A

AQA

Surname _____

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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 forename(s), your centre number, your candidate number and add your signature.

[Turn over]

JUN238465 1F 01

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

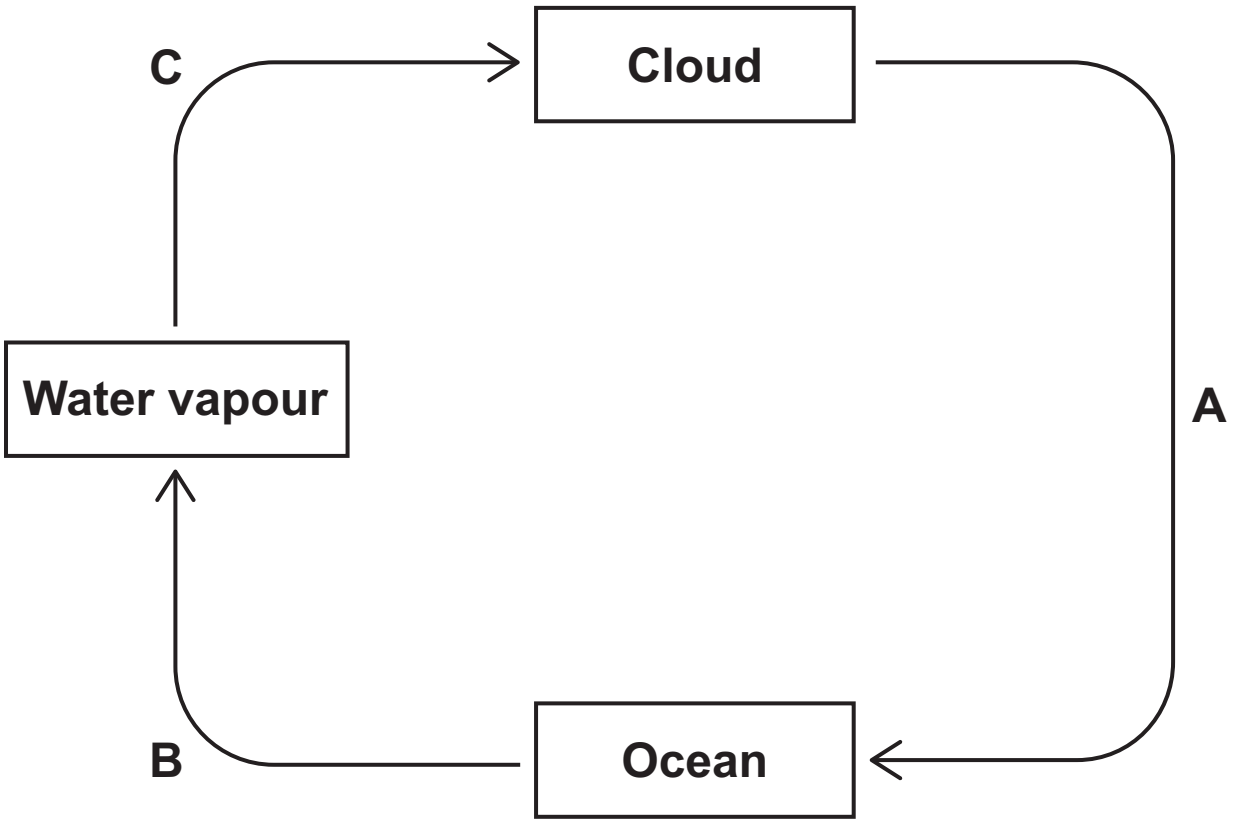
- **The maximum mark for this paper is 100.**
- **The marks for questions are shown in brackets.**
- **You are expected to use a calculator where appropriate.**
- **You are reminded of the need for good English and clear presentation in your answers.**

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.**

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**

0 1 . 5

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

_____

_____

_____

8

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 the opposite page, shows some features of xylem tissue and phloem tissue.

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			

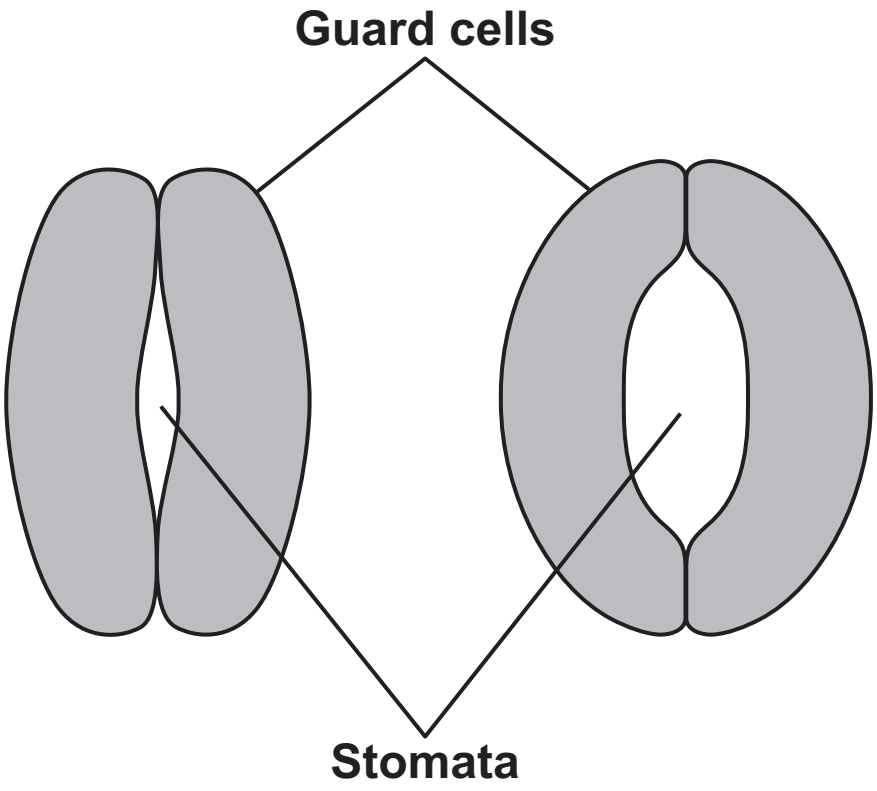
0 2 . 3

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. [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 _____ .

10

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[Turn over]

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 _____ .

0 3 . 2

An isotope of carbon is carbon-14

Plants contain carbon-14

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

_____

_____

_____

Carbon-14 is radioactive.

Carbon-14 nuclei emit beta particles.

A beta particle is an electron.

0 3 . 3

Which symbol represents a beta particle? [1 mark]

Tick (✓) ONE box.

☐ $^{0}_{-1}e$ ☐ $^{4}_{2}He$ ☐ $^{1}_{1}H$

0 3 . 4

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**

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.

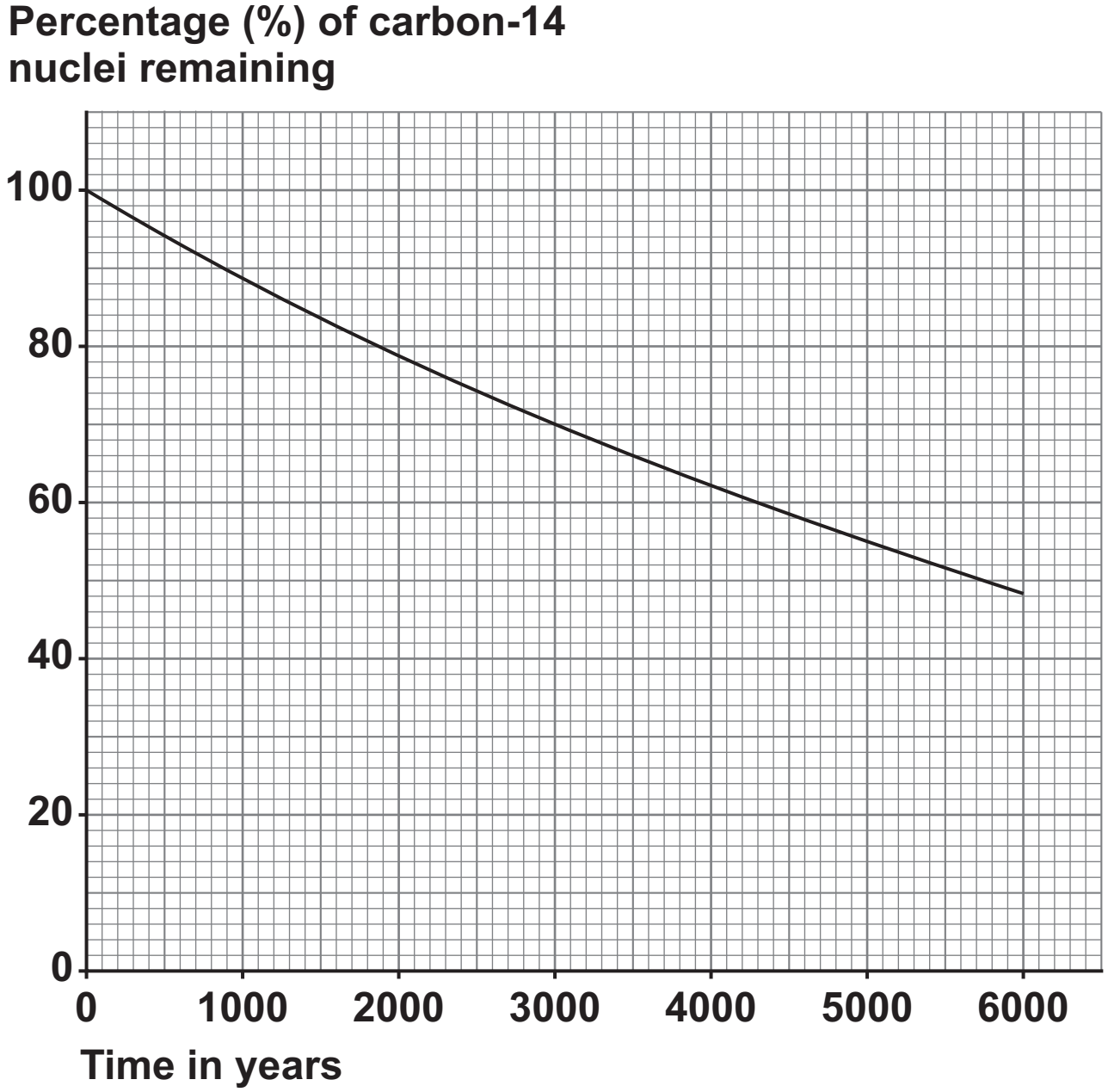
- ☐ **Carbon dioxide**
- ☐ **Microorganisms**
- ☐ **Mineral ions**

[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



0 3 . 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 = _____ %

0 3 . 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]

0 3 . 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.**

10

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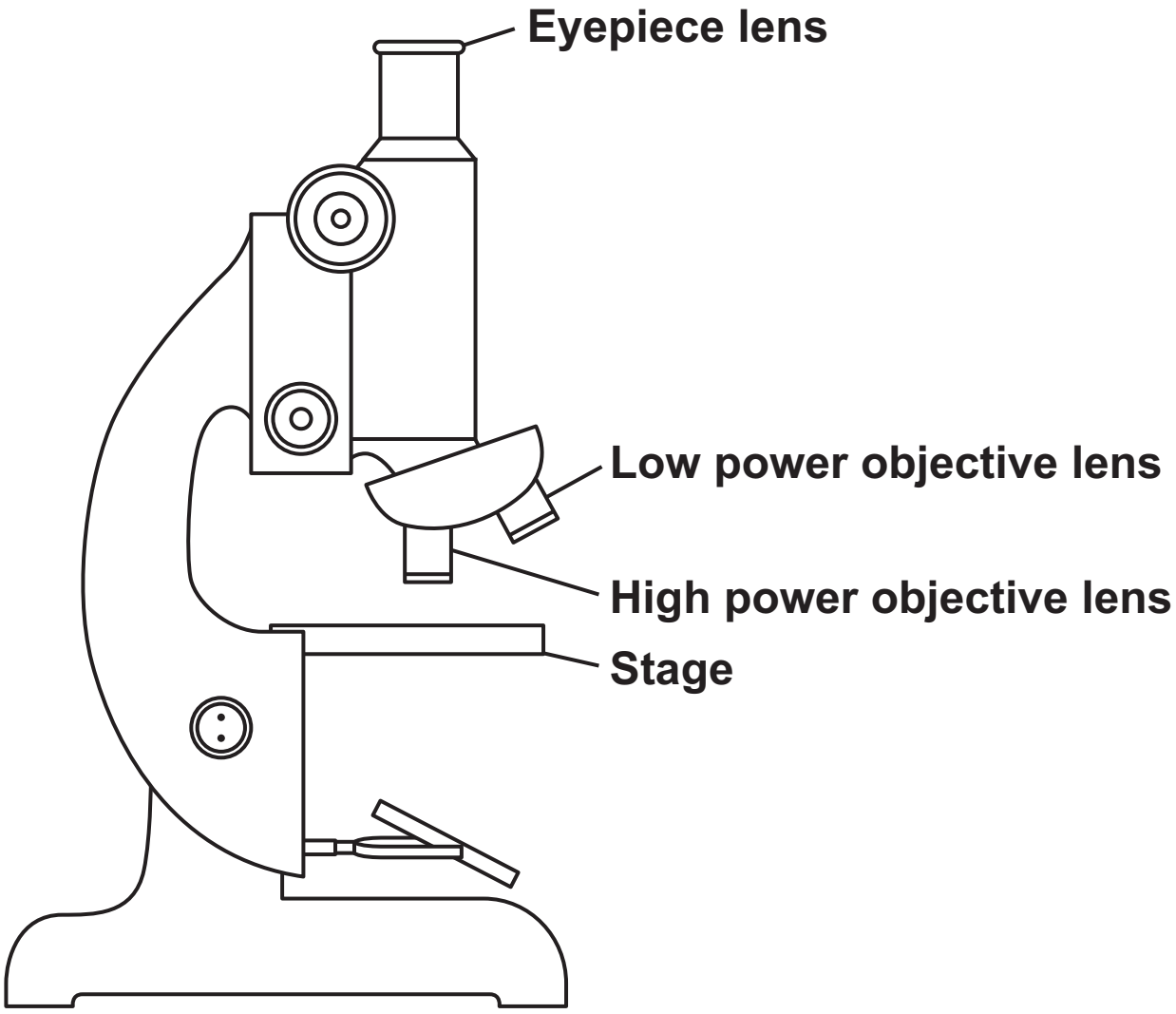
[Turn over]

0 4

FIGURE 4 shows a light microscope.

FIGURE 4



0 4 . 1

The eyepiece lens has a magnification of ×10

The high power objective lens has a magnification of ×40

Which calculation shows the total magnification?
[1 mark]

Tick (✓) ONE box.

☐ **10 × 40**

☐ $\frac{40}{10}$

☐ **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 ×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

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]

[Turn over]

0 4 . 5

Viruses are approximately 100 times smaller than animal cells.

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

_____

_____

_____

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

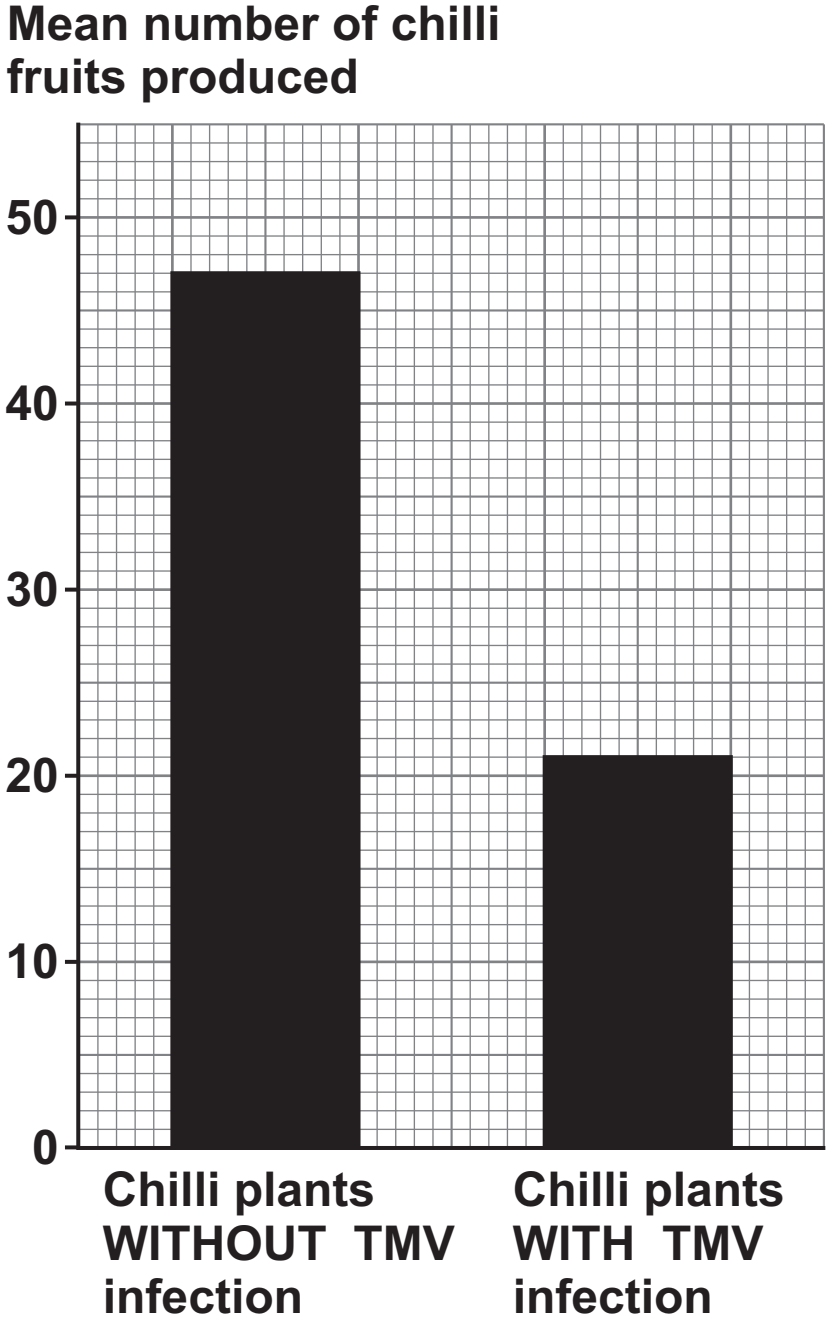
Farmers grow chilli plants and sell chilli fruits.

FIGURE 5 shows chilli fruits growing on a chilli plant.

FIGURE 5

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

FIGURE 6



[Turn over]

0 4 . 6

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

_____

_____

_____

Decrease = _____ fruits

0 4 . 7

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

_____

_____

_____

11

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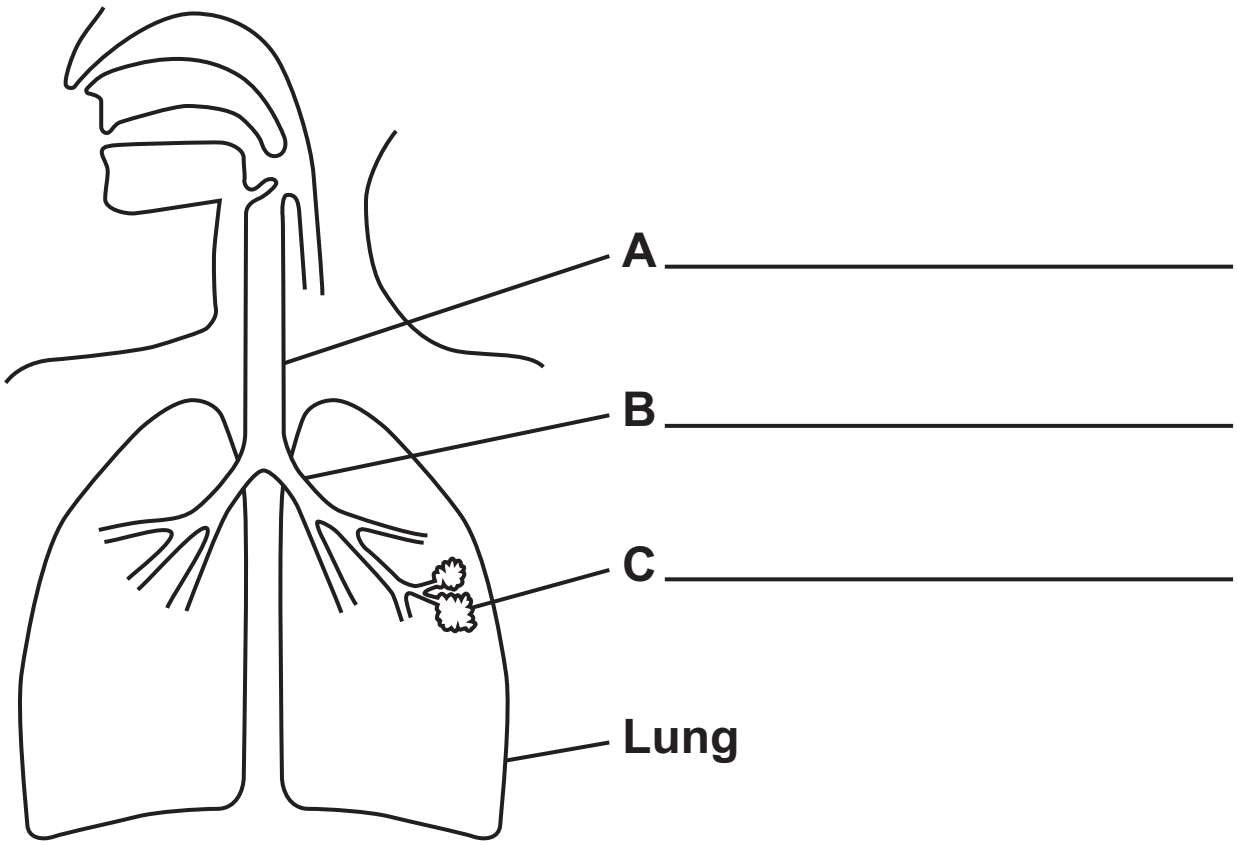
[Turn over]

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]

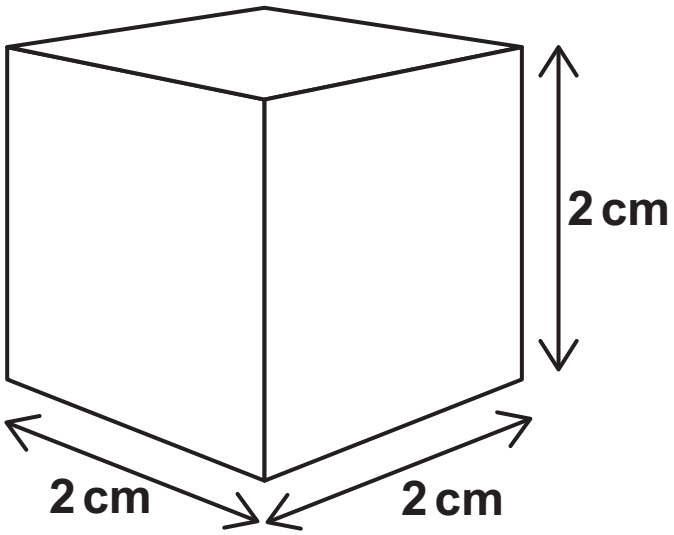
TYPE OF VARIABLE	VARIABLE IN THE INVESTIGATION
	Size of cube
Dependent variable	Temperature
Independent variable	Time taken for the cube to go colourless
	Type of acid used

[Turn over]

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 = _____ cm^2

Calculate the volume of the cube

_____

_____

_____

Volume = _____ cm^3

Give the surface area to volume ratio of the cube

_____

_____

_____

Surface area : volume = _____ : _____

[Turn over]

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]

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.**

11

[Turn over]

0 6

The human body protects itself from pathogens.

0 6 . 1

Describe how the SKIN and the STOMACH protect the human body from pathogens. [4 marks]

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]

_____

_____

[Turn over]

Each person has two alleles for earwax.

0 6 . 4

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

_____

_____

_____

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**

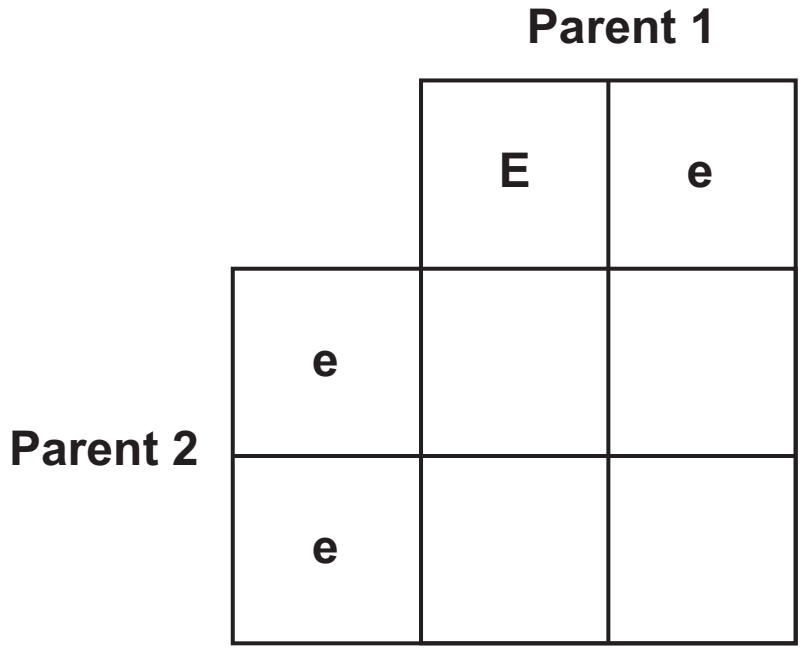
0 6 . 6

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



Probability that the child will have dry earwax =

_____

[Turn over]

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]

_____

_____

0 6 . 8

Give ONE environmental cause for the variation in the characteristic you named in Question 06.7. [1 mark]

_____

_____

_____

14

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[Turn over]

0 7

Heaters can be used to heat homes and gardens.

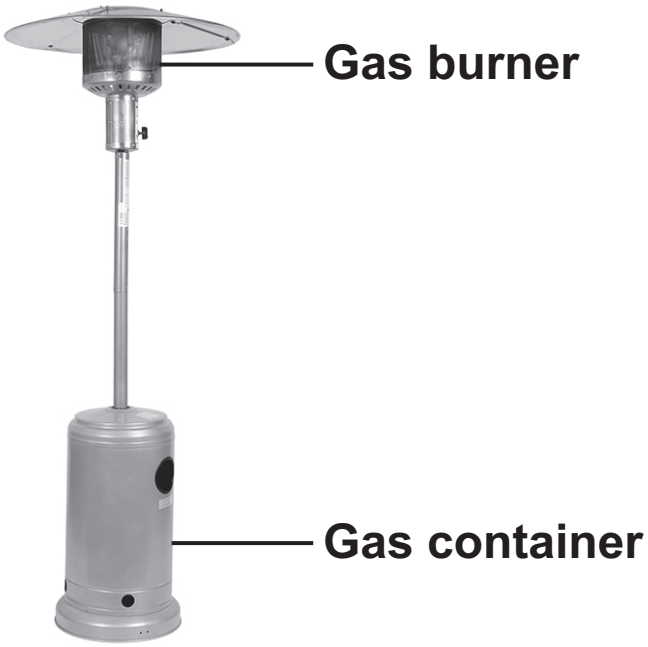
0 7 . 1

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.

FIGURE 10



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

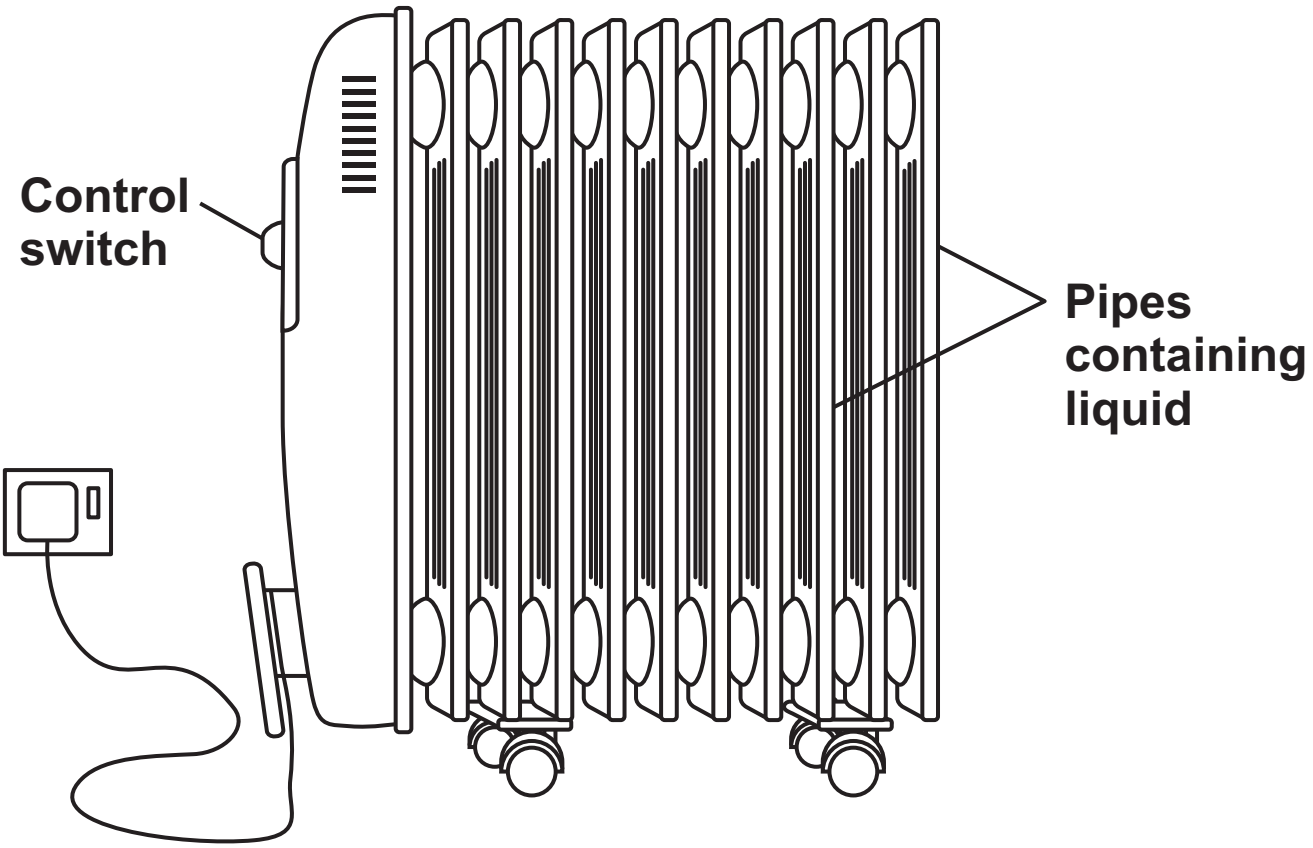
	INCREASES	STAYS THE SAME	DECREASES
Average kinetic energy of the gas particles			
Average speed of the gas particles			
Pressure exerted on the inside of the container			

[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

0 7 . 4

On another day, the temperature change of the liquid was 45.0 °C.

The mass of liquid in the heater is 5.0 kg.

specific heat capacity of liquid = 4200 J/kg °C

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

Use the equation:

change in thermal energy = mass × specific heat capacity × 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.**

8

BLANK PAGE

[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 _____

_____

_____

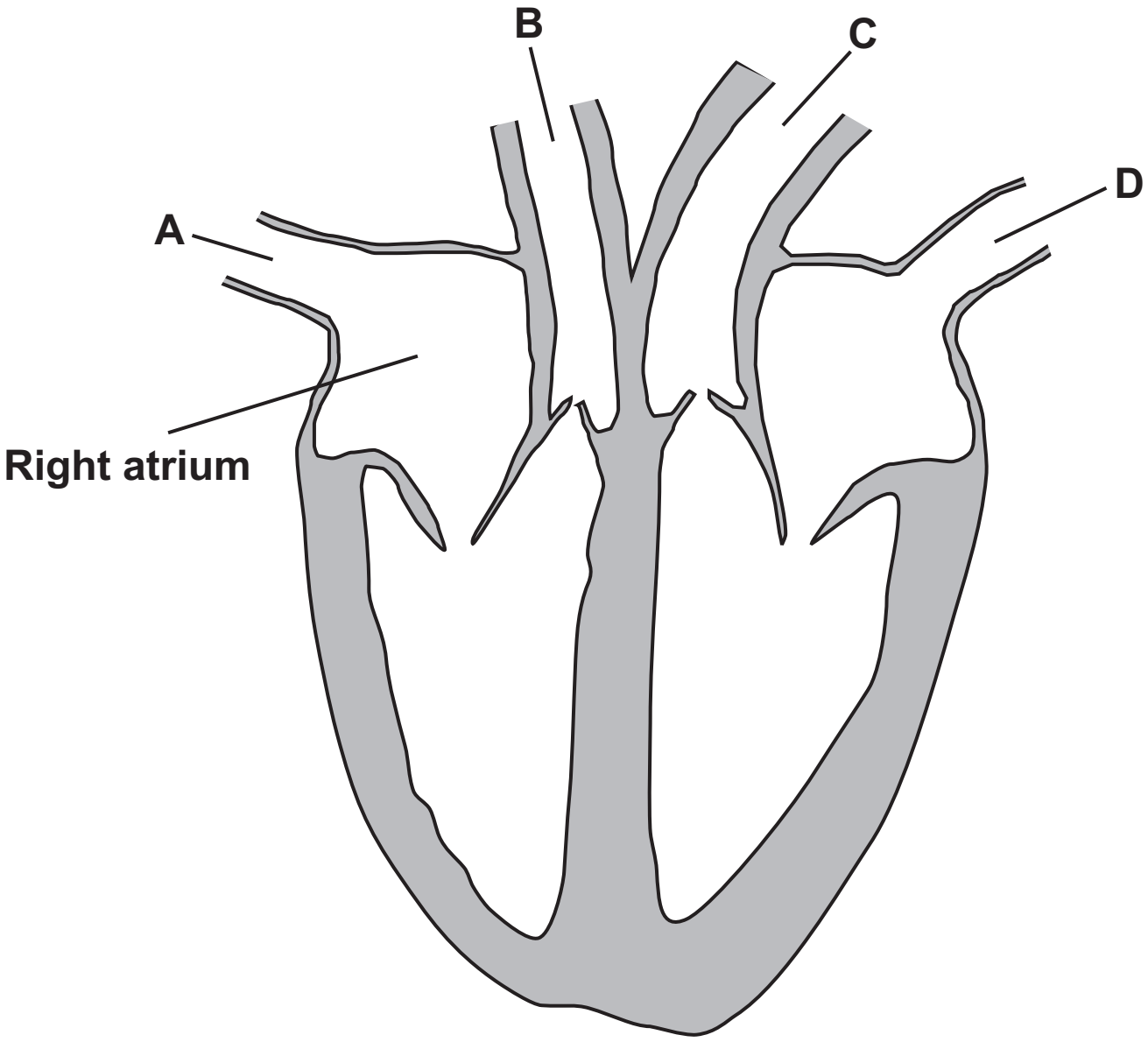
Platelets _____

_____

_____

FIGURE 12 shows a human heart.

FIGURE 12



[Turn over]

0 8 . 2

Draw ONE arrow on FIGURE 12, on page 53, 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]

_____

_____

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**

[Turn over]

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**

Carbon monoxide is a toxic gas.

0 8 . 8

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

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.

Use the equation:

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

[2 marks]

Percentage increase = _____ %

14

BLANK PAGE

[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]

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.

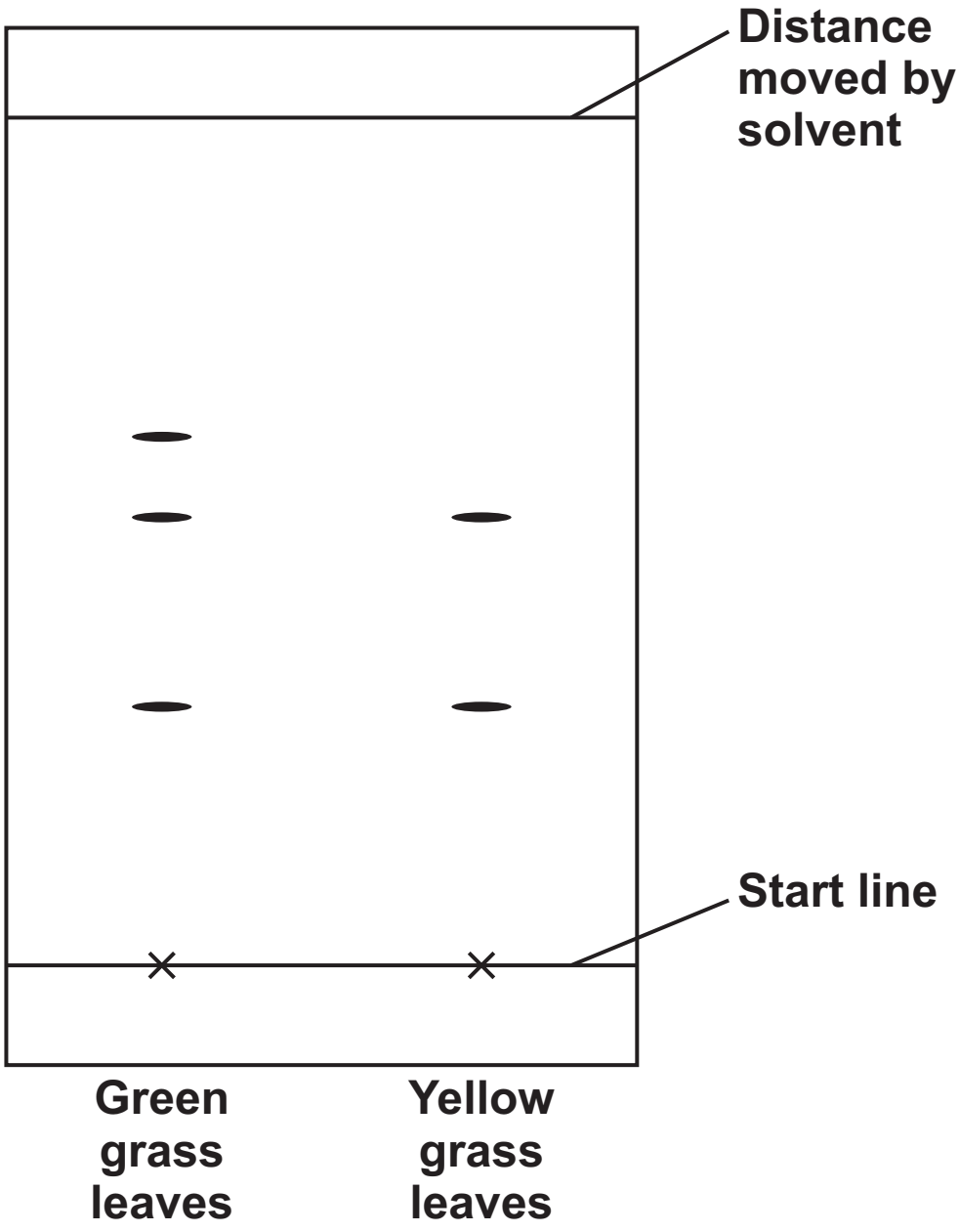
FIGURE 13

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 shows the results.

FIGURE 14



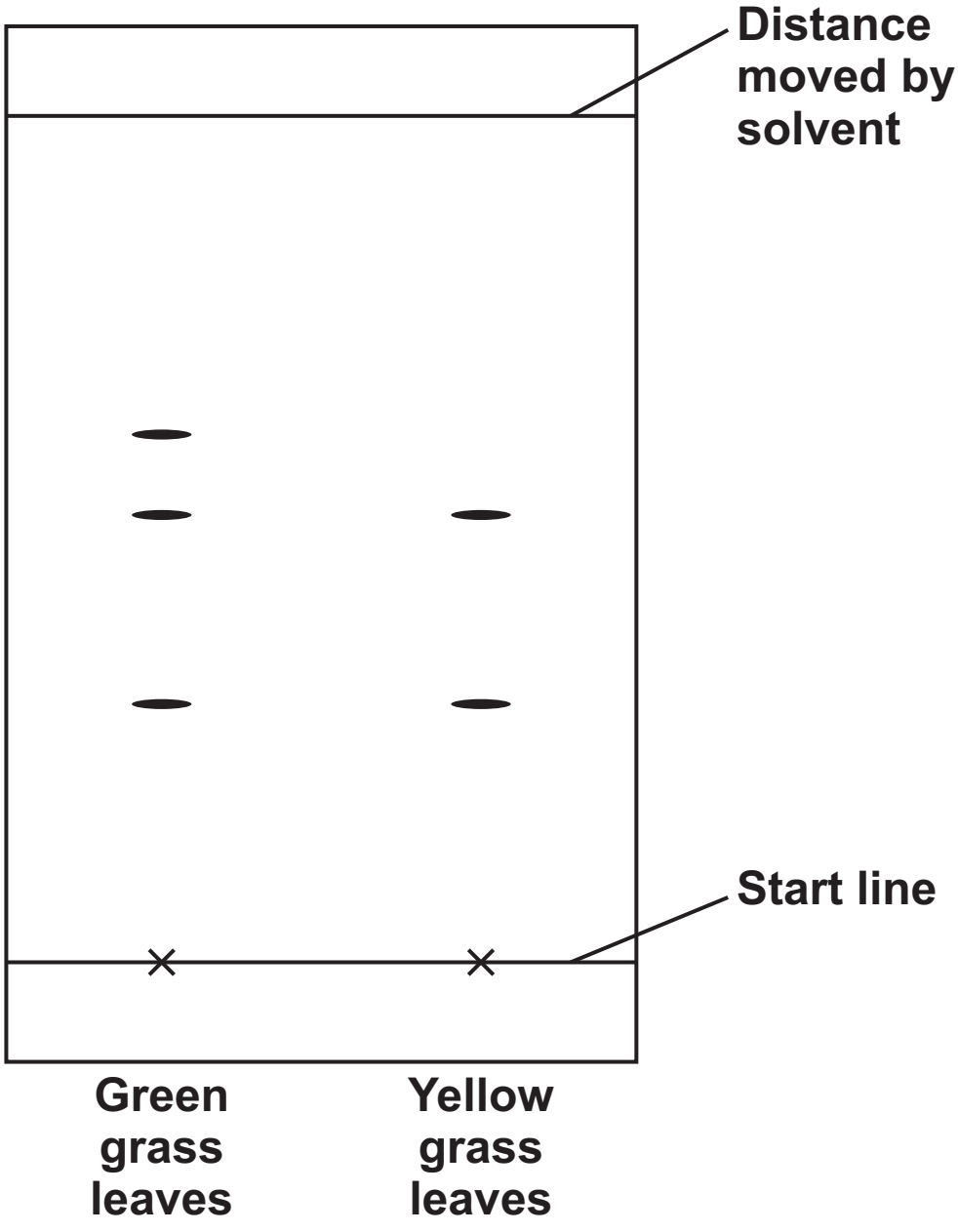
0 9 . 4

The student crushed the grass leaves.

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

FIGURE 14 is repeated below.

FIGURE 14



0 9 . 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 page 65. [4 marks]

_____

_____

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]

_____

_____

_____

14

END OF QUESTIONS

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

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

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For Examiner's Use	
Question	Mark
1	
2	
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7	
8	
9	
TOTAL	

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