



Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: SYNERGY
8465/1F

F

Foundation Tier

Paper 1 Life and Environmental Sciences

Time allowed: 1 hour 45 minutes

MATERIALS

For this paper you must have:

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

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

[Turn over]



J U N 2 1 8 4 6 5 1 F 0 1

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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
---	---

This question is about greenhouse gases.

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

Methane is a greenhouse gas.

Name ONE other greenhouse gas. [1 mark]

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

Greenhouse gases cause global warming.

Global warming can cause a decrease in biodiversity.

What is biodiversity? [1 mark]

Tick (✓) ONE box.

☐

The differences in sunlight in an area

☐

The range of temperatures in an area

☐

The variety of organisms in an area



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

Destruction of peat bogs decreases biodiversity.

Give ONE reason why peat bogs are being destroyed.
[1 mark]

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

Which TWO human activities can INCREASE biodiversity?
[2 marks]

Tick (✓) TWO boxes.

☐

Building more roads

☐

Growing hedgerows between fields

☐

Increasing the use of pesticides

☐

Planting more woodlands

☐

Selective breeding of farm animals

[Turn over]



Methane (CH₄) is a small molecule.

01 . 5

A small molecule has a diameter of 1.0 nm.

1 m = 1 000 000 000 nm

What is the diameter of the small molecule in metres?
[1 mark]

Tick (✓) ONE box.

☐

1.0 × 10¹⁰ m

☐

1.0 × 10⁹ m

☐

1.0 × 10⁻⁹ m

☐

1.0 × 10⁻¹⁰ m



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

Which structure is larger than a methane molecule?
[1 mark]

Tick (✓) ONE box.

☐

A carbon atom

☐

An electron

☐

A neutron

☐

A protein

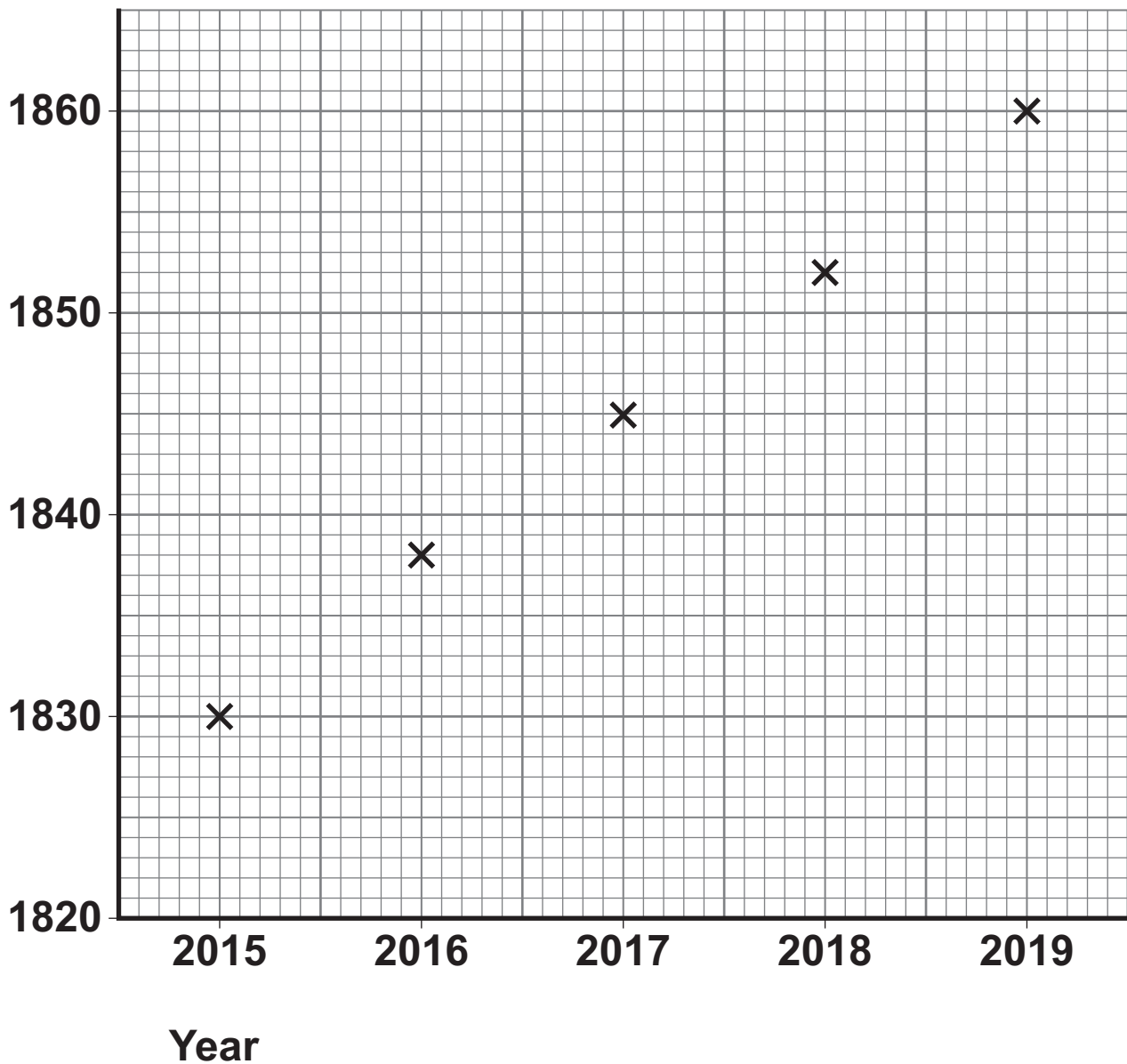
[Turn over]



FIGURE 1 shows the concentration of methane in the Earth's atmosphere from 2015 to 2019.

FIGURE 1

**Concentration of
methane in the
Earth's atmosphere
in arbitrary units**



0	1	.	7
---	---	---	---

What was the concentration of methane in the Earth's atmosphere in 2016? [1 mark]

Use FIGURE 1.

Concentration = _____ arbitrary units

0	1	.	8
---	---	---	---

Give ONE conclusion from FIGURE 1. [1 mark]

9

[Turn over]



0	2
---	---

In 1986 an accident destroyed a nuclear power station.

Radioactive caesium-137 was released into the environment.

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

A nucleus of caesium-137 emits a high-speed electron when it decays.

What type of radiation does a nucleus of caesium-137 emit when it decays? [1 mark]

Tick (✓) ONE box.

☐

Alpha

☐

Beta

☐

Gamma



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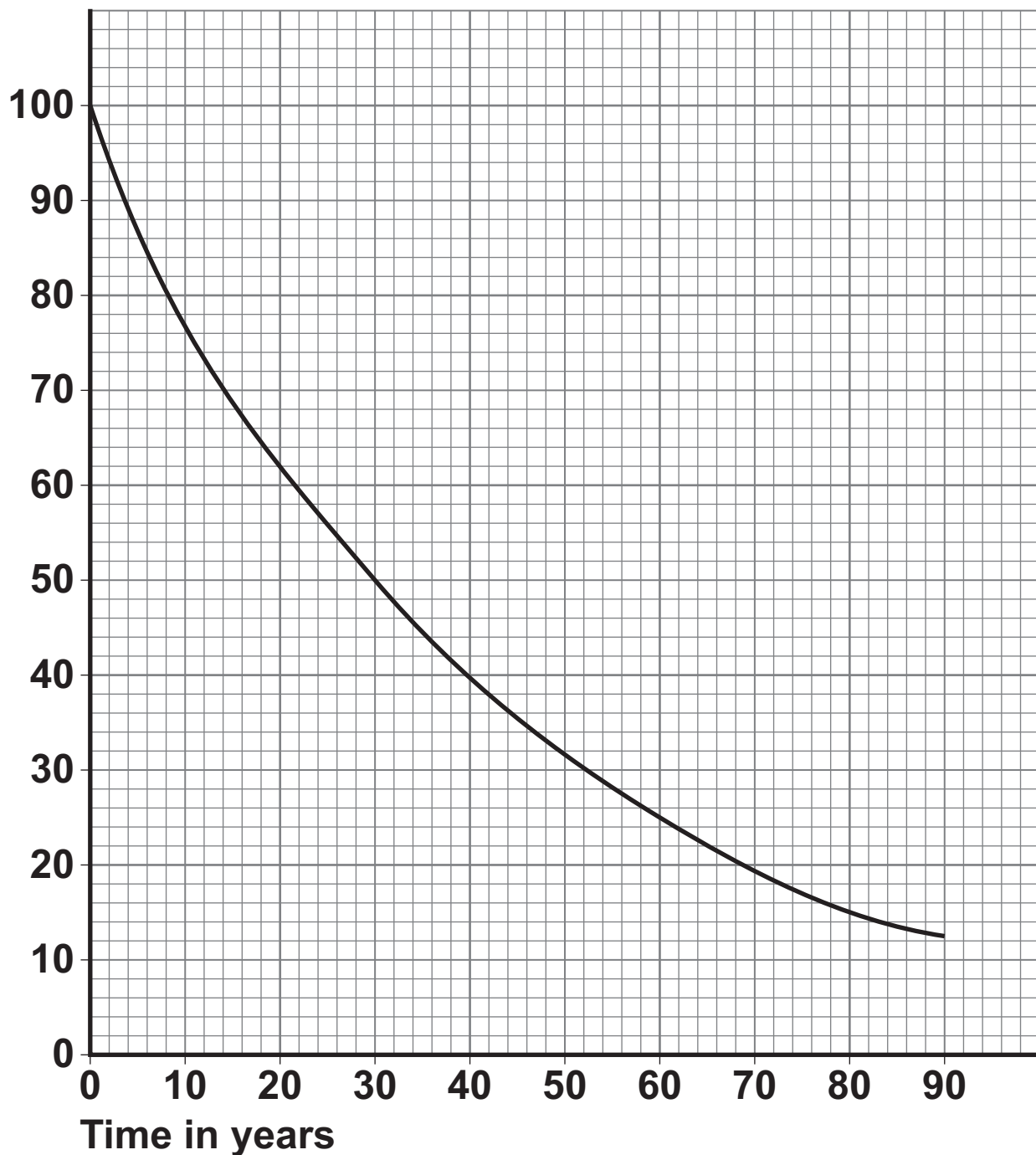
[Turn over]



FIGURE 2 shows how the percentage of caesium-137 nuclei remaining in a sample changes with time.

FIGURE 2

**Percentage of
caesium-137
nuclei remaining**



After one half-life, 50% of the caesium-137 nuclei remain in the sample.

.

What is the half-life of caesium-137? [1 mark]

Use FIGURE 2.

Half-life = _____ years

.

A sample of caesium-137 has a mass of 32 kg.

What mass of caesium-137 remains after TWO half-lives?
[1 mark]

Tick (✓) ONE box.

☐

4 kg

☐

8 kg

☐

16 kg

☐

64 kg

[Turn over]



Scientists investigated the effect of radiation on the dragonfly population near the nuclear power station site.

Dragonflies are insects.

0 2 . 4

The scientists recorded the number of dragonflies and level of radiation at different distances from the nuclear power station.

The scientists used a transect.

What is a transect? [1 mark]

Tick (✓) ONE box.

☐

A line that is sampled along

☐

A quadrat placed randomly

☐

A sample at one location



Radiation from the nuclear power station caused the dragonfly population to decrease.

0 2 . 5

Complete the sentences.

Choose answers from the list. [3 marks]

carbohydrates	infections	lipids
mutations	proteins	tumours

Radiation caused changes in the dragonfly DNA.

The changes in the DNA are called

The changed DNA could not code for the correct

Cells in the dragonfly grew and divided in an uncontrolled way, causing

[Turn over]



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

Nuclear radiation is an ABIOTIC factor affecting the dragonfly population.

Which are TWO other ABIOTIC factors that could affect the dragonfly population? [2 marks]

Tick (✓) TWO boxes.

☐

Air temperature

☐

Other insects

☐

Predators

☐

Prey

☐

Water



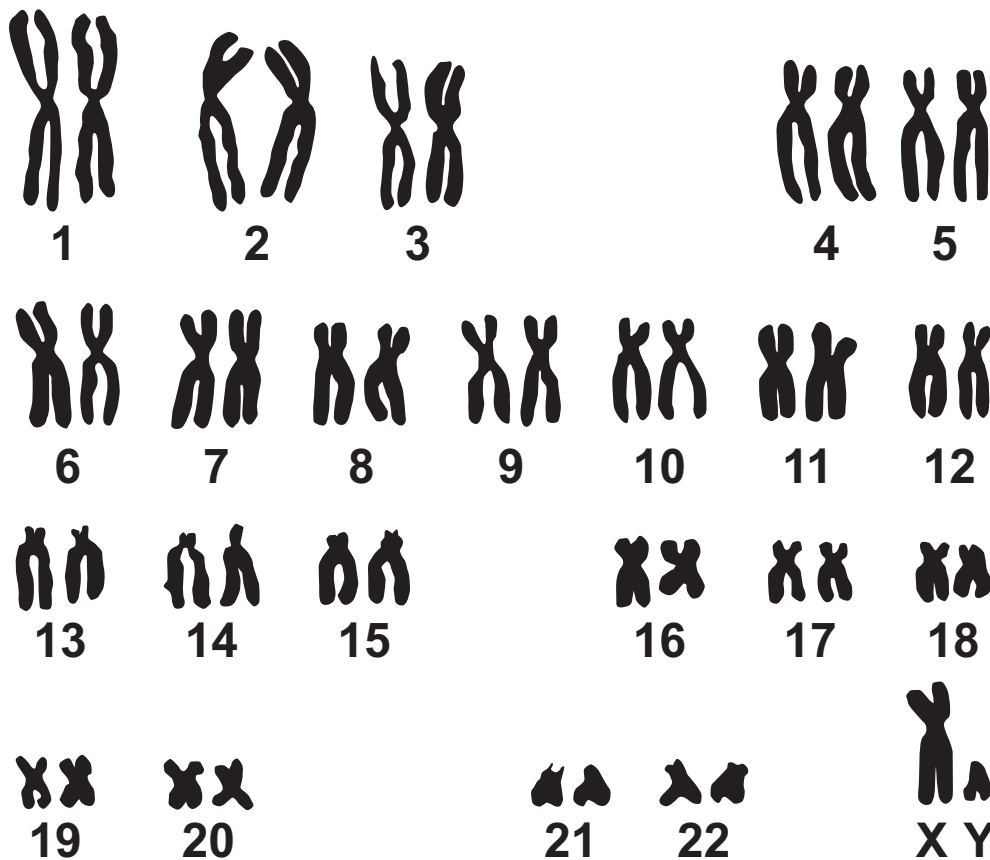
03

This question is about genetics.

03 . 1

FIGURE 3 shows the chromosomes of a man.

FIGURE 3



What evidence is there that the person is male? [1 mark]

Use FIGURE 3.

[Turn over]



03 . 2

A combination of genes and the environment affect how tall a person is.

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

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

Cystic fibrosis is an inherited disorder that affects the lungs.

03 . 3

**Suggest ONE symptom caused by damaged lungs.
[1 mark]**



The allele for having cystic fibrosis is recessive, r.

The allele for NOT having cystic fibrosis is dominant, R.

03 . 4

What is the genotype of a person with cystic fibrosis?
[1 mark]

Tick (✓) ONE box.

☐

RR

☐

Rr

☐

rr

03 . 5

A man has the genotype RR.

Which word describes the genotype RR? [1 mark]

Tick (✓) ONE box.

☐

Characteristic

☐

Homozygous

☐

Phenotype

[Turn over]



03 . 6

A woman has a child with a man.

Complete FIGURE 4 to show the possible genotypes of the child. [2 marks]

FIGURE 4

		Woman	
		R	r
Man	R		
	R		Rr

03 . 7

What is the chance of the child having cystic fibrosis? [1 mark]

Tick (✓) ONE box.

☐

0%

☐

25%

☐

50%

☐

75%



Drugs are being developed to treat cystic fibrosis in humans.

The drugs are tested before being used to treat patients.

03 . 8

Give TWO reasons why drugs are tested. [2 marks]

1 _____

2 _____

[Turn over]



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

The drugs are tested on sheep that have been genetically modified (GM) to develop the symptoms of cystic fibrosis.

Give ONE ethical argument AGAINST the production of sheep with the symptoms of cystic fibrosis.

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

11



0	4
---	---

This question is about hormones.

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

Draw ONE line from each hormone to the function of that hormone. [2 marks]

HORMONE

FUNCTION

Follicle stimulating hormone (FSH)

Matures an egg

Reduces blood glucose concentration

Testosterone

Stimulates sperm production

[Turn over]



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

In one menstrual cycle, an egg is released on day 13.

Which chemical causes the egg to be released? [1 mark]

Tick (✓) ONE box.

☐

Cholesterol

☐

Insulin

☐

Lipase

☐

Luteinising hormone



0	4	.	3
---	---	---	---

Hormones are used in some methods of contraception.

**Which TWO types of contraception use hormones?
[2 marks]**

Tick (✓) TWO boxes.

☐

Condom

☐

Diaphragm

☐

Oral contraceptive pill

☐

Skin patch

☐

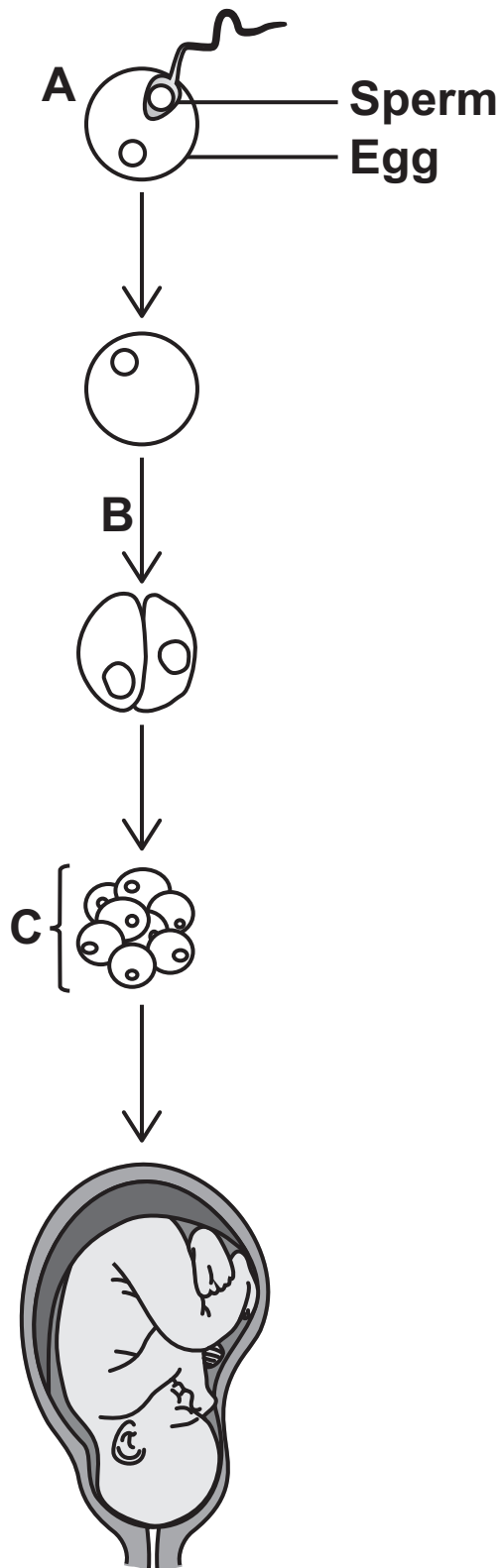
Surgical sterilisation

[Turn over]



FIGURE 5 shows how a baby is formed.

FIGURE 5



Use FIGURE 5 to answer questions 04.4 to 04.6.

04 . 4

Name the process happening at A. [1 mark]

04 . 5

The sperm and egg were formed by meiosis.

Meiosis is a type of cell division.

Name the type of cell division happening at B. [1 mark]

[Turn over]



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

At C the cells are stem cells.

Explain how the stem cells become cells that can carry nervous impulses. [2 marks]

9



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[Turn over]



0	5
---	---

Water can be sterilised.

Sterilised water is safe to drink.

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

**Which TWO methods are used to sterilise water?
[2 marks]**

Tick (✓) TWO boxes.

☐

Removing grit

☐

Removing sediment

☐

Using carbon dioxide

☐

Using chlorine

☐

Using ozone



0 5 . 2

Why is sterilised water safer to drink than water that has NOT been sterilised? [1 mark]

Salt can be separated from sea water.

0 5 . 3

Which method uses membranes and energy to separate salt from sea water? [1 mark]

Tick (✓) ONE box.

☐**Digestion**☐**Paper chromatography**☐**Reverse osmosis**☐**Screening**

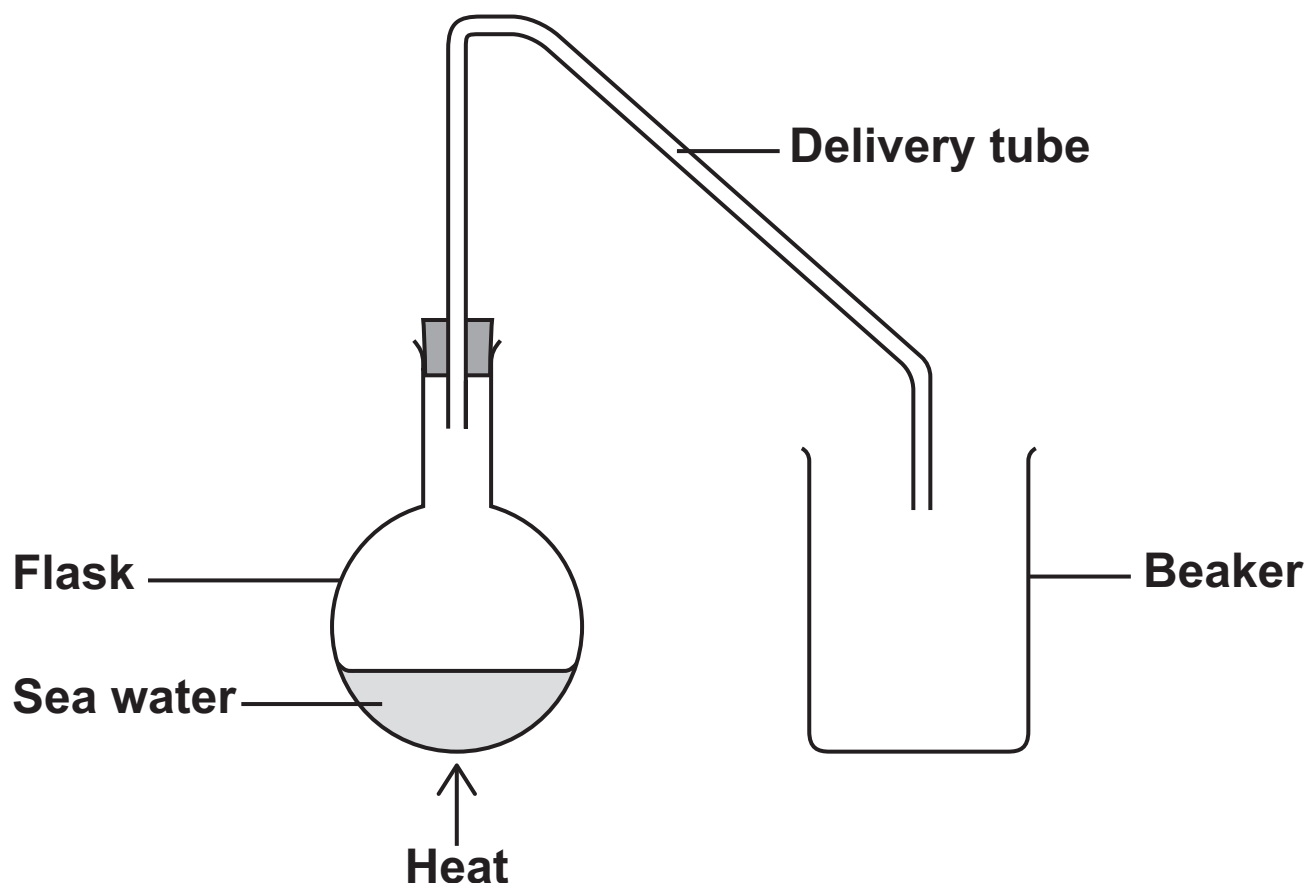
[Turn over]



A student distilled sea water to obtain pure water.

FIGURE 6 shows some of the equipment used.

FIGURE 6



0 5 . 4

Describe what happens during distillation. [3 marks]



0 5 . 5

The student only obtained 10 cm³ of pure water from 50 cm³ of sea water.

How could the student improve the method to obtain more pure water from 50 cm³ of sea water? [1 mark]

[Turn over]



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

A water purification system produced 28 125 dm³ of water.

This system cost £4500.

Calculate the cost per dm³ of water. [2 marks]

Cost = £ _____ per dm³



A different system uses solar panels to extract water vapour from the air to produce liquid water.

0	5
---	---

 .

7

The solar panel system produces 6 dm^3 of water each day.

Calculate the volume of water this system would produce in 15 years.

1 year = 365 days [3 marks]

Volume of water produced = _____ dm^3

[Turn over]



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

Suggest ONE reason why the solar panel system is NOT widely used in the UK. [1 mark]

14



0	6
---	---

Sugars and water are transported in plants.

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

Complete the sentence.

Choose the answer from the list. [1 mark]

osmosis

respiration

translocation

Sugars are transported in the phloem by a process called

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

Name the tissue that water is transported in from the roots to the leaves. [1 mark]

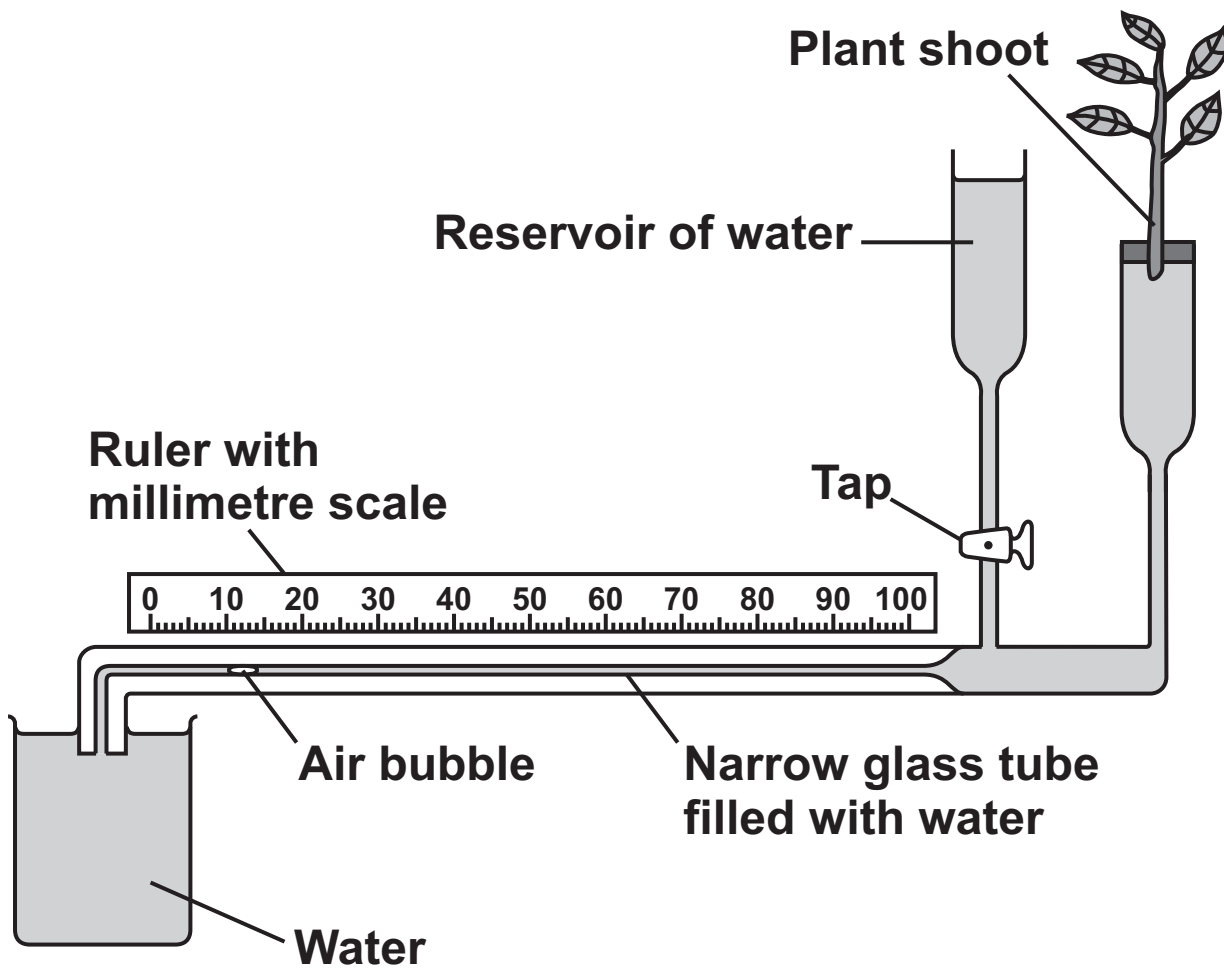
[Turn over]



Students investigated the rate of water uptake by a plant shoot.

FIGURE 7 shows the equipment used.

FIGURE 7



The air bubble moves when the plant shoot loses water by transpiration.

The movement of the air bubble shows the rate of water uptake by the plant shoot.



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

Why is the tap needed below the reservoir? [1 mark]

Tick (✓) ONE box.

☐

To keep air out of the glass tube

☐

To move the air bubble to zero

☐

To stop water reaching the plant shoot

[Turn over]



Students used the equipment in FIGURE 7 to investigate the effect of temperature on water uptake by the plant shoot.

06 . 4

Draw ONE line from each variable to the type of variable it is. [2 marks]

VARIABLE

TYPE OF VARIABLE

Size of plant shoot at the start

Control variable

Dependent variable

Temperature

Independent variable



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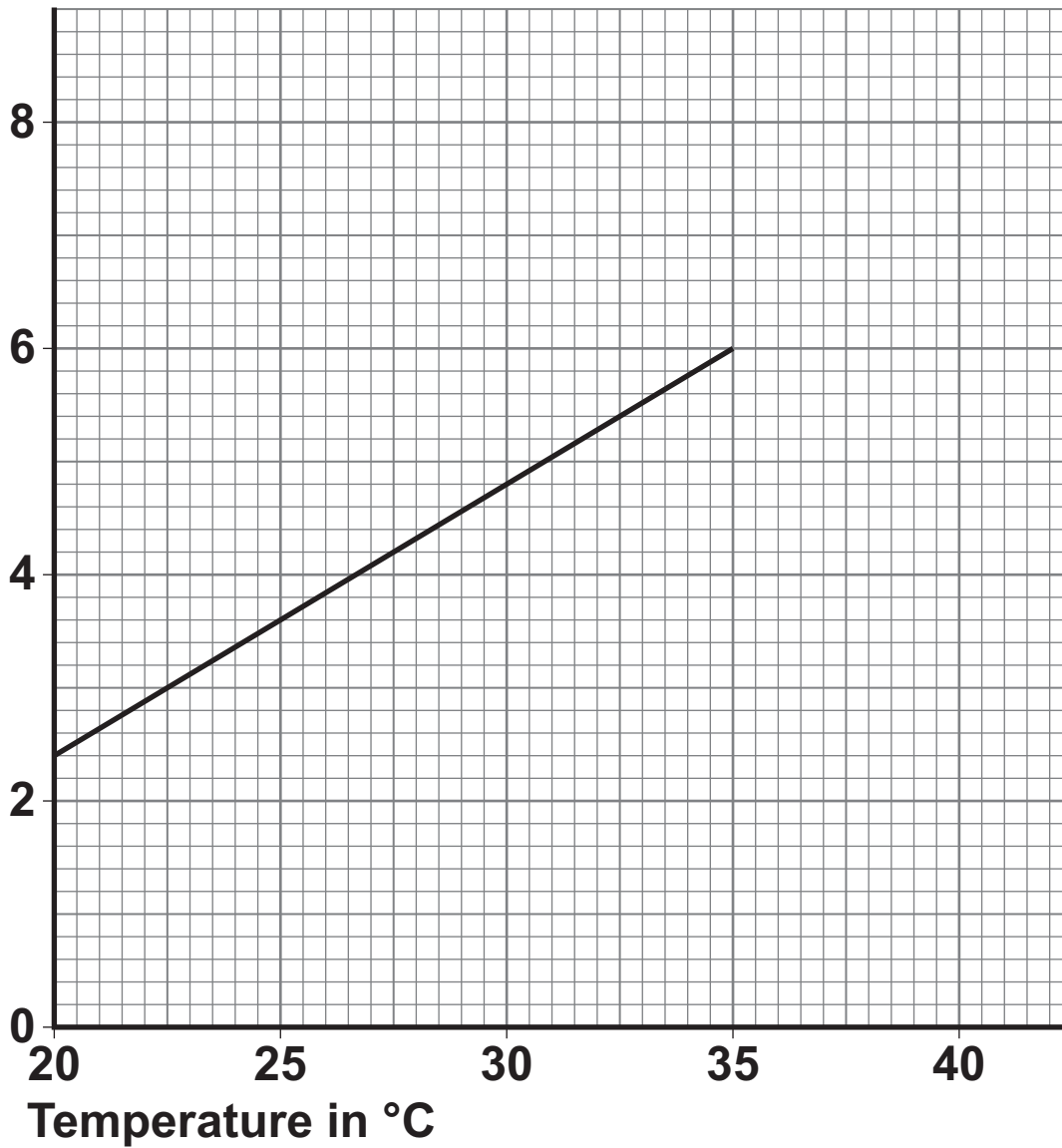
[Turn over]



FIGURE 8 shows the results.

FIGURE 8

Rate of water
uptake in mm^3
per minute



06 . 5

Explain the effect of temperature on the rate of water uptake by the plant shoot.

Use FIGURE 8. [2 marks]

06 . 6

The investigation was repeated with a fan to move the air around the plant shoot.

Predict how an increase in air movement would cause the results to be different. [1 mark]

[Turn over]



0	6	.	7
---	---	---	---

In one test, the water in the tube moved 3 mm in one minute.

The radius of the tube was 0.5 mm.

The volume of water taken up can be calculated using the equation:

$$\text{volume} = \pi \times r^2 \times h$$

where:

$$\pi = 3.14$$

r is the radius

h is the distance moved by the water

Calculate the volume of water taken up in one minute.
[2 marks]

Volume = _____ mm³

10



0	7
---	---

A nose spray has been produced.

The nose spray puts a thin layer of gel in the airways between the nose and the lungs.

The manufacturer of the nose spray claims that:

‘The nose spray defends against diseases such as the common cold.’

0	7	.	1
---	---	---	---

Why is the manufacturer’s claim difficult to test?
[1 mark]

Tick (✓) ONE box.

☐

A symptom of the common cold is a cough.

☐

The common cold does NOT spread through drinking water.

☐

We do NOT know who will get the common cold.

[Turn over]



07 . 2

The nose spray was tested as a new medical drug.

In the drug trial some patients were given a nose spray with NO drug.

What is the word used to describe the nose spray with NO drug? [1 mark]

Tick (✓) ONE box.

☐

Painkiller

☐

Placebo

☐

Statin

07 . 3

Most medicines contain a mixture of ingredients.

Why do some tablets contain sugar as well as the drug? [1 mark]

Tick (✓) ONE box.

☐

So that the tablet is more difficult to swallow

☐

To decrease the size of the tablet

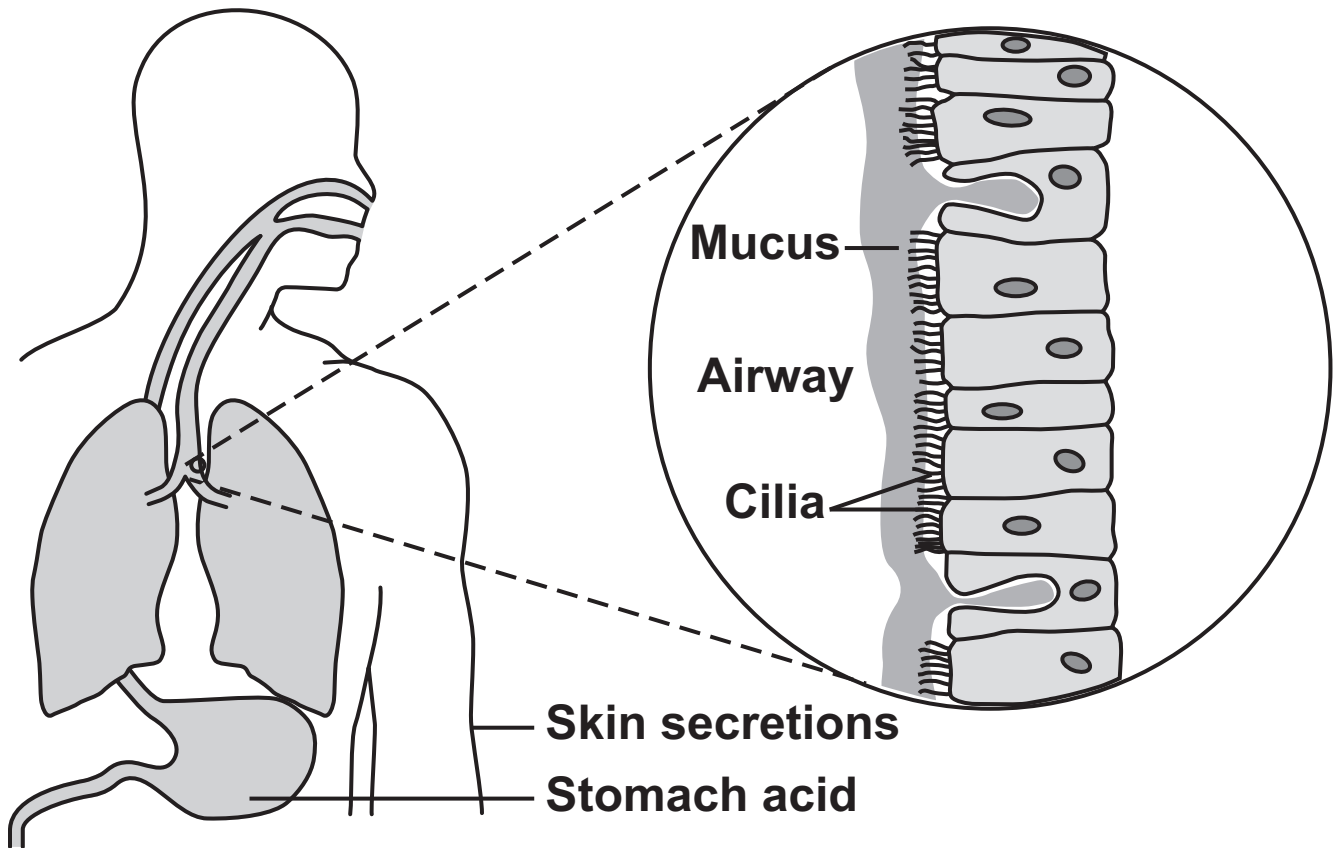
☐

To improve the taste of the tablet



FIGURE 9 shows some of the ways that the body defends itself against infectious diseases.

FIGURE 9



0 7 . 4

Describe how the skin, airways and stomach defend against diseases. [6 marks]

[Turn over]





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[Turn over]

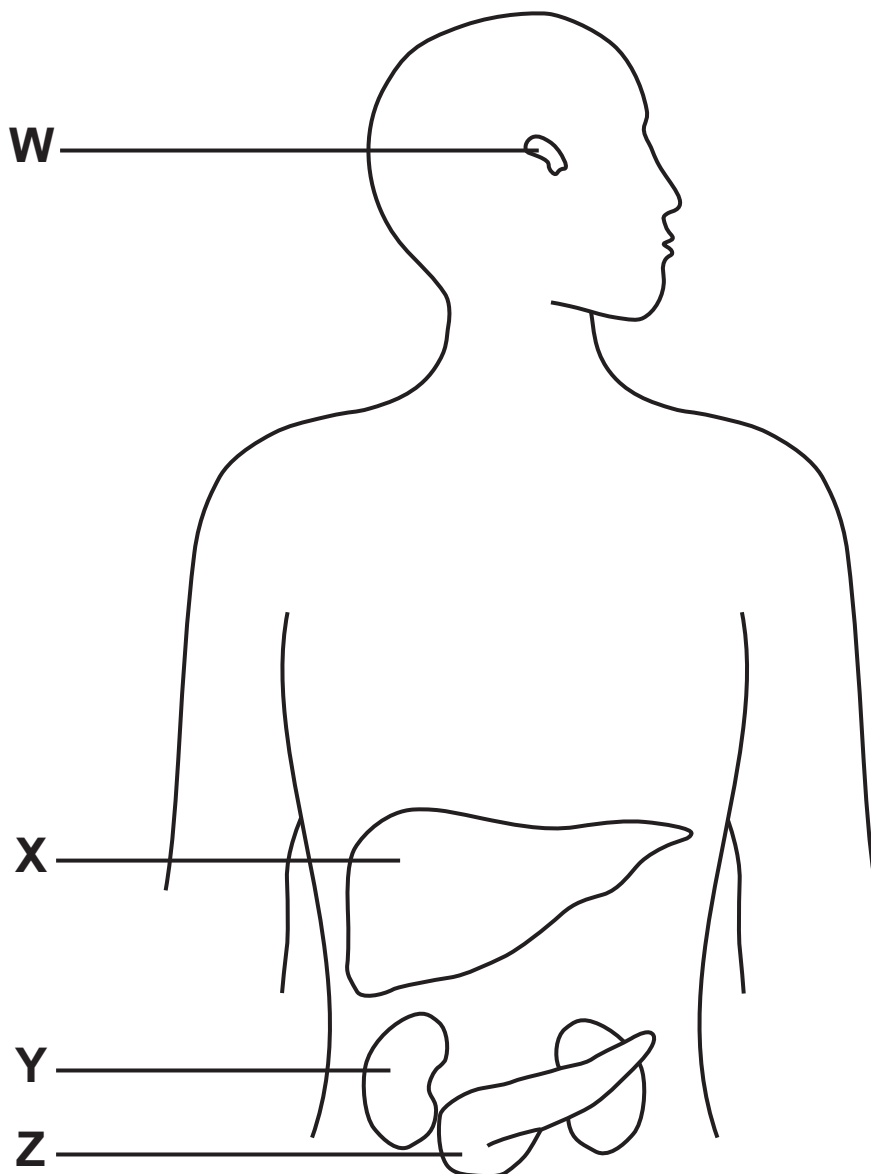


0	8
---	---

The endocrine system releases hormones into the blood.

FIGURE 10 shows some endocrine glands and some target organs.

FIGURE 10



0 8 . 1**Which structure is the pituitary gland? [1 mark]****Tick (✓) ONE box.**☐**W**☐**X**☐**Y**☐**Z****0 8 . 2****Which is the main TARGET organ of the hormone insulin? [1 mark]****Tick (✓) ONE box.**☐**Kidney**☐**Liver**☐**Pancreas****[Turn over]**

08 . 3

The endocrine system sends hormones to target organs.

The nervous system sends impulses to target organs.

How does the speed of movement of hormones compare with the speed of transmission of impulses? [1 mark]

Tick (✓) ONE box.

☐

Hormones travel more slowly than impulses.

☐

Hormones travel at the same speed as impulses.

☐

Hormones travel more quickly than impulses.

08 . 4

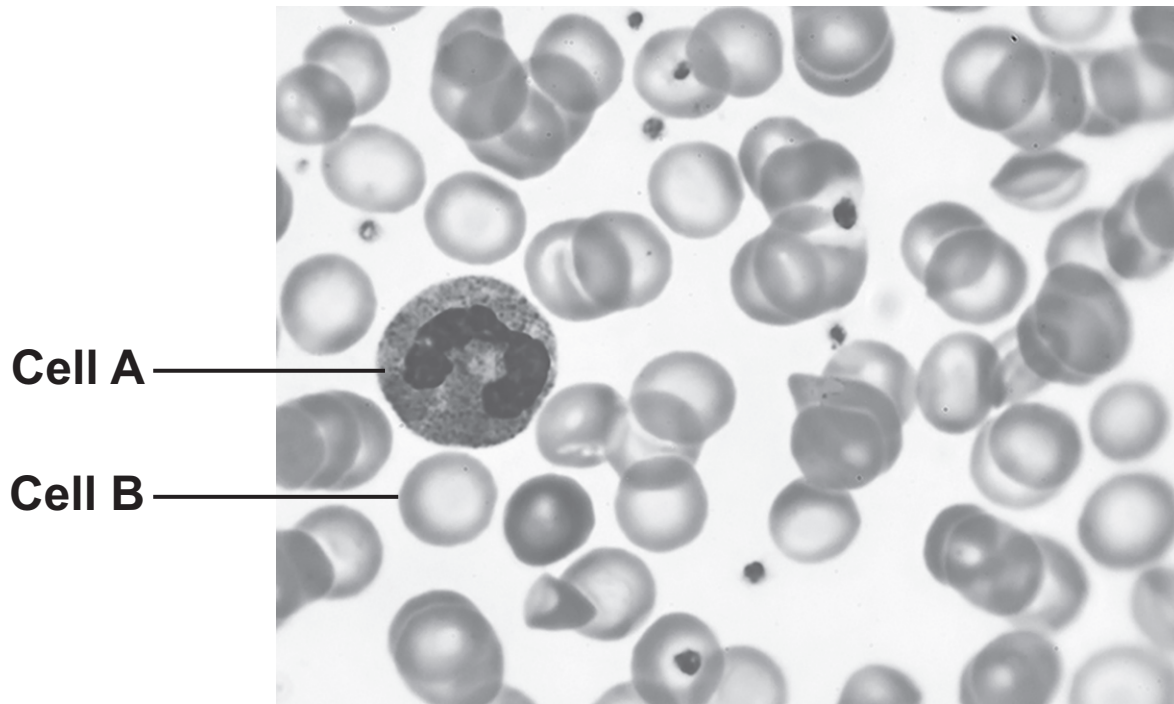
The pituitary gland releases hormones, which results in widespread effects on the body.

Explain why the pituitary gland is sometimes called the 'master gland'. [2 marks]



FIGURE 11 shows human blood viewed through a light microscope.

FIGURE 11



0 8 . 5

Name cell A and cell B. [2 marks]

A _____

B _____

[Turn over]



0 8 . 6

The image of a cell has a diameter of 3.5 millimetres.

The magnification of the image is $\times 500$.

Calculate the diameter of the real cell.

Give your answer in micrometres.

Use the equation:

$$\text{magnification} = \frac{\text{diameter of image}}{\text{diameter of real cell}}$$

1 millimetre = 1000 micrometres

[4 marks]



Diameter of the real cell = _____
micrometres

11

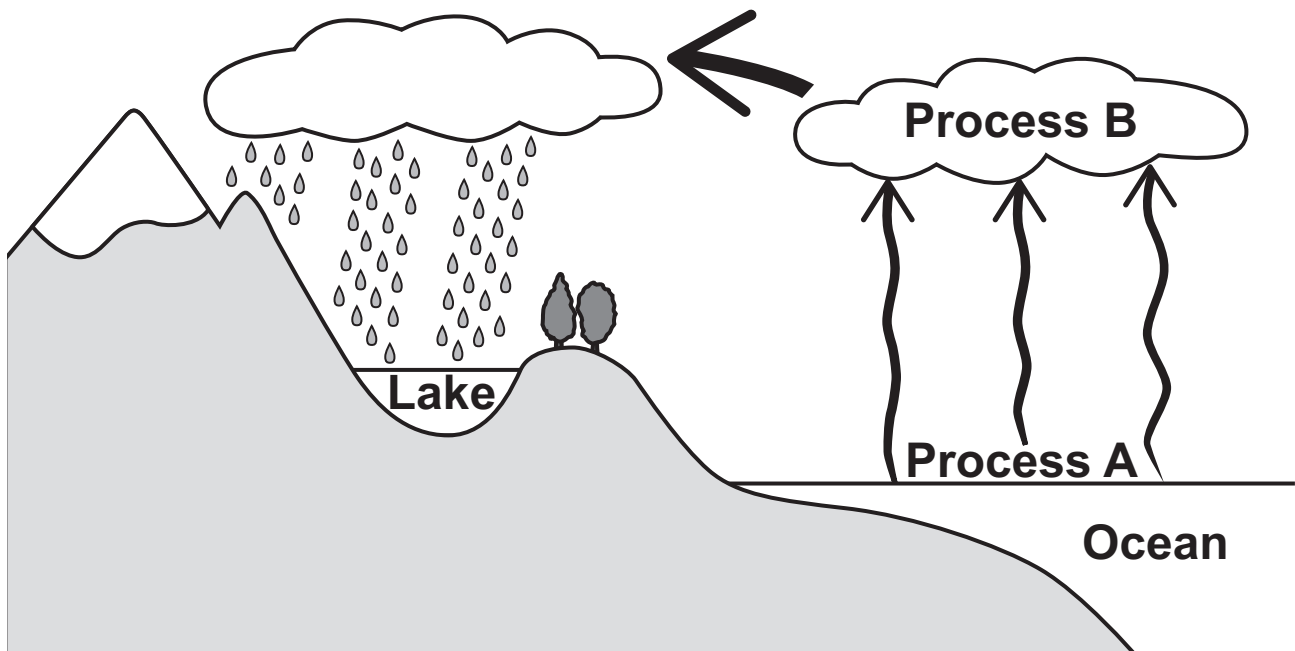
[Turn over]



0	9
---	---

FIGURE 12 shows some of the processes in the water cycle.

FIGURE 12



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

Name process A and process B. [2 marks]

A _____

B _____



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[Turn over]





FIGURE 13

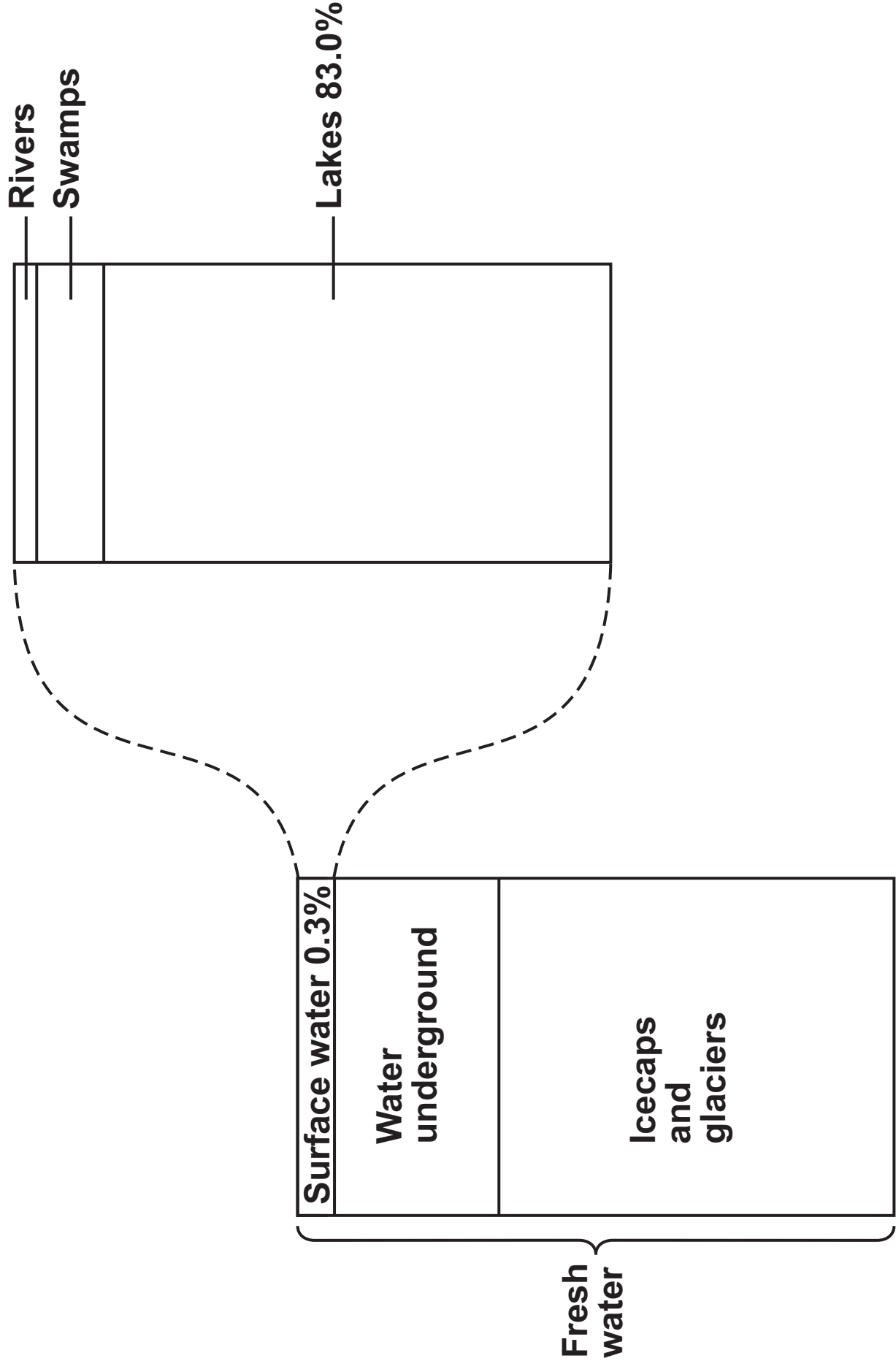




FIGURE 13, on page 58, shows the locations of fresh water on Earth. The diagram is not drawn accurately.

Calculate the amount of fresh water in lakes as a percentage of the total amount of fresh water. [2 marks]

Percentage = _____ **%**

[Turn over]

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

Give TWO ways humans pollute the water in lakes.

Do NOT refer to litter, plastic pollution or rubbish.

[2 marks]

1 _____

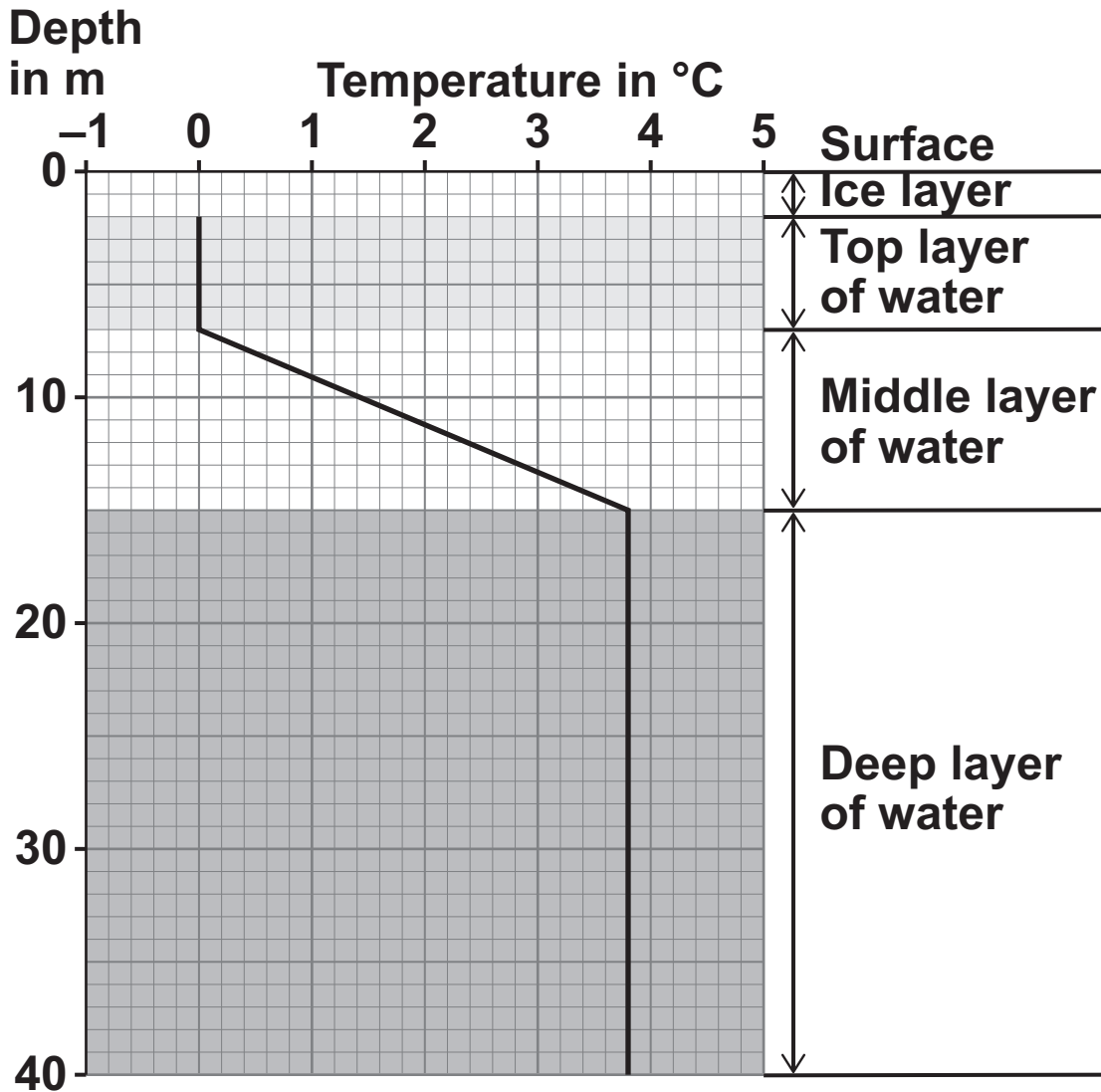
2 _____

The surface of a lake can freeze if the water at the surface of the lake cools to 0 °C.

FIGURE 14, on page 61, shows the temperature of the water at increasing depth in a lake in winter.



FIGURE 14



0 9 . 4

Suggest why organisms in the lake can survive in winter.

Use FIGURE 14. [1 mark]

[Turn over]



0	9	.	5
---	---	---	---

The middle layer of water is from 7 metres below the surface to 15 metres below the surface.

The temperature at a depth of 7 metres below the surface is 0 °C.

Determine the change in temperature per metre in the middle layer of water.

Use the equation:

$$\text{change in temperature per metre} = \frac{\text{change in temperature}}{\text{change in depth}}$$

[3 marks]

Change in temperature = _____ °C/m



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

Write down the equation which links density (ρ), mass (m) and volume (V). [1 mark]

0	9	.	7
---	---	---	---

The density of ice is 920 kg/m^3 .

Calculate the volume of 2.3 kg of ice. [3 marks]

Volume = _____ m^3

[Turn over]



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

Describe a method to measure the mass and volume of a liquid. [4 marks]

[illegible]

18

END OF QUESTIONS



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Additional page, if required.

Write the question numbers in the left-hand margin.

[illegible]

Additional page, if required.

Write the question numbers in the left-hand margin.

[illegible]

Additional page, if required.

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[illegible]

Additional page, if required.

Write the question numbers in the left-hand margin.

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

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