



Surname _____

Forename(s) _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE

COMBINED SCIENCE: SYNERGY

F

Foundation Tier Paper 1

Life and Environmental Sciences

8465/1F

Tuesday 16 May 2023 Morning

Time allowed: 1 hour 45 minutes

At the top of the page, write your surname and forenames, your centre number, your candidate number and add your signature.

[Turn over]



MATERIALS

For this paper you must have:

- **a ruler**
- **a protractor**
- **a scientific calculator**
- **the periodic table (enclosed)**
- **the Physics Equations Sheet (enclosed).**

INSTRUCTIONS

- **Use black ink or black ball-point pen.**
- **Pencil should only be used for drawing.**
- **Answer ALL questions in the spaces provided. Do not write on blank pages.**
- **If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).**
- **Do all rough work in this book. Cross through any work you do not want to be marked.**
- **In all calculations, show clearly how you work out your answer.**



INFORMATION

- **The maximum mark for this paper is 100.**
- **The marks for questions are shown in brackets.**
- **You are expected to use a calculator where appropriate.**
- **You are reminded of the need for good English and clear presentation in your answers.**

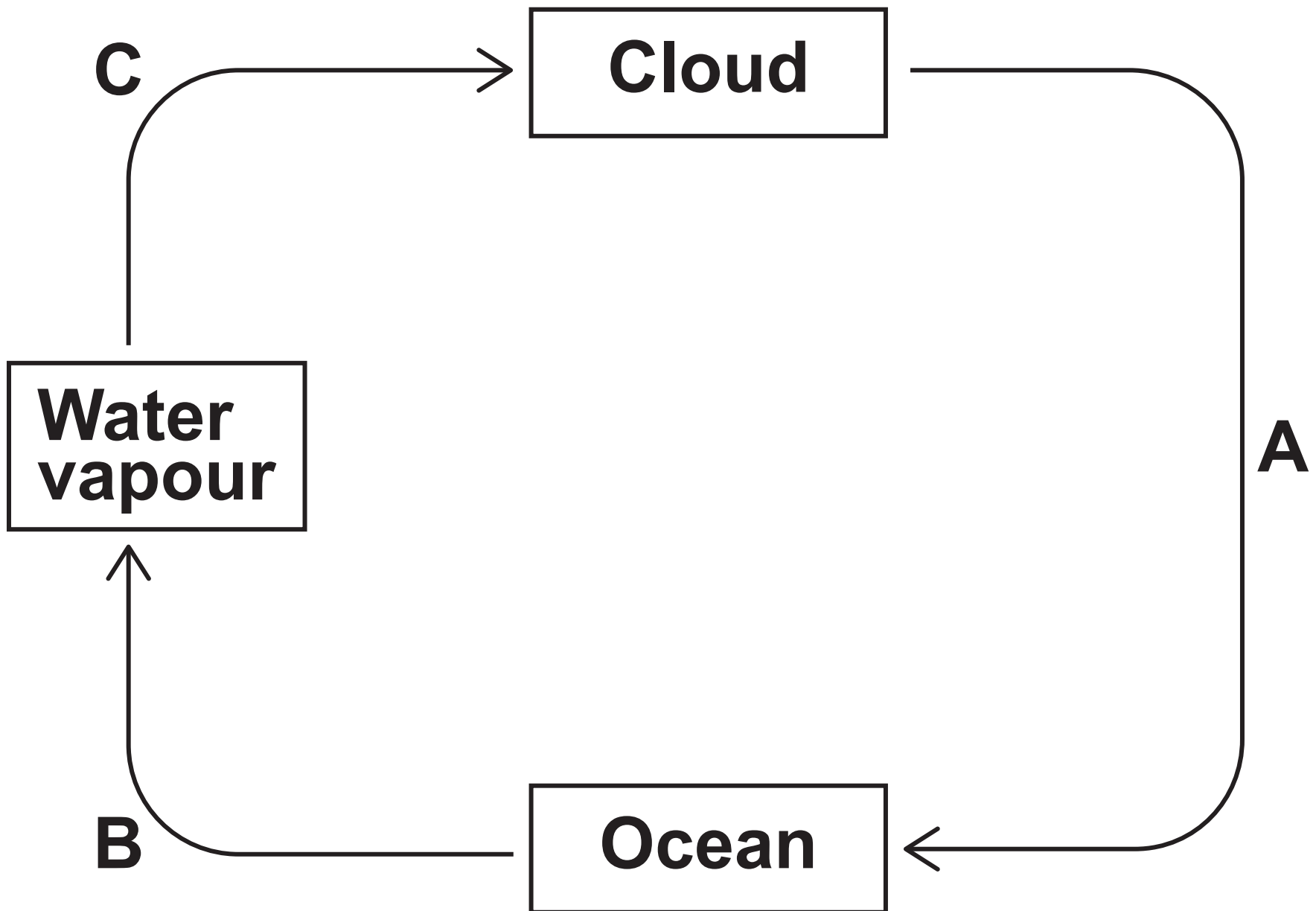
DO NOT TURN OVER UNTIL TOLD TO DO SO



| | |
|---|---|
| 0 | 1 |
|---|---|

FIGURE 1 shows part of the water cycle.

FIGURE 1



0 1 . 1

Name processes A, B and C.

Choose answers from the list. [3 marks]

absorption condensation

evaporation precipitation

transpiration

A _____

B _____

C _____

[Turn over]



0 1 . 2

Drinking water can be produced from sea water.

Which process is used to produce drinking water from sea water? [1 mark]

Tick (✓) ONE box.

Desalination

Digestion

Screening



0 1 . 3

Why is producing drinking water from sea water expensive? [1 mark]

Tick (✓) ONE box.

The process requires energy.

The sea water must be filtered.

The sea water temperature is too high.

[Turn over]



0 1 . 4

Which TWO processes are used to kill bacteria during the production of drinking water? [2 marks]

Tick (✓) TWO boxes.

Adding chlorine

Exposure to ultraviolet light

Freezing

Grit removal

Sedimentation



| | | | |
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|---|---|---|---|

Why is it important to kill bacteria in water during the production of drinking water? [1 mark]

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[Turn over]



0 2

This question is about plants.

0 2 . 1

Meristem is a specialised tissue found at the tips of shoots and roots.

**What is the function of meristem tissue?
[1 mark]**

Tick (✓) ONE box.

Cell division

Fertilisation

Transpiration



0 2 . 2

Xylem tissue and phloem tissue are found in plants.

Cells in phloem tissue contain sugars.

TABLE 1, on page 13, shows some features of xylem tissue and phloem tissue.

[Turn over]





Complete TABLE 1.

Put ONE tick (✓) in each row to show if the feature is true for:

- **xylem only**
- **phloem only**
- **both xylem AND phloem. [4 marks]**



TABLE 1

| FEATURE OF TISSUE | XYLEM ONLY | PHLOEM ONLY | BOTH XYLEM AND PHLOEM |
|---|-------------------|--------------------|------------------------------|
| Involved in transport of substances in the plant | | | |
| Transports water and mineral ions from roots to leaves | | | |
| Consists of hollow tubes of dead cells | | | |
| End walls of the cells have pores | | | |

[Turn over]

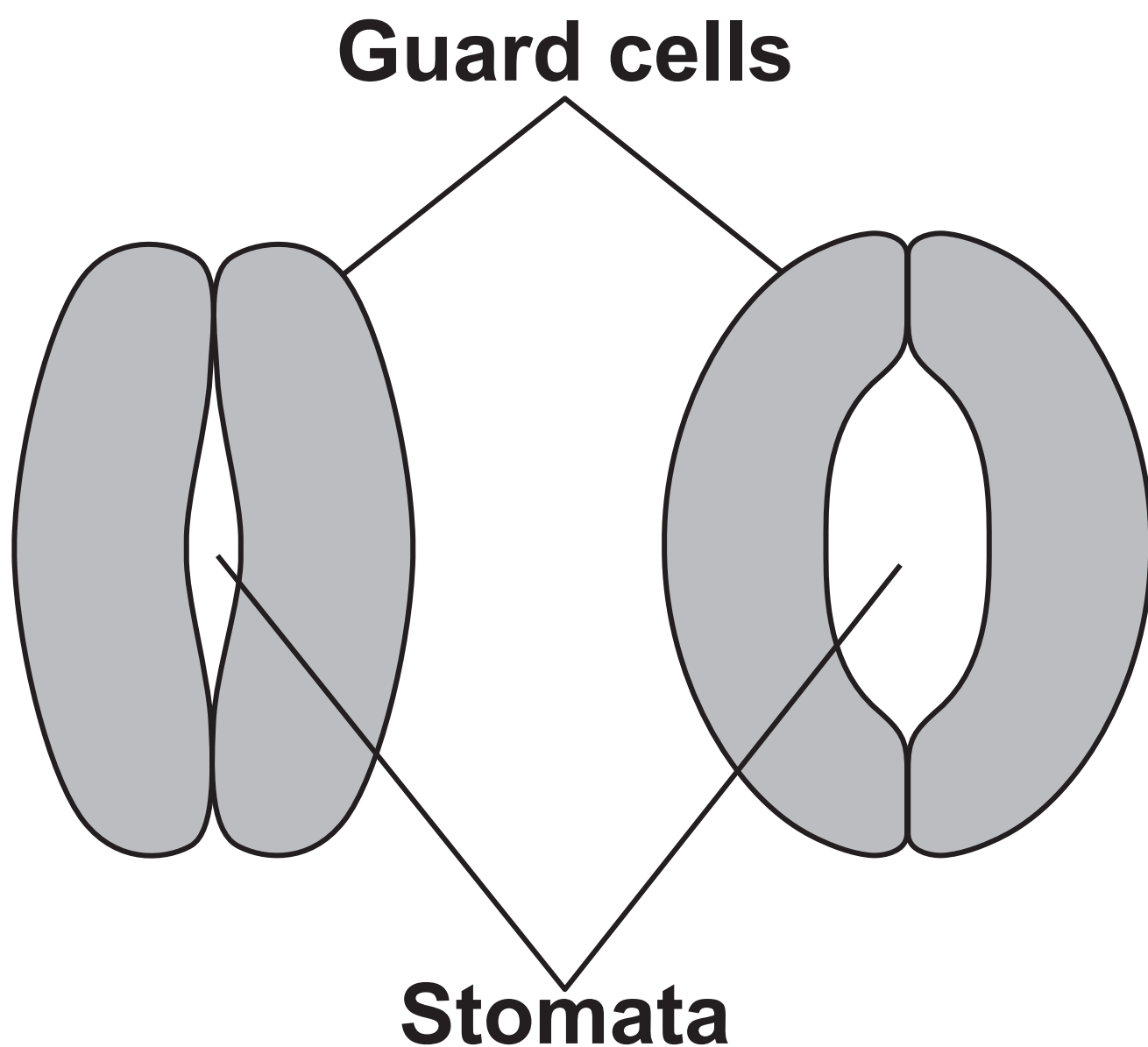
0 2 . 3

Stomata are tiny holes in the surface of leaves.

Guard cells surround the stomata.

FIGURE 2 shows the shape of guard cells around stomata at different times of the day.

FIGURE 2



Guard cells control water loss from the leaf.

Explain what happens to the guard cells to INCREASE water loss from the leaf.

**Use FIGURE 2, on the opposite page.
[2 marks]**

[Turn over]



0 2 . 4

Complete the sentences.

Choose answers from the list. [3 marks]

active transport filtration mitosis

osmosis translocation

Water moves from the soil into the

plant by _____ .

**Mineral ions move from a low
concentration in the soil to a high
concentration in the**

root by _____ .

**Sugars are transported from the leaves to
other parts of the**

plant by _____ .

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[Turn over]



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|---|---|
| 0 | 3 |
|---|---|

Carbon is an element with several isotopes.

| | | | |
|---|---|---|---|
| 0 | 3 | . | 1 |
|---|---|---|---|

Complete the sentence.

Choose the answer from the list. [1 mark]

electrons neutrons protons

**Each isotope of carbon has a different
number of _____ .**



03.2

An isotope of carbon is carbon-14

Plants contain carbon-14

How does carbon-14 pass from plants to animals? [1 mark]

[Turn over]

Carbon-14 is radioactive.

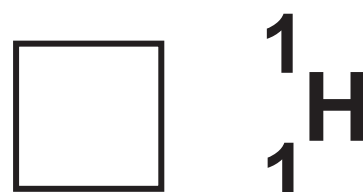
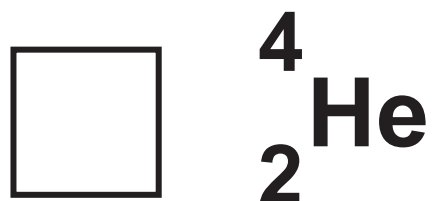
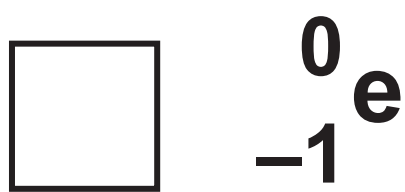
Carbon-14 nuclei emit beta particles.

A beta particle is an electron.

03.3

Which symbol represents a beta particle?
[1 mark]

Tick (✓) ONE box.



| | | | |
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|---|---|---|---|

When a carbon-14 nucleus emits a beta particle, the atomic number changes from 6 to 7

Which element has the atomic number of 7?

Use the periodic table. [1 mark]

Tick (✓) ONE box.

Helium

Lithium

Nitrogen

[Turn over]



0 3 . 5

Which TWO of the following substances would beta particles NOT be able to penetrate? [2 marks]

Tick (✓) TWO boxes.

1 metre of concrete

10 centimetres of lead

1 centimetre of air

1 millimetre of aluminium

0.1 millimetre sheet of paper



In 1991, the frozen remains of a human body were found in a glacier.

The body was 5400 years old.

0 3 . 6

The body tissues had NOT decayed completely.

**What causes the decay of body tissues?
[1 mark]**

Tick (✓) ONE box.

Carbon dioxide

Microorganisms

Mineral ions

[Turn over]

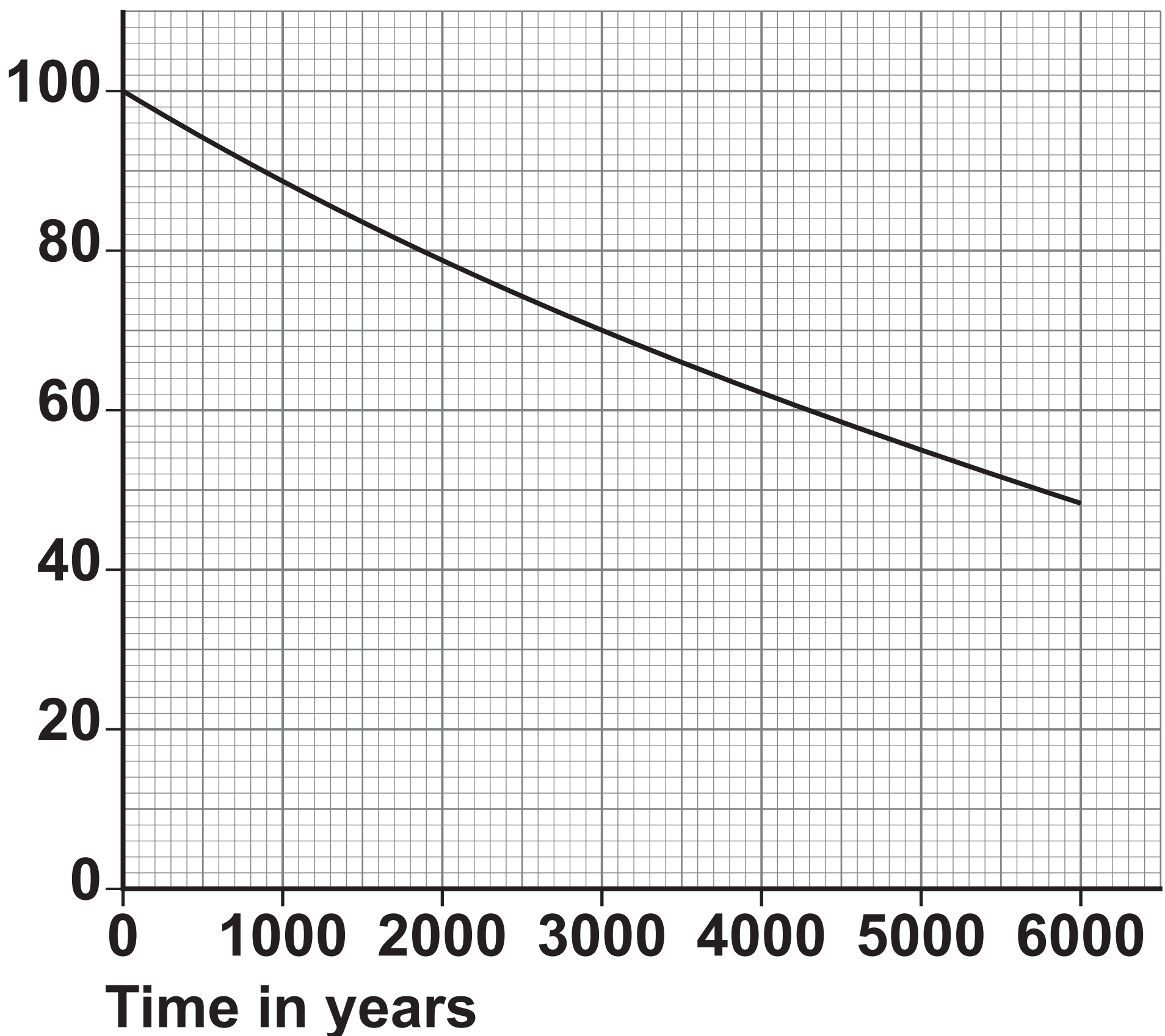


The percentage of carbon-14 in an organism decreases after death.

FIGURE 3 shows how the percentage of carbon-14 nuclei remaining varies with time.

FIGURE 3

Percentage (%) of carbon-14 nuclei remaining



03.7

Determine the percentage of carbon-14 nuclei remaining in an organism after 3000 years.

Use FIGURE 3, on the opposite page.
[1 mark]

Percentage remaining

= _____ %

03.8

The half-life of carbon-14 is the average time taken for the number of carbon-14 nuclei in a sample to halve.

Determine the half-life of carbon-14

Use FIGURE 3. [1 mark]

Half-life = _____ years

[Turn over]



03.9

Only a very small proportion of the carbon in an organism is carbon-14.

Scientists studying the body from the glacier were NOT concerned about the risk from beta radiation emitted by the body.

**Why was the risk to the scientists low?
[1 mark]**

Tick (✓) ONE box.

The beta radiation emitted by the body was a type of ionising radiation.

The carbon-14 nuclei in the body had all decayed.

The radiation dose absorbed by the scientists was low.

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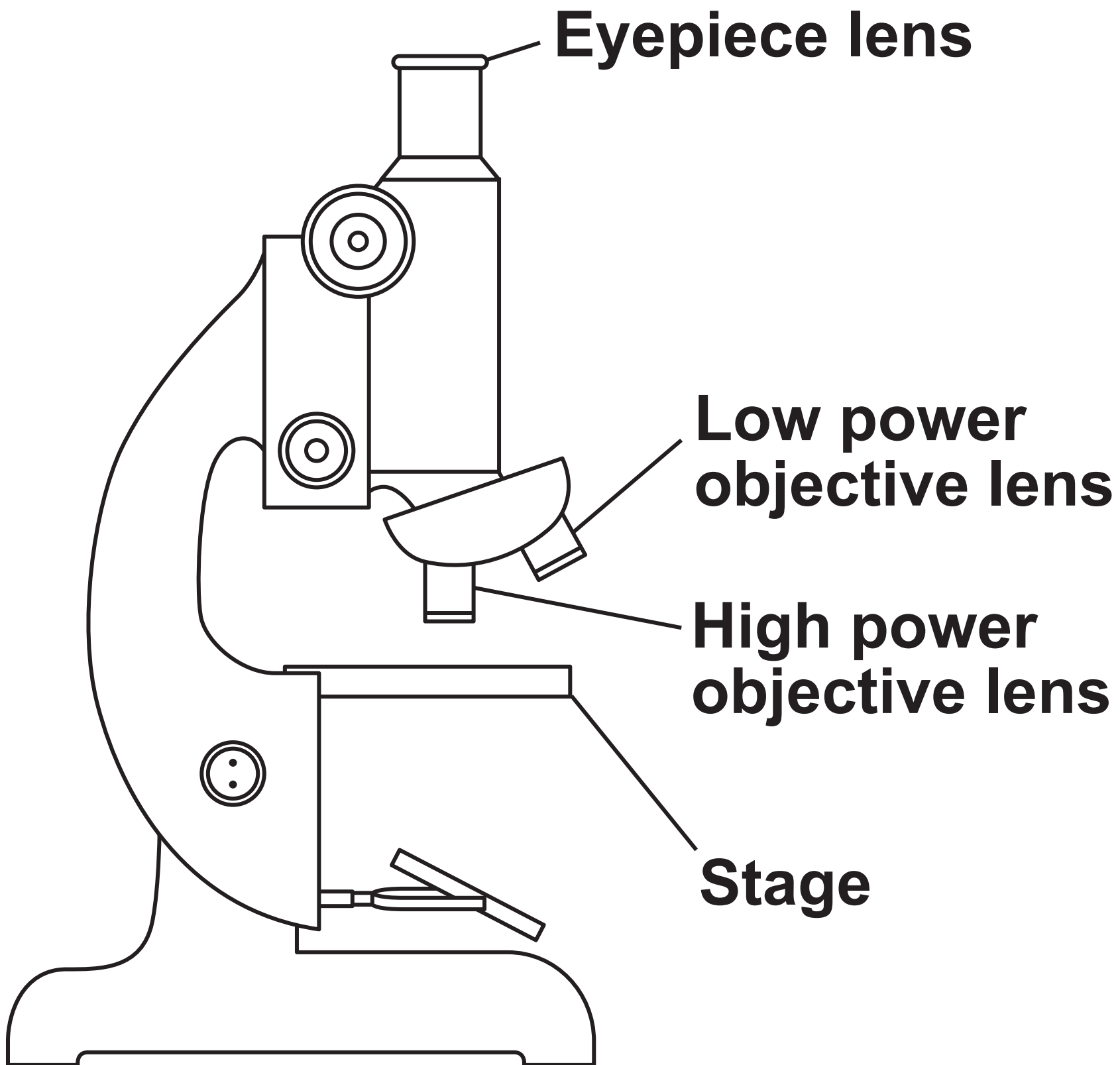
[Turn over]



04

FIGURE 4 shows a light microscope.

FIGURE 4



| | | | |
|---|---|---|---|
| 0 | 4 | . | 1 |
|---|---|---|---|

The eyepiece lens has a magnification of $\times 10$

The high power objective lens has a magnification of $\times 40$

Which calculation shows the total magnification? [1 mark]

Tick (\checkmark) ONE box.

| | |
|--------------------------|----------------|
| <input type="checkbox"/> | 10×40 |
|--------------------------|----------------|

| | |
|--------------------------|-----------------|
| <input type="checkbox"/> | $\frac{40}{10}$ |
|--------------------------|-----------------|

| | |
|--------------------------|-----------|
| <input type="checkbox"/> | $10 + 40$ |
|--------------------------|-----------|

[Turn over]



0 4 . 2

Write down the equation which links magnification, size of image and size of real object. [1 mark]

0 4 . 3

A student used a different microscope to view a cell.

The cell was viewed with a magnification of $\times 250$

The size of the image of the cell was 1.5 cm.

Calculate the real size of the cell.

Give your answer in mm. [4 marks]



Real size of cell = _____ mm

[Turn over]



| | | | |
|---|---|---|---|
| 0 | 4 | . | 4 |
|---|---|---|---|

The student focused the image for the low power objective lens and then changed to the high power objective lens.

The high power objective lens should NOT be moved TOWARDS the stage to focus the image.

Give ONE reason why. [1 mark]



| | | | |
|---|---|---|---|
| 0 | 4 | . | 5 |
|---|---|---|---|

Viruses are approximately 100 times smaller than animal cells.

What type of microscope is used to view viruses? [1 mark]

[Turn over]



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Chilli plants can be infected with tobacco mosaic virus (TMV).

Farmers grow chilli plants and sell chilli fruits.

FIGURE 5 shows chilli fruits growing on a chilli plant.

FIGURE 5



Chilli fruit _____

[Turn over]



FIGURE 6

**Mean number of chilli
fruits produced**

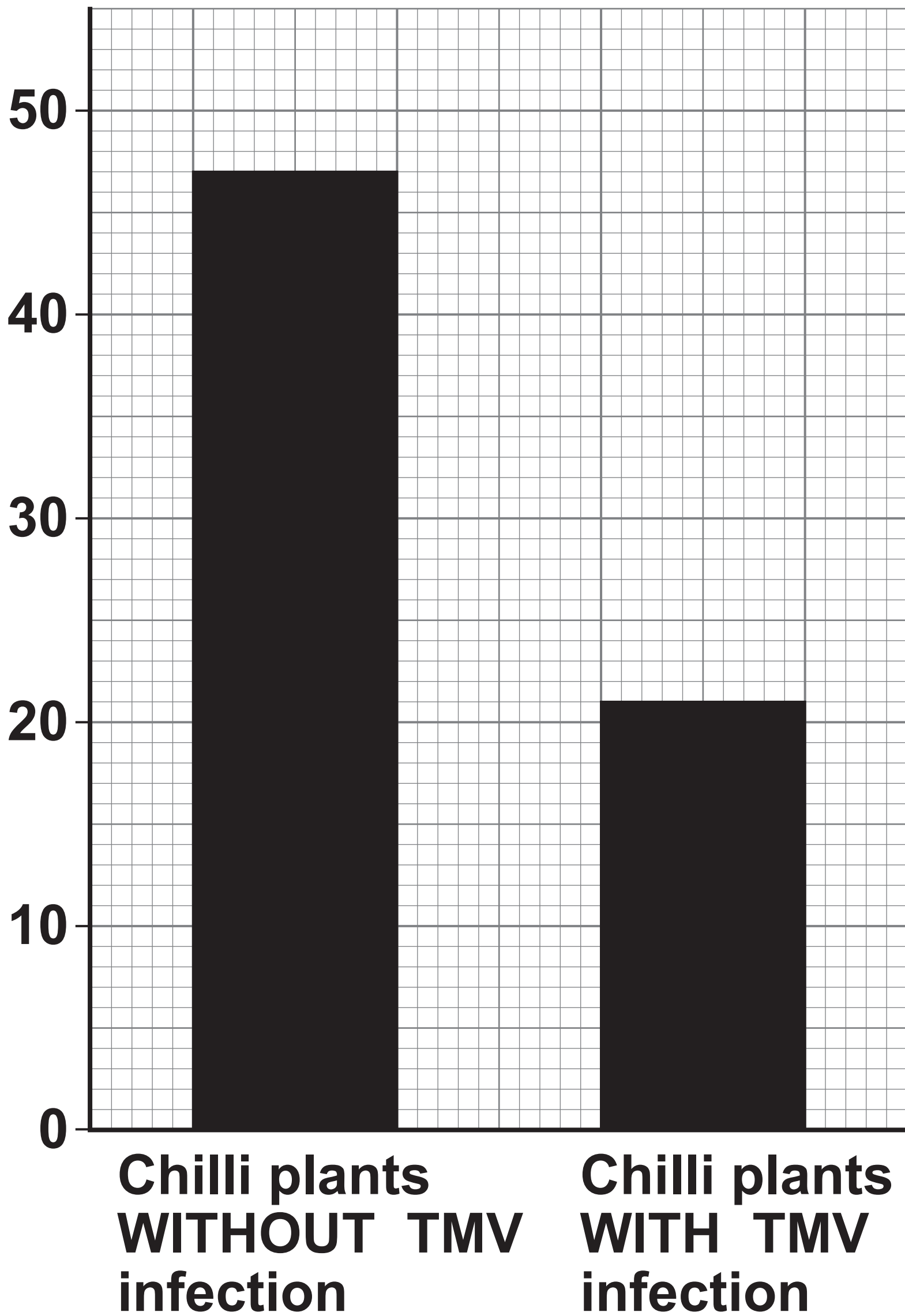


FIGURE 6, on the opposite page, shows how infection with TMV affects the number of chilli fruits produced on chilli plants.

0 4 . 6

Determine the decrease in the mean number of chilli fruits produced when plants are infected with TMV. [2 marks]

Decrease = _____ fruits

[Turn over]



| | | | |
|---|---|---|---|
| 0 | 4 | . | 7 |
|---|---|---|---|

Suggest ONE reason why farmers remove and destroy plants that are infected with TMV. [1 mark]

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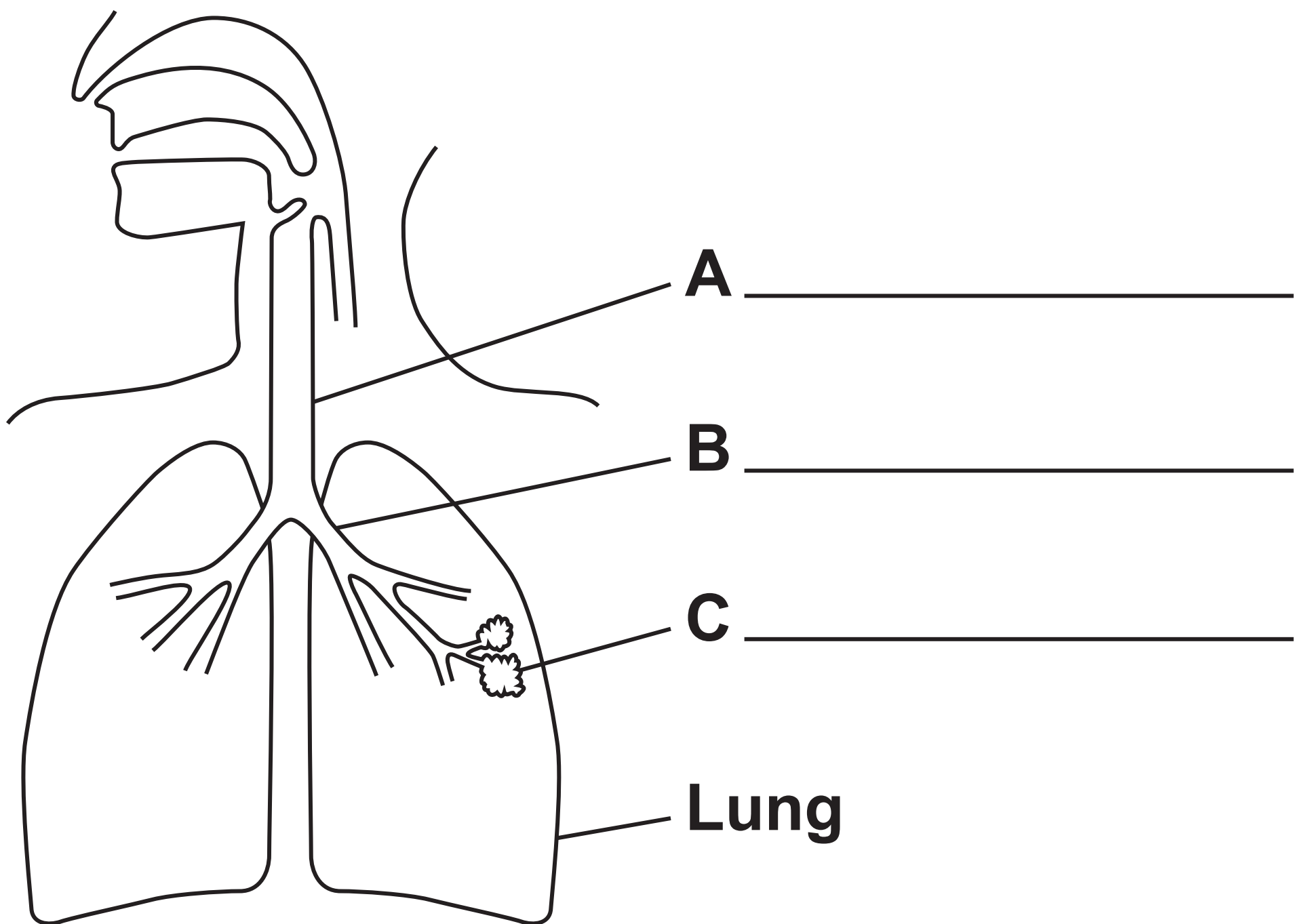
[Turn over]



0 5

FIGURE 7 shows part of the human breathing system.

FIGURE 7



0 5 . 1

Label structures A, B and C on FIGURE 7 on the opposite page.

Choose answers from the list. [3 marks]

alveolus bronchus trachea

valve ventricle

0 5 . 2

Describe ONE way that lungs are adapted for gas exchange. [1 mark]

[Turn over]



A student investigated the effect of surface area to volume ratio on diffusion.

The student used gel cubes with different surface area to volume ratios.

The gel cubes:

- **were pink at the start of the investigation**
- **became colourless as acid diffused into the cube.**

This is the method used.

- 1. Cut the gel into a cube with sides that are 1 cm long.**
- 2. Place the cube in a beaker.**
- 3. Cover the cube with acid.**
- 4. Keep the beaker at 20 °C.**
- 5. Record the time taken for the cube to go colourless.**
- 6. Repeat steps 2 to 5 with cubes of different sizes.**



0 5 . 3

Draw ONE line from each type of variable to that variable in the investigation.

[2 marks]

**TYPE OF
VARIABLE**

**VARIABLE
IN THE
INVESTIGATION**

**Dependent
variable**

Size of cube

Temperature

**Time taken for
the cube to go
colourless**

**Independent
variable**

**Type of
acid used**

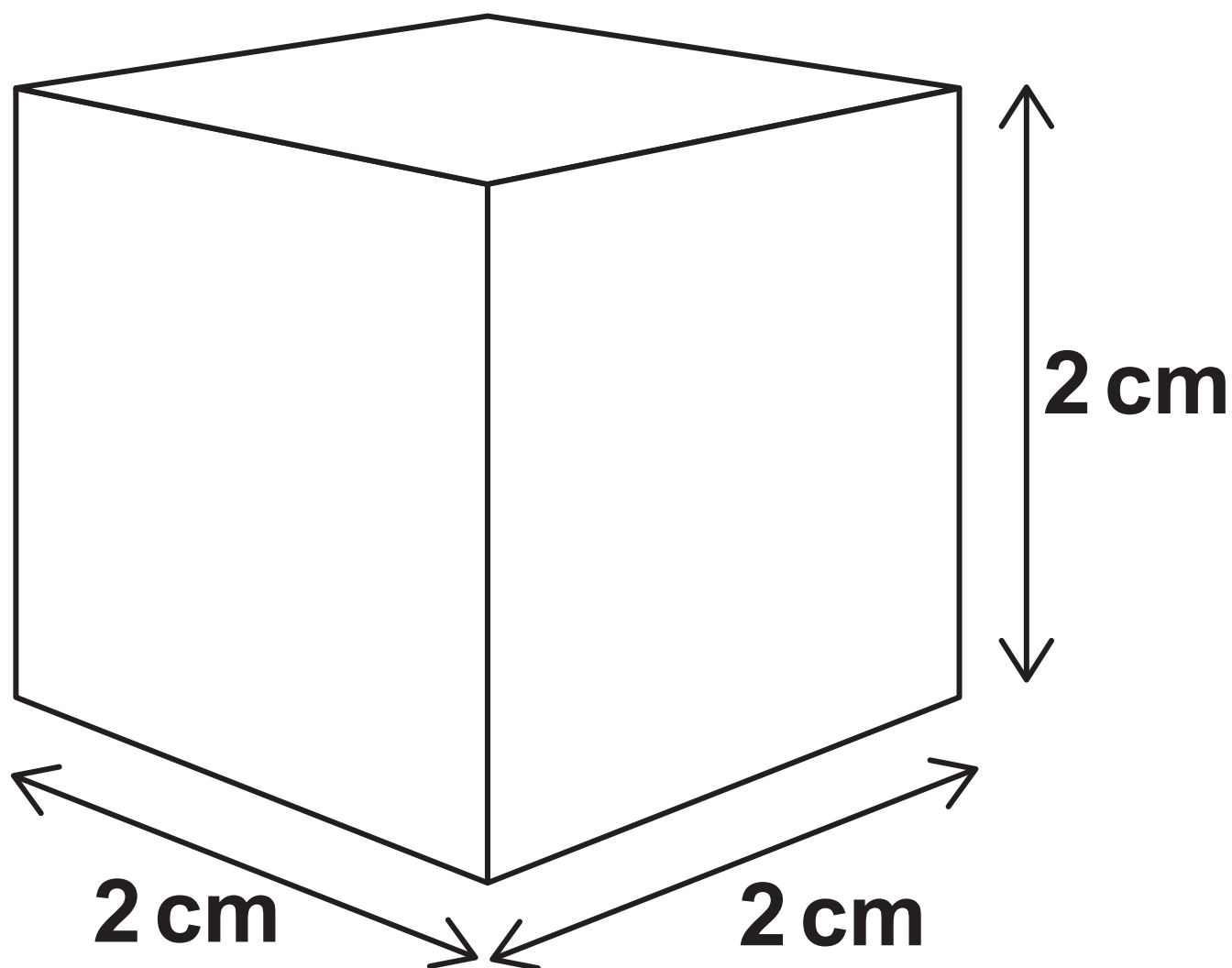
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| | | | |
|---|---|---|---|
| 0 | 5 | . | 4 |
|---|---|---|---|

FIGURE 8 shows one of the cubes.

FIGURE 8



Calculate the surface area to volume ratio for the cube. [3 marks]

Complete the following steps.

The surface area of one face of the cube is 4 cm^2 .



Calculate the TOTAL surface area of the cube

Surface area = _____ cm²

Calculate the volume of the cube

Volume = _____ cm³

[Turn over]



Give the surface area to volume ratio of the cube

Surface area : volume =

_____ : _____

TABLE 2 shows the results.

TABLE 2

| Length of side of cube in cm | Time taken for the cube to go colourless in minutes |
|-------------------------------------|--|
| 1 | 5 |
| 2 | 15 |
| 3 | 30 |
| 4 | 90 |



| | | | |
|---|---|---|---|
| 0 | 5 | . | 5 |
|---|---|---|---|

Describe the effect of increasing the size of the cube on the time taken for the cube to go colourless. [1 mark]

[Turn over]



| | | | |
|---|---|---|---|
| 0 | 5 | . | 6 |
|---|---|---|---|

What would be an improvement to the investigation? [1 mark]

Tick (✓) ONE box.

Repeat the method three times and calculate a mean for each size cube.

Repeat the method with 5 cubes all of the same size.

Repeat the method with a different size beaker for each size cube.

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[Turn over]



[Turn over]



Earwax is produced by specialised cells in the ear.

Earwax can trap and kill bacteria.

People either have wet earwax or dry earwax.

The type of earwax people have is controlled by one gene.

0 6 . 2

Name the part of a human cell where genes are found. [1 mark]



| | | | |
|---|---|---|---|
| 0 | 6 | . | 3 |
|---|---|---|---|

Name the chemical that genes are made of. [1 mark]

Each person has two alleles for earwax.

| | | | |
|---|---|---|---|
| 0 | 6 | . | 4 |
|---|---|---|---|

Why does a person have two alleles for earwax? [1 mark]

[Turn over]



The allele for wet earwax is dominant.

E = allele for wet earwax

e = allele for dry earwax

0 6 . 5

Which word describes a person with the alleles Ee? [1 mark]

Tick (✓) ONE box.

Heterozygous

Phenotype

Recessive



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[Turn over]



06.6

A person with the genotype Ee and a person with the genotype ee plan to have a child.

Complete FIGURE 9 to determine the probability that the child will have dry earwax.

You should identify any offspring genotype that would have dry earwax.
[4 marks]

FIGURE 9

Parent 1

| | | |
|---|---|---|
| | E | e |
| e | | |
| e | | |

Parent 2



Probability that the child will have dry

earwax = _____

0 6 . 7

Type of earwax is only affected by a gene.

Height is a characteristic that is affected by genes and environmental factors.

Give ONE other human characteristic that is affected by genes AND the environment.

**Do NOT refer to height in your answer.
[1 mark]**

[Turn over]



| | | | |
|---|---|---|---|
| 0 | 6 | . | 8 |
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Give ONE environmental cause for the variation in the characteristic you named in Question 06.7. [1 mark]

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0 7

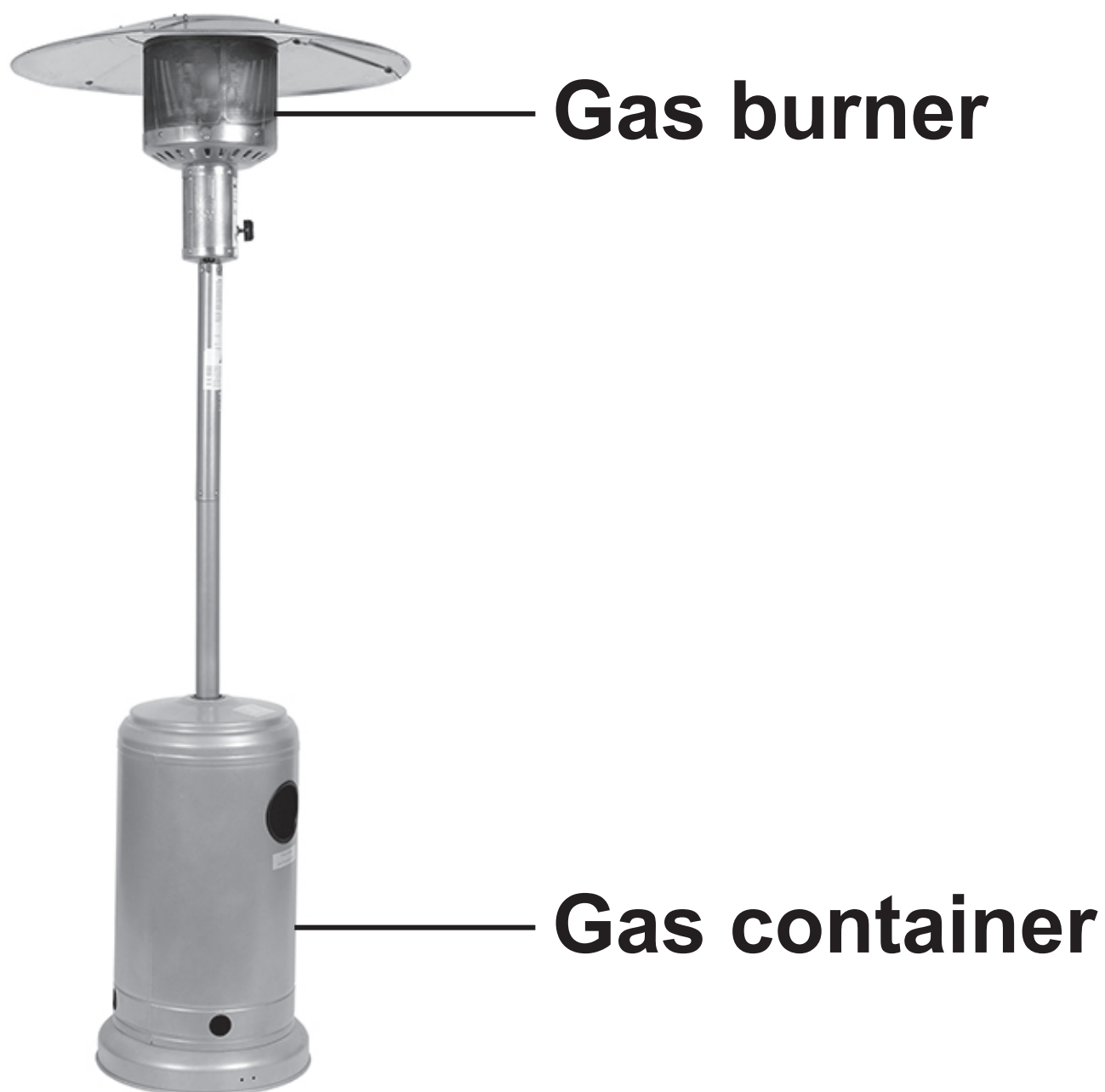
Heaters can be used to heat homes and gardens.

0 7 . 1

Gas heaters can be used to heat gardens.

The gas is stored in a container with a fixed volume.

FIGURE 10 shows a gas heater.



[Turn over]





On a sunny day the burner is NOT lit.

The temperature of the gas in the container increases.

Complete TABLE 3.

Put ONE tick (✓) in each row. [3 marks]

TABLE 3

| | INCREASES | STAYS THE SAME | DECREASES |
|--|------------------|-----------------------|------------------|
| Average kinetic energy of the gas particles | | | |
| Average speed of the gas particles | | | |
| Pressure exerted on the inside of the container | | | |

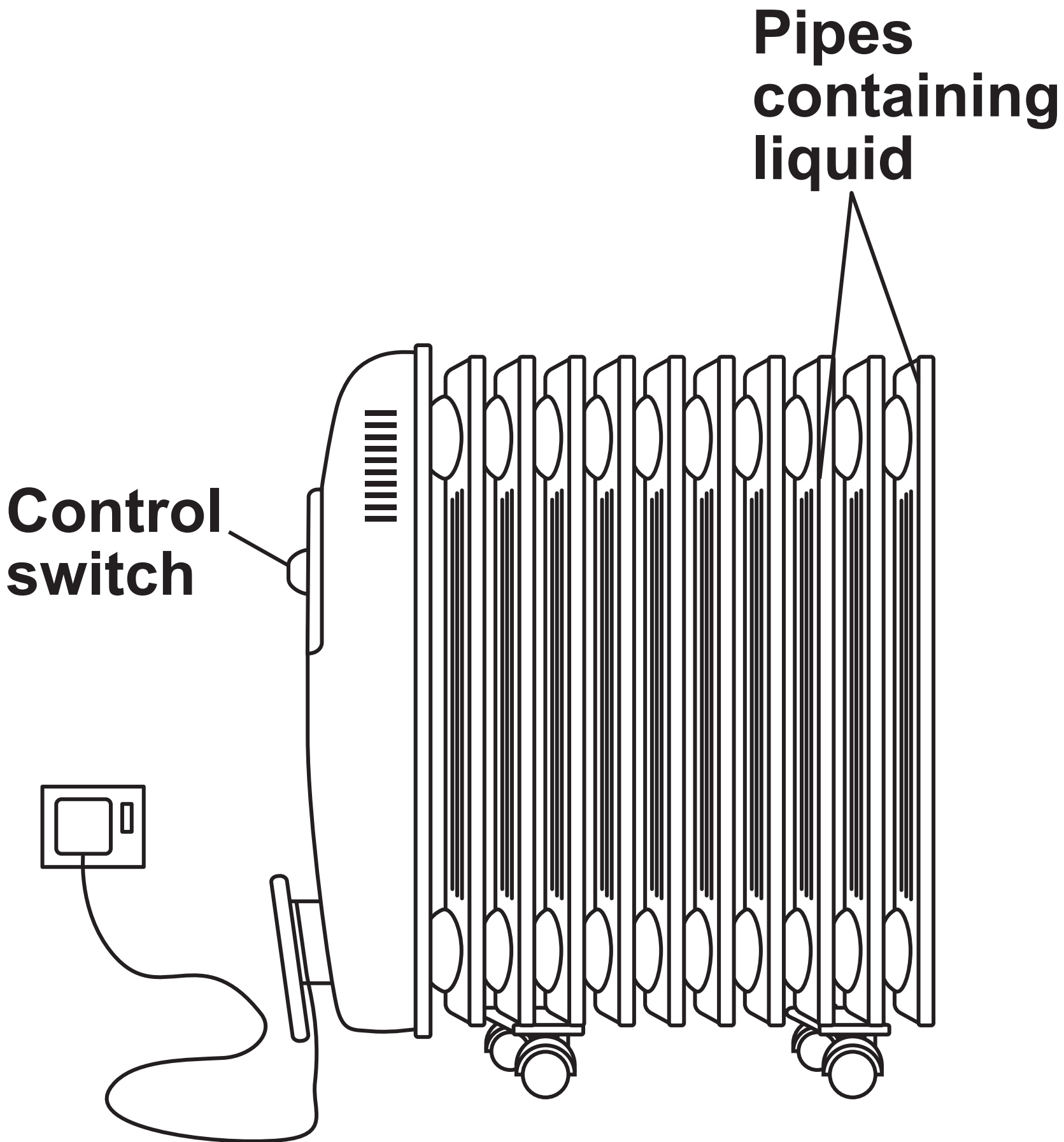
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[Turn over]



FIGURE 11 shows an electric heater.
The heater is filled with a liquid.

FIGURE 11



| | | | |
|---|---|---|---|
| 0 | 7 | . | 2 |
|---|---|---|---|

When the heater is switched on, the temperature of the liquid in the heater increases.

On one day, the starting temperature of the liquid was 15.0 °C.

The final temperature of the liquid was 57.5 °C.

What was the temperature change of the liquid? [1 mark]

Temperature change = _____ °C

[Turn over]



| | | | |
|---|---|---|---|
| 0 | 7 | . | 3 |
|---|---|---|---|

The change in thermal energy of the liquid in the heater was 892 500 J.

What was the change in thermal energy of the liquid in kJ?

1000 J = 1 kJ [1 mark]

Change in thermal energy =

_____ kJ



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[Turn over]



| | | | |
|---|---|---|---|
| 0 | 7 | . | 4 |
|---|---|---|---|

On another day, the temperature change of the liquid was $45.0\text{ }^{\circ}\text{C}$.

The mass of liquid in the heater is 5.0 kg .

specific heat capacity of liquid
 $= 4200\text{ J/kg }^{\circ}\text{C}$

Calculate the change in thermal energy of the liquid in the heater in joules.

Use the equation:

change in thermal energy = mass \times
specific heat capacity \times temperature
change [2 marks]



Change in thermal energy =

_____ **J**

[Turn over]



0 7 . 5

The liquid in the heater was replaced with a new liquid.

The new liquid had a greater specific heat capacity.

What happened to the energy required to increase the temperature of the liquid in the heater by 1 °C? [1 mark]

Tick (✓) ONE box.

The energy required decreases.

The energy required stays the same.

The energy required increases.

| |
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[Turn over]



0 8

This question is about the blood and the circulatory system.

0 8 . 1

Give the functions of red blood cells, white blood cells and platelets. [3 marks]

Red blood cells _____

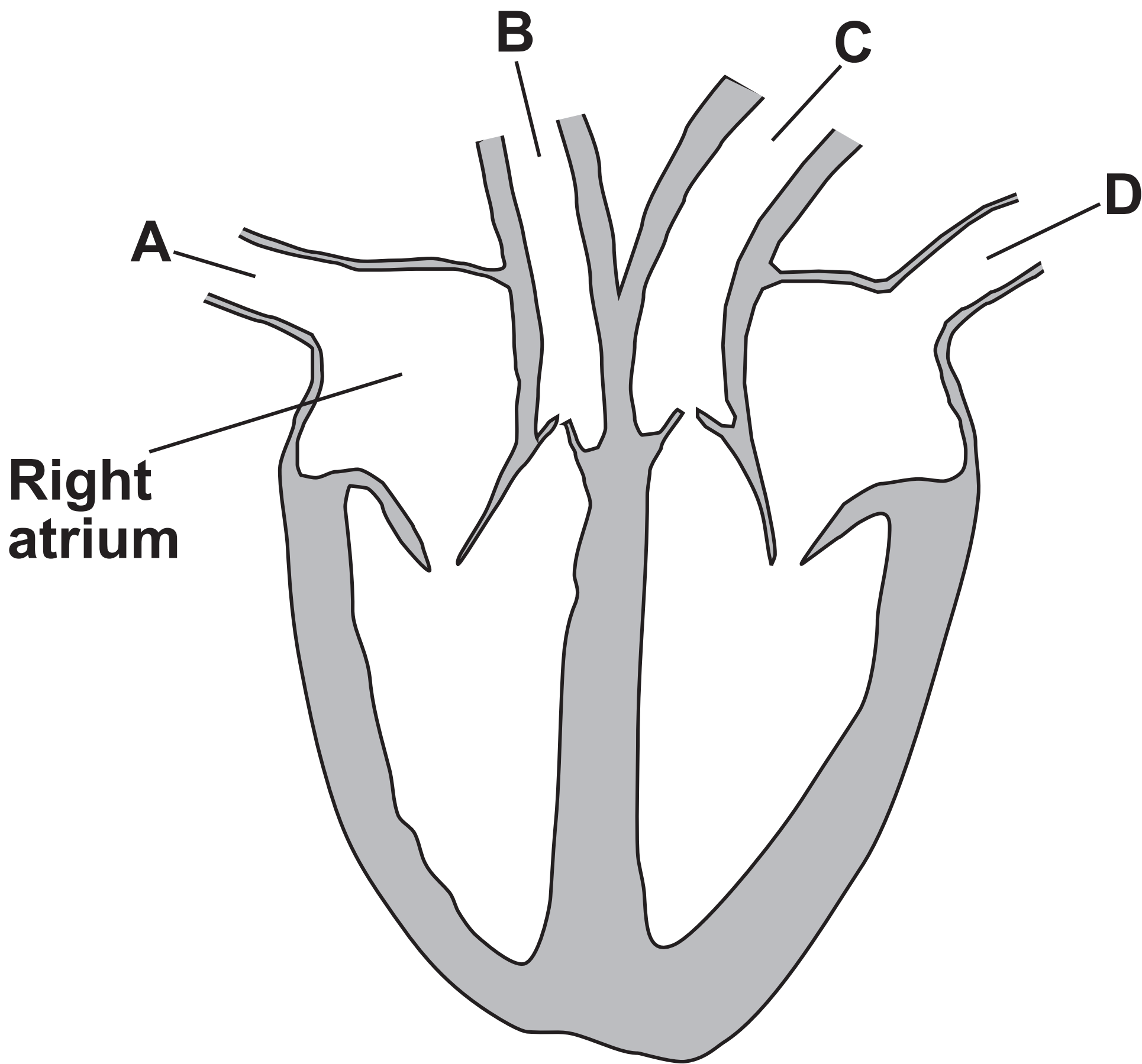
White blood cells _____

Platelets _____



FIGURE 12 shows a human heart.

FIGURE 12



[Turn over]



0 8 . 2

Draw ONE arrow on FIGURE 12, on page 71, to show the movement of the blood between the left atrium and the left ventricle. [1 mark]

0 8 . 3

Which blood vessel carries blood from the lungs INTO the heart? [1 mark]

Tick (✓) ONE box.

A **B** **C** **D**

0 8 . 4

Which blood vessel is the aorta? [1 mark]

Tick (✓) ONE box.

A **B** **C** **D**



| | | | |
|---|---|---|---|
| 0 | 8 | . | 5 |
|---|---|---|---|

What structures prevent blood flowing in the wrong direction through the heart?
[1 mark]

[Turn over]



| | | | |
|---|---|---|---|
| 0 | 8 | . | 6 |
|---|---|---|---|

Heart muscle cells obtain oxygen from the blood.

Which blood vessels exchange oxygen with heart muscle cells? [1 mark]

Tick (✓) ONE box.

Arteries

Capillaries

Veins



| | | | |
|---|---|---|---|
| 0 | 8 | . | 7 |
|---|---|---|---|

Heart rate is controlled by a group of cells called the pacemaker.

**Where is the pacemaker in the heart?
[1 mark]**

Tick (✓) ONE box.

Left atrium

Left ventricle

Right atrium

Right ventricle

[Turn over]



Carbon monoxide is a toxic gas.

0 8 . 8

**Explain why an increase of carbon monoxide in the air increases heart rate.
[3 marks]**



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[Turn over]



| | | | |
|---|---|---|---|
| 0 | 8 | . | 9 |
|---|---|---|---|

A person was exposed to carbon monoxide in the air for 1 hour.

During the hour the person's heart rate increased from 80 beats per minute to 130 beats per minute.

Calculate the percentage increase in heart rate. [2 marks]



Use the equation:

percentage increase =

$$\frac{\text{final heart rate} - \text{starting heart rate}}{\text{starting heart rate}} \times 100$$

Percentage increase = _____ %

| |
|----|
| |
| 14 |

[Turn over]



| | |
|---|---|
| 0 | 9 |
|---|---|

A species of grass has the binomial name 'Lolium perenne'.

| | | | |
|---|---|---|---|
| 0 | 9 | . | 1 |
|---|---|---|---|

What is the genus of the grass? [1 mark]

Grass leaves look green because of a green pigment found in chloroplasts.

| | | | |
|---|---|---|---|
| 0 | 9 | . | 2 |
|---|---|---|---|

Name the green pigment found in chloroplasts. [1 mark]



| | | | |
|---|---|---|---|
| 0 | 9 | . | 3 |
|---|---|---|---|

Which mineral ion is found in the green pigment in chloroplasts? [1 mark]

Tick (✓) ONE box.

Magnesium ion

Nitrate ion

Sodium ion

[Turn over]



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An area of grass changed colour after being covered by a tent.

The colour of the grass changed from green to yellow.

FIGURE 13 shows the area of green grass and the area of yellow grass.

FIGURE 13



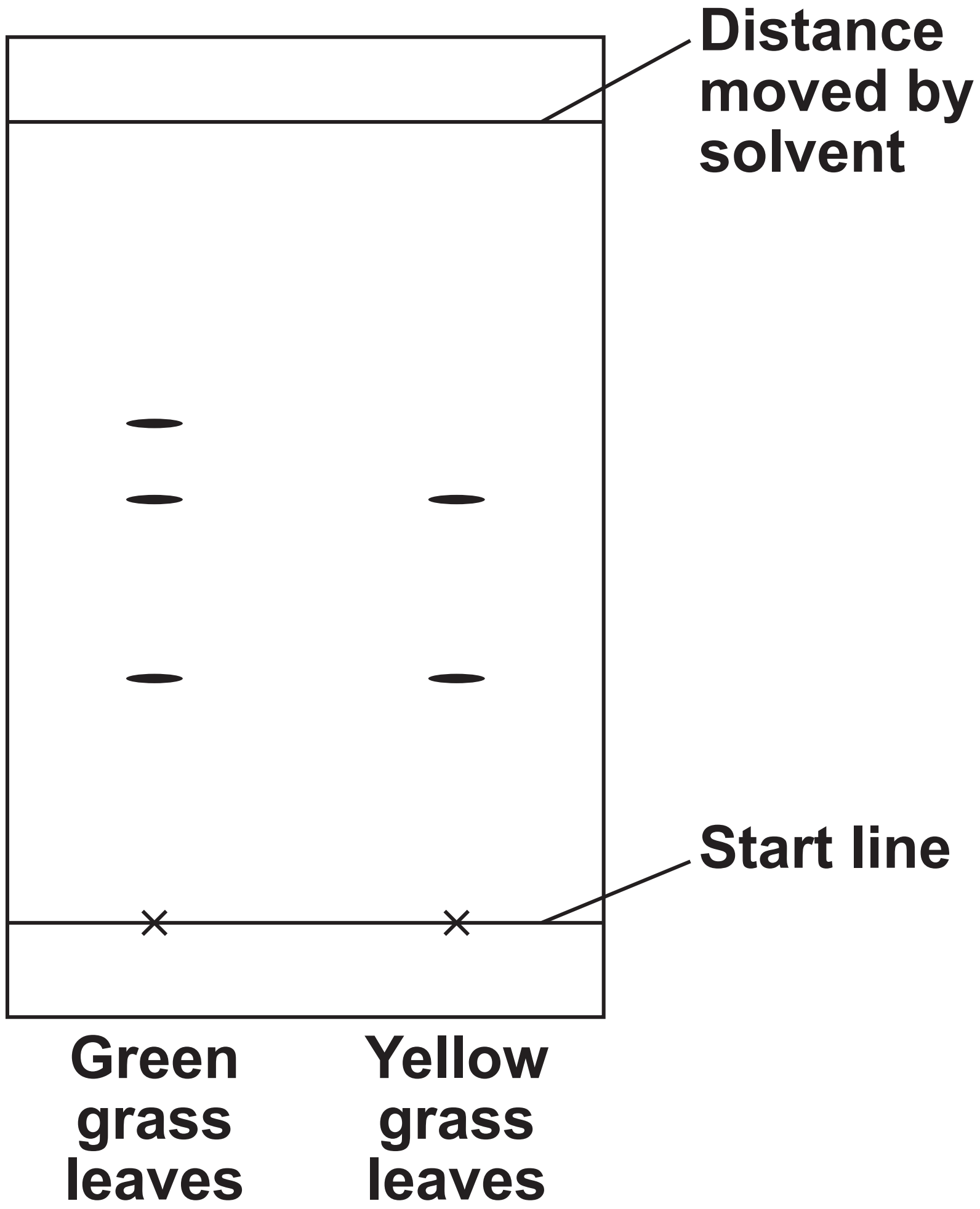
Green grass

Yellow grass

[Turn over]



FIGURE 14



A student used paper chromatography to investigate the pigments in grass leaves from:

- the area of green grass
- the area of yellow grass.

FIGURE 14, on the opposite page, shows the results.

0 9 . 4

The student crushed the grass leaves.

Describe a method to separate the pigments in the crushed grass leaves using paper chromatography. [6 marks]

[Turn over]

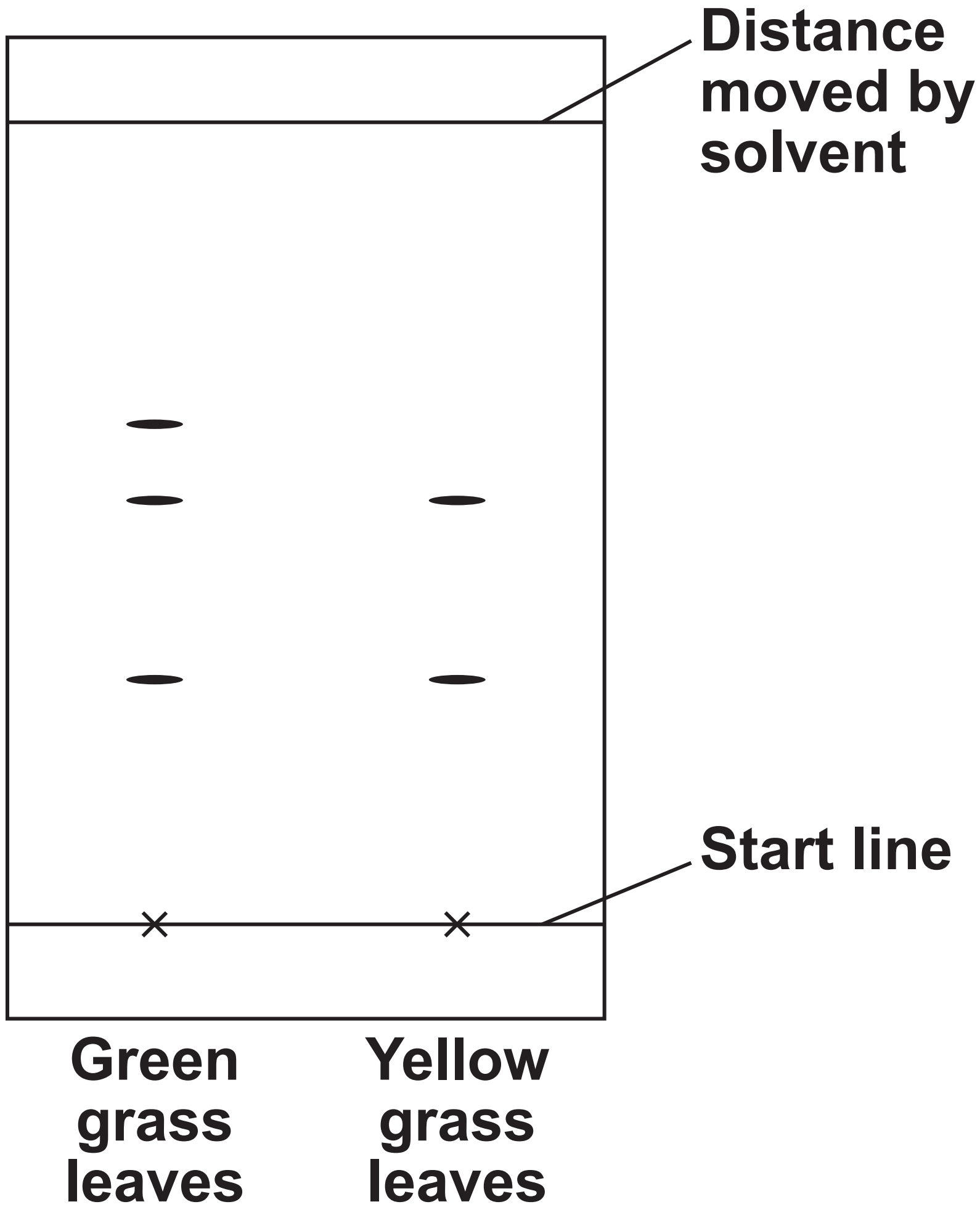


[Turn over]



FIGURE 14 is repeated below.

FIGURE 14



09.5

Determine the R_f value of the pigment that is found in green grass leaves but NOT found in yellow grass leaves.

Use the equation:

$$R_f = \frac{\text{distance moved by pigment}}{\text{distance moved by solvent}}$$

**Use FIGURE 14, on the opposite page.
[4 marks]**

[Turn over]



$R_f =$ _____



| | | | |
|---|---|---|---|
| 0 | 9 | . | 6 |
|---|---|---|---|

There are fewer pigments in the yellow grass leaves than in the green grass leaves.

Suggest ONE reason why. [1 mark]

| |
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END OF QUESTIONS



Additional page, if required. Write the question numbers in the left-hand margin.



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|--------------------|------|
| Question | Mark |
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| 2 | |
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| 6 | |
| 7 | |
| 8 | |
| 9 | |
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