



Surname _____

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Centre Number _____

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I declare this is my own work.

**GCSE
COMBINED SCIENCE: SYNERGY**

H

Higher Tier Paper 1 Life and Environmental Sciences

8465/1H

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]



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



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0 1

This question is about the blood and the circulatory system.

0 1 . 1

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

Red blood cells _____

White blood cells _____

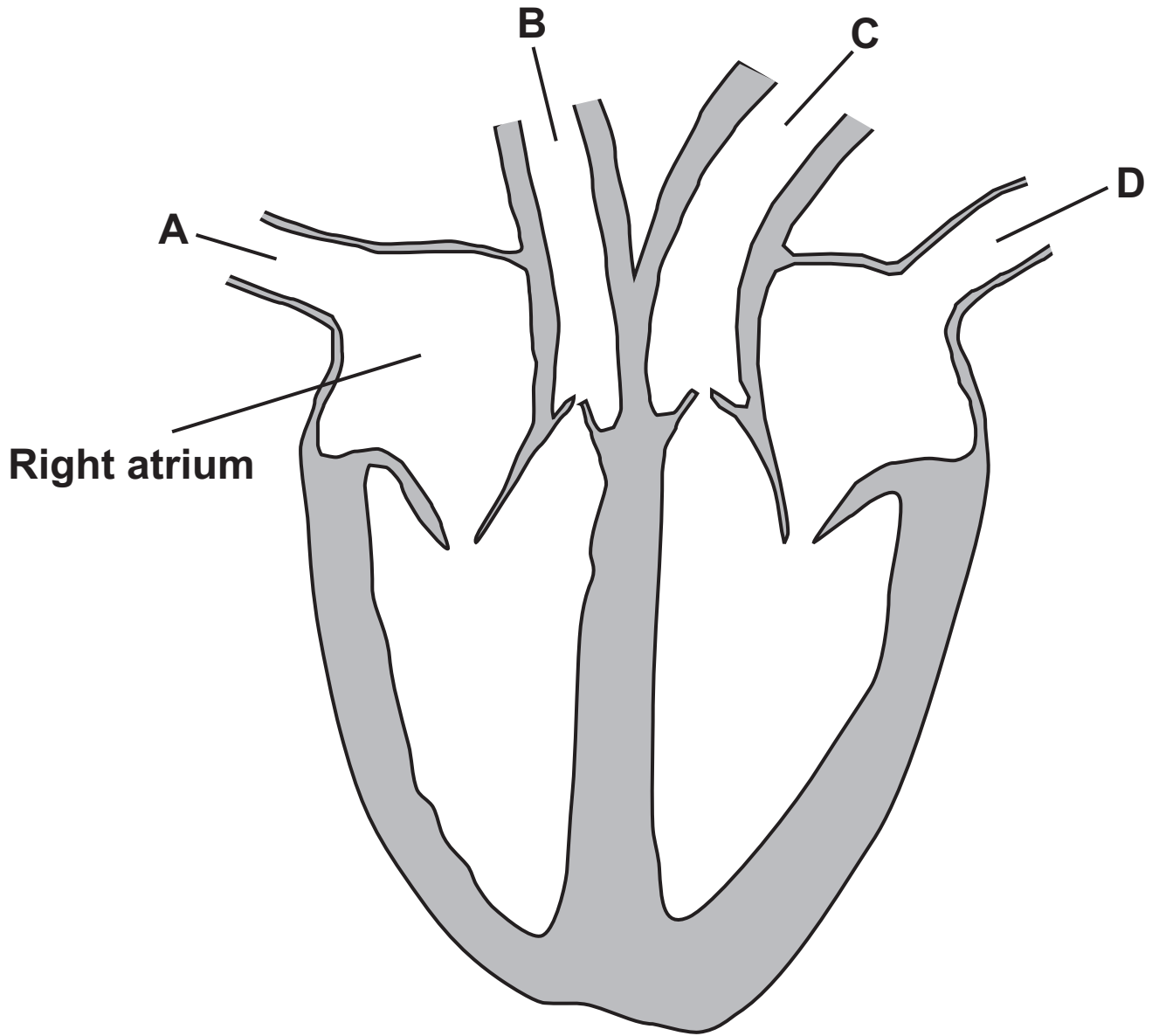
Platelets _____

[Turn over]



FIGURE 1 shows a human heart.

FIGURE 1



0	1	.	2
---	---	---	---

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

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

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

Tick (✓) **ONE** box.

A

B

C

D

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

Which blood vessel is the aorta? [1 mark]

Tick (✓) **ONE** box.

A

B

C

D

[Turn over]



0	1	.	5
---	---	---	---

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

0	1	.	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	1	.	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]



0 1 . 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:

percentage increase =

$$\frac{\text{final heart rate} - \text{starting heart rate}}{\text{starting heart rate}} \times 100 \quad [2 \text{ marks}]$$

Percentage increase = _____ %

14

[Turn over]



0	2
---	---

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

0	2	.	1
---	---	---	---

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

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

0	2	.	2
---	---	---	---

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



0	2	.	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 2 shows the area of green grass and the area of yellow grass.

FIGURE 2



Green grass

Yellow grass

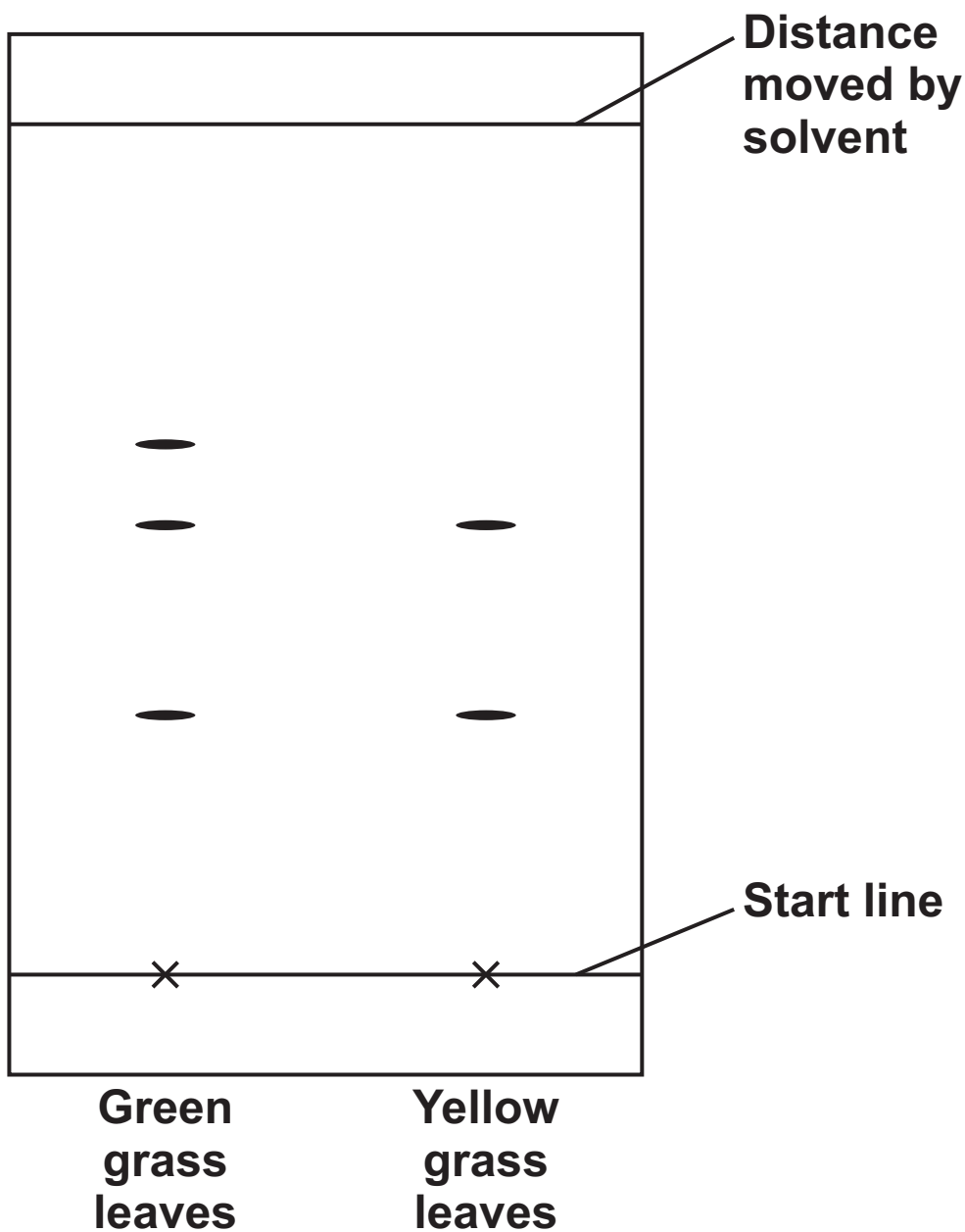


A student used paper chromatography to investigate the pigments in grass leaves from:

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

FIGURE 3 shows the results.

FIGURE 3

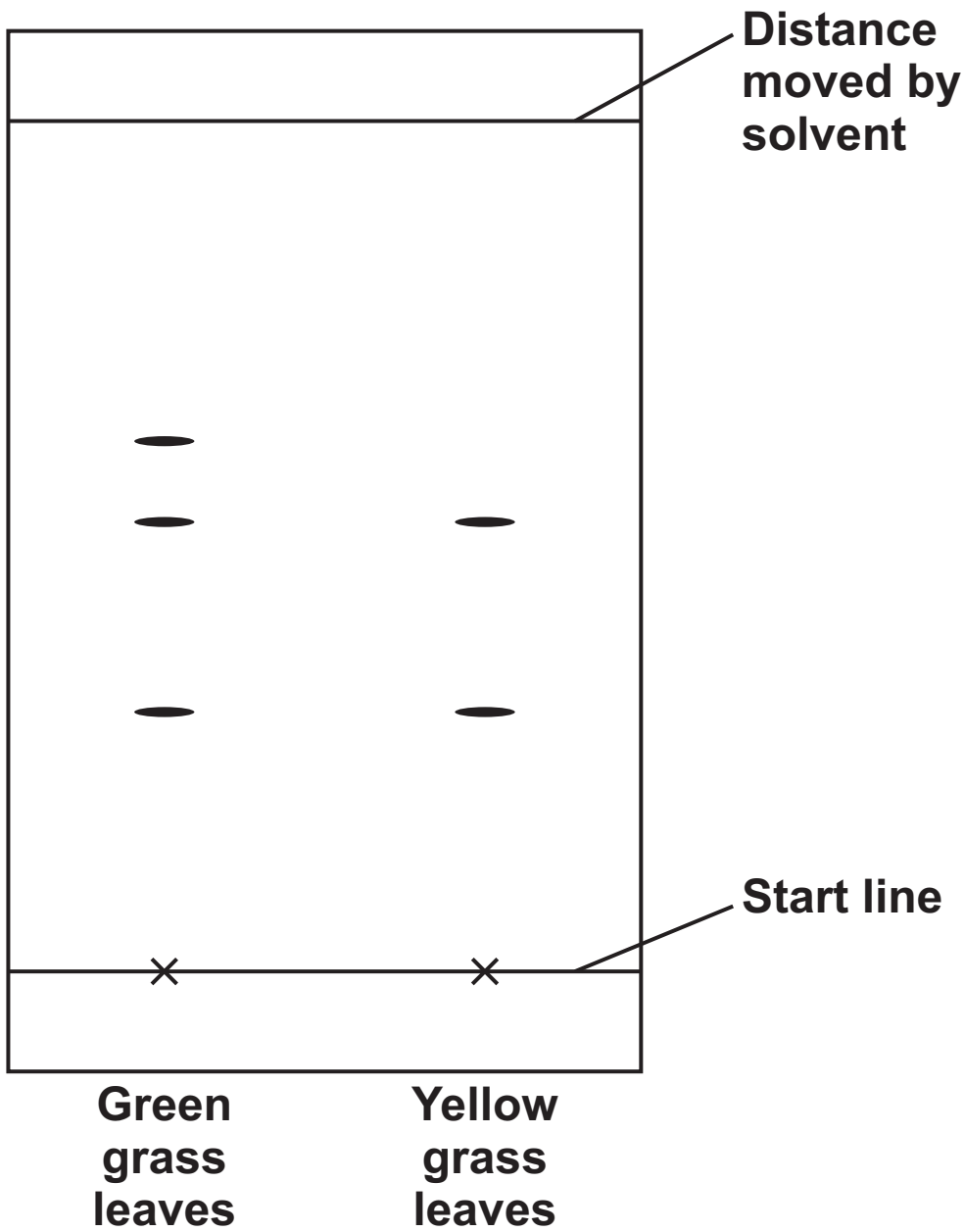


[Turn over]



FIGURE 3 is repeated below.

FIGURE 3



[Turn over]



$R_f =$ _____

0 2 . 6

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

Suggest ONE reason why. [1 mark]

14

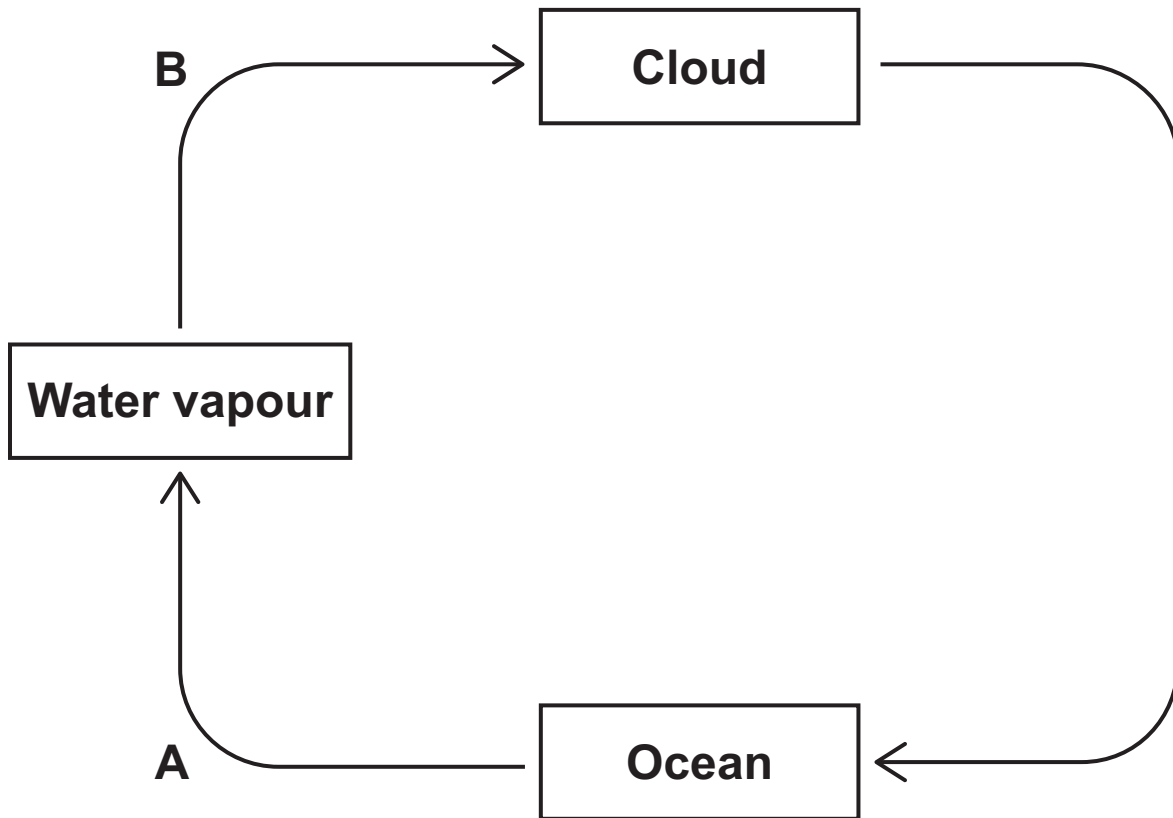
[Turn over]



0 3

FIGURE 4 shows part of the water cycle.

FIGURE 4



0 3 . 1

Name processes A and B shown on FIGURE 4, on the opposite page. [2 marks]

A _____

B _____

0 3 . 2

Water that is safe to drink is called potable water.

Give TWO methods used to sterilise potable water. [2 marks]

1 _____

2 _____

[Turn over]



0	3	.	3
---	---	---	---

Explain why it is more expensive to produce potable water from sea water than from river water. [2 marks]



Waste water must be treated to produce potable water.

0 3 . 4

Waste water from fields where crops are growing may contain chemicals.

Suggest TWO types of chemical from fields where crops are growing that must be removed from waste water.

[2 marks]

1 _____

2 _____

[Turn over]



0 3 . 5

One step in sewage treatment is sedimentation to produce sewage sludge and effluent.

What further treatment is used on the sewage sludge and on the effluent? [2 marks]

Sewage sludge _____

Effluent _____

10



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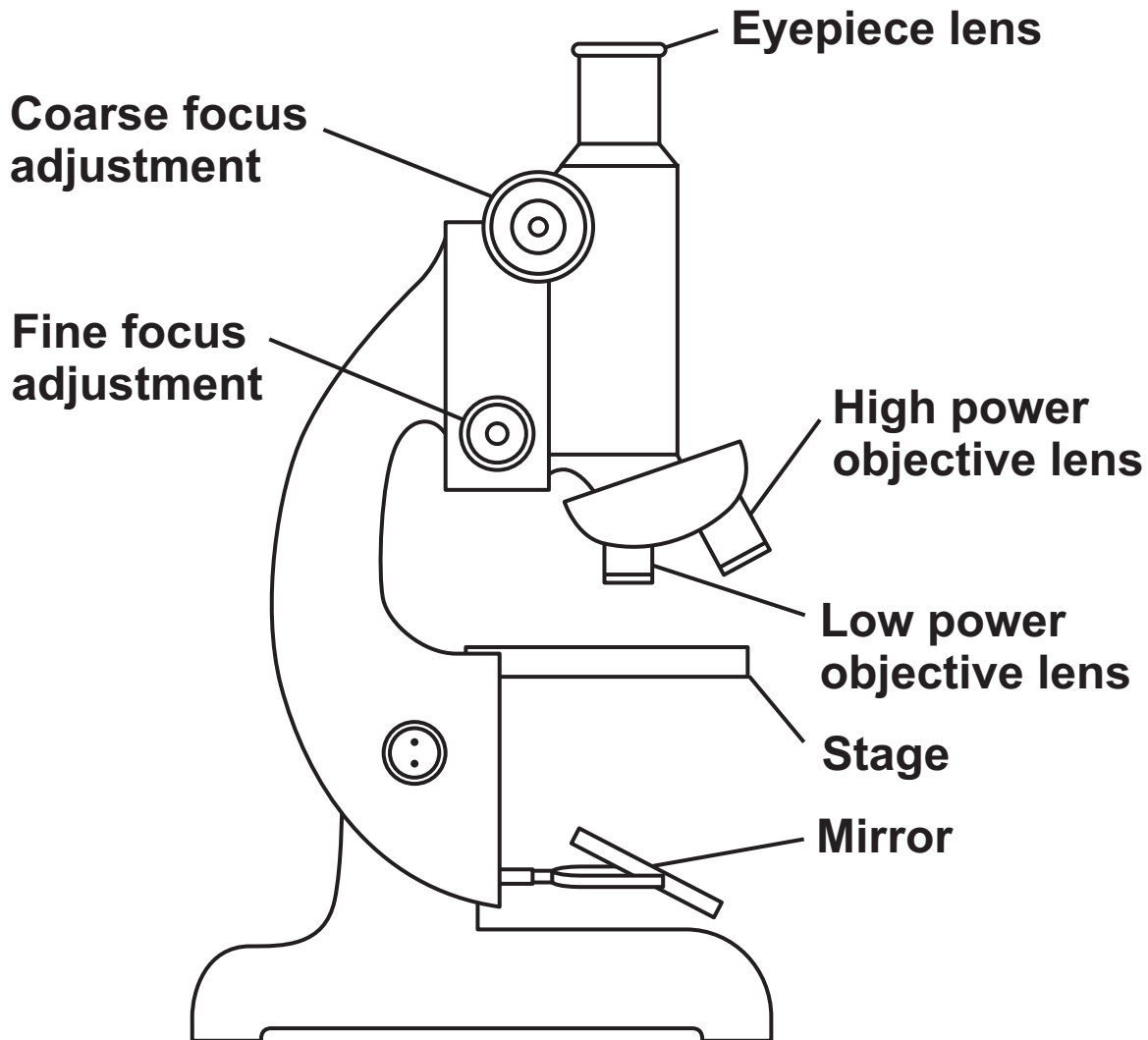
[Turn over]



0 4

FIGURE 5 shows a light microscope.

FIGURE 5



0	4	.	2
---	---	---	---

Light microscopes are **NOT** used to view viruses.

What are **TWO** reasons why electron microscopes are used to view viruses? [2 marks]

Tick (✓) **TWO** boxes.

Electron microscopes are expensive to maintain

Electron microscopes can have a magnification of $\times 1\,000\,000$

Electron microscopes have a high resolving power

Viruses are not living organisms

Viruses are found and are replicated inside living cells



0 5

Earwax is produced by specialised skin cells in the ear.

0 5 . 1

Suggest ONE advantage of producing earwax. [1 mark]

People produce either wet earwax or dry earwax.

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

0 5 . 2

Define the term 'gene'. [2 marks]

[Turn over]



Scientists studied the type of earwax produced by a large number of parents and their offspring.

TABLE 1 shows the type of earwax of the parents and the number of offspring with each type of earwax.

TABLE 1

PHENOTYPE OF PARENTS		NUMBER OF OFFSPRING WITH	
parent 1	parent 2	wet earwax	dry earwax
dry earwax	dry earwax	0	634
wet earwax	dry earwax	205	195
wet earwax	wet earwax	35	12



0	5	.	3
---	---	---	---

The allele for wet earwax is dominant.

Give the evidence from TABLE 1, on the opposite page, that shows the allele for wet earwax is dominant.

[1 mark]

[Turn over]



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

Consider the offspring born when one parent has wet earwax AND one parent has dry earwax.

Explain the number of offspring with each type of earwax born to these parents.

Assume the parent with wet earwax is heterozygous.

Use TABLE 1, on page 32.

You should:

- **draw a Punnett square diagram**
- **identify each offspring phenotype**
- **explain the number of each type of offspring shown in TABLE 1.**



Use the symbols:

E = allele for wet earwax

e = allele for dry earwax [5 marks]

Explanation _____

9

[Turn over]



0	6
---	---

Carbon-12 (${}^1_6\text{C}$) and carbon-14 (${}^{14}_6\text{C}$) are isotopes of carbon.

Carbon-14 is radioactive.

0	6	.	1
---	---	---	---

How are the numbers and type of sub-atomic particles in carbon-14 DIFFERENT from the sub-atomic particles in carbon-12? [1 mark]

0	6	.	2
---	---	---	---

Carbon-14 is formed in the atmosphere.

Carbon-14 reacts with oxygen to produce carbon dioxide.

Explain why ANIMAL TISSUES contain carbon-14 [5 marks]

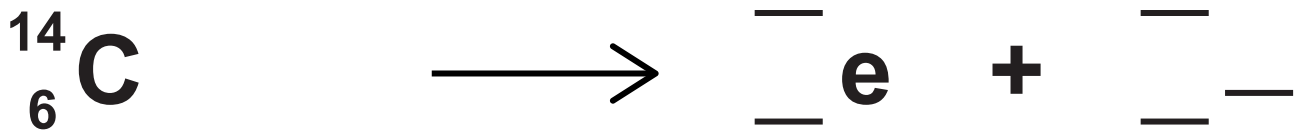


0	6	.	3
---	---	---	---

Carbon-14 emits beta radiation.

Complete the nuclear equation to show the radioactive decay of carbon-14

Use the periodic table. [3 marks]



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

The carbon-14 in the body was used to determine the age of the body.

The body was 5400 years old.

0 6 . 4

Explain why the body tissues had NOT decayed completely. [2 marks]

[Turn over]



0 6 . 5

The amount of carbon-14 in the body had decreased by 47%.

What is the half-life of carbon-14? [1 mark]

Tick (✓) ONE box.

< 5400 years

= 5400 years

> 5400 years

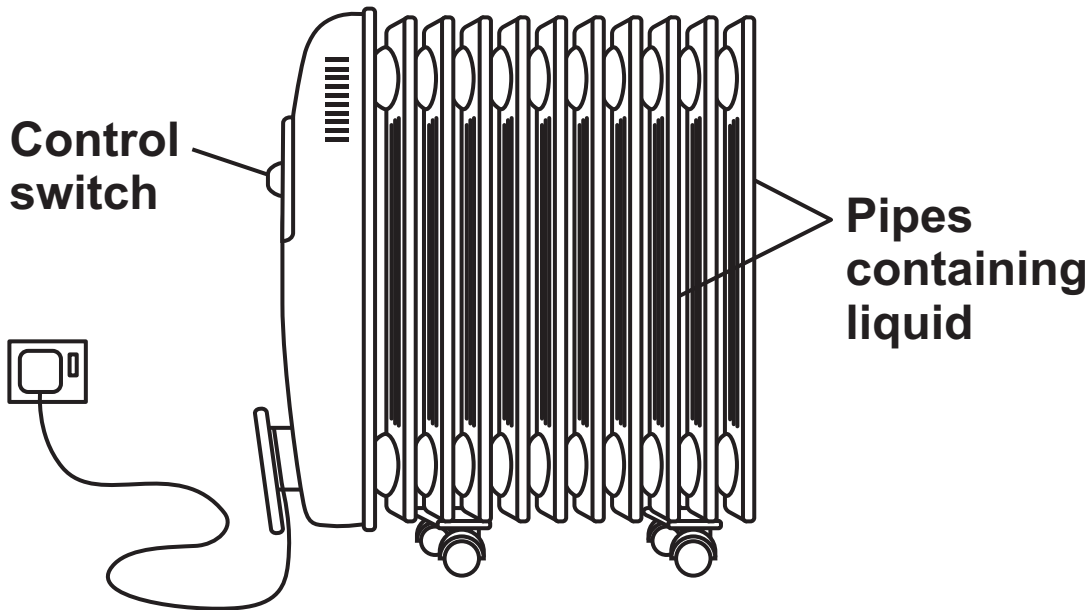


07

FIGURE 6 shows an electric heater.

This type of heater is filled with a liquid.

FIGURE 6



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

An identical heater contains 5.0 kg of oil instead of 5.0 kg of water.

specific heat capacity of oil = 1970 J/kg °C

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

**Explain the difference in the energy needed to cause the same temperature change in the oil and in the water.
[2 marks]**



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[Turn over]



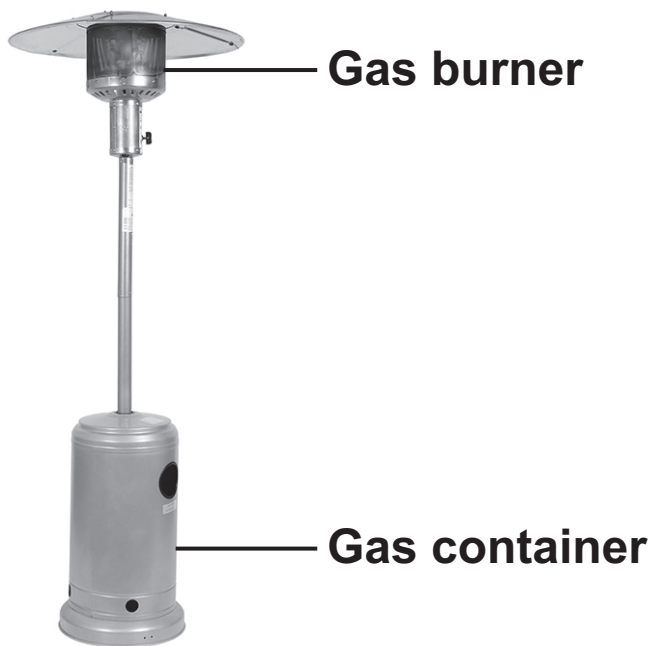
07.3

Gas heaters may be used to heat gardens.

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

FIGURE 7 shows a gas heater.

FIGURE 7



On a sunny day the burner is NOT lit.

The temperature of the gas in the container increases.

Explain why the pressure inside the container changes.
[3 marks]



10

[Turn over]



0	9
---	---

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 cubes contained indicator and an alkaline solution.**
- **The indicator was pink at the start of the investigation because the cubes were alkaline.**
- **As acid diffused into the cubes the indicator changed from pink to colourless.**
- **If acid had NOT diffused to the centre of the cube some of the cube would NOT have changed colour.**

This is the method used.

- 1. Make a gel containing indicator and an alkaline solution.**
- 2. Cut the gel into a cube with 1 cm long sides.**
- 3. Place the cube in a beaker.**
- 4. Cover the cube with acid.**
- 5. After 5 minutes, remove the cube from the acid.**
- 6. Cut the cube in half.**
- 7. Measure the width of the area inside the cube that did not change colour.**
- 8. Calculate the volume at the centre of the cube that did not change colour.**
- 9. Repeat steps 3 to 8 with cubes of different sizes.**



0 9 . 1

Give TWO control variables the student should have used.

Do NOT refer to time in your answer. [2 marks]

1 _____

2 _____

[Turn over]



The student calculated the percentage of the volume of each cube that had changed colour.

TABLE 2 shows the results.

TABLE 2

Length of sides of cube in cm	Volume of cube that had NOT changed colour in cm ³	Percentage (%) of volume of cube that had changed colour
1	0	100
2	1	88
3	8	70
4	27	X

0 9 . 2

Calculate percentage X in TABLE 2. [4 marks]



Percentage X = _____ %

[Turn over]



0	9	.	4
---	---	---	---

Give TWO limitations of using cubes to model diffusion in organisms. [2 marks]

1 _____

2 _____

12

END OF QUESTIONS



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For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

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5 8



2 3 6 G 8 4 6 5 / 1 H