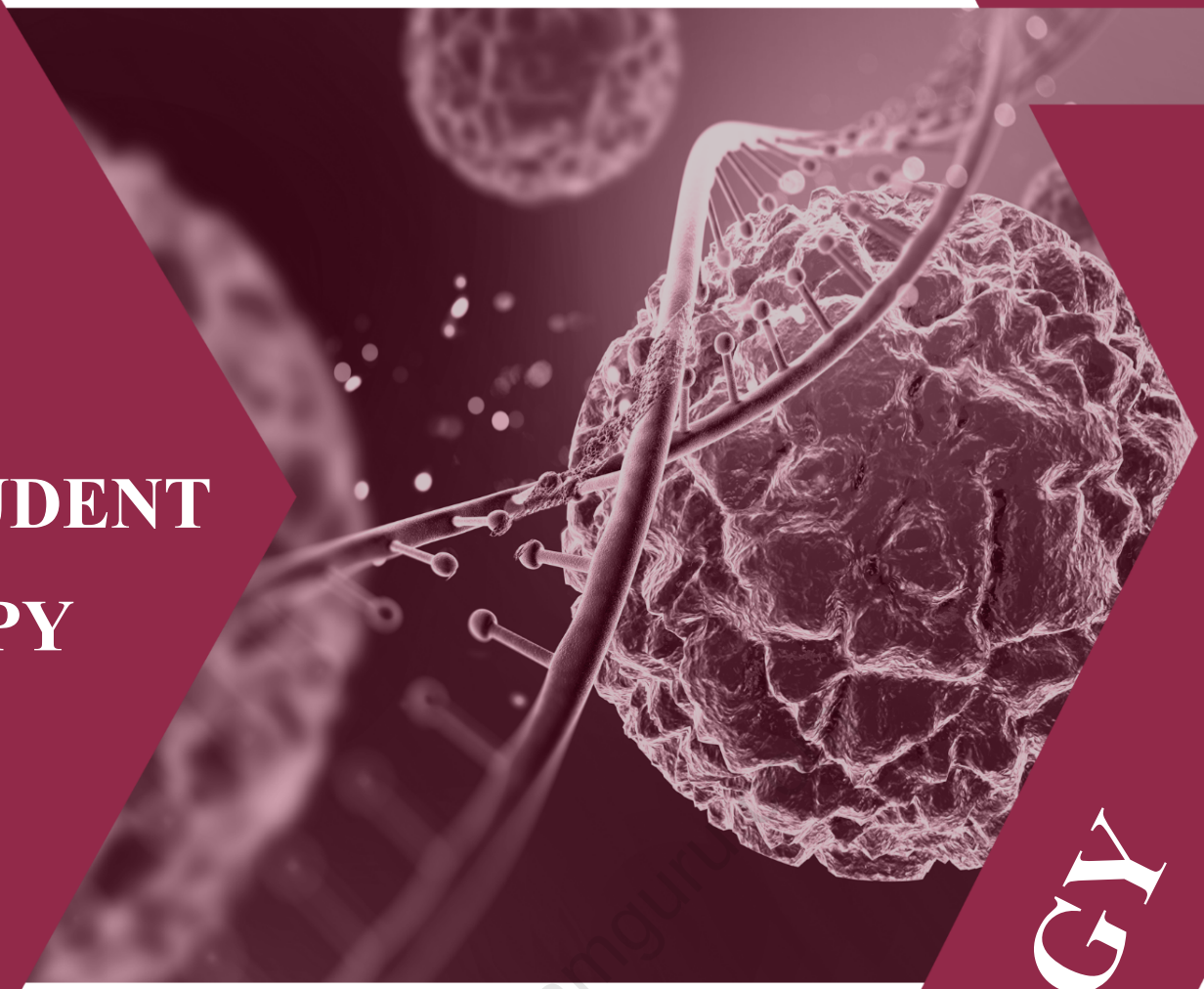
STUDENT COPY



HEADS-UP
REACH FOR THE STARS

IGCSE BIOLOGY

TOPICAL PRACTICE QUESTIONS

PAPER 6

VOL. 2

CHAPTERS 5-7

2020 EDITION

Chapter 5: Enzymes

1 Apple tissue changes colour in the air. Apple cells are thought to contain an enzyme which is a catalyst for the reaction:

$$\text{colourless compounds} + \text{oxygen in the air} \xrightarrow{\text{enzyme}} \text{coloured compounds}$$

Some students investigated this reaction.

The students cut a slice of apple with a knife as shown in Fig. 1.1.

Fig. 1.1

This slice was broken into two pieces as shown in Fig. 1.2.

Fig. 1.2

Each piece was put into a different dish. The dishes were labelled **1** and **2**.

A few drops of water were put on the cut surface and the broken surface of the piece of apple in dish **1**.

A few drops of lemon juice were put on the cut surface and the broken surface of the piece of apple in dish **2**.

Every five minutes for 20 minutes the students observed the pieces of apple and recorded their observations in Table 1.1.

Table 1.1

time / minutes	dish **1**, apple with water		dish **2**, apple with lemon juice	
	broken surface	cut surface	broken surface	cut surface
5	no change	very light brown	no change	no change
10	no change	light brown	no change	no change
15	very light brown	light brown with dark brown patches	no change	no change
20	light brown	dark brown	no change	no change

The lemon juice was tested with litmus paper. It changed colour from blue to red.

(a) State the meaning of this colour change.

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..... [1]

(b) Look at Table 1.1. Describe the differences between the appearance of the **cut surfaces** in dish **1** and dish **2** during the experiment.

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..... [1]

(c) The colour changes are thought to involve enzyme activity.

(i) Explain how the observations in Table 1.1 and your description in **(b)** support this statement.

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(ii) Using your knowledge of enzyme activity, describe another experiment that would test the idea that enzymes are involved in this colour change.

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(d) (i) Look at Table 1.1. Describe the differences between the appearance of the broken **surface** and the **cut surface** in dish **1** during the experiment.

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..... [2]

(ii) Cutting the apple with a knife damages cells, releasing the contents.

Suggest, from the observations in Table 1.1 and your description in **(d)(i)**, how **breaking** instead of cutting the apple may affect the cells.

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..... [1]

[Total: 11]

2 Milk is the main food for young mammals and contains all the required nutrients for the first few months of life. Milk needs to be clotted before it can be digested.

The stomach of a young mammal produces an enzyme which causes soluble proteins in milk to form insoluble clots.

Some students investigated the effect of temperature on this enzyme using two types of milk. The students measured the time taken for clots to form.

Table 1.1 shows the results for **fresh** milk.

Table 1.2 shows the results for **dried** milk mixed with water.

Table 1.1

temperature / °C	time taken for **fresh** milk to clot / seconds			
	1st reading	2nd reading	3rd reading	mean
33	36	42	30	36
35	35	34	30	33
37	15	20	25	.....
39	19	15	20	18
41	27	25	23	25

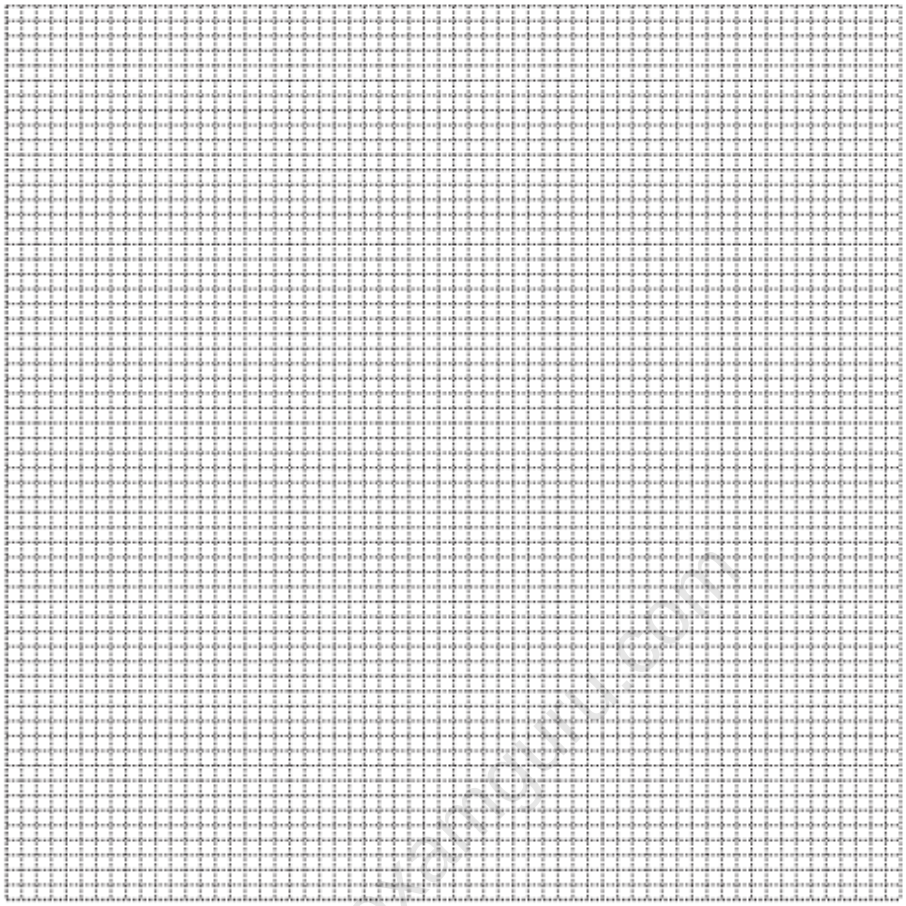
(a) Complete Table 1.1 by calculating the mean value for 37 °C.

Write your answer in Table 1.1 [1]

Table 1.2

temperature / °C	time taken for **dried** milk to clot / seconds			
	1st reading	2nd reading	3rd reading	mean
33	210	160	200	190
35	165	174	150	163
37	150	125	130	135
39	118	90	110	106
41	69	102	60	77

(b) (i) Plot a graph of the data for **both** types of milk on **one** set of axes to show the effect of temperature on the **mean** clotting time.



[5]

(ii) Describe **and** compare the effect of temperature on the clotting time for both types of milk.

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..... [4]

(c) Suggest **and** explain why each test has been carried out three times.

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..... [2]

(d) Enzymes are involved in the clotting process. A water bath was used to keep the temperature constant, at each temperature, for each test.

Suggest why it is important to keep the temperature constant.

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..... [3]

(e) The clots are separated and used in cheese making.

Describe how you would safely carry out a test to compare the protein content of the separated clots with the protein content of the liquid.

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..... [4]

[Total: 19]

3 A protease enzyme digests the white protein in milk to form a clear soluble product.

Some students carried out an investigation to find the effect of temperature on this process.

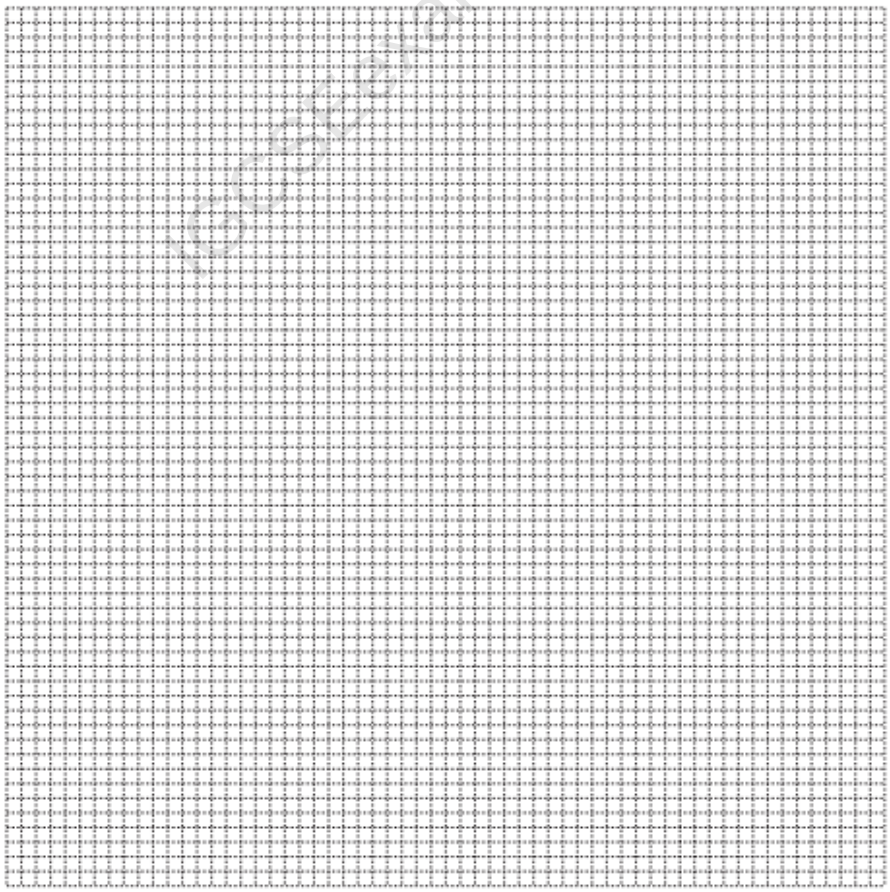
5 cm^3 of milk and a few drops of enzyme were warmed separately to 40 °C and then mixed together. The time taken for the white mixture to clear was recorded. This procedure was repeated two more times at this temperature.

The whole procedure was repeated for a range of temperatures and all the results were recorded in Table 3.1.

Table 3.1

temperature / °C	time for milk to clear / seconds			
	1st test	2nd test	3rd test	mean
20	120	110	115	115
30	60	55	59	58
40	30	35	28	31
50	19	25	22	22
60	80	75	76	77

(a) (i) Plot the data to show the effect of temperature on the mean time for the milk to clear.



[4]

(ii) Describe **and** explain the effect of temperature on the time taken for the milk to clear.

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..... [4]

(b) (i) Suggest **and** explain why each test was carried out three times.

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..... [2]

(ii) In this investigation, temperature was varied.

Suggest **and** explain **one** variable that needs to be controlled.

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..... [2]

[Total: 12]

4 Catalase is a common enzyme found in both plants and animals.

Some students investigated the activity of catalase in seeds and seedlings.

They used extracts from soaked seeds and from seedlings which had been grown for four days. All the seeds and the seedlings were from the same plant.

Catalase breaks down hydrogen peroxide into water and oxygen.

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

Fig. 1.1 shows the apparatus used to compare the catalase activity of the two extracts. This was done by counting the number of bubbles of oxygen released in one minute.

Oxygen starts to be released as soon as hydrogen peroxide is added to the extract.

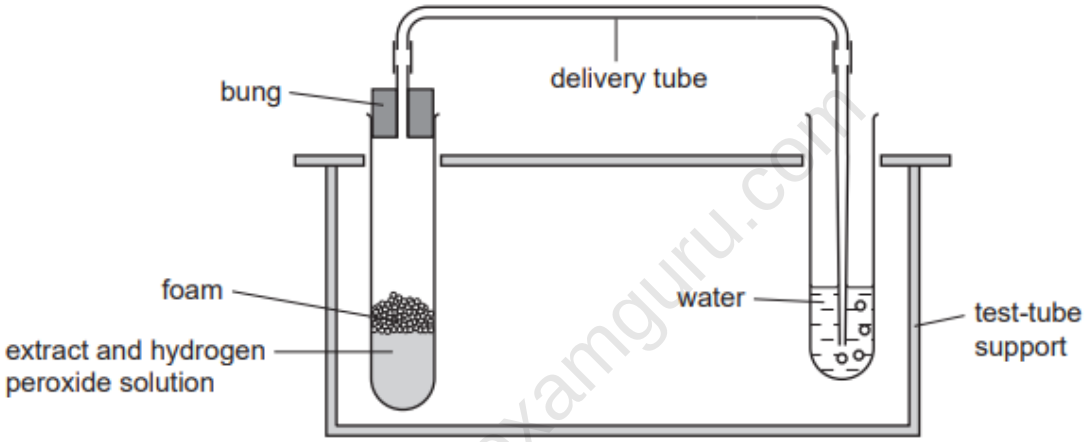

Fig. 1.1

- 2 g of extract from soaked seeds was used. This was placed in a test-tube, labelled **seeds 1** as shown in Fig. 1.1.
- Hydrogen peroxide was poured into the test-tube.
- The bung was quickly replaced into the top of this test-tube. The number of bubbles of oxygen released in one minute was counted and recorded in Table 1.1.
- This was repeated with another extract of soaked seeds, labelled **seeds 2**. The results were recorded in Table 1.1.
- The whole procedure was repeated with extracts from four-day old seedlings, labelled **seedlings 1** and **seedlings 2**. The results were recorded in Table 1.1.

Table 1.1

extract	number of bubbles of oxygen released in one minute
seeds 1	43
seeds 2	50
seedlings 1	30
seedlings 2	37

(a) (i) Describe the results.

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..... [3]

(ii) State the conclusion that can be made from these results.

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..... [1]

(b) (i) State **two** possible sources of experimental error in this investigation.

1 .....

2 ..... [2]

(ii) Suggest how to improve the method to reduce **one** of the errors stated in **(b)(i)**.

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..... [1]

- After the reaction had finished the four test-tubes contained different heights of foam.

Fig. 1.2 shows the four test-tubes.

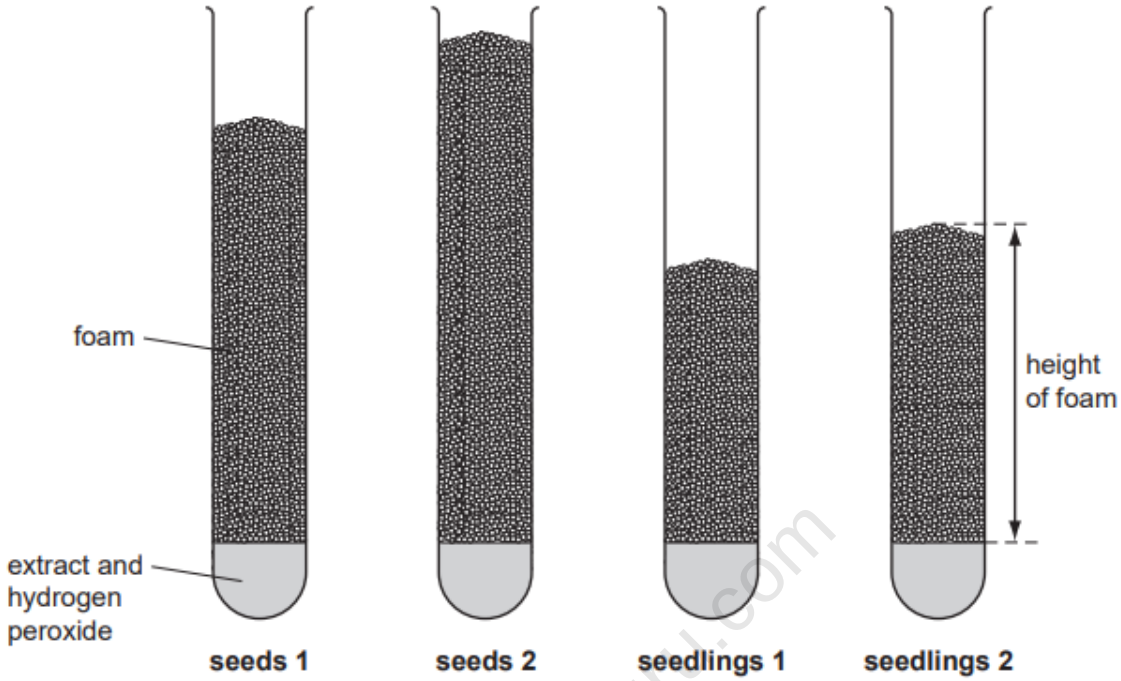

Fig. 1.2

(c) (i) Measure the height of the foam in each of the test-tubes shown in Fig. 1.2.

Record the height of foam in Table 1.2.

Table 1.2

extract	height of foam / mm
seeds 1	
seeds 2	
seedlings 1	
seedlings 2	

[2]

(ii) State the conclusion that can be made from these results.

.....

..... [1]

(iii) State **and** explain whether your conclusion in **(a)(ii)** is consistent with your conclusion in **(c)(ii)**.

.....

.....

..... [1]

(d) (i) Explain why the tests for seeds and seedlings were repeated.

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..... [2]

(ii) Seeds and seedlings were crushed to make the extracts.

Suggest **two** reasons why whole seeds and seedlings were **not** used in this investigation.

1 .....

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2 .....

..... [2]

(e) Another group of students wanted to investigate the activity of catalase in different types of seeds.

For this investigation suggest:

(i) a variable to change;

..... [1]

(ii) **two** variables to keep constant;

1 .....

2 ..... [1]

(iii) a variable to measure;

..... [1]

(iv) a suitable control.

..... [1]

[Total: 19]

5 Trypsin is an enzyme that breaks down the white protein in milk to gradually produce a soluble product and a clear, colourless solution.

A group of students investigated the effect of pH on the activity of trypsin at two different temperatures.

Five different values of pH were tested and each pH was controlled using a buffer solution.

Temperature was controlled using two water baths; at 40 °C and 50 °C.

20 cm^3 of milk and 5 cm^3 of trypsin was used in each test. Before being mixed together, test-tubes of milk and trypsin were both placed together in the water bath for 6 minutes.

The students then observed the test-tubes and recorded the time taken for the milk to become clear.

Table 2.1 shows their results at 40 °C.

Table 2.2 shows their results at 50 °C.

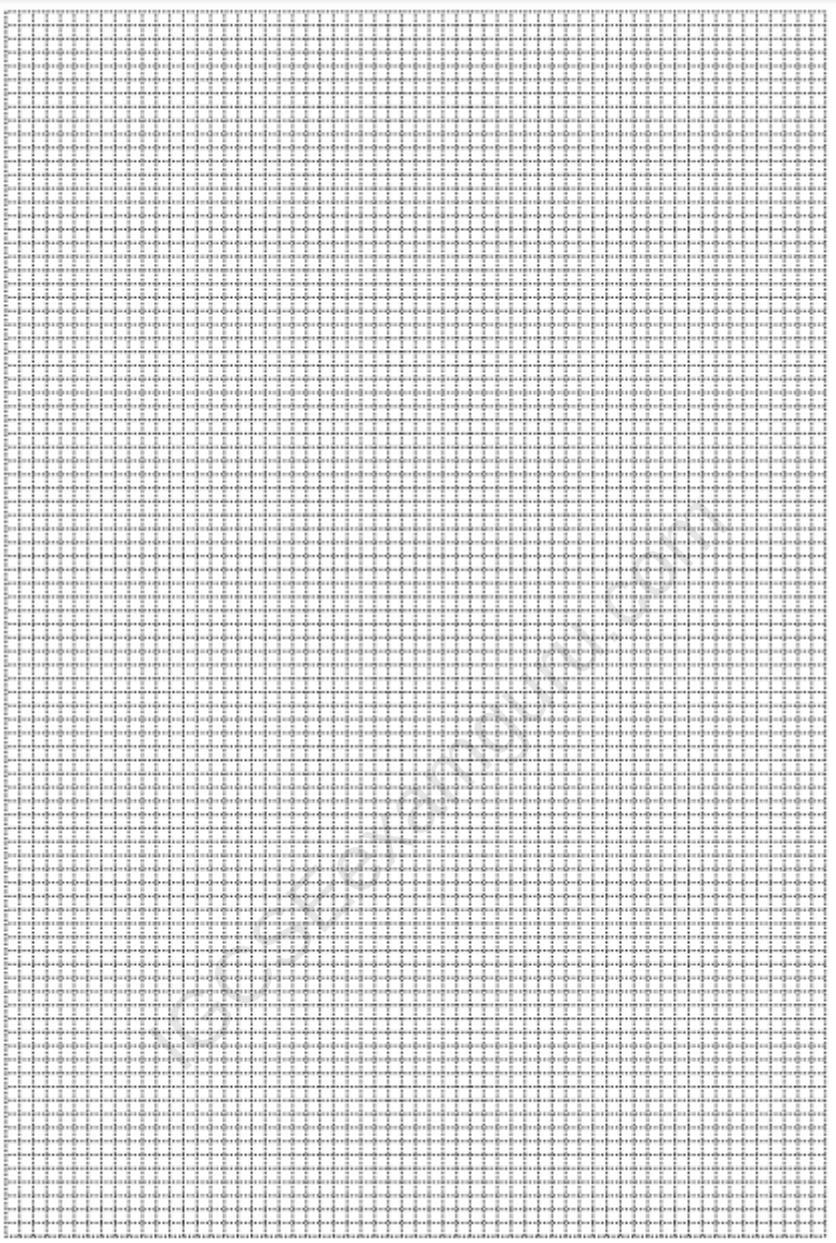
40 °C **Table 2.1**

pH	time for milk to clear / s
5.5	600
6.0	360
7.0	50
7.5	35
8.0	45

50 °C **Table 2.2**

pH	time for milk to clear/ s
5.5	850
6.0	500
7.0	70
7.5	65
8.0	100

(a) Plot a graph using the data in Tables 2.1 and 2.2 to compare the effect of pH on trypsin at **40 °C** and **50 °C**. Use the same axes for both temperatures.



[5]

(b) (i) Describe **and** explain the effect of pH on the activity of trypsin.

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..... [4]

(ii) Describe the effect of raising the temperature by 10 °C on the activity of trypsin.

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..... [2]

(c) (i) Before being mixed together, the test-tubes of milk and trypsin were both placed in the water bath for six minutes.

Suggest a reason for this procedure.

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..... [1]

(ii) The students found it difficult to determine when the milk had gone completely clear.

Suggest how they could improve the method.

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..... [1]

(d) Another group of students wanted to investigate the effect of temperature on the activity of trypsin.

For this investigation suggest:

(i) a suitable range of temperatures;

.....

..... [1]

(ii) **two** variables to keep constant;

1 .....

2 ..... [2]

(iii) a variable to measure;

.....

..... [1]

(iv) a suitable control.

.....

..... [1]

[Total: 18]

6 The enzyme lipase digests fats into fatty acids and glycerol.

Some students investigated how temperature affects the break down of the fats in milk using lipase.

A pH indicator called bromothymol blue was used and the colour change was observed and recorded every two minutes for a total time of 20 minutes.

Table 1.1 shows the colour changes of this indicator.

Table 1.1

pH	6	7	8
colour	yellow	green	blue

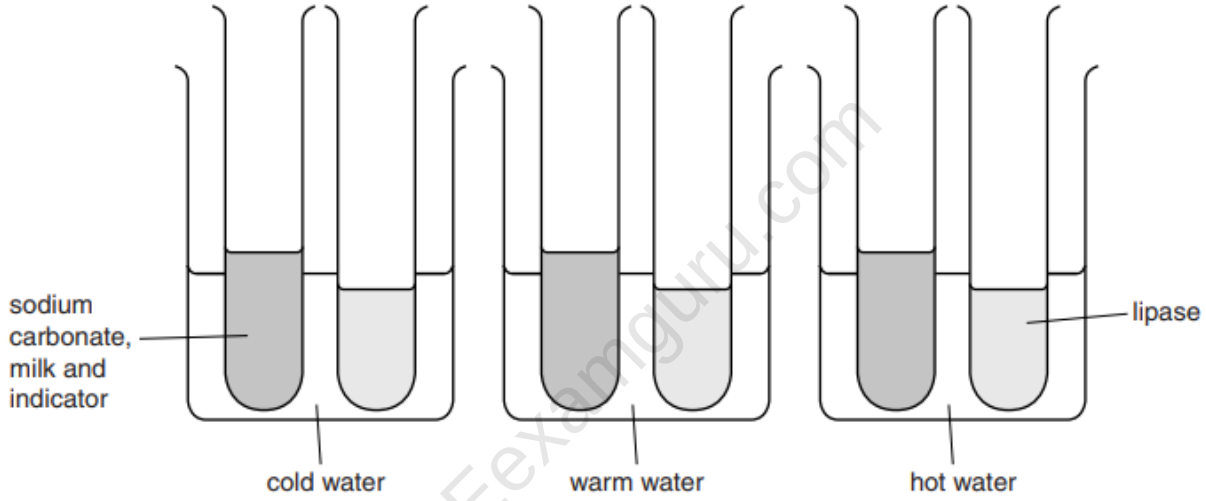

Fig. 1.1

Three beakers were labelled: **cold**, **warm** and **hot**. One test-tube was placed in each of the labelled beakers. Three drops of bromothymol blue indicator were put into each test-tube. 2 cm^3 of sodium carbonate solution was added to each test-tube and then 2 cm^3 of milk was added to each test-tube. Finally, one test-tube containing 3 cm^3 of lipase was put into each of the three beakers. The temperature in each beaker was measured and recorded.

The experiment was left for 5 minutes, as shown in Fig. 1.1.

After 5 minutes, the lipase was poured from the test-tube labelled **lipase** in the **cold** beaker into the other test-tube in the **cold** beaker.

This process was repeated for the **warm** beaker and the **hot** beaker.

The mixtures were stirred and the colour of the bromothymol blue indicator in each test-tube was recorded at 0 (start), 2, 4, 6, 8,10, 12, 14, 16, 18 and 20 minutes.

Fig. 1.2 shows the students' results.

Temperatures	times and colours
ice and water = 4,	0 – blue, 2 – blue, 4 – blue, 6 – blue, 8 – blue, 10 – blue, 12 – blue, 14 – blue, 16 – blue, 18 – blue, 20 – blue
room temp = 21,	0 – blue, 2 – blue, 4 – blue, 6 – blue, 8 – green, 10 – blue, 12 – green, 14 – green, 16 – yellow, 18 – yellow, 20 – yellow
hot water = 50,	0 – blue, 2 – blue, 4 – blue, 6 – green, 8 – green, 10 – green / yellow, 12 – green / yellow, 14 – yellow, 16 – yellow, 18 – yellow, 20 – yellow

Fig. 1.2

(a) Complete Table 1.2 to record the students' results.

Table 1.2

time / min	colour of indicator		
	cold .....°C	warm .....°C	hot .....°C
0			

[3]

(b) (i) Sodium carbonate solution has a pH of 8. Suggest why sodium carbonate solution was added to the milk in this investigation.

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.....[1]

(ii) State why the two test-tubes in each of the labelled containers were left for 5 minutes before mixing their contents.

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.....[1]

(iii) Explain why the colour of the bromothymol blue indicator changed during the investigation.

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.....[2]

(iv) Predict the colour that you would observe if the experiment had been repeated using water at 80 °C.

Explain your answer.

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.....[2]

(v) Suggest a result that may be anomalous. Give a reason for your answer.

anomalous result .....

reason .....

.....[2]

(c) State **two** variables that have been controlled in this investigation.

For each of these variables, describe how it has been controlled.

1 variable .....

how has it been controlled .....

.....

2 variable .....

how has it been controlled .....

.....[4]

(d) Suggest **two** ways to modify this investigation to find the optimum (best) temperature for the enzyme lipase to break down the fats in milk.

1 .....

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2 .....

.....[2]

[Total: 17]

7 Living cells produce catalase to break down the toxins, such as hydrogen peroxide, that are formed in cells.

Catalase breaks down hydrogen peroxide to form oxygen and water.

$$\text{hydrogen peroxide} \xrightarrow[\text{catalase}]{} \text{oxygen + water}$$

An investigation was carried out to find out if ripe fruits produce more catalase than unripe fruits.

The unripe pepper fruits of *Capsicum annuum* are green in colour when they start developing. As the fruit ripens it turns red and tastes sweeter.

Extracts were prepared from both green and red pepper fruits.

Small squares of filter paper were soaked in the extracts and dried for testing.

The pieces of filter paper were placed in hydrogen peroxide solution as shown in Fig. 1.1.

As the catalase in the extracts breaks down the hydrogen peroxide, the pieces of filter paper rise to the surface. The time taken for each piece of filter paper to reach the surface was measured.

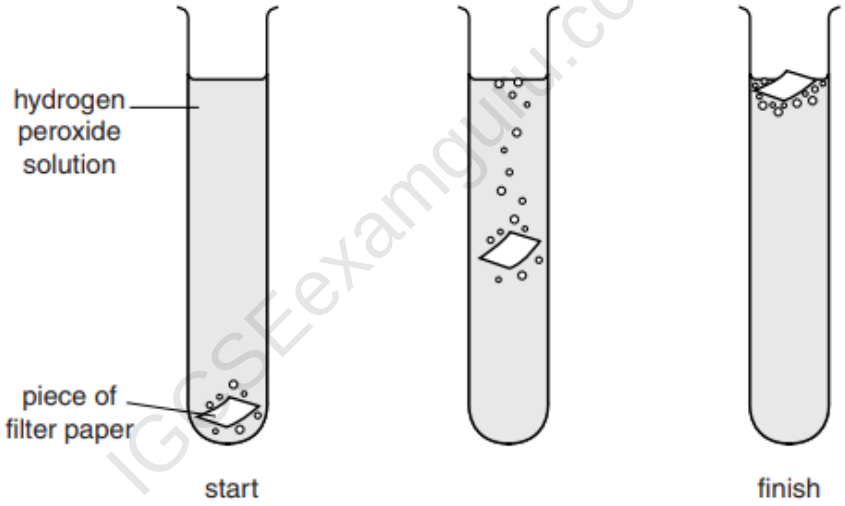

Fig. 1.1

The procedure was carried out to obtain three results for red pepper fruits and three results for green pepper fruits.

The measurements are shown in Table 1.1.

Table 1.1

pepper extract	time / s		
	filter paper 1	filter paper 2	filter paper 3
red	50	35	30
green	75	60	62

(a) Calculate the total time and the mean time for each extract.

Give your answers to the nearest whole number.

red pepper extract: total time ..... s

mean time ..... s

green pepper extract: total time ..... s

mean time ..... s

[2]

(b) Describe and explain whether this investigation supports the statement 'ripe fruits produce more catalase than unripe fruits'.

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.....[3]

(c) State **two** variables that must be controlled to compare the catalase activity in the extracts.

1.....

2.....

[2]

(d) The red pepper fruit is said to be sweeter than the unripe green pepper fruits.

Describe how you could safely test if the sweetness is due to the presence of reducing sugar.

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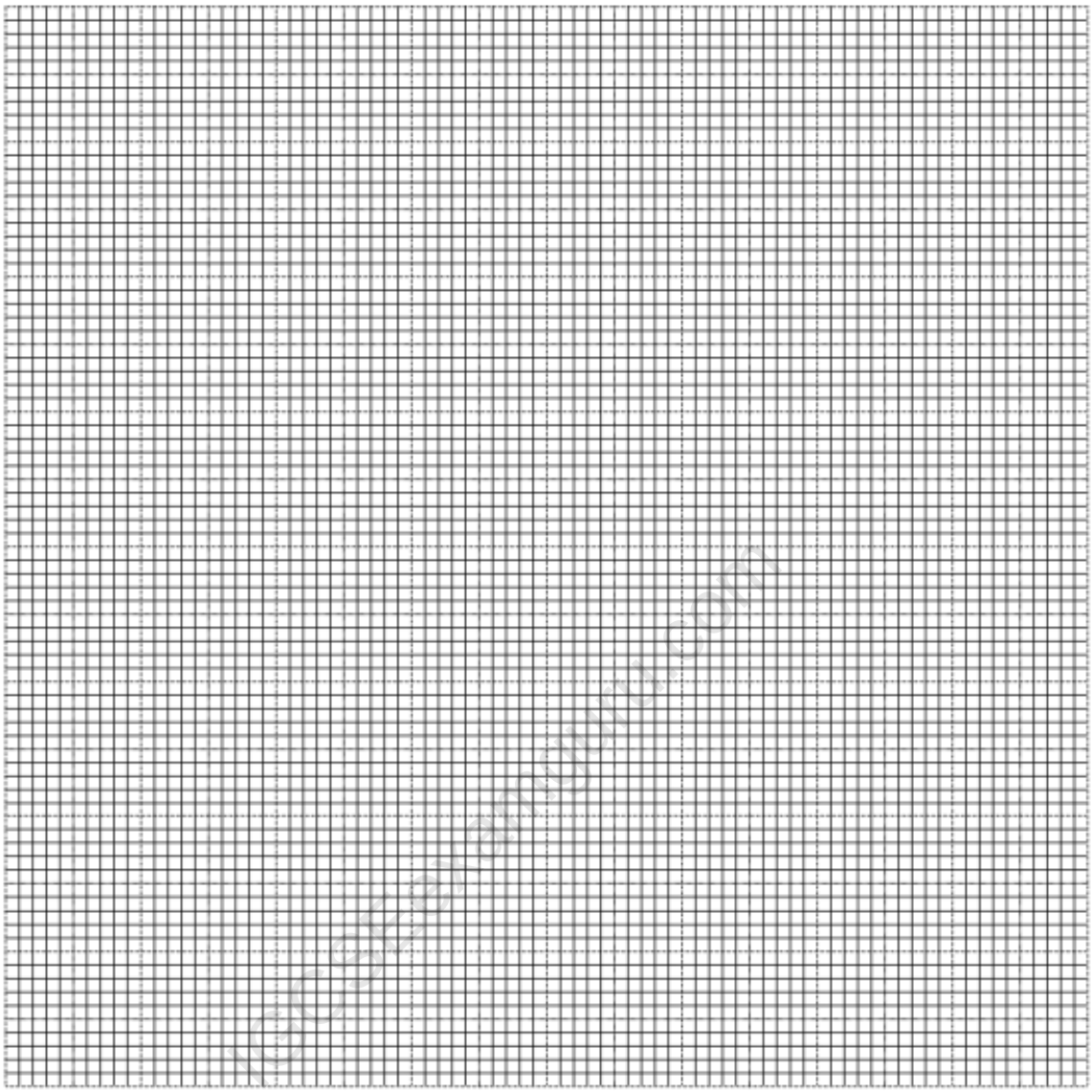
.....[5]

(e) The sugar content of the green pepper and four other types of fresh fruit is shown in Table 1.2.

Table 1.2

type of fresh fruit	sugar content / g per 100 g
banana	15.0
green pepper	2.7
lemon	3.5
orange	9.0
tomato	2.0

(i) Plot a graph of the data in Table 1.2 to compare the sugar content of the five fruits.



[4]

(ii) Calculate how many times more sugar can be found in 100 g of banana compared to 100 g of green pepper.

Show your working.
Give your answer to the nearest whole number.

[2]

[Total: 18]

8 Hydrogen peroxide is produced by metabolism in most cells and is toxic in high concentration. Cells contain the enzyme catalase to break down the hydrogen peroxide.
Fig. 1.1 shows this reaction.

$$\text{hydrogen peroxide} \xrightarrow{\text{catalase}} \text{water} + \text{oxygen}$$

Fig. 1.1

Some students investigated the activity of catalase found in leaves. Two different sized pieces of leaf were placed into hydrogen peroxide solution and the time taken for the pieces of leaf to rise was recorded.

- A ruler was used to measure a distance of 40 mm from the bottom of **three** containers and a line drawn on the containers.
- Hydrogen peroxide solution was poured into each container until it reached the line at 40 mm.
- A ruler and scissors were used to cut **three** pieces of leaf, each measuring 10 mm × 10 mm, from leaves of the same species.
- A 1 cm length of metal wire was bent into a U-shape. A piece of leaf was placed into the U-shape and the wire pinched to hold the leaf in place as shown in Fig. 1.2.

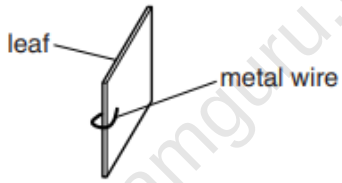


Fig. 1.2

- One piece of leaf was placed in the hydrogen peroxide solution in each of the containers and pushed gently with forceps to make it sink.
- The leaves were observed and a timer was used to measure the time taken for each piece of leaf to rise from the bottom of the container to the surface of the hydrogen peroxide solution.
- Forceps were used to remove the pieces of leaf from each container.
- The experiment was then repeated using three pieces of leaf cut to a size of 15 mm × 15 mm from leaves of the same species as previously used.

Fig. 1.3 shows the times for each set of leaves.

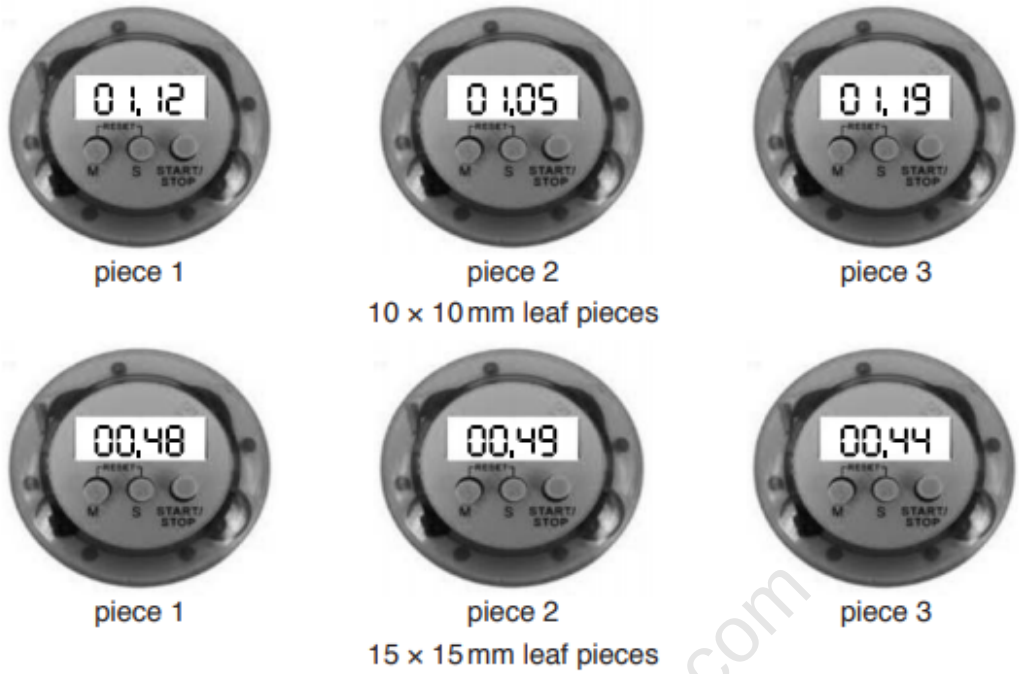


Fig. 1.3

(a) (i) Prepare a table to record the results shown in Fig. 1.3.

Record the times taken for the leaf pieces to rise into this table.

[4]

(ii) Calculate the mean time taken for each size of leaf piece to reach the surface.
Show your working.

10 mm × 10 mm .....

15 mm × 15 mm .....[1]

(iii) Describe the effect of the size of leaf piece on the time taken to rise to the surface.

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.....[1]

(b) Fig. 1.4 shows the students' observations of the pieces of leaf.

10 x 10	Many small bubbles formed on the leaf at first and then some large bubbles. There were more at the edge. Then the leaf tipped and started to rise.
15 x 15	This was the same as the first set of leaves, but the bubbles seemed to start quicker.

Fig. 1.4

Use the information you have been given and the observations in Fig. 1.4 to explain why the leaf pieces rose to the surface.

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.....[2]

(c) Predict, with reasons, the effect of using a piece of leaf 20 mm × 20 mm on the time taken to rise to the surface.

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.....[2]

(d) (i) State **one** variable that has been controlled in the students' investigation.

variable .....[1]

(ii) State **one** source of error in the method used in this investigation.
Describe how to improve the method to decrease the effect of this error.

error.....

improvement .....

.....

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[2]

(iii) Describe a control experiment for this investigation.

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.....[2]

(iv) State one hazard (danger to the students) in this investigation and describe one safety precaution the students should take to reduce this hazard.

hazard .....

safety precaution .....

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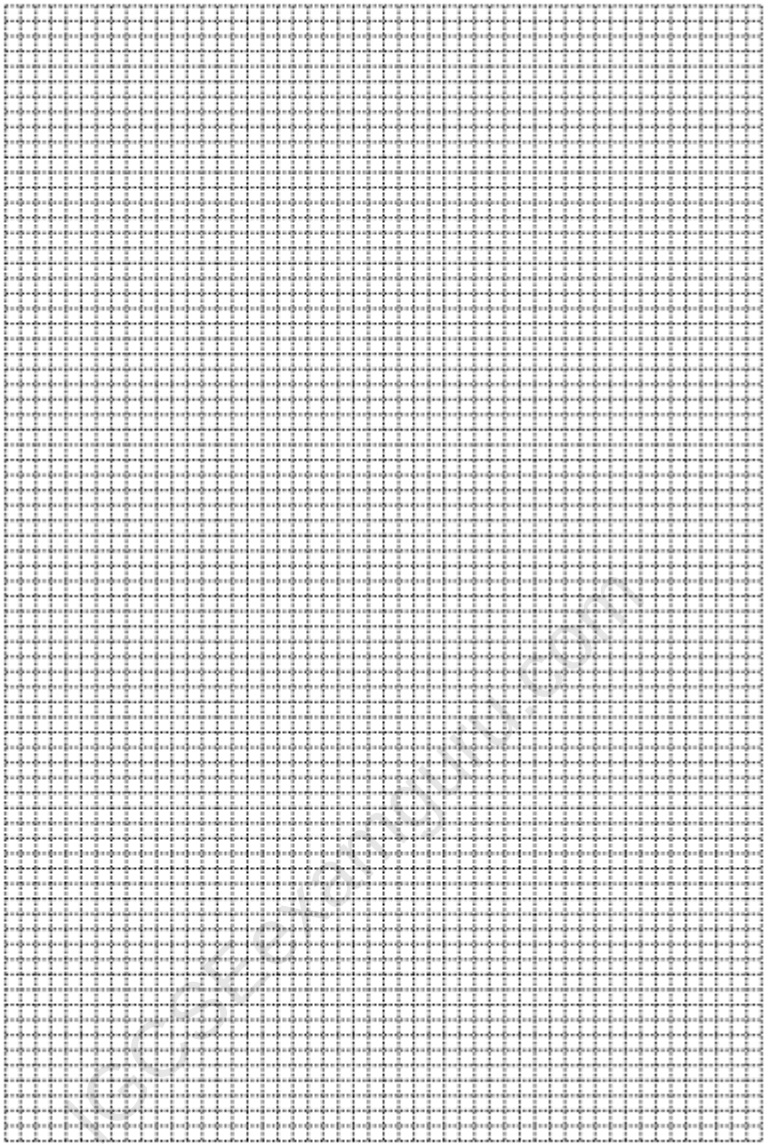
[2]

(e) The students used the same method to investigate the catalase activity in pieces of leaf of four different species, **W**, **X**, **Y** and **Z**. Each piece of leaf was the same size.
Fig. 1.5 shows their results.

species	average time/s
W	290
X	130
Y	170
Z	50

Fig. 1.5

(i) Plot a bar chart of the data shown in Fig. 1.5.



[4]

(ii) Describe the results and suggest what the students could conclude from this investigation.

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.....[3]

[Total: 24]

Chapter 6: Plant Nutrition

1 Some students investigated the effect of different conditions on onion leaves.

Fig.1.1 is a photograph of growing onion plants. They have tubular leaves that are hollow inside.

Fig. 1.1

In an experiment an onion leaf was cut into three pieces each 2 cm long.

Four cuts were made in each piece as shown in Fig. 1.2.

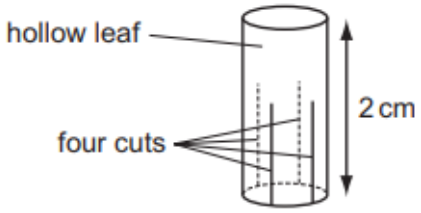


Fig. 1.2

The first piece was put into water.

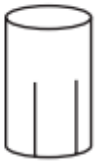
The second piece was put into salt solution.

The third piece was put on dry filter paper.

The three pieces were left in their different conditions for 10 minutes after which the students made their observations.

Table 1.1 shows the shape of the pieces and how they felt when the students held them between their fingers.

Table 1.1

in water	in salt solution	in air
		
springy, firm	soft, slimy	soft, limp

(a) (i) Explain the reasons for any differences that were observed.

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..... [3]

(ii) Suggest how this investigation could be improved.

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..... [2]

(b) Fig. 1.3 is a photomicrograph of a section through a tubular onion leaf.

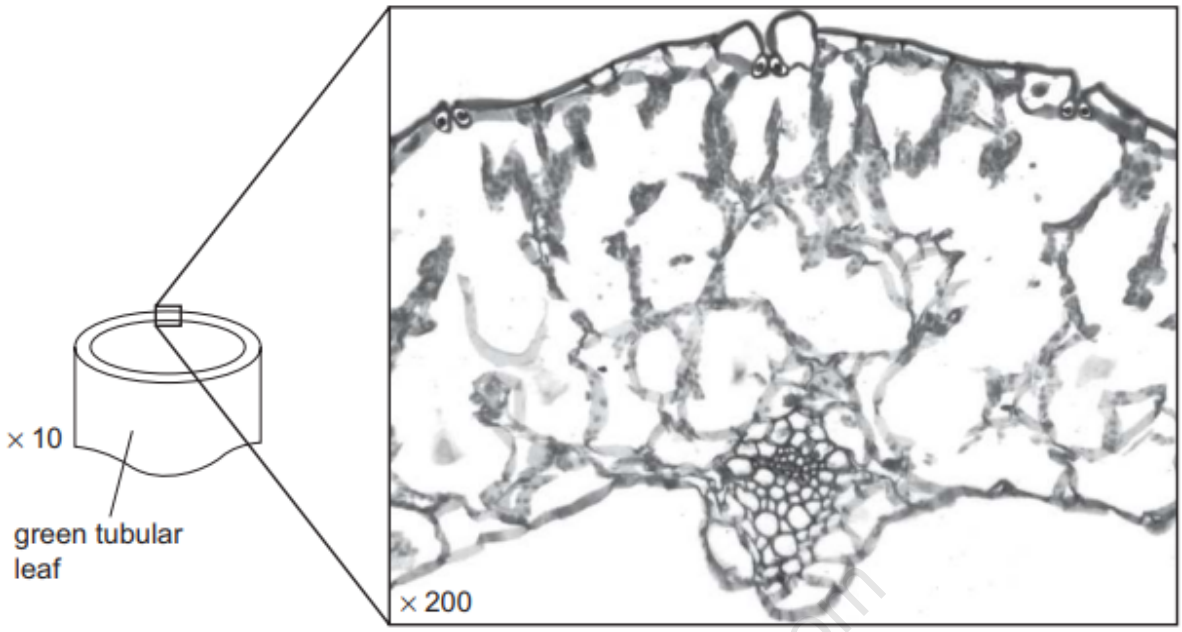


Fig. 1.3

(i) On Fig. 1.3, use lines and the letters **A**, **B** and **C** to label,

A - a mesophyll cell
B - a xylem vessel
C - an epidermal cell.

Draw the label lines with the letters **A**, **B** and **C** on Fig. 1.3. [3]

(ii) There are stomata on the leaf in Fig. 1.3. Draw a circle round **one** of them.

Draw the circle on Fig. 1.3. [1]

(c) Fig. 1.4 shows a photograph of a section through the onion leaf. Its actual diameter was 5 mm.

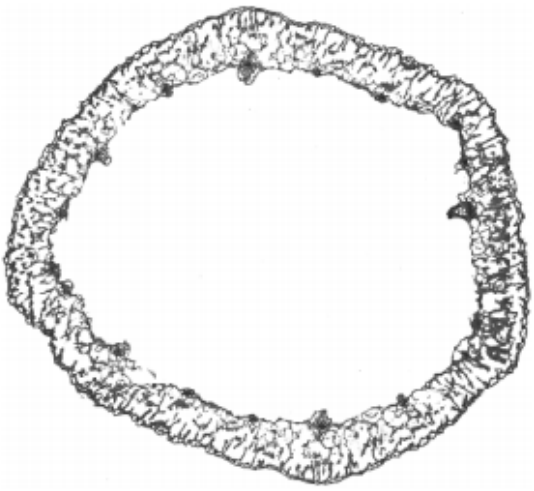


Fig. 1.4

Measure the diameter of the leaf shown in the photograph in Fig. 1.4.

diameter .....

Calculate the magnification of the onion leaf in the photograph in Fig. 1.4.

Show your working.

Magnification X ..... [3]

(d) (i) Explain exactly how you would safely test another 2 cm piece of onion leaf for the presence of reducing sugar.

.....

.....

.....

.....

.....

..... [3]

(ii) The reducing sugar test can tell you that:

- reducing sugar is absent
- reducing sugar is present at a low concentration
- reducing sugar is present at a high concentration

Explain how you can tell the difference between these possible results.

.....

.....

.....

.....

.....

..... [3]

(e) Onion leaves are green. Students testing onion leaves for the presence of starch used the method shown in the four stages of Fig. 1.5.

Explain the reasons for the details shown in each stage. Write your answers on the lines below Fig. 1.5

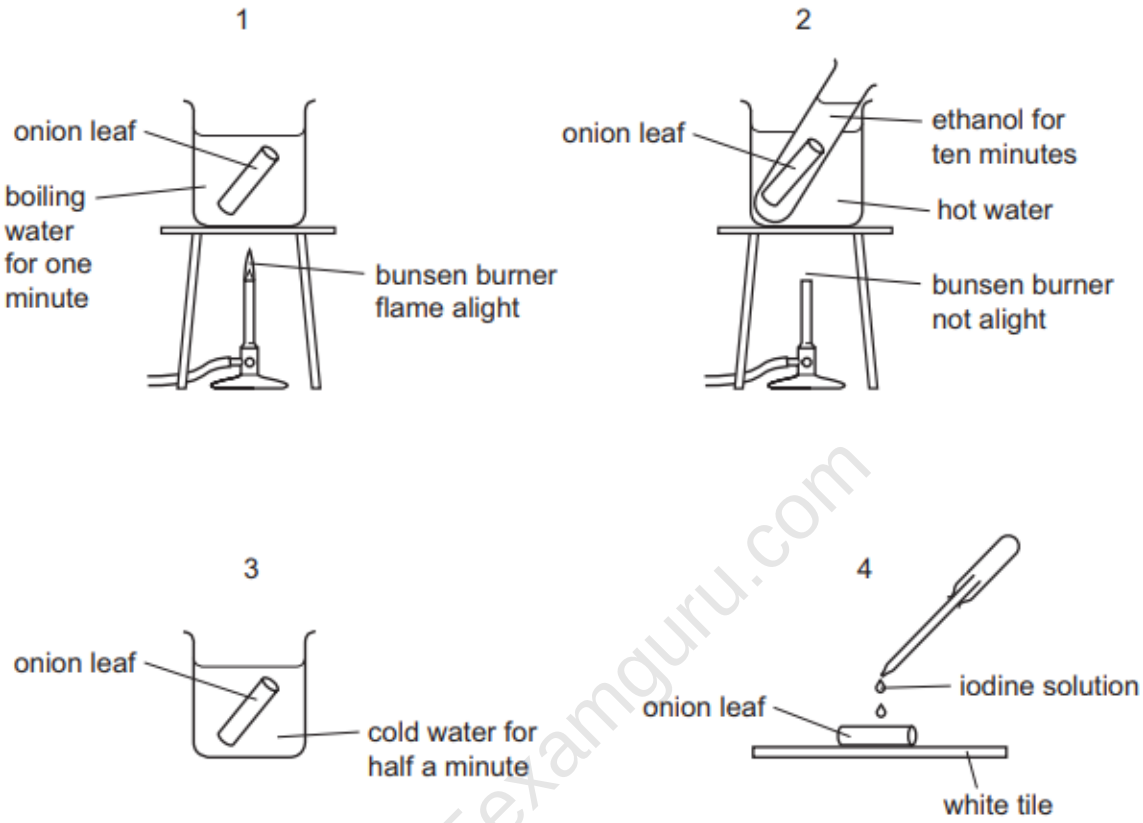


Fig. 1.5

reasons for stage 1 .....

.....

reasons for stage 2 .....

.....

reasons for stage 3 .....

.....

reasons for stage 4 .....

..... [4]

[Total: 22]

2 Fig. 2.1 shows the upper surface of two leaves, **W3** and **W4**.

W3 W4

Fig. 2.1

(a) Make a large, labelled drawing of leaf **W3**.

[4]

(b) Carefully observe leaf **W3** and leaf **W4** in Fig. 2.1.

Describe **one similarity** and **two differences** that you can see. Do **not** include size in your comparison.

(i) similarity

.....

..... [1]

(ii) differences

1 .....

.....

2 .....

..... [2]

Fig. 2.2 shows a photomicrograph of a section of a leaf similar to **W3**.

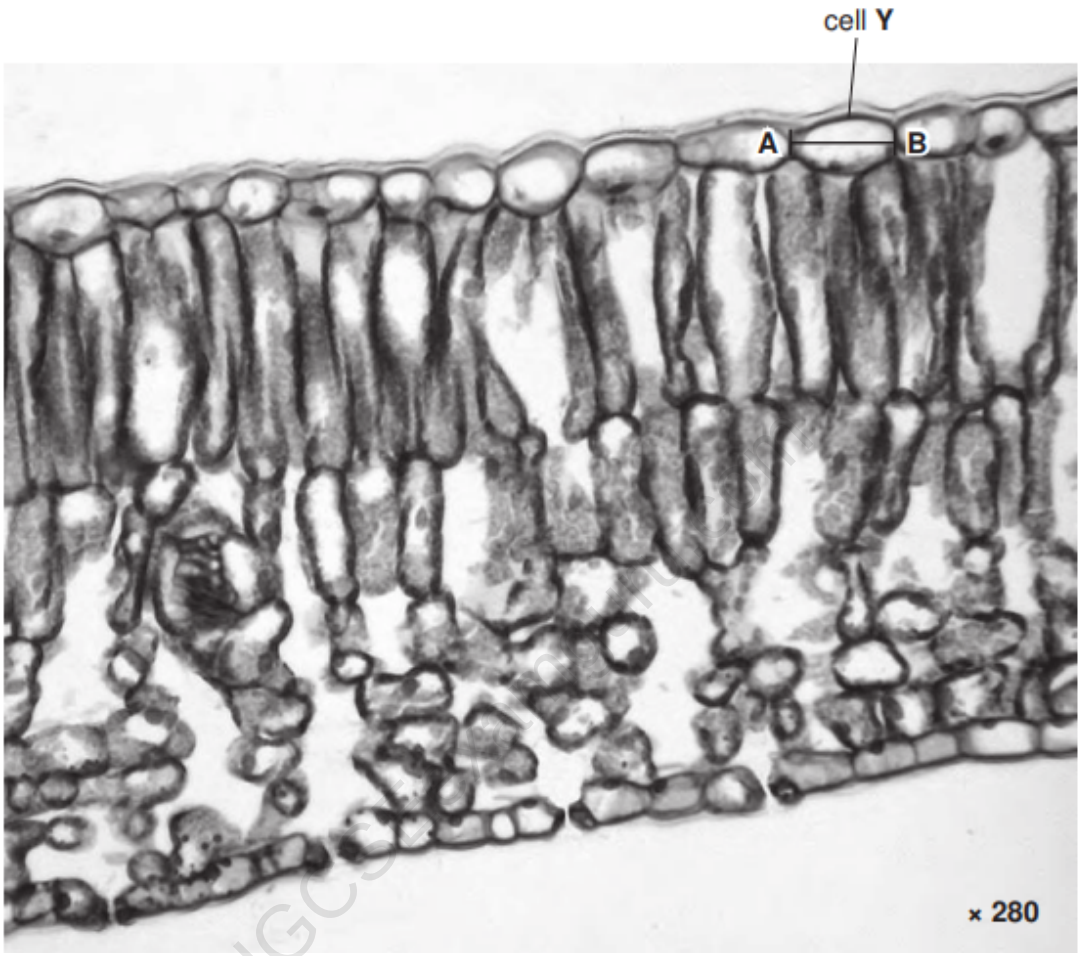


Fig. 2.2

(c) (i) On Fig. 2.2, draw a line to label a photosynthetic cell in the palisade layer. [1]

(ii) Draw arrows on Fig. 2.2 to show the pathway that carbon dioxide gas must take to reach the photosynthetic cell labelled in **(c)(i)** from the air outside the leaf. [2]

(d) Measure the length, from **A** to **B**, of cell **Y** on Fig. 2.2.

Record your measurement.

length from **A** to **B** ..... mm

Calculate the actual length of cell **Y**.

Show your working.

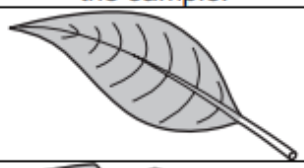
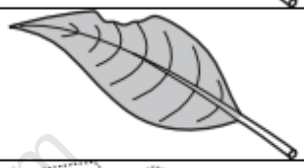
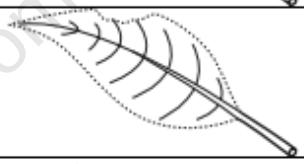
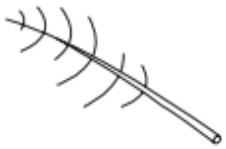
actual length of cell **Y** ..... mm [3]

When leaves die, they fall from the tree and are eventually decomposed.

Some students investigated the decomposition of samples of leaves. They made drawings and weighed the samples at intervals over a period of two years.

Table 2.1 shows the results of this investigation.

Table 2.1

time / months	mass of leaves in sample / g	appearance of one leaf in the sample.
0	42.5	
6	46.0	
12	32.5	
18	16.0	
24	7.5	

(e) (i) Describe **and** explain the changes in appearance of the leaves during the two years.

.....

.....

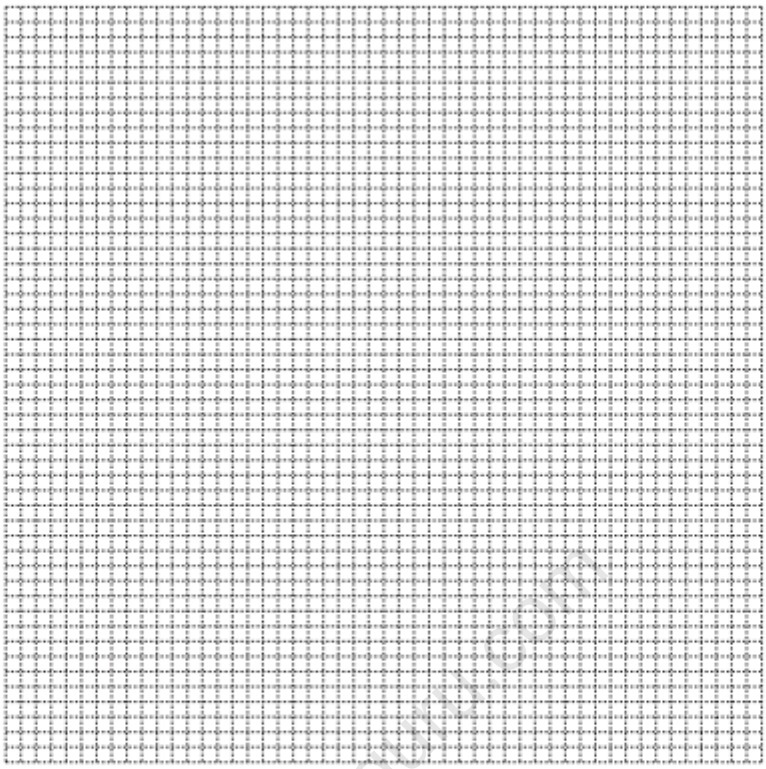
.....

.....

.....

..... [3]

(ii) Use the measurements from Table 2.1 to plot a graph to show how the mass of the leaf samples change with time.



[4]

(iii) Describe the results for the change in mass shown on the graph.

.....

.....

.....

.....

.....

..... [3]

[Total: 23]

Chapter 7: Human Nutrition

1 A student investigated the effect of surface area on the rate of digestion of food by observing the colour change in agar jelly pieces placed in dilute sulfuric acid.

The student was provided with a Petri dish of agar jelly. The agar jelly contained Universal Indicator that changed colour according to the pH of its environment.

RED pH1	ORANGE	BLUE pH10

The student was also provided with a beaker of sulfuric acid.

When a small piece of agar jelly was put into the beaker of dilute sulfuric acid, it gradually changed colour.

(a) Suggest what colour the agar jelly became after it changed colour in the dilute sulfuric acid.

It started orange and changed to ..... [1]

The student cut four identical blocks of agar jelly, each 2 cm × 1 cm × 1 cm, as shown in Fig. 1.1.

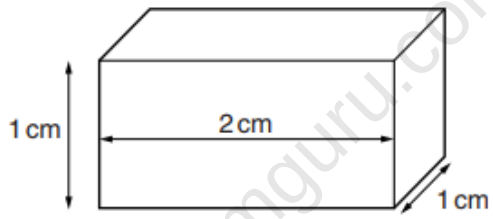


Fig. 1.1

The student labelled the agar blocks **A**, **B**, **C** and **D**.

The blocks of agar jelly were then cut up as shown in Fig 1.2.

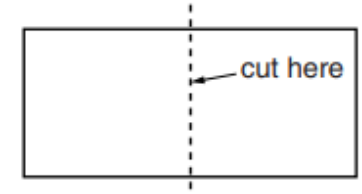
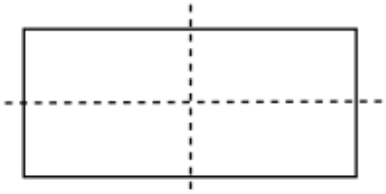
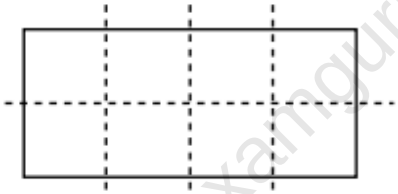
block	view of block from above showing cuts that were made	total number of pieces after cutting	total surface area of all pieces/cm^2
A		1	.....
B		2	12
C		4	16
D		8	20

Fig. 1.2

The student calculated the total surface area of all the pieces cut from each block.

(b) (i) Calculate the surface area of block **A**.

Show your working.

surface area of block **A** .....cm^2 [2]

(ii) Calculate the volume of block **A**.

Show your working and include the units.

volume of block **A** .....[2]

The student labelled four large test-tubes, **A**, **B**, **C** and **D**.

The student put all the agar pieces that had been cut from each agar block, **A**, **B**, **C** and **D**, into the large test-tube that was labelled with the same letter as the agar block.

This is shown in Fig. 1.3.

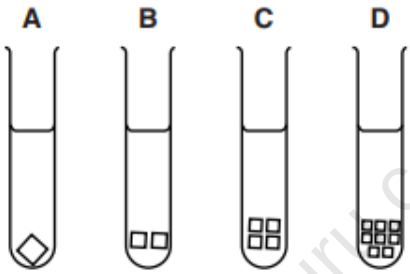


Fig. 1.3

The student poured sulfuric acid into each large test-tube and timed how long it took for all the pieces of agar jelly in each large test-tube to change colour.

The student wrote down their results.

Block **A** took 12 minutes to change.

Block **B** took 6 minutes 25 seconds.

Block **C** took 2 minutes 40 seconds.

Block **D** took 4 minutes 10 seconds.

(c) **(i)** State **two** pieces of apparatus, not shown in Fig. 1.3, that the student needed to use for this investigation.

.....[1]

(ii) Use the space below to draw a suitable results table for this investigation.

[5]

(d) Describe **and** explain the results.

.....

.....

.....

.....

.....

.....

.....[4]

(e) Explain why it was important for blocks **A**, **B**, **C** and **D** to have the same volume at the start, before they were cut into pieces.

.....

..... [1]

(f) Suggest **two** possible sources of errors in the investigation.

For each error, describe one way that you could improve the investigation.

error 1 .....

.....

improvement 1 .....

.....

error 2 .....

.....

improvement 2 .....

..... [4]

(g) The surface area of food particles affects the rate of their break down.

A student carried out an experiment to investigate the rate of the break down of fat.

Two test-tubes were set up as shown in Table 1.1.

Each test-tube contained the same volumes and concentrations of enzyme.

Table 1.1

test-tube	contents of test-tube	time taken for break down of fat / min
E	fat + enzyme + water	8
F	fat + enzyme + bile	3

(i) Suggest a reason for the difference in results recorded in Table 1.1.

.....

.....

.....

..... [2]

(ii) Another student carried out a similar experiment but also included a test-tube that contained fat and water only.

Suggest a reason for this additional test-tube.

.....

..... [1]

[Total: 23]

1 During digestion, the enzyme amylase breaks down starch to maltose, a reducing sugar.

2 **(a)** Describe a test you could safely carry out to show the presence of starch in a solution.

.....

.....

.....

.....

.....

..... [3]

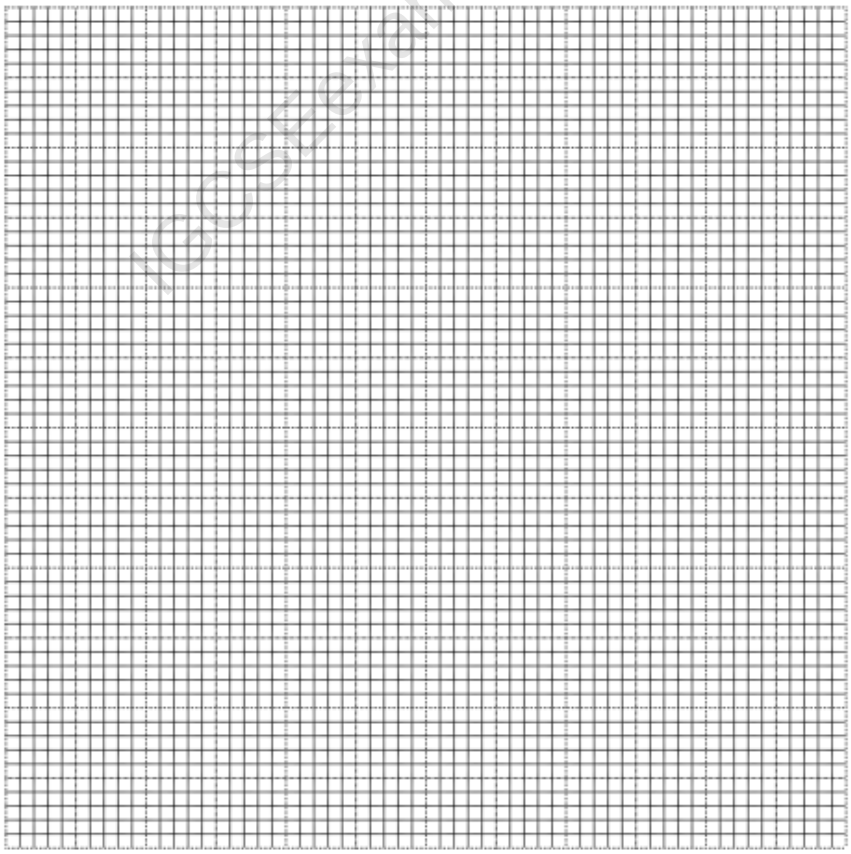
Some students investigated the effect of pH on the activity of amylase during the breakdown of starch. The starch test that you have described in **(a)** was carried out at intervals, until the starch was no longer present.

Their results, in Table 1.1, show the time in minutes for the breakdown of starch using solutions of different pH.

Table 1.1

pH	time/mins
3.0	4.1
4.0	0.5
5.0	0.8
6.0	1.5
7.0	3.5
8.0	4.8

(b) (i) Plot the data from Table 1.1 to show the effect of pH on the time taken for amylase to break down starch.



[4]

(ii) State the optimum (best) pH for the activity of amylase.

..... [1]

(iii) Use this formula to calculate the rate of activity of amylase at the pH given in **(b)(ii)**:

$$\text{rate of enzyme activity} = \frac{1}{\text{time taken in minutes}}$$

Show your working. Give your answer to the nearest whole number.

rate .....
[1]

(iv) Describe the effect of pH on the activity of amylase.

.....

.....

.....

.....

.....

..... [3]

(c) **(i)** Name **two** variables that need to be controlled in this investigation.

1 .....

2 .....
[2]

(ii) Explain **two** ways this investigation could be improved.

.....

.....

.....

..... [2]

[Total: 16]

3 A student tested some solid egg white for protein.

(a) (i) Describe the method the student would use to test the egg white for protein.

.....

.....

.....

.....[2]

(ii) Describe how the student's observations would allow them to decide whether the egg white contained protein or not.

.....

.....

.....

.....[2]

(iii) You would be expected to wear eye protection for this investigation.
State **one** other safety procedure you should follow.

.....

.....[1]

Some students investigated the effect of different concentrations of enzyme on cooked egg white.

The students set up three test-tubes, **A**, **B** and **C**, as shown in Fig. 1.1.

They timed how long it took for all of the pieces of egg white in each test-tube to go clear.

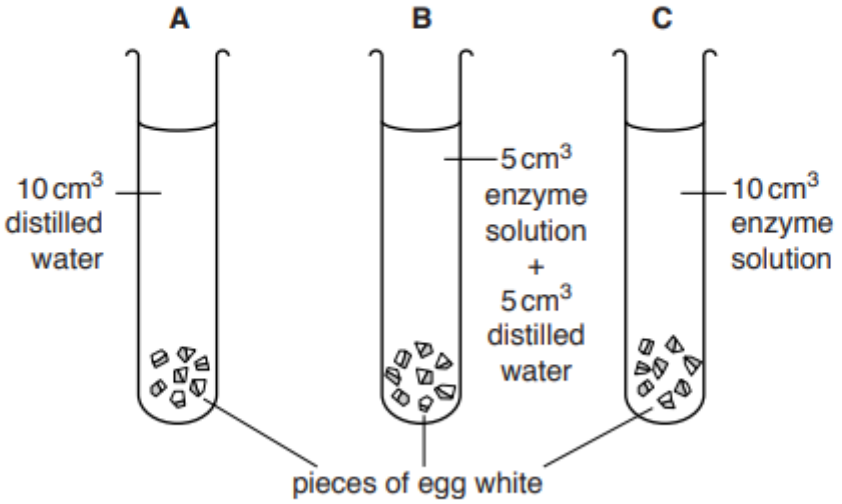


Fig. 1.1

Fig. 1.2 shows the students' results.

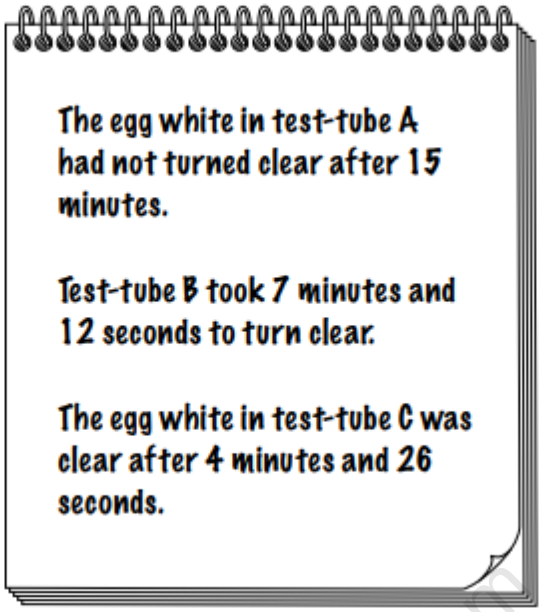


Fig. 1.2

(b) (i) In order to see patterns in the data more clearly, it is necessary to convert times from minutes and seconds into seconds.

Test-tube **A** had not turned clear after 900 seconds.

State the time **in seconds** it took for the pieces of egg white in test-tubes **B** and **C** to turn clear.

Test-tube **B** ..... seconds

Test-tube **C** .....seconds

[1]

(ii) Draw and complete a table to show the students' results.

(c) Using the results in **(b)(ii)**, describe the pattern shown.

.....

.....

.....

.....[2]

(d) State the purpose of test-tube **A** in the investigation.

.....

.....[1]

(e) The test-tubes were kept at 40°C throughout the investigation.

Suggest why this is important.

.....

.....

.....

.....[2]

(f) The students put the same mass of egg white into each test-tube.

However, the size of the pieces of egg white was not controlled.

Suggest why this is a source of error in this investigation.

.....

.....

.....[1]

(g) Enzymes usually have a pH at which they work fastest. This is called the optimum pH.

Fig. 1.3 shows the rate of activity of three different enzymes over a range of pH values.

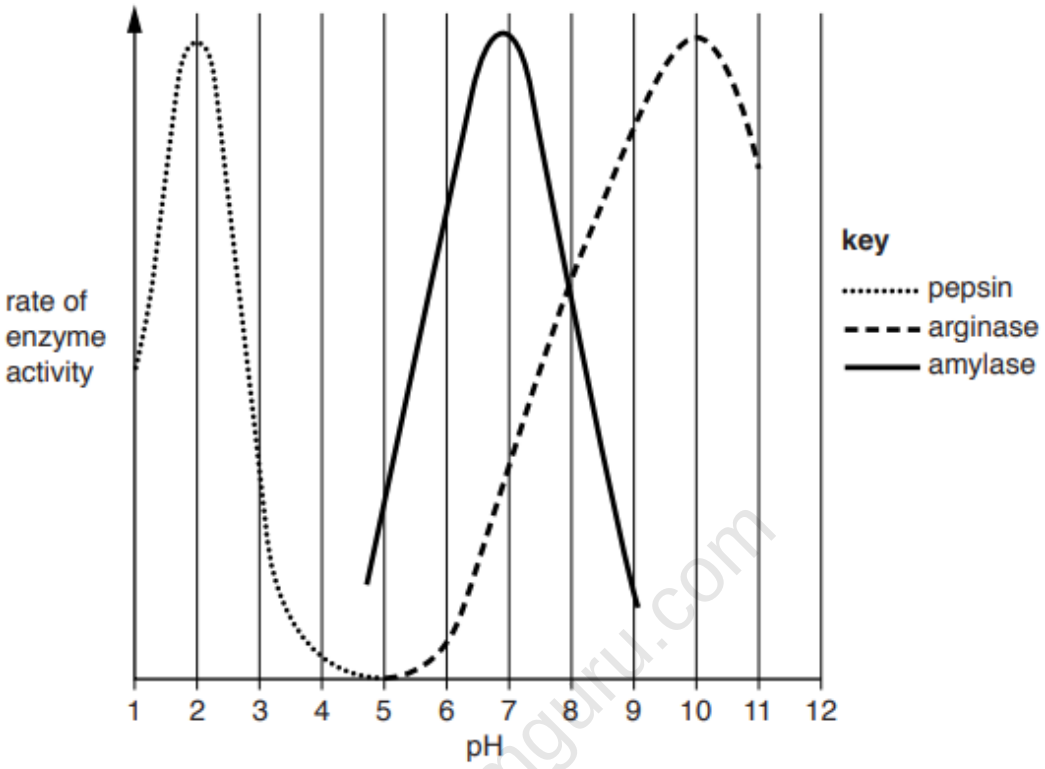


Fig. 1.3

(i) State the optimum pH for arginase.

.....[1]

(ii) Your stomach contains acid. Suggest which enzyme is most likely to be found in your stomach.

.....[1]

[Total: 17]

4 Fig. 2.1 shows part of a yellow maize cob, *Zea mays*.

A cob is composed of many individual fruits known as grains.

Fig. 2.1

Many colours of maize grains are known. The colour is inherited.

Fig. 2.2 shows part of a cob with light and dark coloured grains.

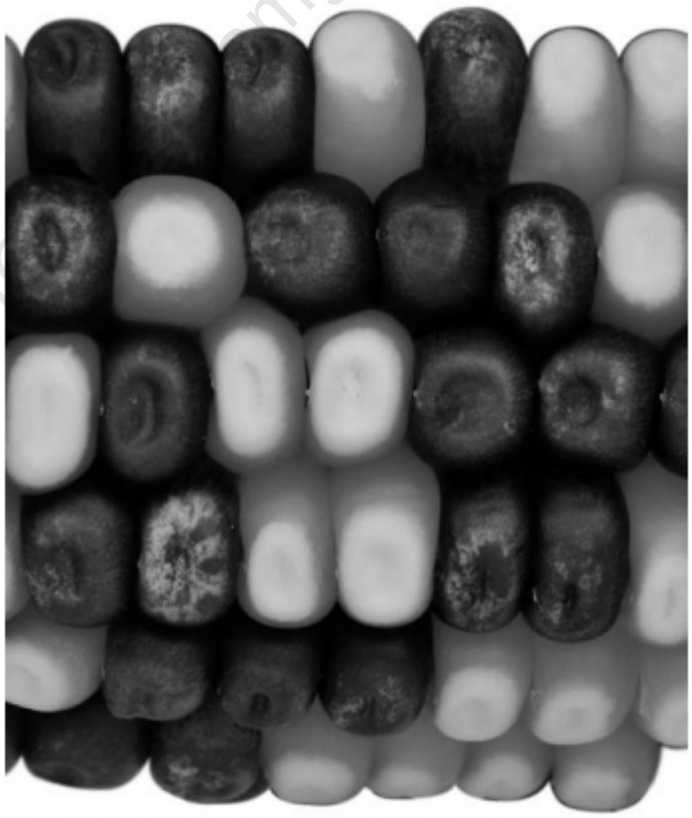


Fig. 2.2

(a) (i) Complete Table 2.1 by counting the number of light and dark coloured grains.

Table 2.1

number of grains	
light	dark

[1]

(ii) Use the data in Table 2.1 to suggest the phenotypic ratio of light to dark coloured grains.

..... [1]

(iii) Describe **one** visible phenotypic difference, other than colour, between the grains shown in Fig. 2.2.

.....

..... [1]

Maize is used as a food source for humans and livestock. It contains mainly starch but also other nutrients including proteins and fat.

(b) Describe how to test maize grains for the presence of protein and fat.

protein .....

.....

.....

.....

fat .....

.....

.....

.....

[5]

Maize is a cereal. Cereals form a high proportion of the daily energy intake for many people.

The protein and fat content of maize and five other cereals is shown in Table 2.2.

Table 2.2

cereal	content per 100 g of dried cereal / g	
	protein	fat
maize	9.5	3.8
millet	10.4	5.0
oats	12.6	7.5
rice	7.1	1.8
sorghum	9.7	3.4
wheat	13.8	2.0

(c) Use Table 2.2 to identify the cereal that provides the largest energy content per 100 g.

Explain your choice of cereal.

.....

.....

.....

.....

.....

..... [3]

[Total: 11]