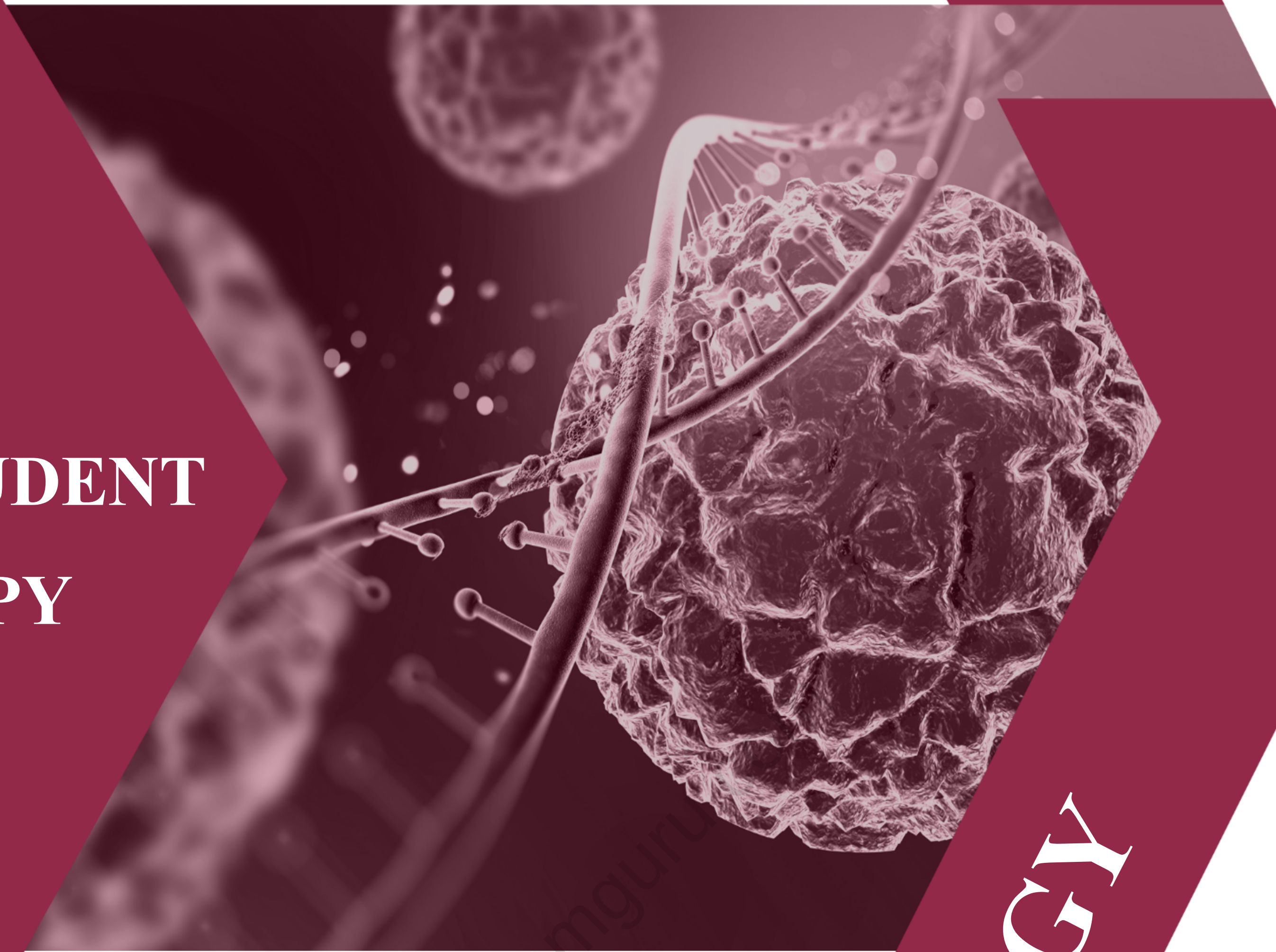

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IGCSE BIOLOGY

HEADS-UP
REACH FOR THE STARS

TOPICAL PRACTICE QUESTIONS

PAPER 6

VOL. 3

CHAPTERS 8-15

2020 EDITION

Chapter 8: Transport in Plants

1 Fig. 1.1 shows two similar cut shoots in test-tubes that contained 20 cm^3 of water at the start.

One shoot has its leaves attached and the other shoot has had its leaves removed.
The shoots were placed in the water immediately after being cut.
A small quantity of oil was added to cover the water in these test-tubes.
The two test-tubes with the shoots were left in the light for two days.

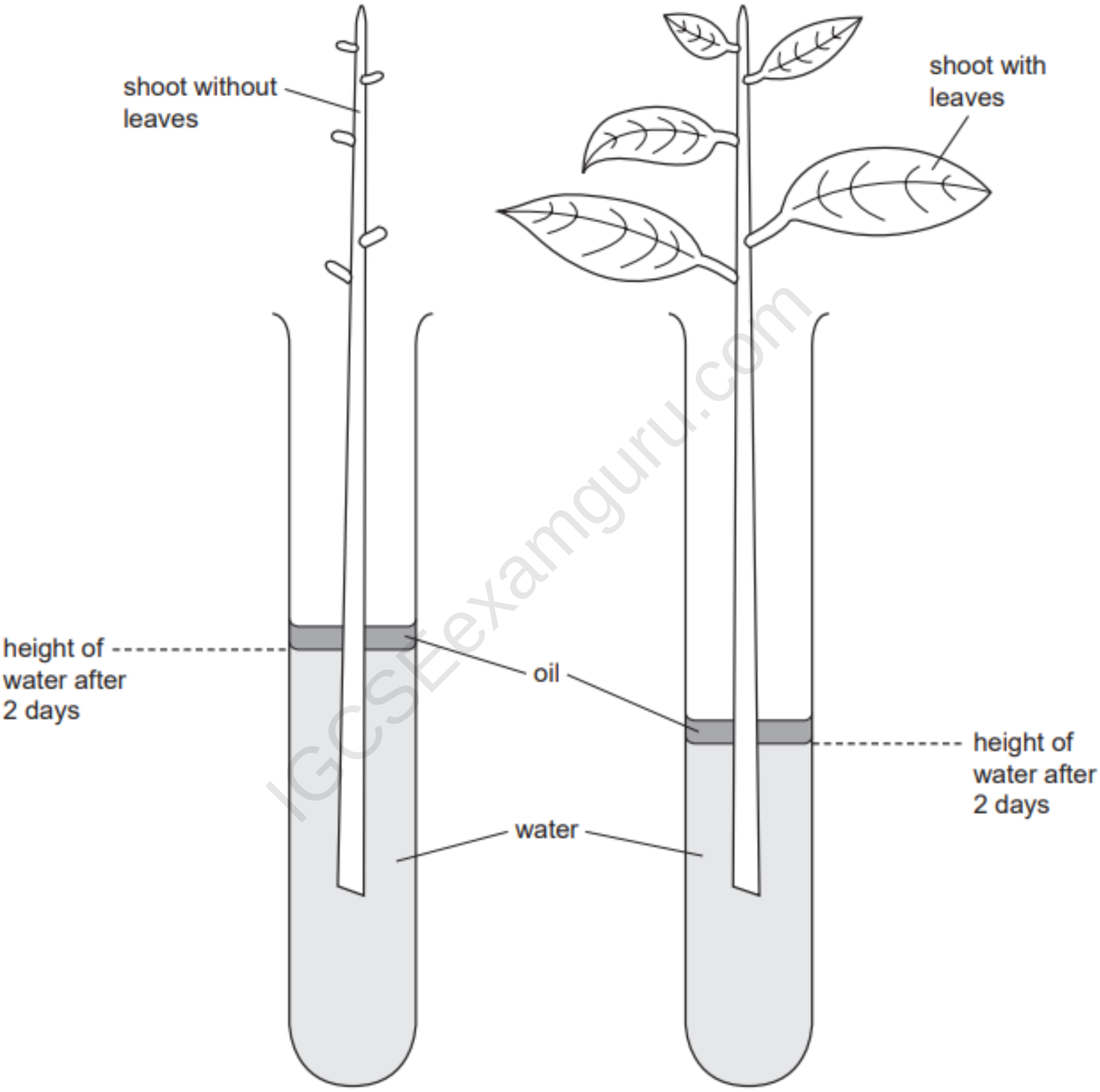


Fig. 1.1

(a) (i) Identify the variable that was changed (independent variable) in this investigation.

....

.... [1]

(ii) Suggest why oil was placed on top of the water in both test-tubes.

....

.... [1]

(iii) Use a ruler to measure the height of the water in the two test-tubes, shown in Fig. 1.1.

test-tube containing shoot without leaves .... mm

test-tube containing shoot with leaves .... mm [1]

(iv) Describe **and** explain your observations.

....

....

....

.... [2]

(b) The two shoots were removed from the test-tubes.
Both shoots were immediately placed in a beaker of coloured water and left for 10 minutes.
After 10 minutes the shoots were removed from the coloured water.
The shoots were cut in half, as shown in Fig. 1.2, to see how far up the stem the coloured water had moved.

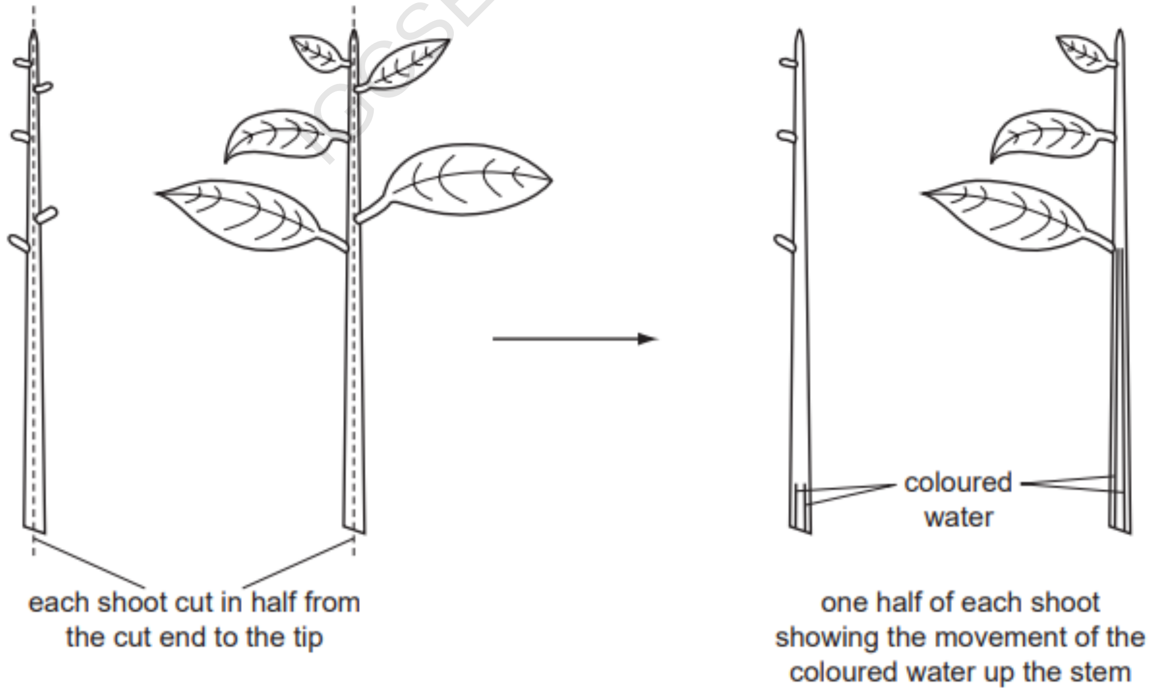


Fig. 1.2

Fig. 1.3

(i) Use a ruler to measure the distance moved by the coloured water, shown in Fig. 1.3.

shoot without leaves .... mm

shoot with leaves .... mm [1]

(ii) Do the measurements in **(b)(i)** support the measurements in **(a)(iii)**? Explain your answer.

....

....

....

.... [2]

(iii) Describe how you could carry out a similar investigation to determine whether **temperature** affects the rate of water uptake of shoots with leaves.

....

....

....

....

....

.... [3]

(c) A group of students measured the mass lost from a flask containing a shoot with leaves.
The shoot was placed in water, on a balance as shown in Fig. 1.4.
An automatic data logger recorded the mass every six hours for two days.

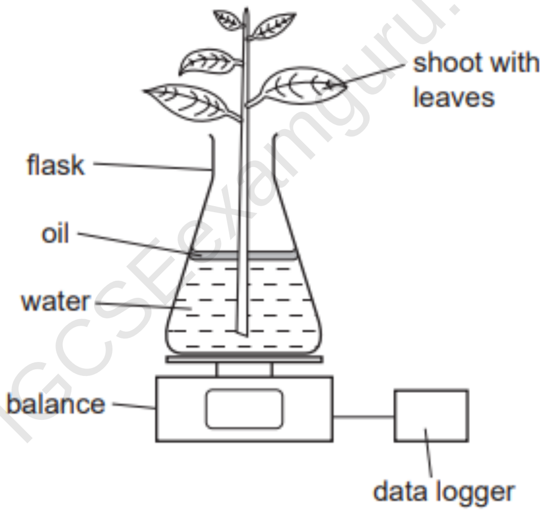


Fig. 1.4

Only natural light from the sun was allowed to fall on the shoot.

The students calculated the mass lost every six hours. The data is shown in Table 1.1.

Table 1.1

time of day	mass lost / g
10:00	0.0
16:00	3.0
22:00	5.0
04:00	5.0
10:00	7.0
16:00	10.0
22.00	11.5
04.00	11.5
10.00	13.5

(c) (i) Plot the data from Table 1.1 on Fig. 1.5.

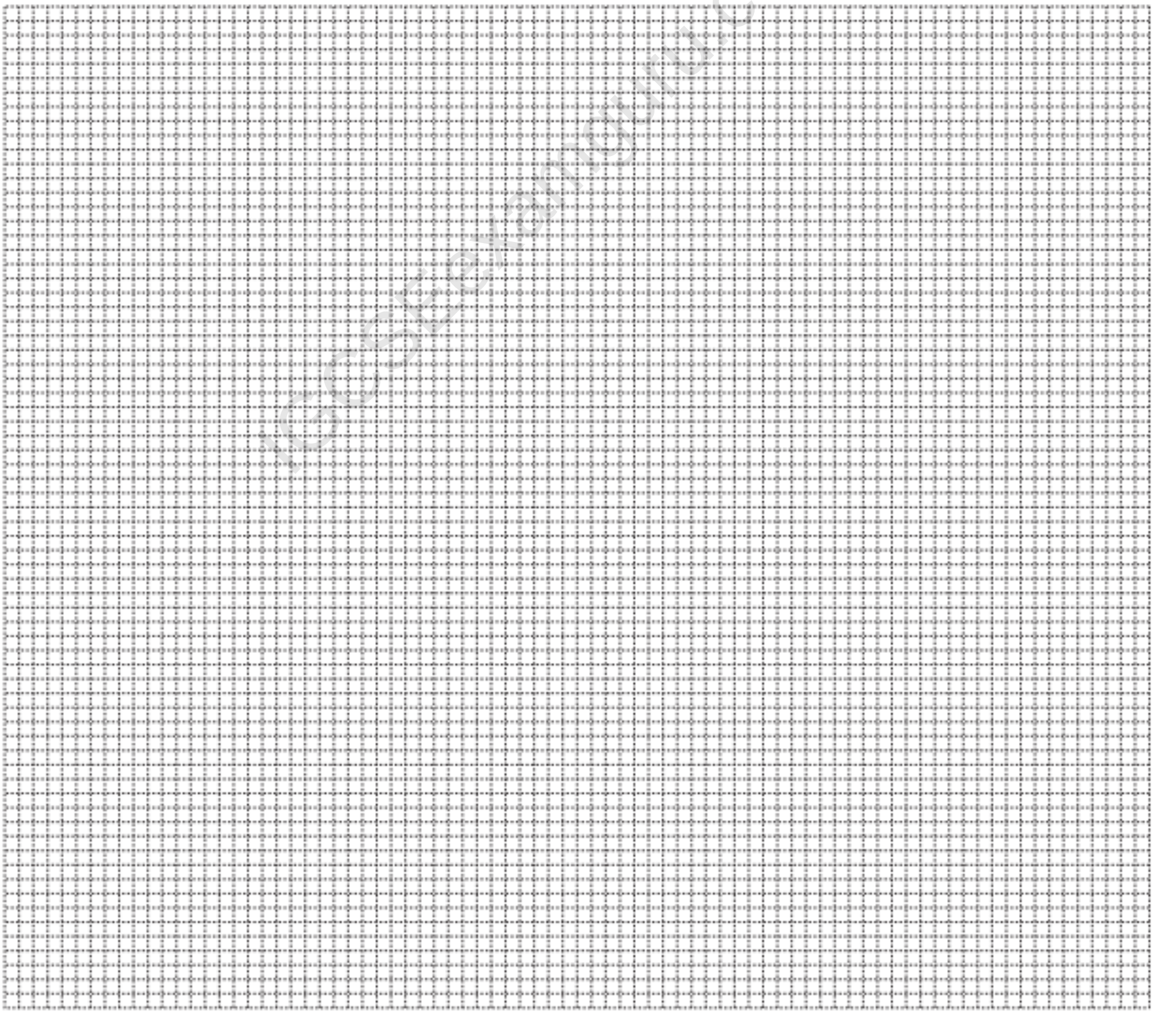


Fig. 1.5

[4]

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

description ....

....

explanation ....

....

....

.... [3]

Fig. 1.6 shows part of the lower surface of a leaf as viewed under a microscope.

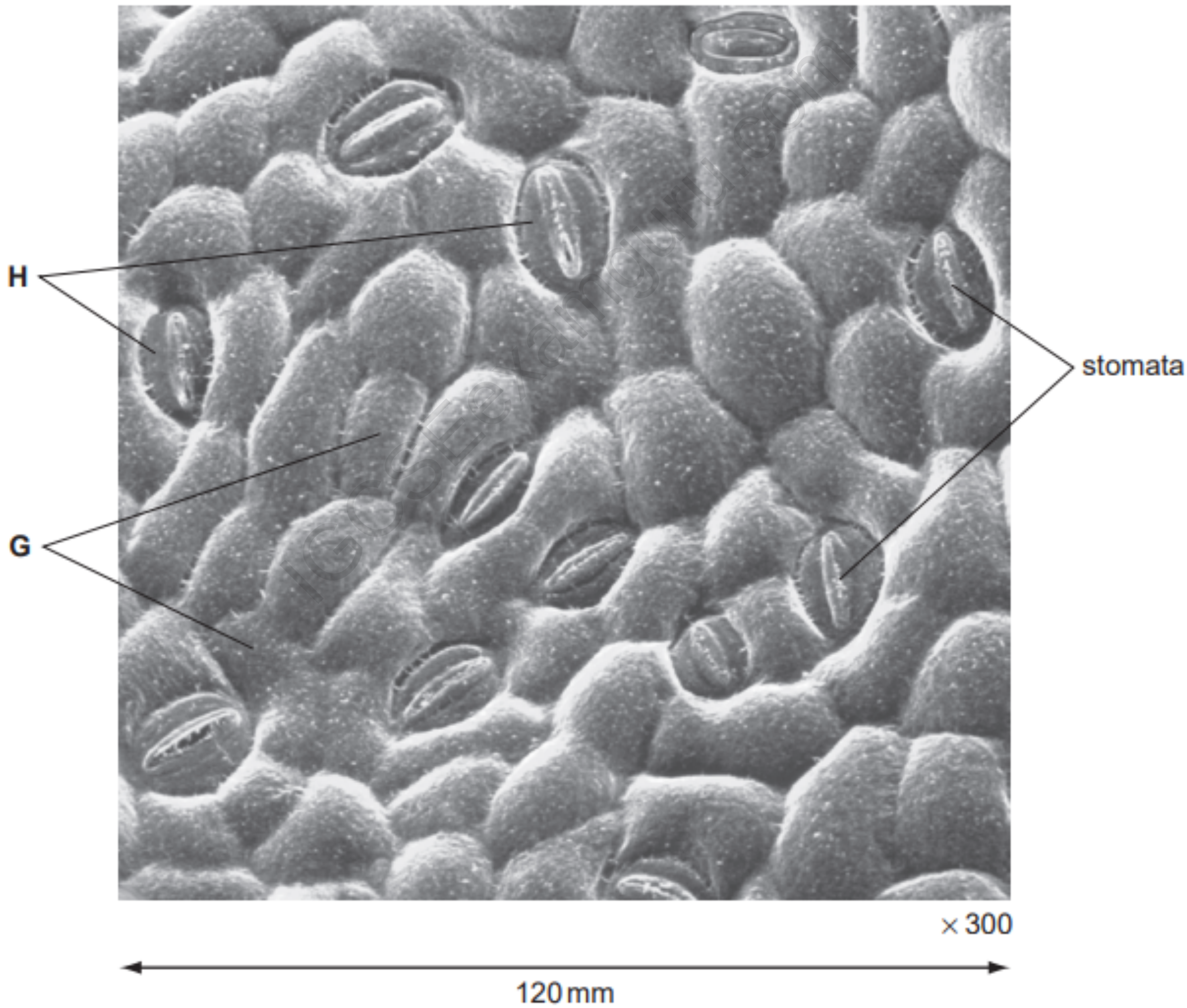


Fig. 1.6

(d) Name the structures labelled **G** and **H**.

G ....

H .... [2]

(e) The number of stomata on the lower surface of the leaf can be calculated by using Fig. 1.6.

(i) Count the number of stomata visible in Fig. 1.6.

number of stomata .... [1]

(ii) The magnification of the image in Fig. 1.6 is × 300.

The length of one side of the image is 120 mm. The image is a square.

You can calculate the actual length of one side of the square of leaf surface shown in Fig. 1.6 by dividing the length of one side of the image by the magnification.

Calculate the actual length of one side of the square of leaf surface shown in Fig. 1.6.
Show your working.

actual length of one side of the square of leaf surface .... mm [1]

(iii) Calculate the actual total area of the square of leaf surface shown in Fig. 1.6.
Show your working.

actual total area of the square of leaf surface .... mm^2 [2]

(iv) The number of stomata per mm^2 can be calculated from the number of stomata and the actual total area of the square of leaf surface shown in Fig. 1.6.

Calculate the number of stomata per mm^2 of this leaf.
Show your working.

number of stomata per mm^2 .... [2]

(v) The total area of the lower surface of this leaf was measured and found to be 9000 mm^2.

Calculate the total number of stomata on the lower surface of this leaf.
Show your working.

total number of stomata .... [1]

[Total: 27]

2 The outline of a leaf has been drawn on the grid in Fig. 2.1.

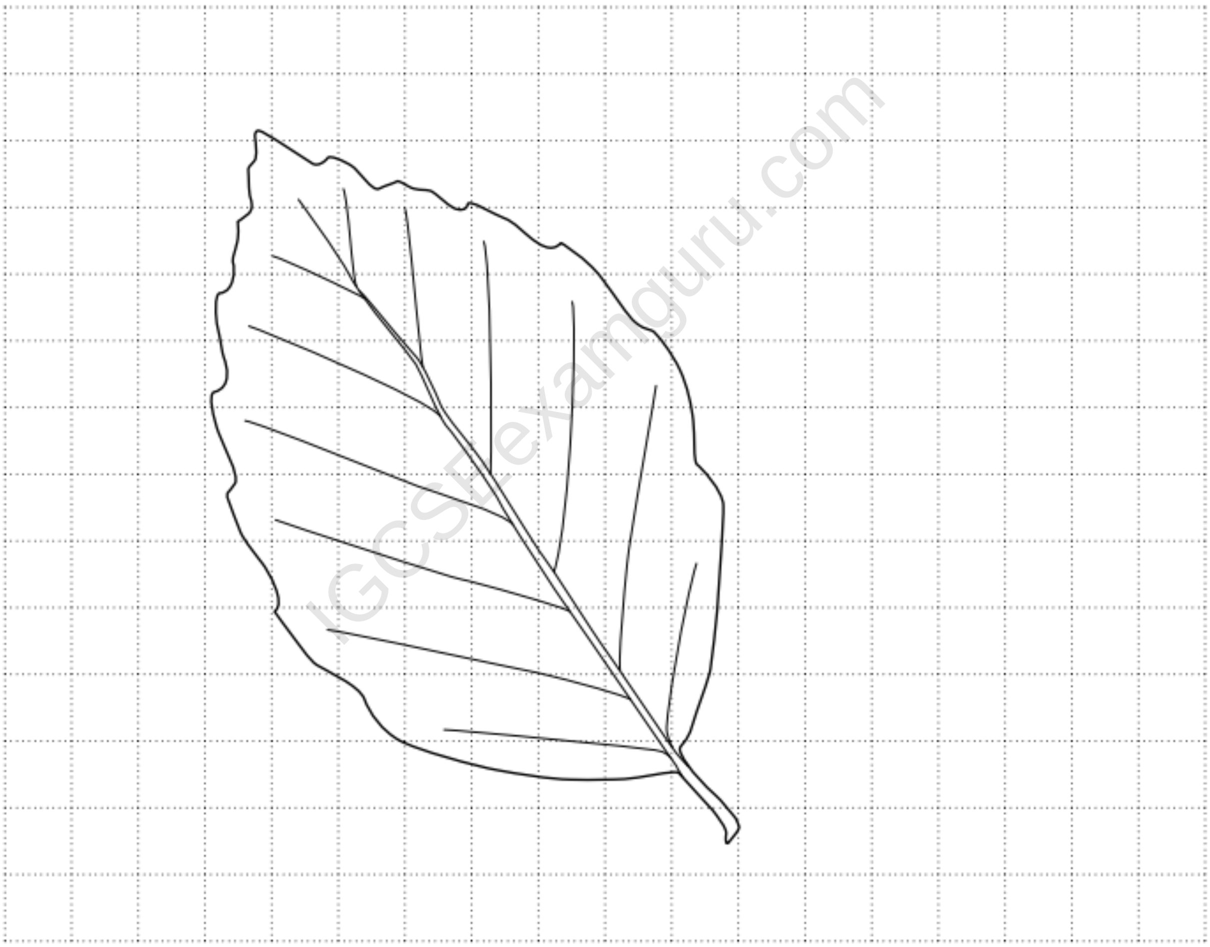


Fig 2.1

(a) Label **two** features of the leaf shown in Fig. 2.1. [2]

(b) **(i)** Use the grid to estimate the area of the surface of the leaf shown in Fig. 2.1.

Each square of the grid has an area of 1 cm^2.

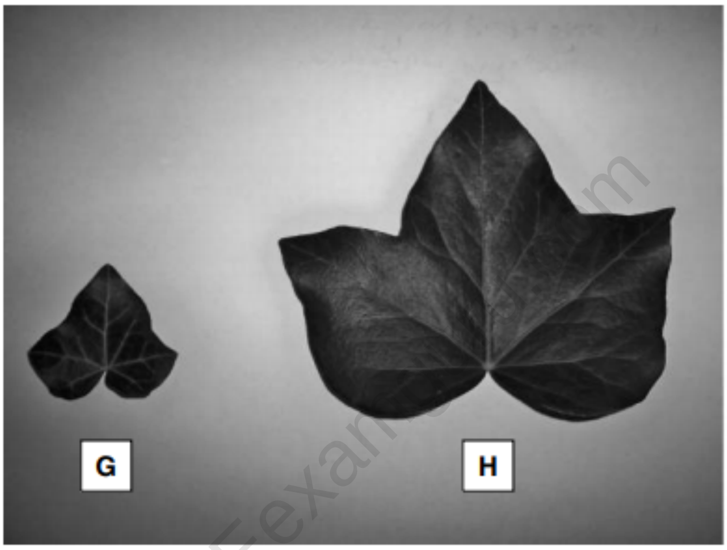
.... cm^2 [1]

(ii) Suggest **one** way to improve the accuracy of this method of calculating the surface area of a leaf.

....

.... [1]

(c) The two leaves, **G** and **H**, shown in Fig. 2.2 are from the same plant.



× 1

Fig. 2.2

One of the leaves was from higher up the plant, in full sunlight.

The other leaf was from lower down the plant, in the shade.

Suggest **and** explain which leaf is from lower down the plant, in the shade.

....

....

....

.... [2]

(d) Table 2.1 shows the results of an investigation into the relationship between the total surface area of the leaves on a plant and the volume of water lost from the plant.

Table 2.1

total surface area of leaves / m^2	volume of water lost from plant per day / dm^3
0.05	4.5
0.10	6.5
0.15	8.0
0.20	10.0
0.25	12.5

(i) Plot a graph of the data in Table 2.1 on the grid below. Draw a straight line of best-fit.

[4]

(ii) Describe the trend shown by the results.

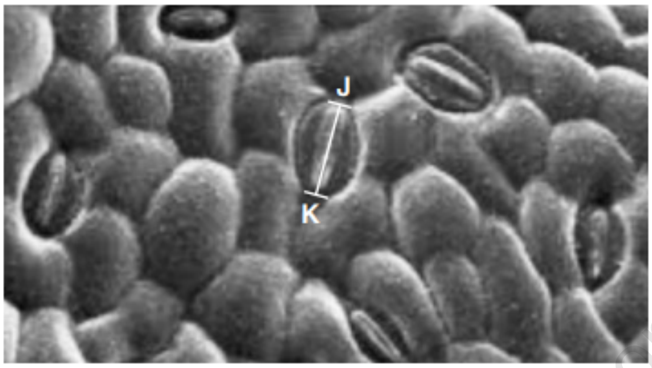
....

....

....

.... [2]

(e) Fig. 2.3 shows the lower surface of a leaf as seen under a microscope.



× 400

Fig. 2.3

JK shows the length of a stoma in Fig. 2.3.

Measure the length of **JK**.

length of **JK** .... mm

Calculate the actual length of the stoma.

Show your working.

actual length of stoma .... mm

[3]

(f) A student investigated how light intensity affected the rate of water loss from a leaf.

Suggest **two** variables that the student would control in their investigation.

1 ....

....

2 ....

.... [2]

[Total: 17]

2 Fig. 2.1 shows two leaves, **R** and **S**, from different plants.

R **S**

actual size

Fig. 2.1

3

(a) (i) Make a large drawing of **R** to show:

- the shape of the leaf
- the arrangement of the veins in the leaf.

Label the main vein (midrib).

[4]

(ii) Draw a line across the widest part of **R** in Fig. 2.1. Measure, in millimetres, the distance and record your result. Include your units.

distance across the widest part of **R** ....

Draw a line across the widest part of your drawing, measure the distance (in millimetres) and record your result. Include your units.

distance across widest part of drawing of **R**...[3]

(iii) Calculate the magnification of your drawing.

Show your working.

Give your answer to the nearest whole number.

magnification × ....[2]

(b) (i) Complete Table 2.1 by recording two **visible** differences, other than colour, between leaves **R** and **S**.

Table 2.1

R	S
1..	....
2..	....

[2]

(ii) State, with a reason, which of the leaves, **R** or **S**, is from a monocotyledon.

....

....[1]

(c) Some students were provided with two leaves, **V** and **W**, from different plants. In an investigation into water loss, the students recorded the mass of each of these leaves every 5 minutes for 60 minutes.

(i) The humidity did not change during the investigation.

State **two** other variables that should be kept constant during the investigation.

Describe how each variable could be kept constant.

1. variable ....

method of keeping constant ....

....

2. variable ....

method of keeping constant ....

....[4]

The results are shown in Table 2.2.

Table 2.2

time / min	mass of **V** / g	mass of **W** / g
0	5.2	7.5
5	4.8	7.2
10	4.0	6.5
15	5.5	6.0
20	3.2	5.5
25	2.9	5.1
30	2.8	4.3
35	2.7	4.0
40	2.4	3.6
45	2.2	3.2
50	1.8	3.0
55	1.8	2.9
60	1.8	2.7

(ii) The students assumed that the change in mass was due to water loss.

Describe how the students could show that **water** is lost from the leaves.

....

....

....

....

....

....[3]

(iii) Describe **two** similarities and **two** differences in the pattern of water loss of leaf **V** and leaf **W**.

similarities

1 ....

....

2 ....

....

differences

1 ....

....

2 ....

....[4]

[Total: 23]

4 Fig. 2.1 shows a leaf from a plant.

Fig. 2.1

(a) Draw a large diagram of the leaf shown in Fig. 2.1.

[3]

(b) A group of students investigated the rate of transpiration from four leaves.

They covered different surfaces of the leaves with petroleum jelly. Petroleum jelly creates a waterproof barrier.

They then measured the mass of each leaf.

The leaves were left hanging from a piece of string in a warm place for 24 hours.

The students then measured the mass of each leaf again.

Table 2.1 shows their results.

Table 2.1

leaf	surfaces covered with petroleum jelly	mass at start / g	mass at end / g	percentage decrease in mass / %
P	upper and lower	4.8	4.6	4.2
Q	upper only	4.6	4.1	10.9
R	lower only	4.6	4.3	6.5
S	none	4.2	3.5	

(i) Calculate the percentage decrease in mass for leaf **S**.

Show your working.

Write your answer to one decimal place.

.... %
[2]

(ii) Suggest why it is important to calculate the percentage decrease in mass for each leaf.

....

....

....

....[2]

(iii) Plot a bar chart to show the percentage decrease in mass for each leaf.

[4]

(iv) Use the results to explain whether the upper or lower surface of the leaf loses the most water.

....

....[1]

(c) The students decided to investigate how temperature affects the rate of transpiration.

Suggest the variable they should change (independent variable), the variables they should control (control variables) and the variable they should measure (dependent variable).

independent variable

....

control variables

....

....

....

dependent variable

....
[4]

[Total: 16]

Chapter 9: Transport in Animals

1 A group of students investigated how their pulse rate changed during exercise.

They measured their resting pulse rate before they started exercising.

(a) (i) Describe how to measure pulse rate.

....

....

....[2]

(ii) Explain why it is important to measure the **resting** pulse rate.

....

....[1]

(b) The students exercised for 1 minute and then measured their pulse rate.

They immediately exercised for another minute and measured their pulse rate again.

They continued exercising and measured their pulse rate every minute up to a total of 5 minutes.

Fig. 1.1 shows the results for one of the students.

Resting = 68

After 1st exercise, my pulse rate was 88.

Then it was 82.

Then 102.

Then 110.

At the end, it was 110.

Fig. 1.1

(i) Draw a results table for the results shown in Fig. 1.1.

Write the results in your table.

[4]

(ii) Describe the results and suggest an explanation for them.

description ....

....

....

....

....

....

explanation ....

....

....

....[4]

(c) Suggest **two** changes that could be made to improve the results of this investigation.

For each change, explain how it would improve the results.

change ....

....

....

explanation ....

....

....

change ....

....

....

explanation ....

....

....[4]

(d) Fig. 1.2 shows a cross-section of a human coronary artery as seen with a microscope.

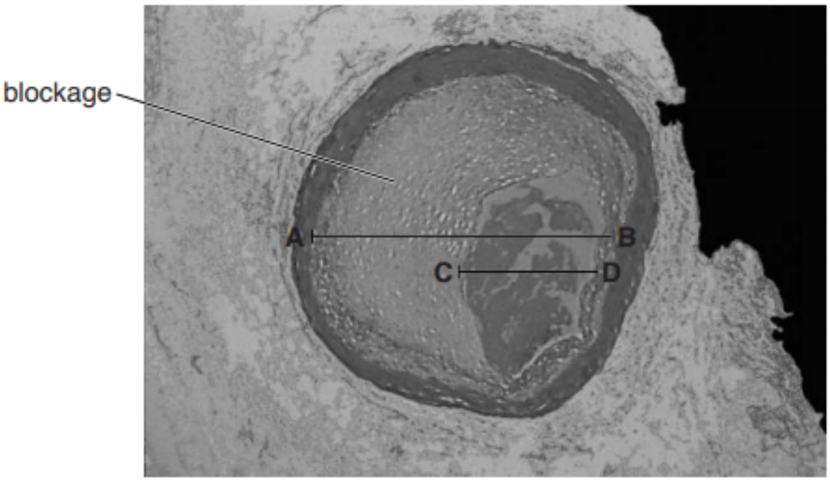


Fig. 1.2

The actual internal diameter of this coronary artery at **AB** is 4.3 mm.

(i) Measure the length of **AB** in Fig. 1.2.

length of **AB** in Fig. 1.2 .... mm

Calculate the magnification of Fig. 1.2.

Show your working.

magnification × .... [3]

(ii) The coronary artery in Fig. 1.2 has been affected by coronary heart disease.

A blockage has reduced the internal diameter of the coronary artery.

This reduced diameter is shown by the line **CD**.

The actual diameter **AB** is 4.3 mm.

The reduced actual diameter **CD** is 2.0 mm.

Calculate the percentage decrease in the diameter of the artery from **AB** to **CD**.

Show your working.

Give your answer to the nearest whole number.

....% [3]

[Total: 21]

Chapter 11: Gas Exchange in Humans

1 Inhaled air differs in composition from exhaled air.

Table 3.1 shows some of these differences.

Table 3.1

	inhaled air	exhaled air
temperature	varies	body temperature
oxygen	higher	lower
carbon dioxide		
water vapour		

(a) Complete Table 3.1, to show the difference in composition of inhaled and exhaled air for carbon dioxide **and** water vapour.

Write your answers in Table 3.1. [2]

(b) Describe how you could test for the presence of:

(i) carbon dioxide;

test ....

result .... [2]

(ii) water vapour.

test ....

result .... [2]

[Total: 6]

Chapter 12: Respiration

1 Some students compared the metabolism of two yeast mixtures in test-tubes **W1** and **W2**, using the apparatus shown in Fig. 1.1. Both mixtures contained the same concentration of sucrose.

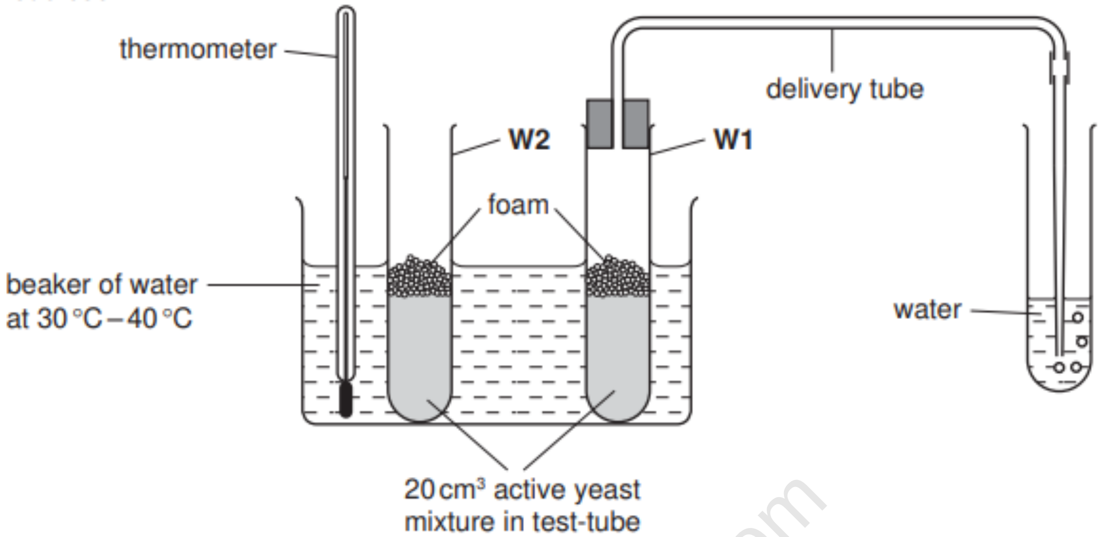


Fig. 1.1

The apparatus was left for two minutes. After this period, the number of gas bubbles released from the delivery tube was counted for two minutes. This number was recorded as **trial 1** in Table 1.1.

The yeast mixture was shaken and the number of bubbles was recorded for two more minutes as **trial 2**. This was repeated for **trial 3**.

The whole procedure was then repeated using test-tube **W2**.

The results for all three trials for test-tube **W2** were recorded in Table 1.1.

Table 1.1

yeast mixture	number of bubbles of gas released in two minutes		
	trial 1	**trial 2**	**trial 3**
W1	5	3	2
W2	20	15	10

(a) Gas bubbles are produced in this experiment.

(i) State which metabolic process is being carried out by the yeast cells to produce this gas.

.... [1]

(ii) Name this gas. .... [1]

(iii) Describe a test for this gas and the result that you would expect.

....

....

....

.... [2]

(b) Suggest why the test-tubes **W1** and **W2** were placed in a beaker of warm water during the experiment.

....

....

....

.... [2]

(c) Describe **and** explain any differences observed in the number of bubbles of gas released.

....

....

....

....

....

.... [3]

(d) State **two** sources of error in the **method** of this investigation.
Suggest how to improve the method to reduce **each** source of error.

source of error ....

....

improvement ....

....

source of error ....

....

improvement ....

.... [4]

[Total: 13]

2 Flies lay eggs which hatch into maggots. An investigation was carried out on the respiration rate of maggots.

Fig. 3.1 shows some living maggots in a large test-tube.

The apparatus was left to settle with the clip open.

The clip was then closed and a drop of coloured liquid was introduced into the open end of the capillary tube.

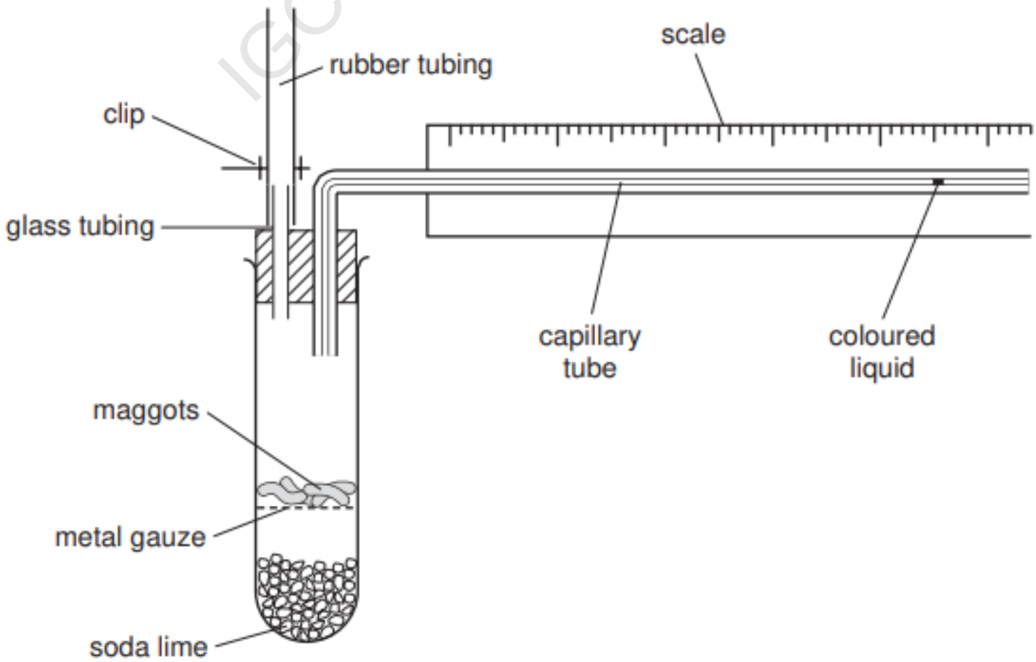


Fig. 3.1

Soda lime absorbs carbon dioxide.

During the investigation, the drop of coloured liquid moved along the capillary tube **towards** the test-tube.

(a) Explain why the drop of coloured liquid moved towards the test-tube.

....

....

....

....

....

....

....

.... [4]

(b) Suggest a suitable control for this investigation.

....

.... [1]

Some students carried out a similar investigation with another sample of maggots to find the effect of temperature on this process.

The distance moved by the drop of coloured liquid was measured after one minute at each temperature.

Fig. 3.2 shows the results.

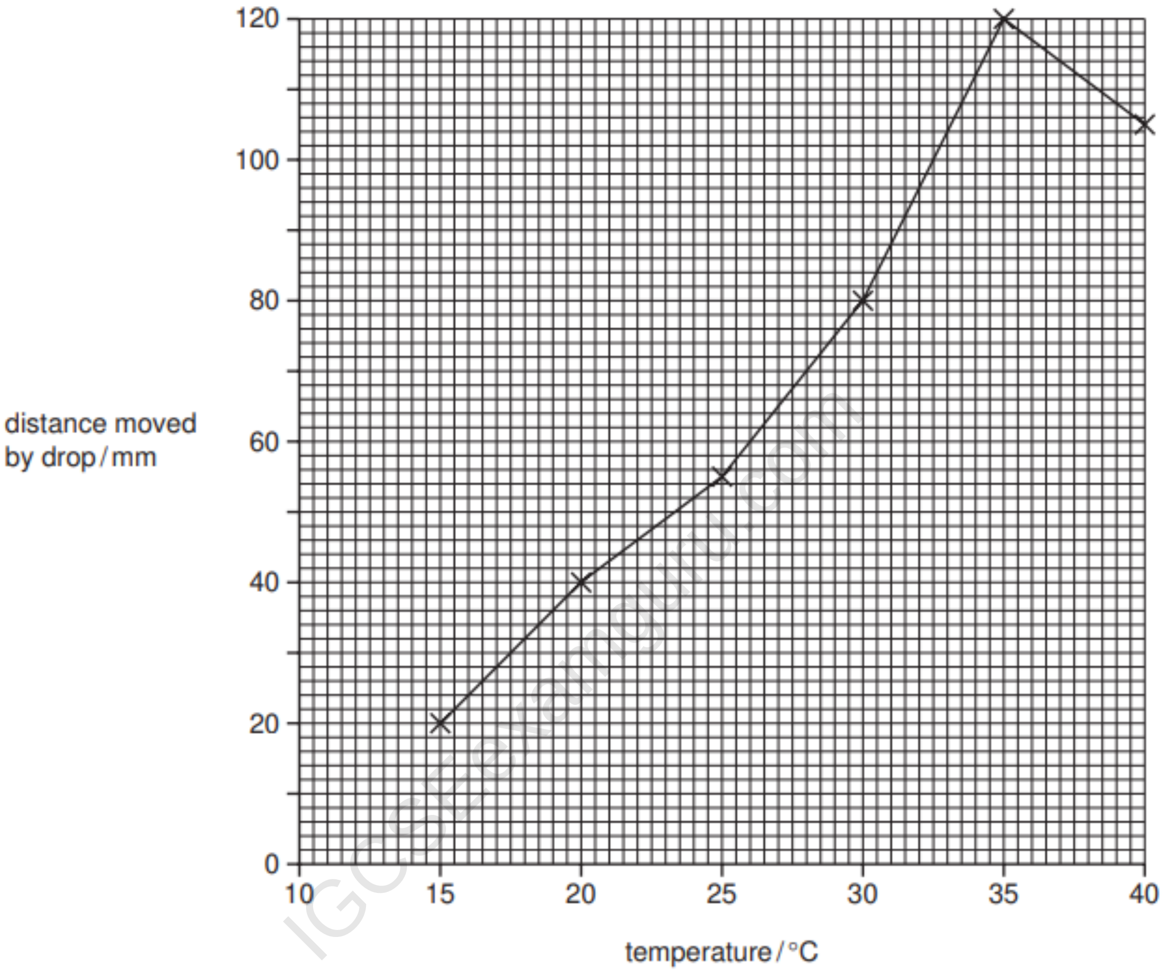


Fig. 3.2

(c) Describe the results shown on the graph.

....

....

....

....

....

.... [3]

(d) Explain the difference between the results at 20 °C and 30 °C.

....

....

....

.... [2]

[Total: 10]

3 During respiration, a chemical is produced that causes the indicator methylene blue to change from blue to colourless.

Some students investigated the effect of temperature on the rate of respiration in yeast, using yeast and methylene blue.

- A ruler was used to measure 2 cm from the top of **three** test-tubes and a line was drawn on each test-tube.
- Yeast suspension with glucose was poured into each test-tube until it reached the line drawn on the test-tube.
- Three beakers were labelled: **cold**, **warm** and **hot**.
- One test-tube was placed in each container.
- A mixture of ice and water was placed into the beaker labelled **cold**, tap water at room temperature into the beaker labelled **warm** and hot water from a tap into the beaker labelled **hot**.
- A thermometer was used to measure the temperature in each beaker.
- The test-tubes were left for five minutes and then 1 cm^3 of methylene blue was added to each test-tube.
- A glass rod was used to stir the mixture so the methylene blue spread evenly.
- A stopper (bung) was placed in each test-tube and a timer started.
- The time for the methylene blue to become colourless was recorded. This was trial 1.
- The same procedure for trial 1 was repeated twice to give results for trial 2 and trial 3.

Fig. 1.1 shows the temperatures of the water in each beaker and the times, in minutes and seconds, for each test-tube to become colourless.

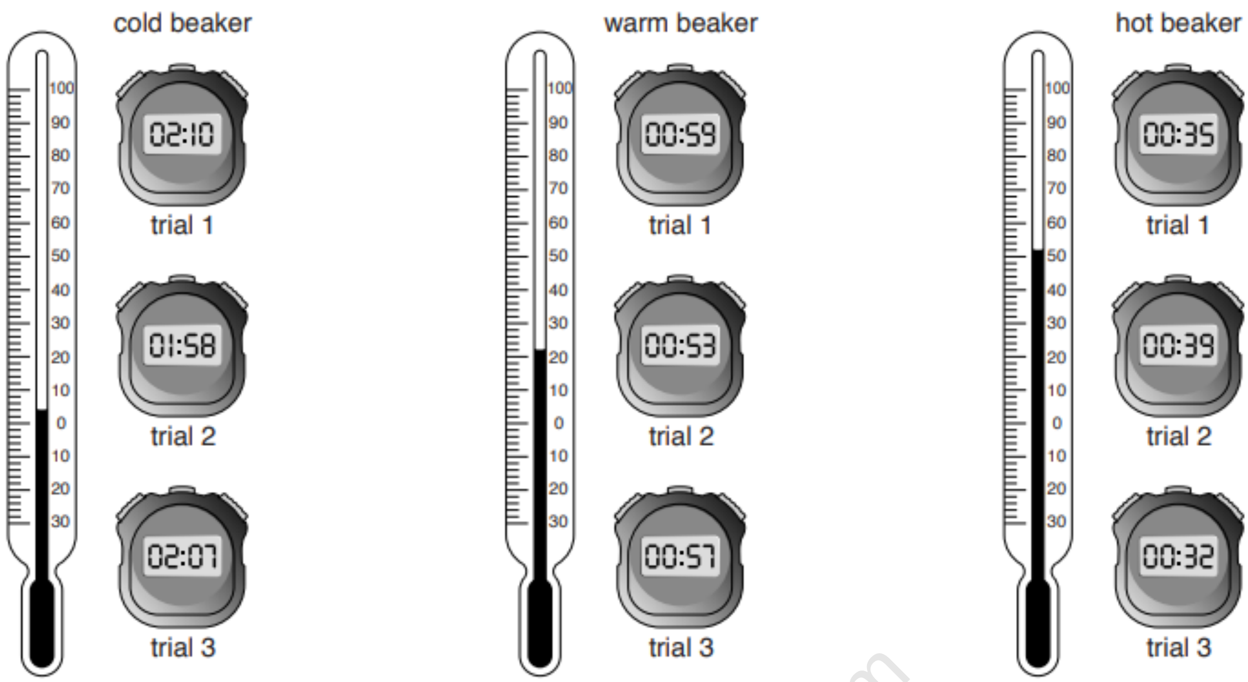


Fig. 1.1

(a) Prepare a table to record the results of the investigation shown in Fig. 1.1.

Read the temperature for each beaker and the times taken for the methylene blue to become colourless at each temperature.

In your table:

- record the temperatures in degrees Celsius
- record the times in **seconds**.

(b) **(i)** State a reason why the students took three readings for each temperature.

....

....[1]

(ii) Calculate the average time for the methylene blue to become colourless at each temperature.
Show your working and record your results in Table 1.1.

Give your answer to the nearest whole number.

Table 1.1

temperature / °C	working	average

[2]

(iii) State **one** conclusion about the effect of temperature on the rate of respiration in yeast.

....

....[1]

(c) (i) The method of timing how long it takes for the methylene blue in the three test-tubes to become colourless is a source of error. Suggest why.

....

....[1]

(ii) Describe how you could improve the method to reduce this source of error.

....

....

....[1]

(d) Some students investigated the effect of pH on the rate of respiration by measuring the volume of carbon dioxide produced by yeast in 30 minutes.

Their results are shown in Table 1.2.

Table 1.2

pH	average volume of carbon dioxide produced in 30 minutes / cm^3	rate of carbon dioxide production / cm^3 per minute
4	6	0.2
5	12	0.4
6	36	1.2
7	54	....
8	63	2.1

(i) Complete Table 1.2 by calculating the rate of carbon dioxide production at pH 7.

Write your answer in the space in Table 1.2.

Show your working in the space below.

[1]

(ii) Plot the data from Table 1.2 to show the effect of pH on the rate of carbon dioxide production by yeast.

[4]

(iii) Describe **and** explain the trend shown by the results in Table 1.2 and the graph you have drawn.

....

....

....

....

....[3]

[Total: 20]

ChChapter 13: Excretion in Humans

1 Urine is a waste product released from the body. It contains urea, water, salts and other metabolic wastes.

A student investigated the chemicals present in different samples of urine, **A**, **B** and **C**.

These samples were made up in the laboratory to represent urine.

The student carried out a test for protein and a test for reducing sugar on each sample.

(a) Describe the method that the student should use to safely test the samples for:

reducing sugar

....

....

....

....

protein.

....

....

....

....
[4]

(b) Table 1.1 shows the student's observations of the final colour in each of the two tests.

Table 1.1

sample	observation of final colour	
	reducing sugar test	protein test
A	blue	blue
B	red	blue
C	orange	violet

Urine is often tested as part of a medical health check. The results of these urine tests can be used to suggest whether a person has a health problem.

Assume samples **A**, **B** and **C** were collected from three different people during a medical health check.

If reducing sugar is present, the person may be suffering from a disease called diabetes.

If protein is present, the person may be suffering from kidney problems.

However, if reducing sugar and protein are both absent from the urine, the person is likely to be healthy.

Use this information to make and explain a conclusion about the health of each of these people.

(i) person **A**

....

....

....

....

.... [2]

(ii) person **B**

....

....

....

....

.... [2]

(iii) person **C**

....

....

....

....

.... [2]

(c) The student decided to test the pH of samples **A**, **B** and **C** using litmus paper. Their teacher suggested that this was not the best way to test the pH and recommended that they used another method.

(i) Describe why the teacher thought that litmus was not suitable.

....

....

.... [1]

(ii) Suggest a suitable alternative method of determining the pH of a solution.

.... [1]

(d) One of the functions of the kidney is to reabsorb glucose back into the blood.

Table 1.2 shows the relationship between the glucose concentration in the blood and the amount of glucose excreted in the urine.

Table 1.2

blood glucose concentration / mg per 100 cm^3	glucose excreted in urine / mg per minute
0	0
100	0
200	0
300	40
400	100
500	190
600	280
700	370

(i) Plot a graph of the data in Table 1.2.

[4]

(ii) Describe the trend shown by the data plotted in **(i)**.

....

....

....

....

.... [2]

(iii) Use your graph to find how much glucose is excreted in the urine when the blood glucose concentration is 280 mg per 100 cm^3.

.... mg per minute [1]

[Total: 19]

Chapter 14: Coordination & Response

63/MJ 2016

1 Fig. 1.1 shows an elephant, *Loxodonta africana*. They have large ears which help them to control their body temperature.

Fig. 1.1

When the elephant is too hot, more blood is pumped into the blood vessels in the elephant's ears. Increasing blood flow to the surface of the skin helps the elephant to cool down.

A student set up a model of what happens in the elephant's ears, as shown in Fig. 1.2.

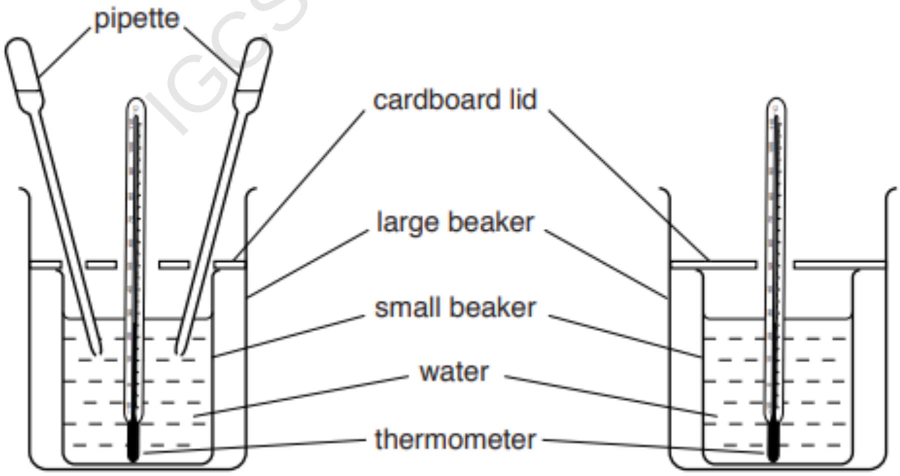


Fig. 1.2

They placed hot water into two small beakers and stood each one in a larger beaker. One of the small beakers had 'ears' and the other did not.

The 'ears' were represented by two plastic dropping pipettes. The student squeezed and released the pipette ears throughout the experiment so that water continuously moved out of and into the pipettes.

The student placed a cardboard lid on top of each small beaker. They made holes in the cardboard lids so that a thermometer and the pipettes could pass through them.

(a) The student recorded the starting temperature of the water in both small beakers.

The thermometer readings are shown in Fig. 1.3.

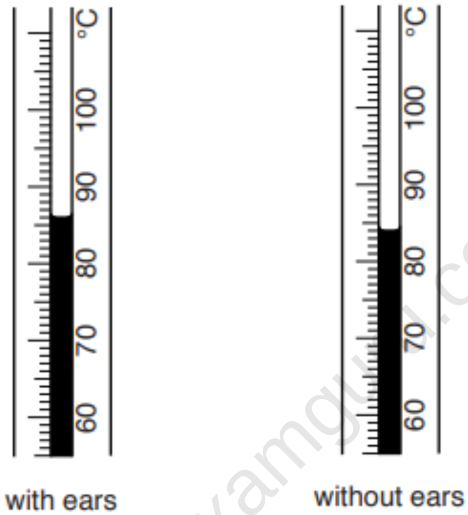


Fig. 1.3

Read the starting temperatures of the two thermometers shown in Fig. 1.3 and record the temperatures below.

with ears ....   without ears ....   [2]

(b) The student measured and recorded the temperature of the hot water in both beakers every minute for a total of eight minutes.

The student obtained the results shown in Fig. 1.4.

> With ears (pipettes) the temperature went down to 84 after a minute, then 80, 78, 76, 74, 72, 71 and finished at 70°C after 8 minutes.
>
> Without the ears the other beaker of water dropped every minute to 83, 82, 81, 79, 78, 77, 76 and finished at 75.

Fig. 1.4

Prepare a table to record the observations shown in Fig. 1.4 **and** the starting temperatures from Fig. 1.3.

Complete the table by entering all of the results.

(c) Suggest **one** safety precaution that should be taken during this experiment.

....

....

....[1]

(d) (i) A student repeated this experiment and calculated the change in temperature of the water each minute for eight minutes in both small beakers.

The change in temperature in the small beaker with pipette ears was 18 °C.

The change in temperature in the small beaker without pipette ears was 11 °C.

Explain why it is important to calculate the change in temperature in each beaker.

....

....

....

....

....[2]

(ii) Use the information in part **(d)(i)** to calculate the **rate** of temperature change in the small beaker with pipette ears for the student's experiment.

Show your working.

Give your answer to two significant figures.

rate of temperature change ....°C per min [2]

(e) (i) Suggest why the student used cardboard lids on top of each of the small beakers.

....

....

....[1]

(ii) Suggest and explain **one** source of error in the method as a result of using the cardboard lids.

....

....

....[2]

(iii) Suggest **two** improvements which could be made to the method, other than changing the cardboard lids.

1 ....

....

....

2 ....

....

....

[2]

(f) Fig. 1.5 shows a different species of elephant, *Elephas maximus*, to the one shown in Fig. 1.1.

Fig. 1.5

(i) State **one** visible difference between the ears of the elephant in Fig. 1.5 and those of the elephant shown in Fig. 1.1.

....

....[1]

(ii) Based on this difference and the results of the student's experiment in part **(d)(i)**, what can you conclude about the environmental conditions that the elephant shown in Fig. 1.5 lives in compared to the elephant in Fig. 1.1?

....

....

....[1]

[Total: 18]

61/ON 2016

2 Some animals have a body temperature that is higher than the temperature of the environment. As a result these animals lose heat to the environment, causing their body temperature to fall.

An investigation was carried out to find the effect of the volume of the body on the loss of heat to the environment.

The volume of the body of an animal and its temperature can be represented by hot water.

Step 1 Two 250 cm^3 beakers were labelled **A** and **B**.

Step 2 A line was drawn on beaker **A**, 6 cm up from the bottom of the beaker.
A line was drawn on beaker **B**, 3 cm up from the bottom of the beaker.

Step 3 Hot water was added to both beakers up to these marks.

Step 4 A thermometer was placed in the water in each beaker and a timer started.
The temperature of the water was measured immediately in both beakers and recorded in a results table.
The thermometers were left in the water throughout the investigation.

Step 5 The temperature of the water in both beakers was measured and recorded every minute for five minutes.

Fig. 1.1 on page 3 shows the results of this investigation

(a) Prepare a table in the space provided to record these results. Use Fig. 1.1 to complete this table.

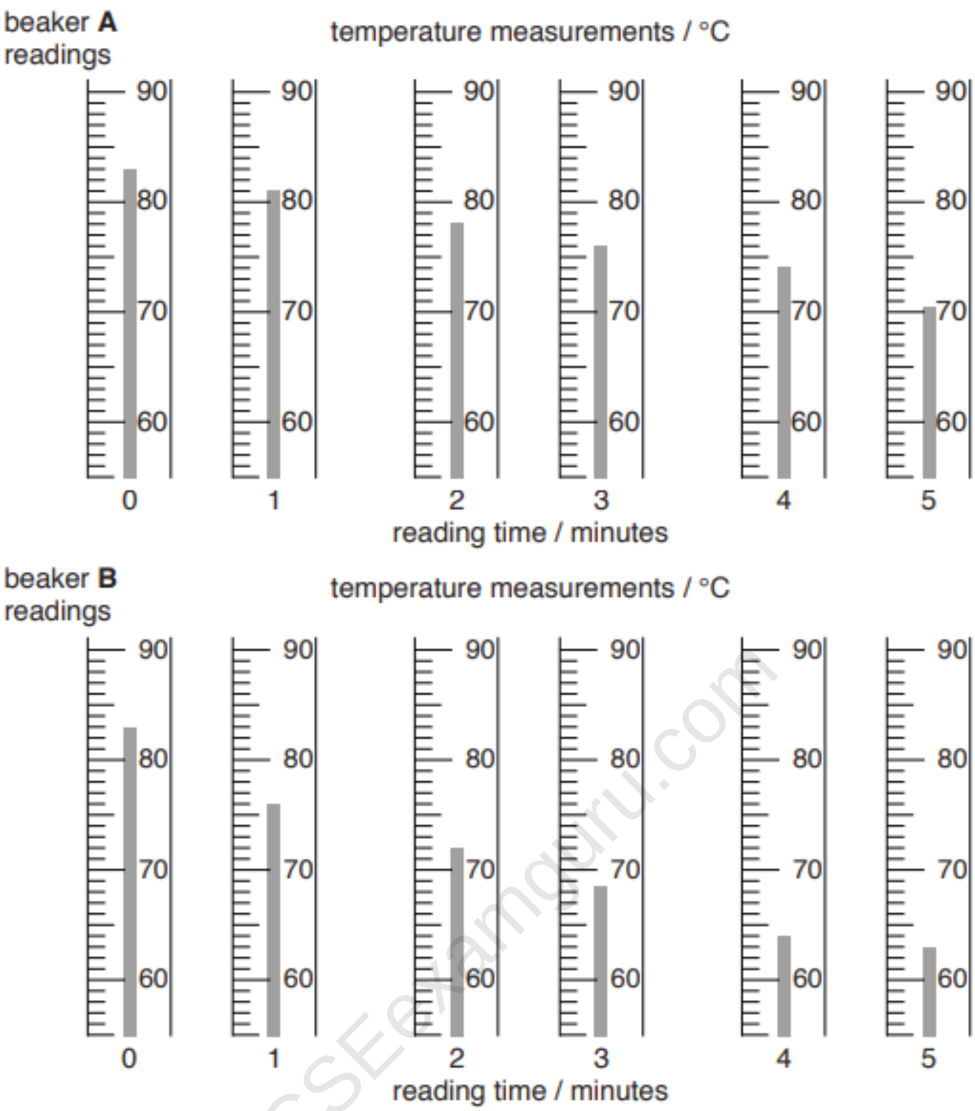


Fig. 1.1

(b) (i) The rate of heat loss is the fall in temperature per minute.

Calculate the rate of heat loss between 0 and 5 minutes for both beakers.
Include the units.

Show your working.

beaker **A**

....

beaker **B**

....

[4]

(ii) Using your results, suggest a relationship between the volume of the body and heat loss.

....

....

....

....[2]

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

1 ....

2 ....
[2]

(ii) Suggest why the thermometer must be left in the water throughout the investigation.

....

....[1]

(iii) There is a possible source of error in step 2 of the investigation.

Identify this source of error and describe how to modify step 2 to improve the investigation.

....

....

....

....[2]

(iv) Suggest **one** safety precaution students should take while carrying out this investigation.

....

....[1]

(d) Some students were asked to test the hypothesis:

The colder the surroundings, the faster a small mammal's temperature will drop.

Describe how the students could modify the investigation described in steps 1–5 to test this hypothesis.

....

....

....

....

....

....

....

....

....

....

....

....

....[6]

(e) Humans sweat when they get too hot.

The effect of the temperature of the room on the average rate of sweating was investigated.

The results are shown in Table 1.1.

Table 1.1

temperature of the room / °C	average rate of sweating / cm^3 per hour
13	10
22	40
30	320
36	740
40	1180

(i) Plot a graph, using the data in Table 1.1, on the grid.

[4]

(ii) Describe the effect of the temperature of the room on the average rate of sweating.

....

....

....

....[2]

[Total: 29]

61/MJ 2016

1 Metabolic reactions in cells produce toxic chemicals which can be converted to harmless or less toxic chemicals.

Hydrogen peroxide is broken down using the enzyme catalase which is found in most cells.

Fig. 1.1 shows this reaction.

$$\underset{2H_2O_2}{\text{hydrogen peroxide}} \xrightarrow{\text{catalase}} \underset{2H_2O \;+\; O_2}{\text{water and oxygen}}$$

Fig. 1.1

A student investigated the effect of alcohol (ethanol) on the activity of catalase found in potato, using three pieces of potato cut to the same size.

Fig. 1.2 shows these pieces of potato.

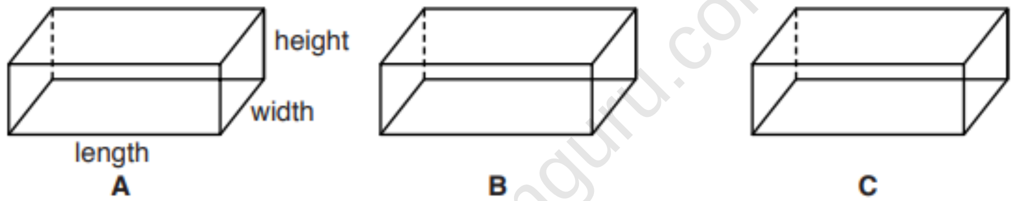


Fig. 1.2

(a) **(i)** Measure the length, width and height of one of these pieces of potato.

Record your results in Table 1.1.

Table 1.1

length of potato piece /mm	width of potato piece /mm	height of potato piece /mm

[1]

Step 1 The student labelled six test-tubes, **1**, **2**, **3**, **4**, **5**, and **6** and used a syringe to add 10 cm^3 of hydrogen peroxide solution to each of the test-tubes.

Step 2 They cut potato piece **A** to obtain two slices of similar size.

Step 3 The student placed the free end of a delivery tube into a large test-tube containing water.

Step 4 They placed one of the slices of potato piece **A** into the hydrogen peroxide solution in test-tube **1**.

Step 5 The student immediately placed the rubber bung attached to the delivery tube into test-tube **1** and pushed it in as tightly as possible, as shown in Fig. 1.3.

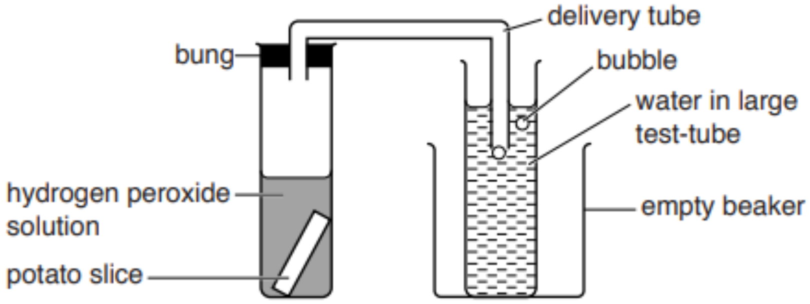


Fig. 1.3

Step 6 They counted the number of bubbles released from the delivery tube in 3 minutes.

Step 7 The student repeated steps **4–6** for the second slice of potato piece **A** using test-tube **2**.

Step 8 They repeated steps **2–7** for potato piece **B** using test-tubes **3** and **4**.

Step 9 They repeated steps **2–7** for potato piece **C** using test-tubes **5** and **6**.

The student used a tally to count the number of bubbles.

Fig. 1.4 shows their tally count.

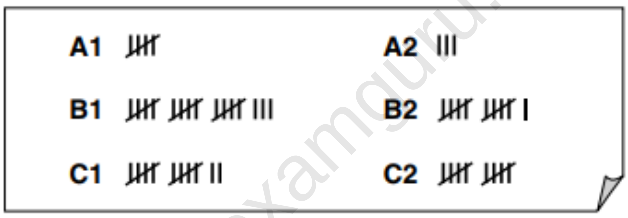


Fig. 1.4

(ii) Prepare a table to record the student's results.
Your table should show:

- the numbers of bubbles produced by each slice of potato in 3 minutes
- the mean number of bubbles produced by each of potato piece **A**, **B** and **C**.

Complete your table using the results from Fig. 1.4.

[5]

(b) **(i)** Suggest why the free end of the delivery tube was placed in the water before adding the potato slice to the hydrogen peroxide solution and connecting the test-tube to the bung of the delivery tube.

....

....

....[1]

(ii) Explain why the bung of the delivery tube must fit tightly into the test-tube.

....

....

....[2]

(c) The pieces of potato that the student used in their investigation were soaked in different concentrations of alcohol for 24 hours.

- Potato piece **A** was soaked in 20% alcohol.
- Potato piece **B** was soaked in 2% alcohol.
- Potato piece **C** was soaked in 10% alcohol.

(i) Suggest the relationship between the number of bubbles and the activity of catalase.

....

....

....[1]

(ii) Compare the activity of catalase in the potato pieces **A**, **B** and **C**.

....

....

....[1]

(iii) Predict the number of bubbles that would be produced in 3 minutes if a piece of potato was soaked in 50% alcohol before being placed in hydrogen peroxide solution.

....[1]

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

Describe how this variable was controlled.

variable ....

how it was controlled ....

....

....

[2]

(ii) The method of measuring the oxygen gas produced is a source of error.

State **one** reason why this method is a source of error.

....

....

Suggest how to improve the method to minimise this error.

....

....

....

[2]

(iii) Identify the source of error in step **2**. State why this is a source of error.

source of error ....

....

reason ....

....

....

[2]

(iv) Describe a control experiment that the student could carry out for this investigation.

....

....

....

....

....[2]

(v) Predict the result expected from the control experiment described in **(iv)**.

....

....[1]

(e) State one safety precaution required when ethanol is used in an investigation.

....

....

....[1]

(f) In an investigation into the effects of alcohol on the nervous system, people were asked to carry out a test on their reaction time.

The person being tested looked at a coloured block on a computer screen.
As soon as the colour changed they pressed a button.
The time taken to press the button was recorded by the computer.
This was their reaction time.

Twenty people were tested before and after consuming a drink containing the same concentration of alcohol.

Table 1.2 shows the results of this investigation.

Table 1.2

test person	reaction time before consuming alcohol / milliseconds	reaction time after consuming alcohol / milliseconds
1	272	322
2	310	350
3	225	270
4	243	290
5	240	308
6	264	315
7	201	238
8	262	300
9	225	252
10	235	278
11	225	253
12	247	271
13	226	266
14	194	220
15	206	239
16	309	340
17	223	261
18	243	286
19	270	316
20	180	225
mean	240	

(i) Calculate the mean for the reaction time after consuming alcohol.

Write your answer in Table 1.2. [1]

(ii) Plot a bar chart to show the **mean** reaction time of the people tested before and after consuming alcohol.

[3]

(iii) The range of reaction times recorded before consuming alcohol is 180–310 milliseconds.

Use Table 1.2 to identify the range of reaction times recorded after consuming alcohol.

.... milliseconds [1]

[Total: 27]