again.
- The fructose does not have any enzyme in it.
- The enzyme can also be used to pre-digest baby foods.

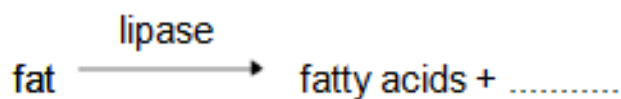
[2 mark]

Q:7 Lipase is an enzyme that digests fat.

(a) (i) Complete the equation to show the digestion of fat.

Use the correct answer from the box.

glucose	glycerol	glycogen
---------	----------	----------



[1 mark]

(a) (ii) Name one organ that makes lipase.

[1 mark]

(b) Some students investigated the effect of bile on the digestion of fat by lipase.

The students:

- 1 mixed milk and bile in a beaker
- 2 put the pH sensor of a pH meter into the beaker
- 3 added lipase solution
- 4 recorded the pH at 2-minute intervals
- 5 repeated steps 1 to 4, but used water instead of bile.

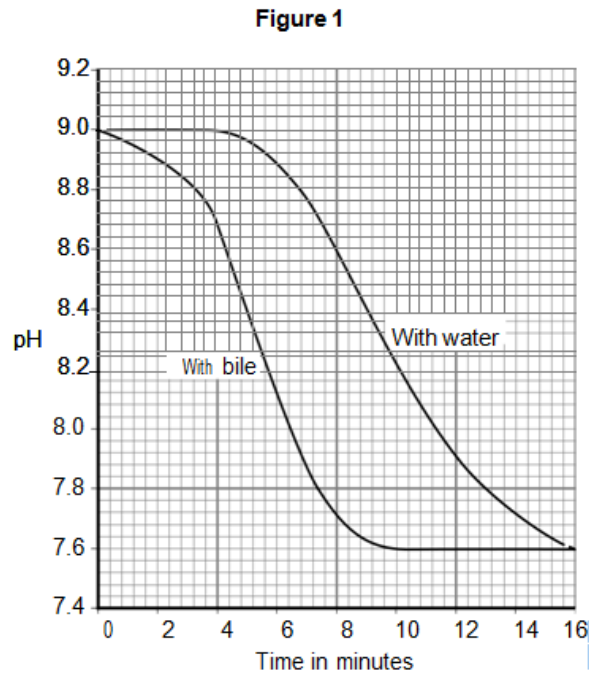
Suggest two variables that the students should have controlled in this investigation.

1 _____

2 _____

[2 mark]

(c) Figure 1 shows the students' results.



(c) (i) Why did the pH decrease in both investigations?

[1 mark]

(c) (ii) Bile helps lipase to digest fat.

What evidence is there in Figure 1 to support this conclusion?

[1 mark]

(c) (iii) Suggest one reason why the contents of both beakers had the same pH at the end of the investigations.

[1 mark]

TOTAL MARKS=47