AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

# GCSE
# COMBINED SCIENCE: SYNERGY

**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).

**Instructions**
- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. Do not write outside the box around each page or 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.

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

**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 write outside the box*

**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]**

_____

_____

*Do not write outside the box*

**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 ☐

**Question 1 continues on the next page**

Do not write outside the box

Methane ($CH_4$) is a small molecule.

**0 1 . 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.

$1.0 \times 10^{10}$ m ☐

$1.0 \times 10^{9}$ m ☐

$1.0 \times 10^{-9}$ m ☐

$1.0 \times 10^{-10}$ m ☐

**0 1 . 6** Which structure is larger than a methane molecule?

**[1 mark]**

Tick (✓) **one** box.

A carbon atom ☐

An electron ☐

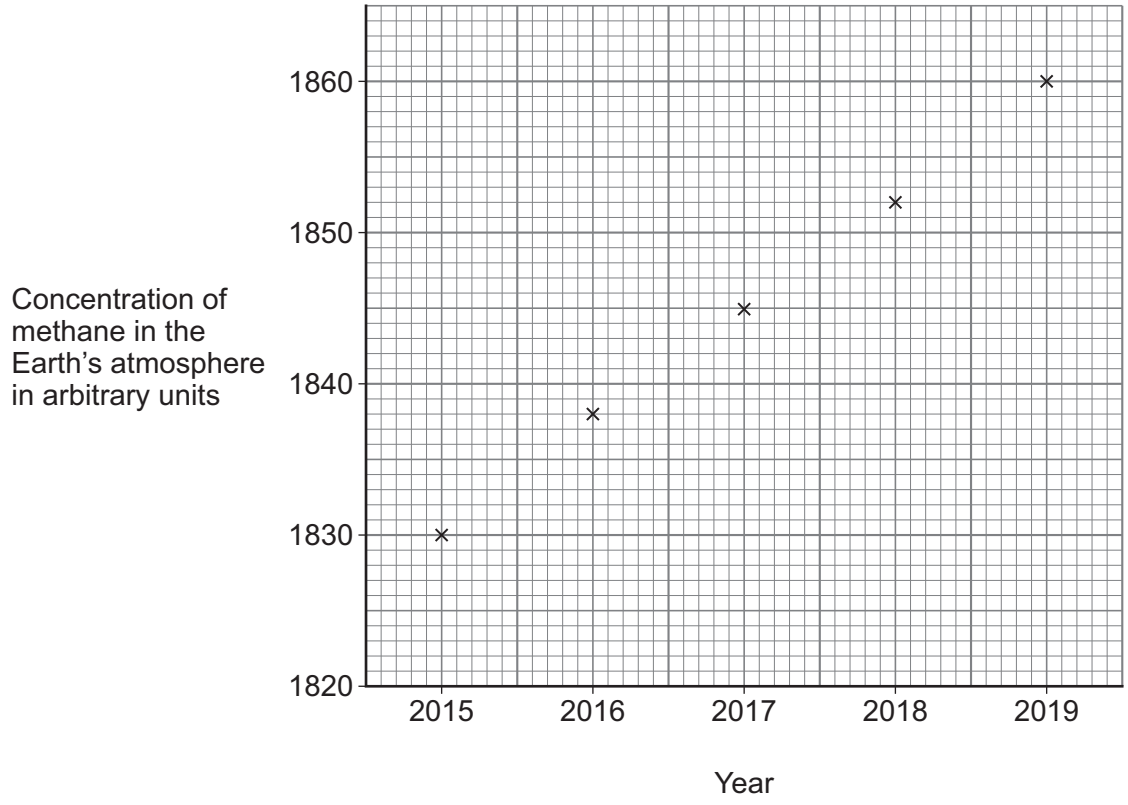
A neutron ☐

A protein ☐

Do not write outside the box

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

**Figure 1**




**0 1 . 7** What was the concentration of methane in the Earth's atmosphere in 2016?

Use **Figure 1**.

**[1 mark]**

Concentration = _____ arbitrary units

**0 1 . 8** Give **one** conclusion from **Figure 1**.

**[1 mark]**

_____

_____

9

**Turn over ▶**

*Do not write outside the box*

**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 ☐

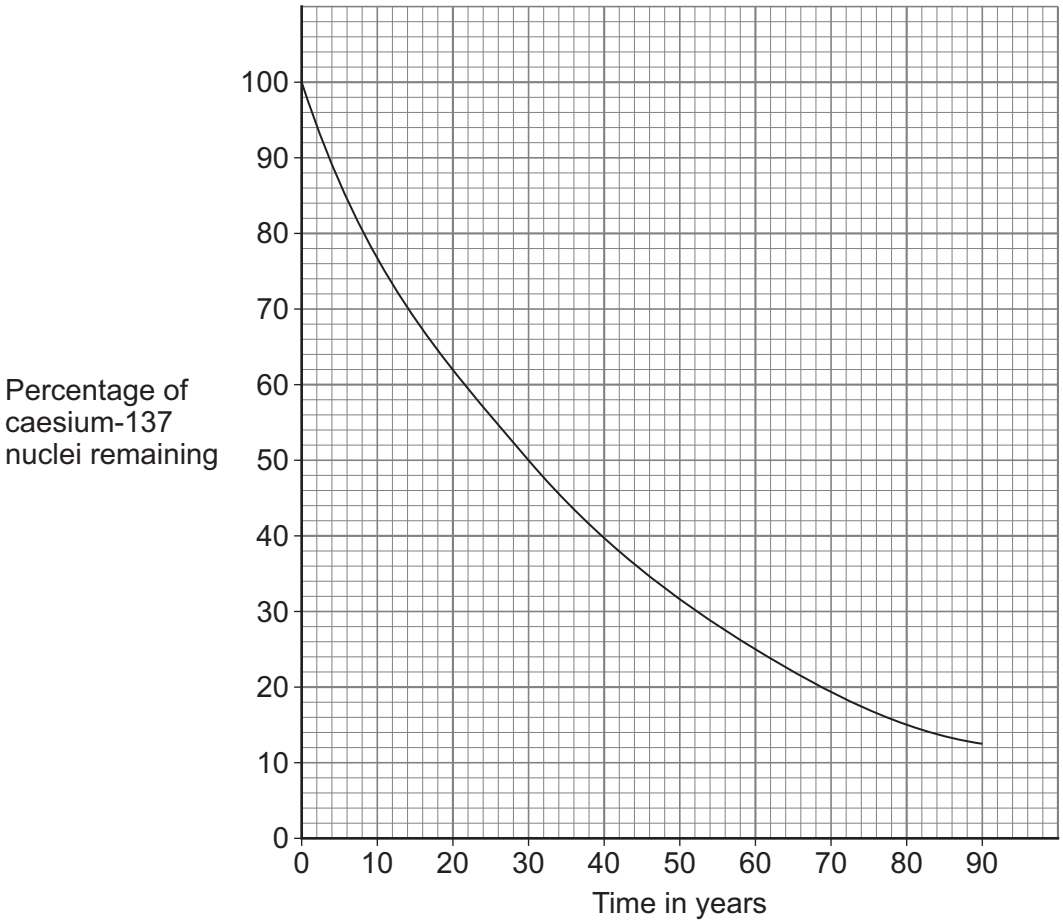
Beta ☐

Gamma ☐

Do not write outside the box

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

**Figure 2**




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

**0 2 . 2** What is the half-life of caesium-137?

Use **Figure 2**.

**[1 mark]**

Half-life = _____ years

**Question 2 continues on the next page**

*Do not write outside the box*

**0 2 . 3** 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 ☐

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 ☐

Do not write outside the box

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

**0 2 . 5** Complete the sentences.

Choose answers from the box.

**[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 _____ .

**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 ☐

9

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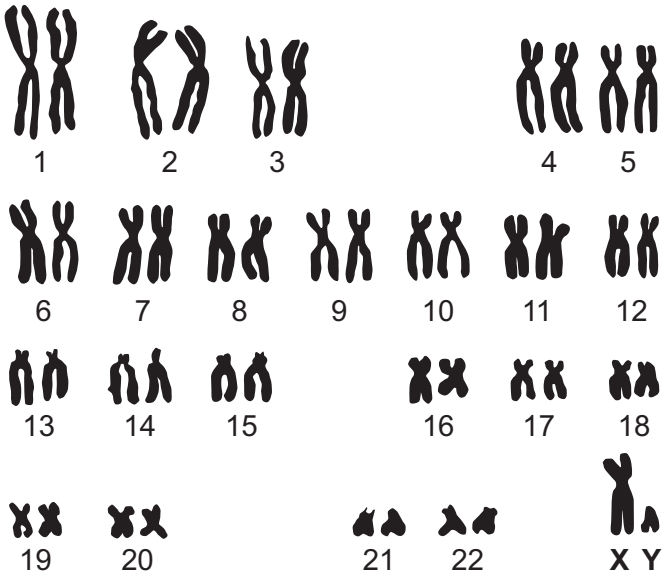
**DO NOT WRITE ON THIS PAGE**
**ANSWER IN THE SPACES PROVIDED**

*Do not write outside the box*

**0 3** This question is about genetics.

**0 3 . 1** **Figure 3** shows the chromosomes of a man.

**Figure 3**




What evidence is there that the person is male?

Use **Figure 3**.

**[1 mark]**

**0 3 . 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]**

**Question 3 continues on the next page**

*Do not write outside the box*

Cystic fibrosis is an inherited disorder that affects the lungs.

**0 3 . 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**.

**0 3 . 4** What is the genotype of a person with cystic fibrosis?

**[1 mark]**

Tick (✓) **one** box.

**RR** ☐ **Rr** ☐ **rr** ☐

**0 3 . 5** A man has the genotype **RR**.

Which word describes the genotype **RR**?

**[1 mark]**

Tick (✓) **one** box.

Characteristic ☐

Homozygous ☐

Phenotype ☐

*Do not write outside the box*

**0 3 . 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** |

**0 3 . 7** What is the chance of the child having cystic fibrosis?

**[1 mark]**

Tick (✓) **one** box.

0% ☐ 25% ☐ 50% ☐ 75% ☐

**Question 3 continues on the next page**

*Do not write outside the box*

Drugs are being developed to treat cystic fibrosis in humans.

The drugs are tested before being used to treat patients.

**0 3 . 8** Give **two** reasons why drugs are tested.

**[2 marks]**

1 _____

_____

2 _____

_____

**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**

*Do not write outside the box*

**Turn over for the next question**

**DO NOT WRITE ON THIS PAGE**
**ANSWER IN THE SPACES PROVIDED**

*Do not write outside the box*

**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 |
| Testosterone | Reduces blood glucose concentration |
| | Stimulates sperm production |

**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 ☐

*Do not write outside the box*

**0 4 . 3** Hormones are used in some methods of contraception.

Which **two** types of contraception use hormones?

**[2 marks]**

Tick (✓) **two** boxes.

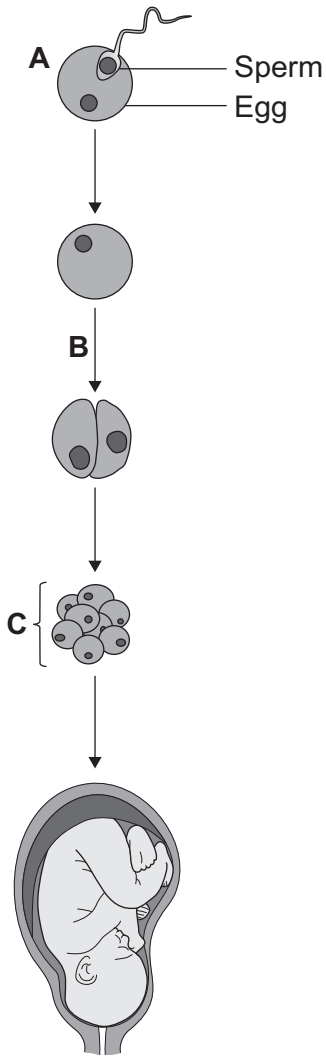
- Condom ☐
- Diaphragm ☐
- Oral contraceptive pill ☐
- Skin patch ☐
- Surgical sterilisation ☐

**Question 4 continues on the next page**

Do not write outside the box

**Figure 5** shows how a baby is formed.

**Figure 5**




Use **Figure 5** to answer questions **04.4** to **04.6**.

**0 4 . 4** Name the process happening at **A**.

**[1 mark]**

*Do not write outside the box*

**0 4 . 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]**

_____

**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

**Turn over for the next question**

*Do not write outside the box*

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**ANSWER IN THE SPACES PROVIDED**

*Do not write outside the box*

**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]**

_____

_____

**Question 5 continues on the next page**

Do not write outside the box

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 ☐

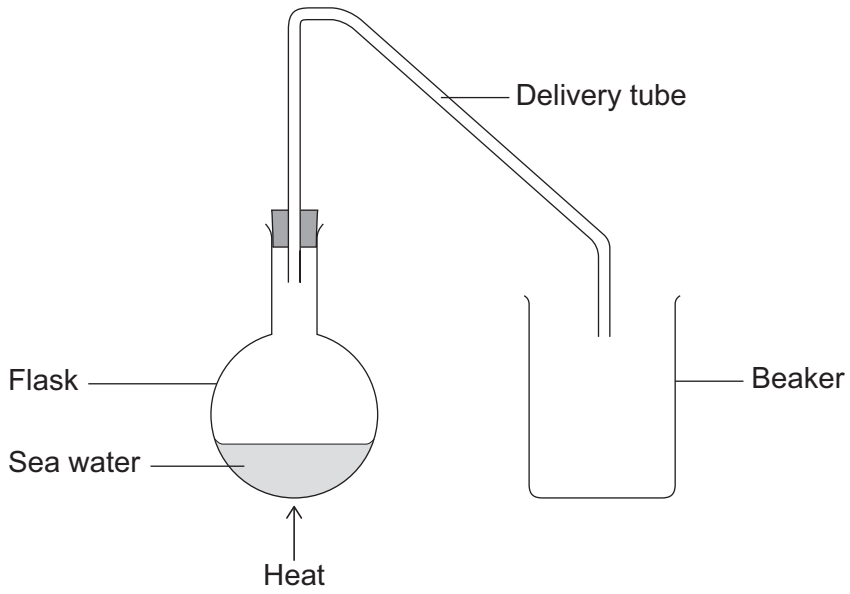
Reverse osmosis ☐

Screening ☐

A student distilled sea water to obtain pure water.

**Figure 6** shows some of the equipment used.

**Figure 6**



*Do not write outside the box*

**0 5 . 4** Describe what happens during distillation.

**[3 marks]**

**0 5 . 5** The student only obtained 10 $cm^3$ of pure water from 50 $cm^3$ of sea water.

How could the student improve the method to obtain more pure water from 50 $cm^3$ of sea water?

**[1 mark]**

**0 5 . 6** A water purification system produced 28 125 $dm^3$ of water.

This system cost £4500.

Calculate the cost per $dm^3$ of water.

**[2 marks]**

Cost = £ _____ per $dm^3$

**Question 5 continues on the next page**

Do not write outside the box

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 = _____ $dm^3$

**0 5 . 8** Suggest **one** reason why the solar panel system is **not** widely used in the UK.

**[1 mark]**

14

*Do not write outside the box*

**0 6** Sugars and water are transported in plants.

**0 6 . 1** Complete the sentence.

Choose the answer from the box.

**[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]**

_____

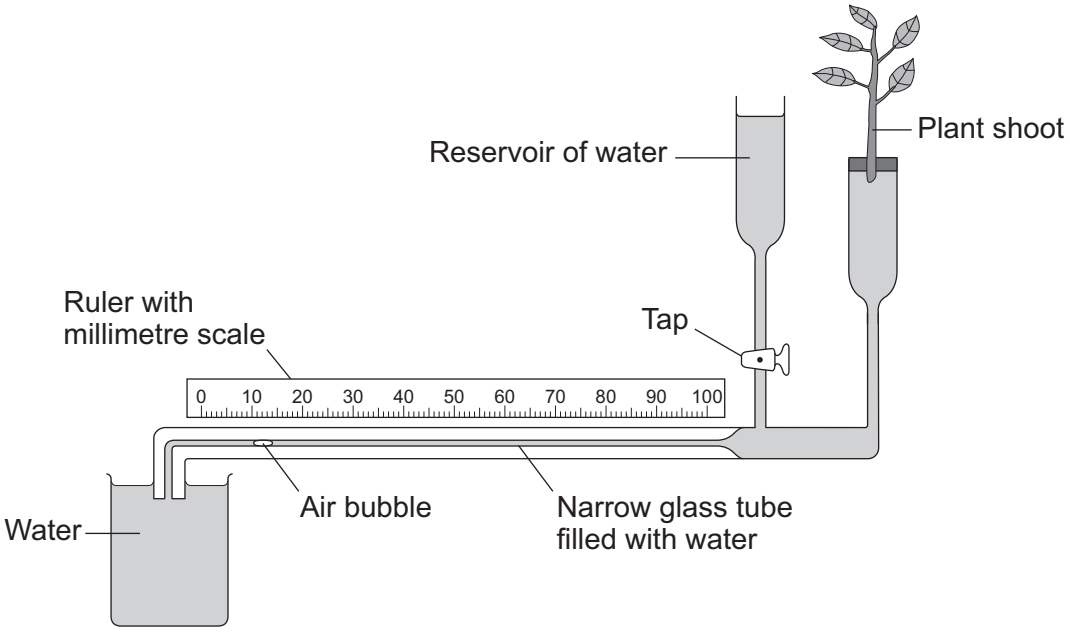
**Question 6 continues on the next page**

Do not write outside the box

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 ☐

Do not write outside the box

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

**0 6 . 4** Draw **one** line from each variable to the type of variable it is.

**[2 marks]**

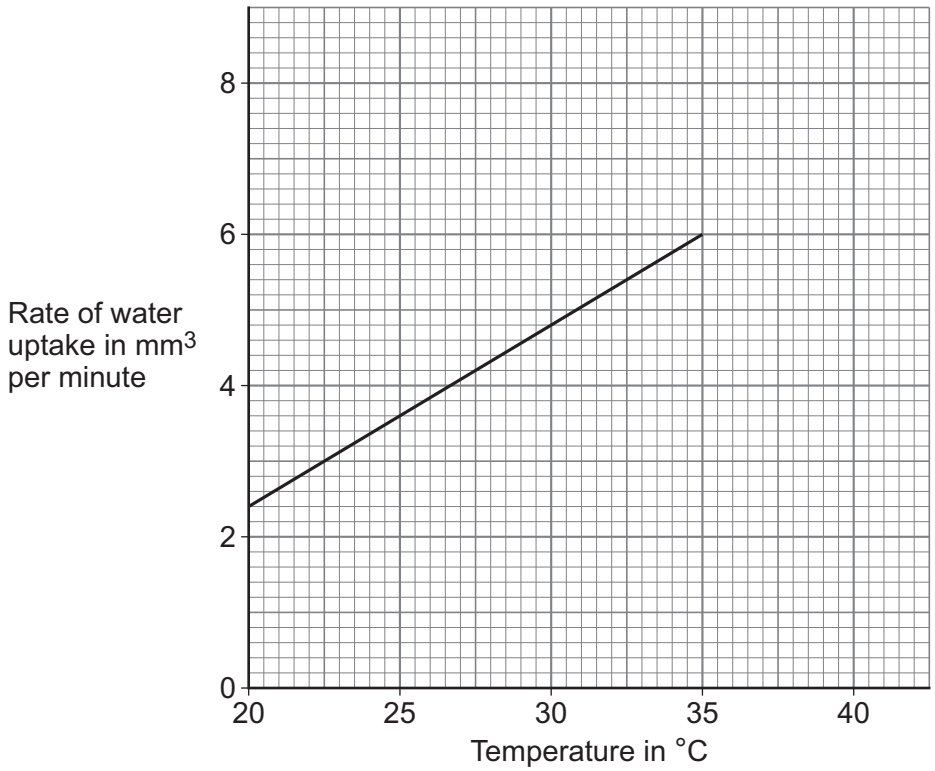
| Variable | Type of variable |
| --- | --- |
| Size of plant shoot at the start | Control variable |
| Temperature | Dependent variable |
| | Independent variable |

**Question 6 continues on the next page**

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**Figure 8** shows the results.

**Figure 8**




**0 6 . 5** Explain the effect of temperature on the rate of water uptake by the plant shoot.

Use **Figure 8**.

**[2 marks]**

Do not write outside the box

**0 6 . 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]**

_____

_____

**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 = _____ $mm^3$

10

*Do not write outside the box*

**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. ☐

**0 7 . 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 ☐

*Do not write outside the box*

**0 7 . 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 ☐

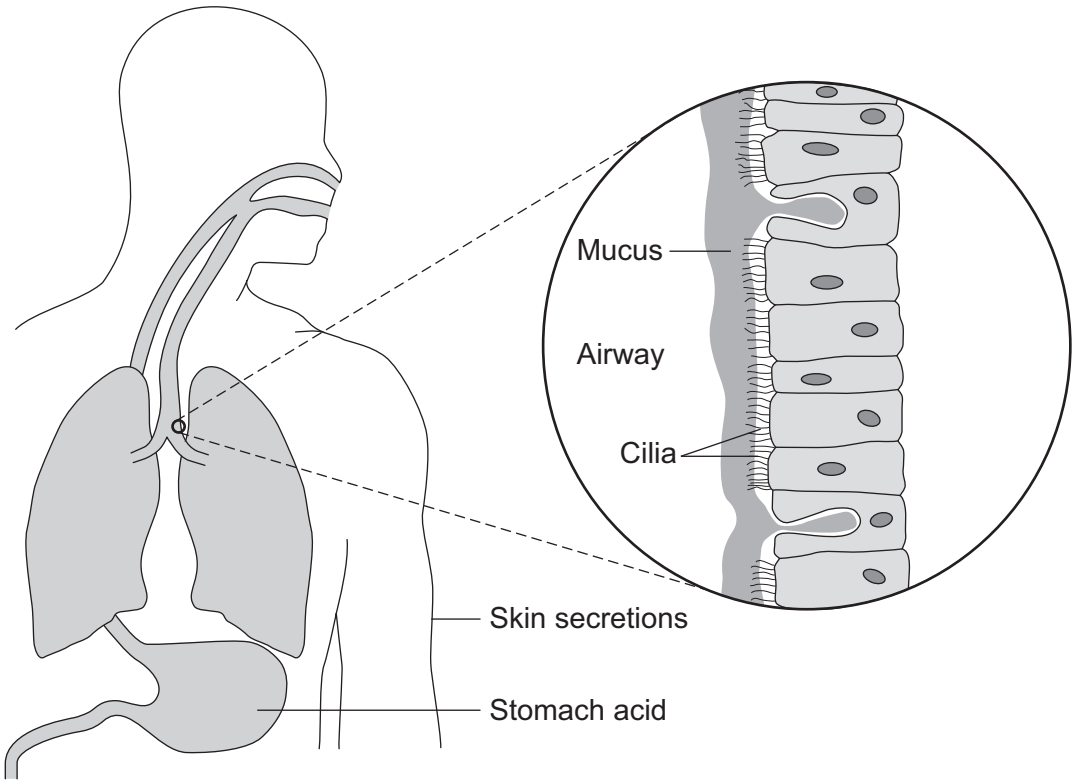
To improve the taste of the tablet ☐

**Question 7 continues on the next page**

Do not write outside the box

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

**Figure 9**



*Do not write outside the box*

**0 7 . 4** Describe how the skin, airways and stomach defend against diseases.

**[6 marks]**

9

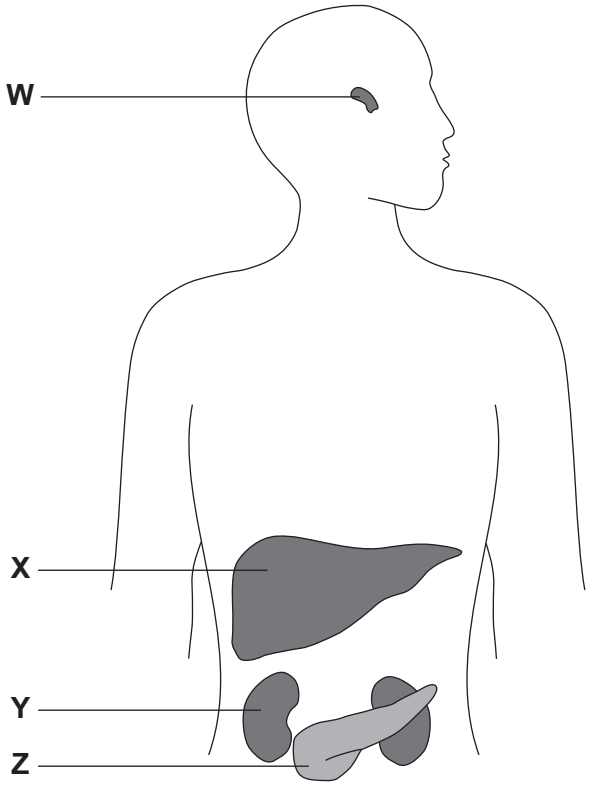
**Turn over for the next question**

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**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** ☐

*Do not write outside the box*

**0 8 . 2** Which is the main **target** organ of the hormone insulin?

**[1 mark]**

Tick (✓) **one** box.

Kidney ☐ Liver ☐ Pancreas ☐

**0 8 . 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. ☐

**0 8 . 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'.

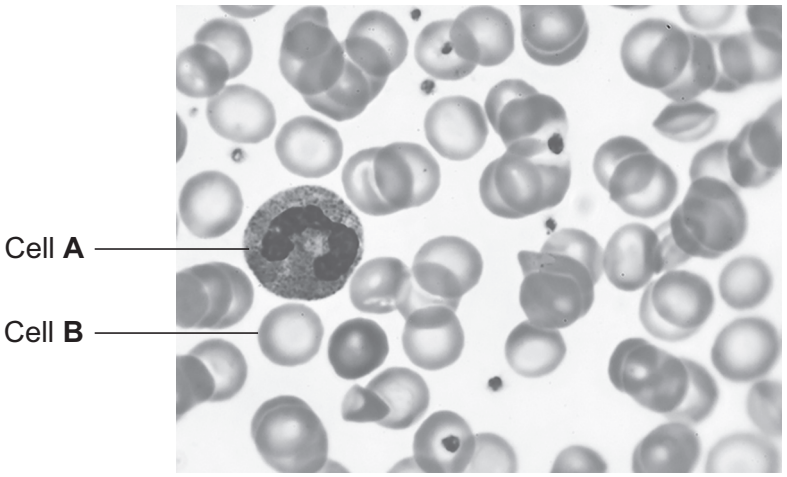
**[2 marks]**

**Question 8 continues on the next page**

*Do not write outside the box*

**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** _____

Do not write outside the box

**0 8 . 6** The image of a cell has a diameter of 3.5 millimetres.

The magnification of the image is ×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

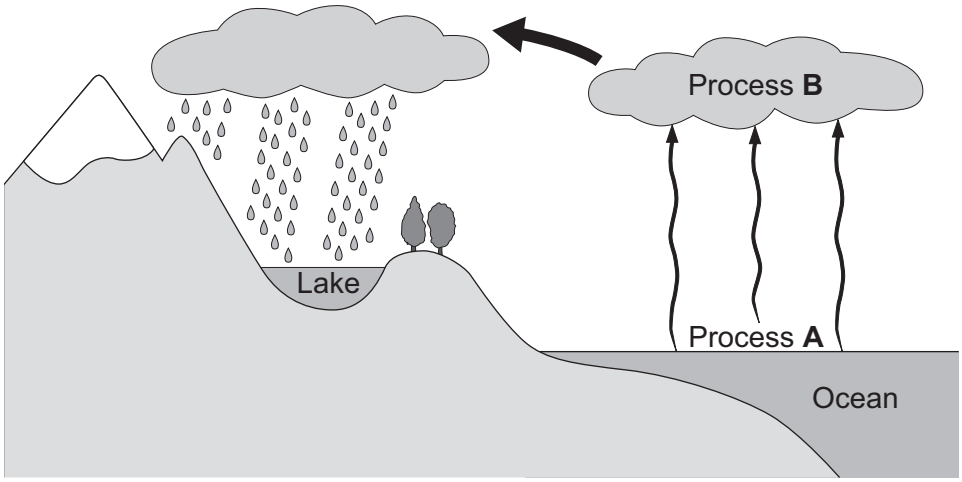
11

**Turn over for the next question**

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**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]**

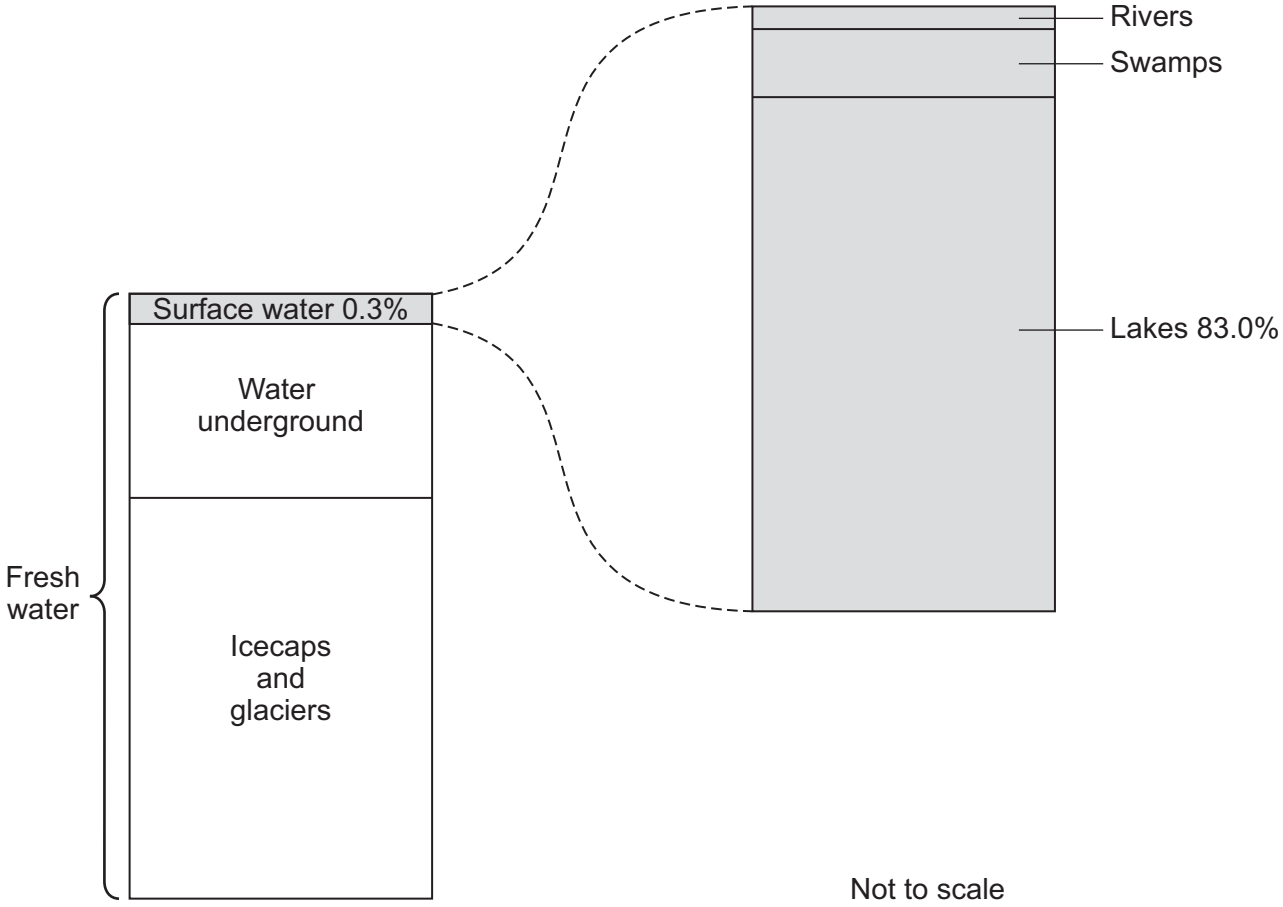
**A** _____

**B** _____

Do not write outside the box

**0 9 . 2** **Figure 13** shows the locations of fresh water on Earth.

**Figure 13**




Calculate the amount of fresh water in lakes as a percentage of the total amount of fresh water.

**[2 marks]**

Percentage = _____ %

**Question 9 continues on the next page**

*Do not write outside the box*

**0 9 . 3** Give **two** ways humans pollute the water in lakes.

Do **not** refer to litter, plastic pollution or rubbish.

**[2 marks]**

1 _____

_____

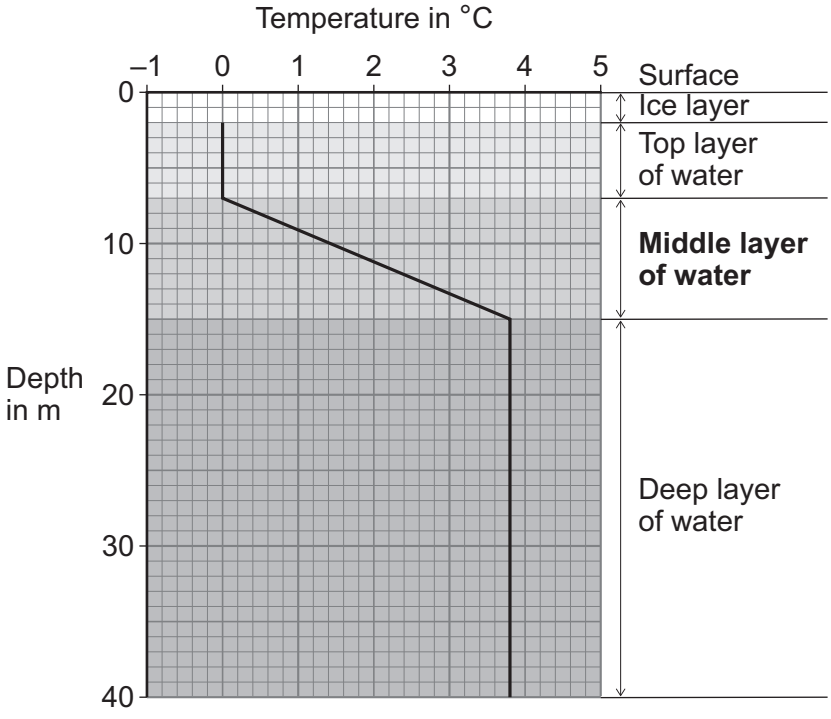
2 _____

_____

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

**Figure 14** shows the temperature of the water at increasing depth in a lake in winter.

**Figure 14**



*Do not write outside the box*

**0 9 . 4** Suggest why organisms in the lake can survive in winter.

Use **Figure 14**.

**[1 mark]**

**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

**Question 9 continues on the next page**

*Do not write outside the box*

**0 9 . 6** Write down the equation which links density ($\rho$), 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$^3$

*Do not write outside the box*

**0 9 . 8** Describe a method to measure the mass and volume of a liquid.

**[4 marks]**

**18**

**END OF QUESTIONS**

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**ANSWER IN THE SPACES PROVIDED**

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