AQA

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

Friday 10 May 2024 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

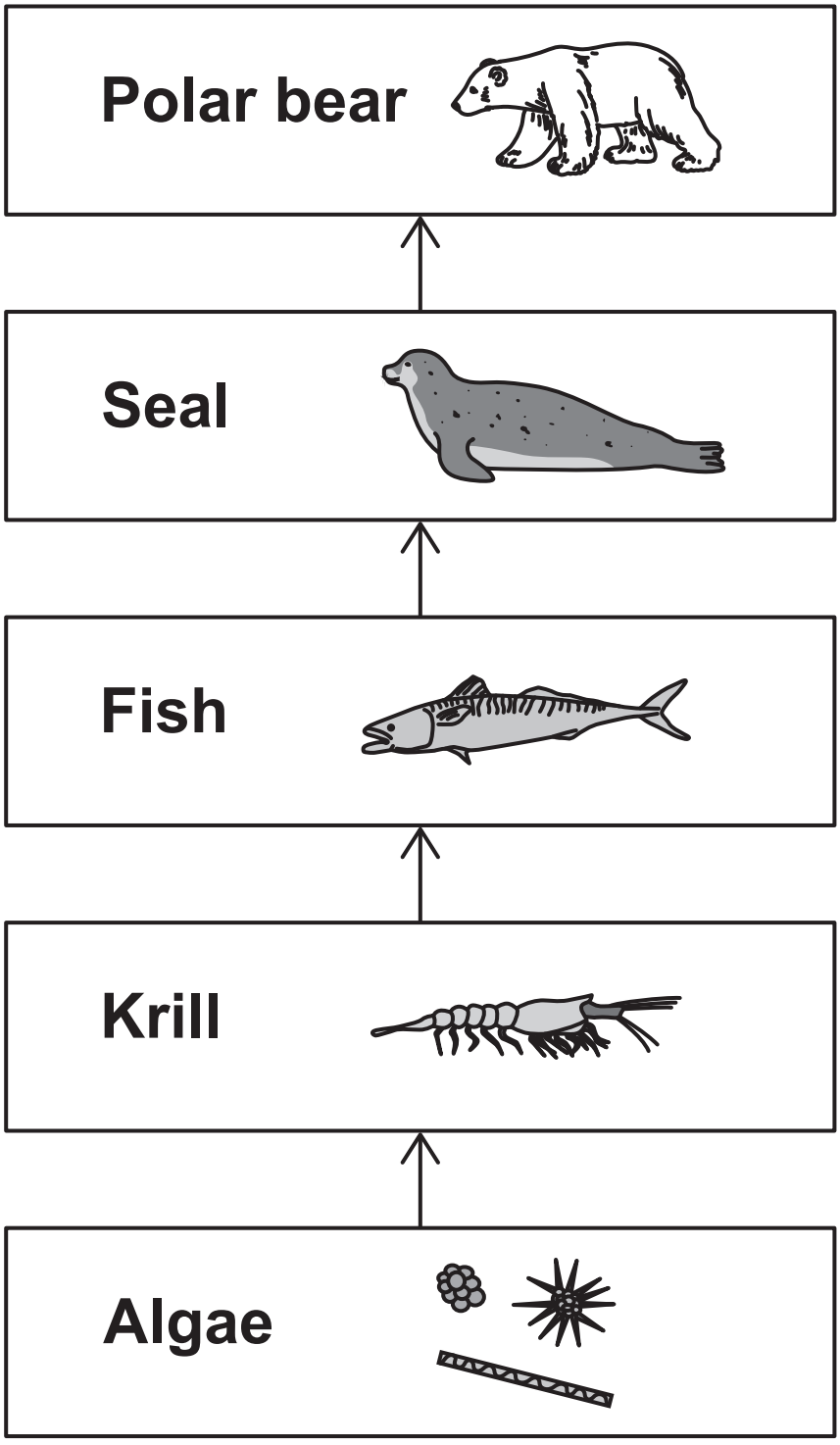
- **The maximum mark for this paper is 100.**
- **The marks for questions are shown in brackets.**
- **You are expected to use a calculator where appropriate.**
- **You are reminded of the need for good English and clear presentation in your answers.**

DO NOT TURN OVER UNTIL TOLD TO DO SO

0 1

FIGURE 1 shows a food chain.

FIGURE 1
not to scale



0 1 . 1

Which of the organisms in FIGURE 1 is the primary consumer? [1 mark]

0 1 . 2

Name the predator of the fish in FIGURE 1. [1 mark]

[Turn over]

0 1 . 3

Draw ONE line from each term to the definition of the term. [3 marks]

TERM	DEFINITION
	All the living organisms and non-living parts of an environment.
Ecosystem	The effect of species on each other.
Interdependence	The limited resources that animals compete for.
Population	The number of individuals of one species in a habitat.

0 1 . 4

Complete the sentence.

Choose the answer from the list. [1 mark]

DECREASE

STAY THE SAME

INCREASE

A decrease in the number of polar bears would cause the number of seals to

_____ .

[Turn over]

0 1 . 5

Food chains and food webs can be used to predict the effect of a decreasing number of polar bears.

Why is a food web more useful than a food chain? [1 mark]

Tick (✓) ONE box.

- ☐ **Food webs show where energy is wasted.**
- ☐ **Most animals eat more than one type of prey.**
- ☐ **Producers are at the start of all food webs.**

BLANK PAGE

[Turn over]

0 1 . 6

Krill eat algae.

Algae store a mass of 68 arbitrary units of carbon in 1 year.

8% of the carbon stored in algae becomes part of the carbon stored in krill.

Calculate the mass of carbon that becomes stored in krill.

Use the equation:

$$\text{mass of carbon stored in krill} = \text{mass of carbon stored in algae} \times \frac{8}{100}$$

[2 marks]

Mass of carbon stored in krill =

arbitrary units

[Turn over]

0 1 . 7

Algae and plants need magnesium ions to grow.

Complete the sentence.

Choose the answer from the list. [1 mark]

CHLOROPHYLL

GLUCOSE

UREA

In algae and plants, magnesium ions become part of

_____ .

0 1 . 8

The minerals in sea water are one abiotic factor that affects algae.

Which are TWO other ABIOTIC factors that affect algae? [2 marks]

Tick (✓) TWO boxes.

- ☐ **Food availability**
- ☐ **Light intensity**
- ☐ **Pathogens**
- ☐ **Prey**
- ☐ **Temperature**

12

0 2

A student investigated the heating of some wax.

This is the method used.

1. **Put a cube of wax in a beaker.**

2. **Place the beaker on a heater connected to a joulemeter.**

3. **Turn on the heater.**

4. **When the wax begins to melt, turn on the joulemeter.**

5. **When all the wax has melted, record the reading shown on the joulemeter.**

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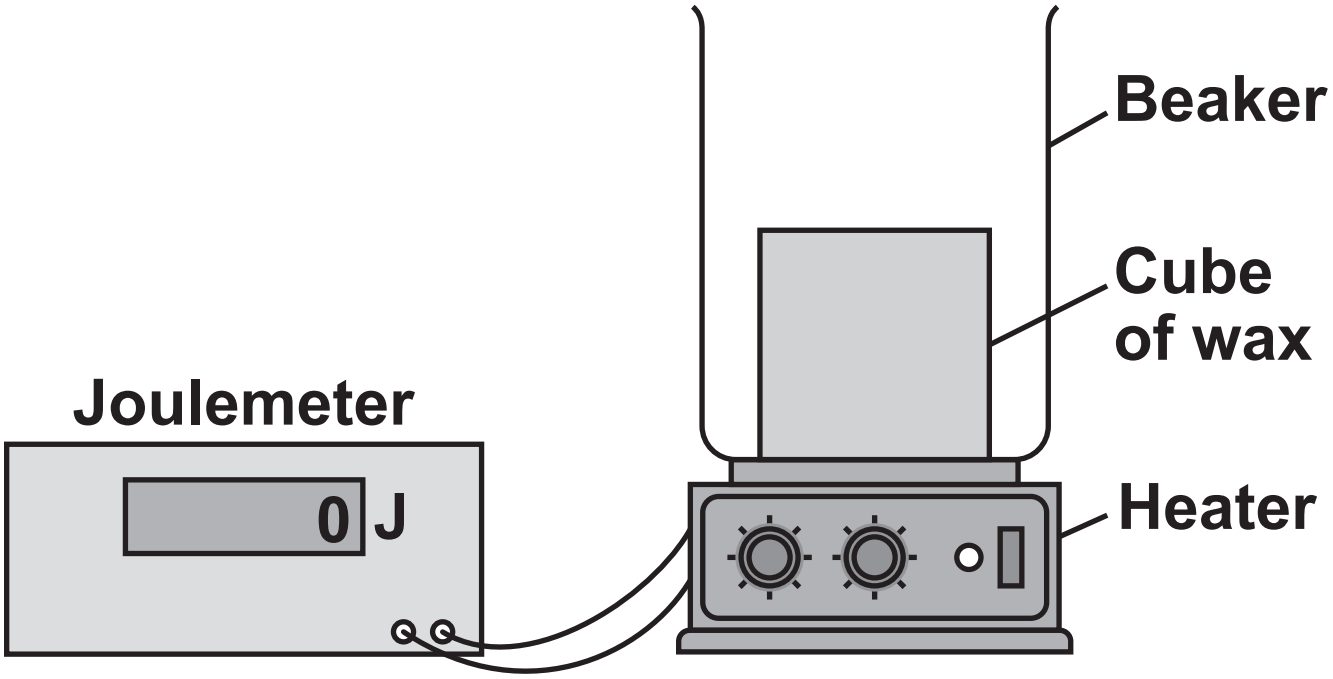
[Turn over]

FIGURE 2 shows the arrangement.

FIGURE 2



0 2 . 1

The mass of the cube of wax was 0.15 kg.

The energy transferred to melt the wax was 31 500 J.

Calculate the specific latent heat of fusion of wax.

Use the equation:

$$\text{specific latent heat} = \frac{\text{energy for a change of state}}{\text{mass}}$$

Choose the unit from the list. [3 marks]

J

J/kg

kg

Specific latent heat of fusion =

Unit

0 2 . 2

Not all of the energy transferred by the heater was used to melt the wax.

What happened to the energy that was NOT used to melt the wax? [1 mark]

Tick (✓) ONE box.

- ☐ **The energy decreased the temperature of the wax.**
- ☐ **The energy increased the mass of the wax.**
- ☐ **The energy was transferred to the surroundings.**

[Turn over]

0 2 . 3

Which TWO of the following would increase the accuracy of the student's results? [2 marks]

Tick (✓) TWO boxes.

- ☐ **Completing the investigation in a colder environment.**
- ☐ **Insulating the sides of the beaker that the wax was in.**
- ☐ **Stirring the wax as it was melting.**
- ☐ **Using a beaker with a larger volume.**
- ☐ **Using a smaller mass of wax.**

BLANK PAGE

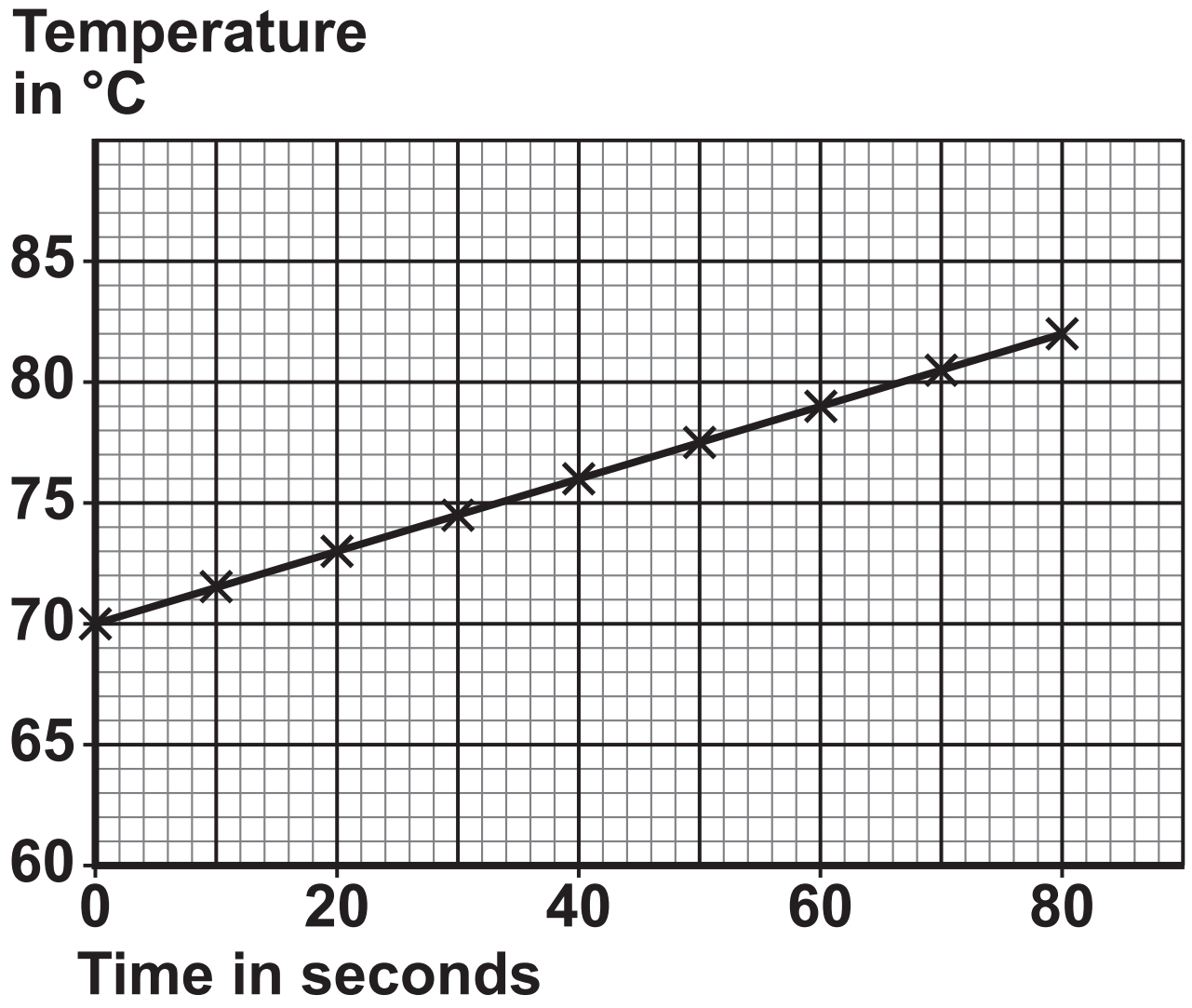
[Turn over]

The student continued to heat the wax after it had melted.

The student measured the temperature of the wax every 10 seconds.

FIGURE 3 shows how the temperature of the liquid wax varied with time.

FIGURE 3



0 2 . 4

What was the temperature change between 0 seconds and 80 seconds? [1 mark]

Tick (✓) ONE box.

- ☐ **12 °C**
- ☐ **70 °C**
- ☐ **82 °C**

[Turn over]

0 2 . 5

Between 0 seconds and 80 seconds, 3600 J of energy was transferred to the wax.

The mass of wax was 0.15 kg.

Calculate the specific heat capacity of the wax using the student's data.

Use your answer to Question 02.4 and the equation:

$$\text{specific heat capacity} = \frac{\text{change in thermal energy}}{\text{mass} \times \text{temperature change}}$$

[2 marks]

Specific heat capacity =

_____ J/kg °C

9

[Turn over]

0 3

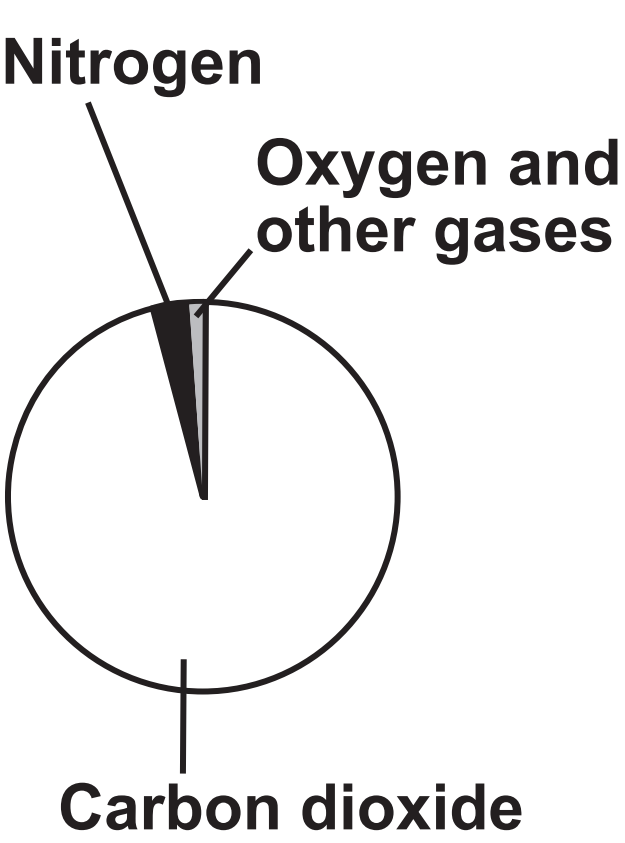
The atmosphere of the Earth has changed since the Earth formed.

The Earth's early atmosphere may have been similar to the atmosphere of Mars today.

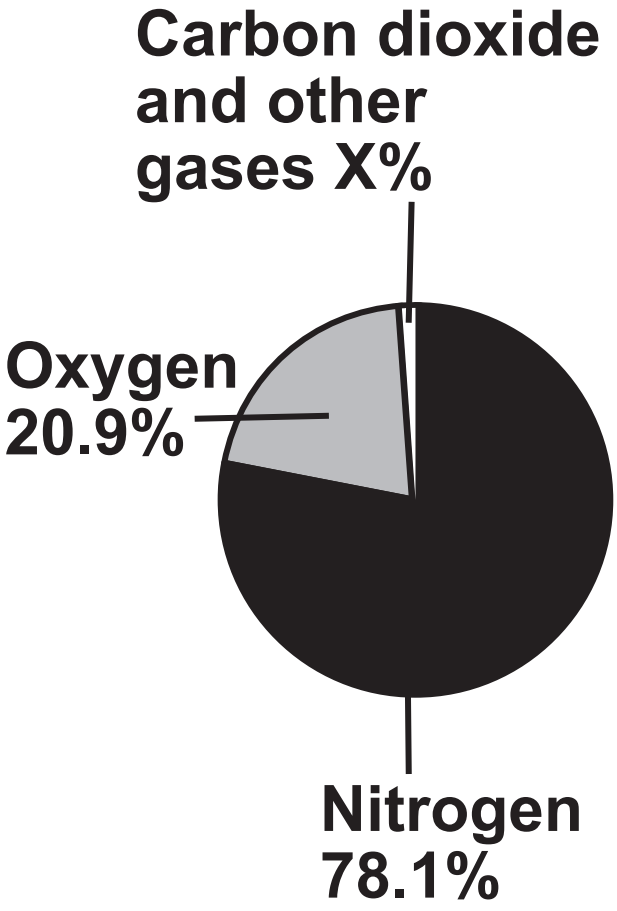
FIGURE 4 shows the main gases in the atmosphere of Mars today and the atmosphere of the Earth today.

FIGURE 4

MARS TODAY



EARTH TODAY



0 3 . 1

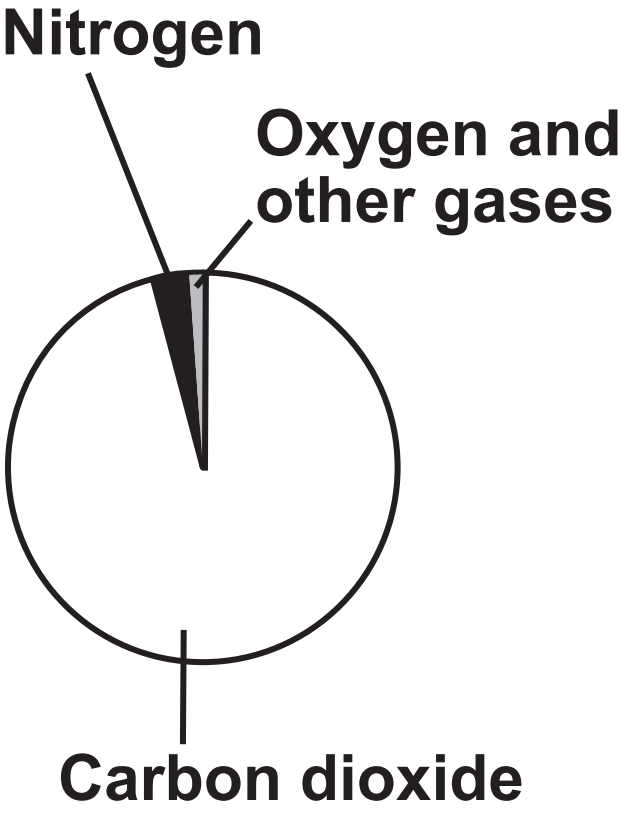
Determine percentage X in FIGURE 4 on the opposite page. [2 marks]

X = _____ %

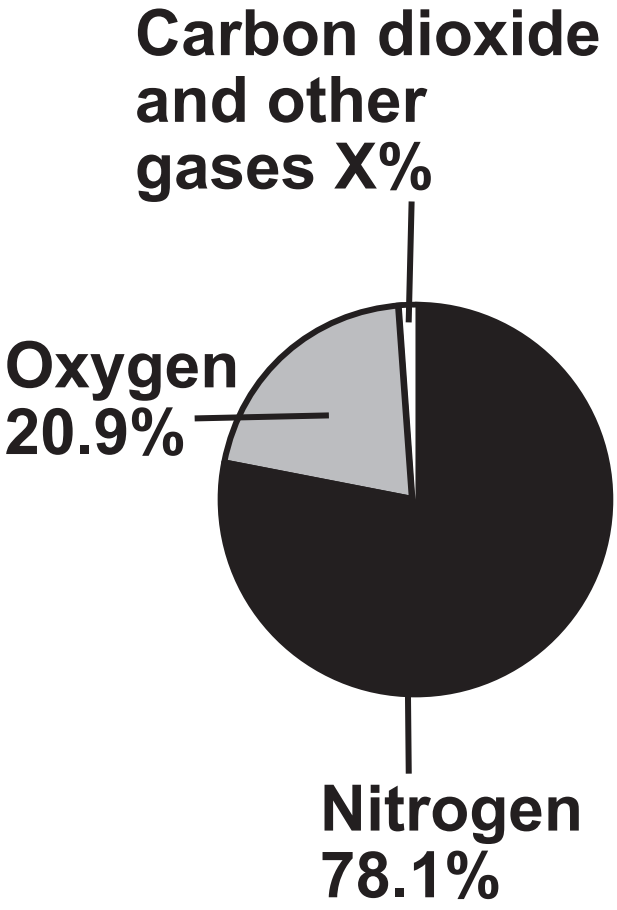
[Turn over]

FIGURE 4 is repeated here.

MARS TODAY



EARTH TODAY



0 3 . 2

Give THREE differences between the atmosphere of the Earth today and the atmosphere of Mars today.

Use FIGURE 4 on the opposite page.
[3 marks]

1 _____

_____

_____

2 _____

_____

_____

3 _____

_____

_____

0 3 . 3

What was the source of the nitrogen in the Earth's early atmosphere? [1 mark]

Tick (✓) ONE box.

☐ **Decay of dead animals**

☐ **Formation of sedimentary rocks**

☐ **Volcanic activity**

0 3 . 4

Why did the formation of oceans cause the carbon dioxide concentration in the Earth's early atmosphere to change? [1 mark]

Tick (✓) ONE box.

- ☐ **Carbon dioxide condensed to form the oceans.**
- ☐ **Carbon dioxide dissolved in the oceans.**
- ☐ **Carbon dioxide evaporated from the oceans.**

[Turn over]

Meteorites are rocks that fall to Earth from space.

A meteorite landed in the UK.

The water in the meteorite was analysed.

The water in the meteorite and water in the oceans contain similar ratios of hydrogen isotopes.

0 3 . 5

Complete the sentence.

Choose the answer from the list. [1 mark]

ELECTRONS

NEUTRONS

PROTONS

Isotopes of hydrogen are atoms of hydrogen with different numbers of

_____

_____ .

0 3 . 6

It was important that the water in the meteorite was analysed as soon as possible.

Suggest ONE reason why. [1 mark]

_____

_____

_____

[Turn over]

0 3 . 7

The evolution of algae and plants changed the Earth's atmosphere.

Algae and plants photosynthesise.

Complete the word equation for photosynthesis. [2 marks]

water + _____ $\xrightarrow{\text{light}}$

_____ + oxygen

11

0 4

The symptoms of a measles infection include:

- **a fever**
- **a red skin rash.**

0 4 . 1

Why do antibiotics NOT treat measles? [1 mark]

Tick (✓) ONE box.

☐ **Antibiotics cause the measles pathogen to release toxins.**

☐ **Antibiotics do not kill viruses.**

☐ **Antibiotics increase body temperature.**

0 4 . 2

Cilia are small hair-like structures in the trachea and bronchi.

Describe how mucus and cilia defend against the entry of pathogens into the lungs. [2 marks]

Mucus _____

_____

_____

Cilia _____

_____

_____

0 4 . 3

How does stomach acid defend the body against pathogens? [1 mark]

_____

_____

_____

_____

[Turn over]

People can be vaccinated against measles.

0 4 . 4

What does the measles vaccine contain?
[1 mark]

Tick (✓) ONE box.

- ☐ Hormones
- ☐ Two types of blood cell
- ☐ Weakened pathogen

0 4 . 5

Which part of the blood produces antibodies after receiving the measles vaccination? [1 mark]

Tick (✓) ONE box.

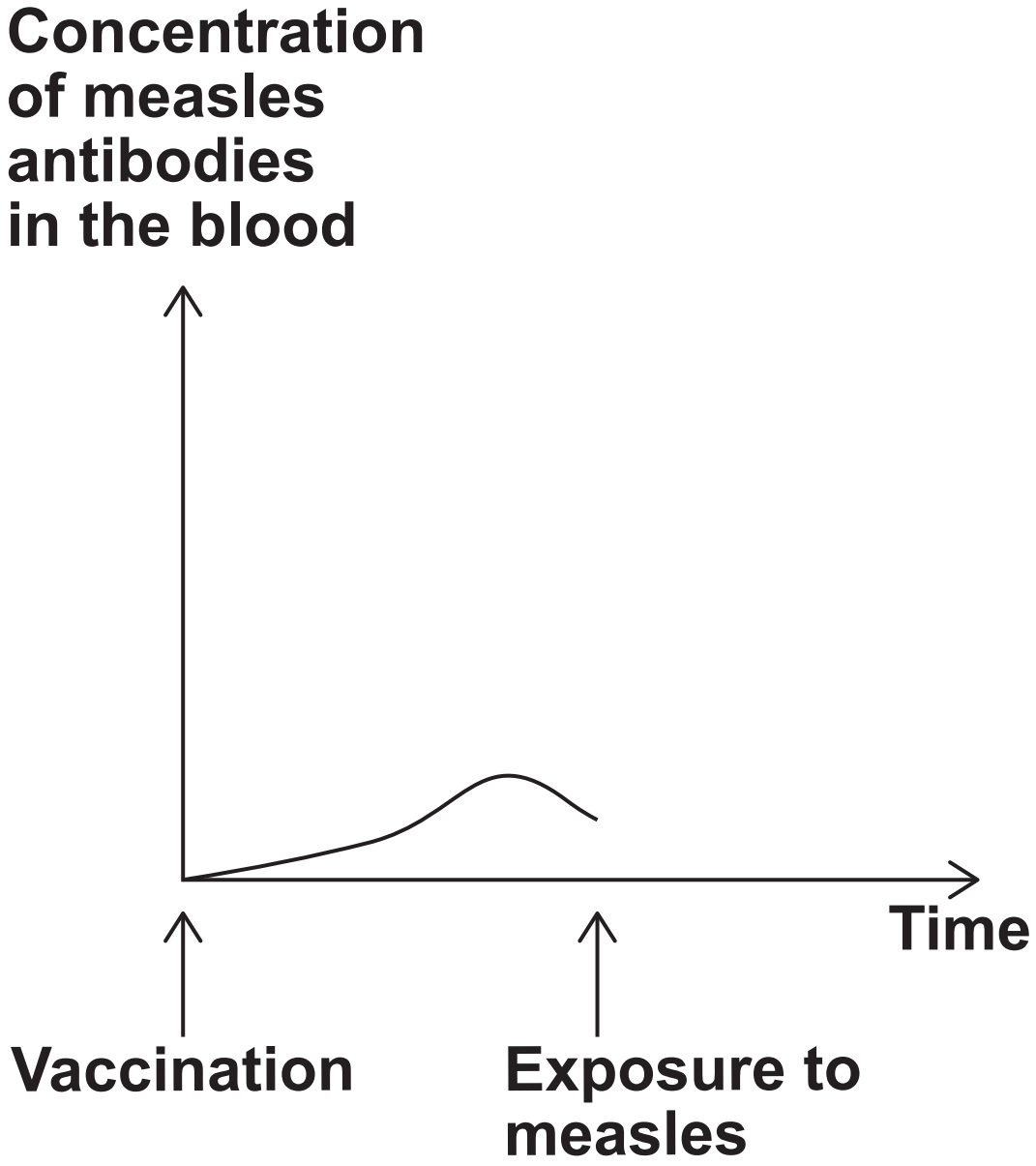
- ☐ **Platelets**
- ☐ **Red blood cells**
- ☐ **White blood cells**

[Turn over]

0 4 . 6

FIGURE 5 shows how the concentration of measles antibodies in the blood changes after vaccination.

FIGURE 5



Complete FIGURE 5, on the opposite page, to show how the concentration of measles antibodies will change after the exposure to measles pathogens. [2 marks]

[Turn over]

0 4 . 7

In one group of people:

- **25 people have been vaccinated against measles**
- **5 people have NOT been vaccinated against measles.**

What is the simplest ratio of people who have been vaccinated to people who have NOT been vaccinated? [1 mark]

Tick (✓) ONE box.

☐ **30 : 1**

☐ **25 : 1**

☐ **5 : 1**

0 4 . 8

Scientists recommend that over 95% of the population should be vaccinated against measles.

What is the advantage of a large percentage of the population being vaccinated against measles? [1 mark]

_____

_____

_____

10

[Turn over]

0 5

This question is about the nervous system.

0 5 . 1

A person steps on a sharp object.

The person immediately moves their foot away from the object in a reflex action.

Complete the sentences on the opposite page.

Choose answers from the list. [3 marks]

A GLAND

A MUSCLE

A NEURONE

THE SKIN

THE SPINAL CORD

When the person steps on the object, the receptor is in

_____ .

An electrical impulse travels from the receptor along

_____ .

The effector is

_____ .

[Turn over]

0 5 . 2

What is the name of the gap between two neurones? [1 mark]

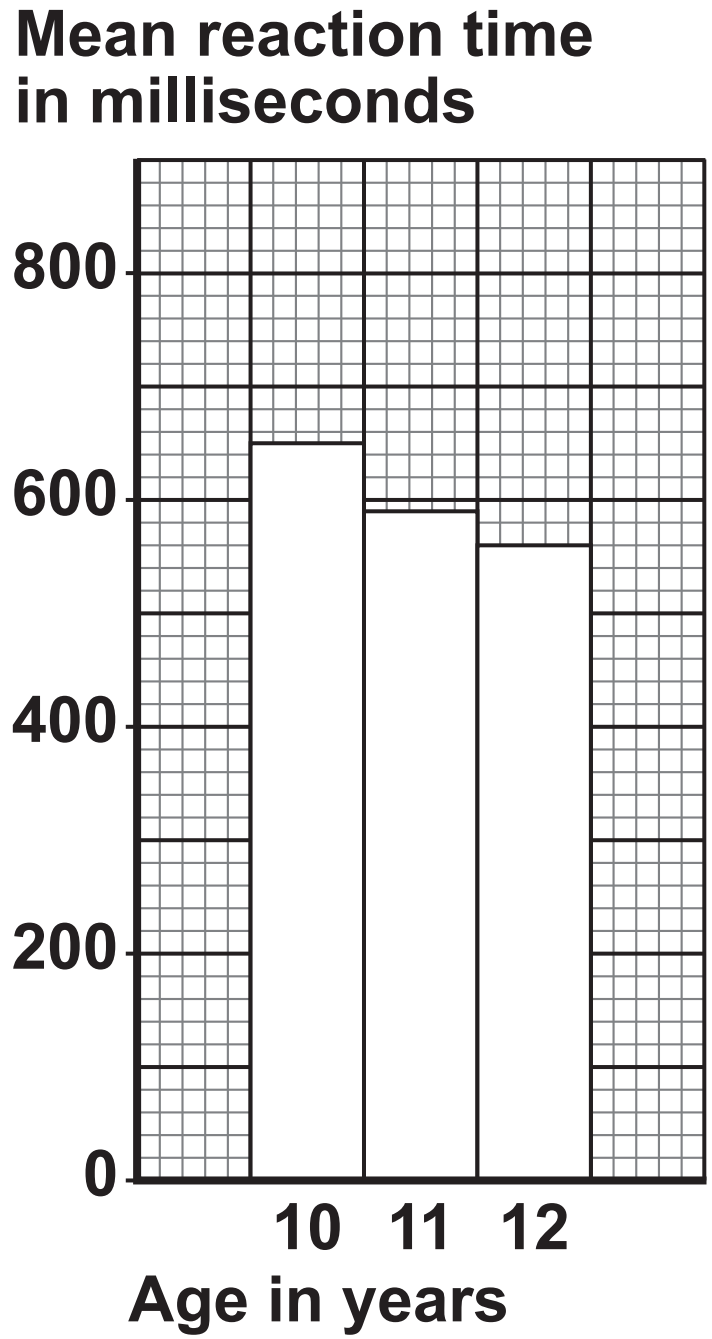
Tick (✓) ONE box.

- ☐ **A coordinator**
- ☐ **A reflex arc**
- ☐ **A synapse**

A scientist investigated how age affects reaction time in a group of students.

FIGURE 6 shows the results.

FIGURE 6



0 5 . 3

The students had NOT practised the reaction time test.

Suggest TWO OTHER control variables the scientists should have used. [2 marks]

1 _____

_____

_____

2 _____

_____

_____

0 5 . 4

What was the mean reaction time of 10-year-olds?

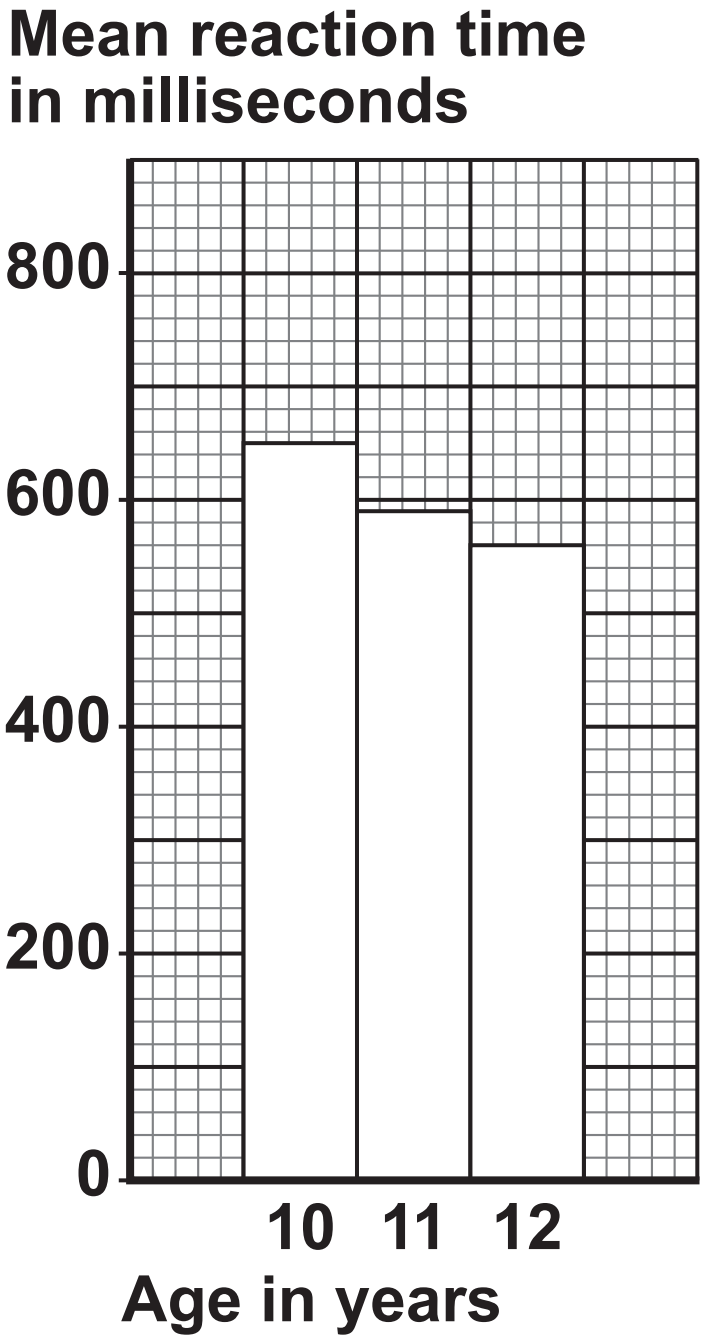
Use FIGURE 6, on page 47. [1 mark]

Mean reaction time =

_____ milliseconds

[Turn over]

FIGURE 6 is repeated here.



0 5 . 5

How old were the students with the lowest mean reaction time?

Use FIGURE 6 on the opposite page.
[1 mark]

Tick (✓) ONE box.

- ☐ **10 years old**
- ☐ **11 years old**
- ☐ **12 years old**

[Turn over]

0 5 . 6

The scientist also measured the reaction time of 35 adults.

Describe how to calculate the MEAN reaction time for the 35 adults. [2 marks]

0 5 . 7

The reaction time of one adult was 450 milliseconds.

What is the reaction time of the adult in seconds?

1 second = 1000 milliseconds. [1 mark]

_____

_____

_____

Reaction time =

_____ **seconds**

11

[Turn over]

0 6

FIGURE 7 shows an oak tree.

FIGURE 7

The binomial name of the oak tree is 'Quercus robur'.

0 6 . 1

What is the genus name of the oak tree?
[1 mark]

Tick (✓) ONE box.

- ☐ **Oak**
- ☐ **Quercus**
- ☐ **Robur**

[Turn over]

0 6 . 2

Other species of tree are in the same genus as 'Quercus robur'.

What does it mean if two species of tree are in the same genus? [1 mark]

Tick (✓) ONE box.

- ☐ **The two species are always found in the same place.**
- ☐ **The two species are closely related to each other.**
- ☐ **The two species look exactly the same.**

0 6 . 3

Oak trees grow at points where cells can divide.

Growth in oak trees happens at the tips of the branches.

Name the type of tissue at the tips of the branches. [1 mark]

Oak trees reproduce by sexual reproduction to produce seeds.

An acorn is a nut that contains a seed.

The seed may become a new oak tree.

0 6 . 4

Which process produces the cell that grows into the seed? [1 mark]

Tick (✓) ONE box.

- ☐ **Evolution**
- ☐ **Fertilisation**
- ☐ **Translocation**

One type of insect lays eggs in acorns.

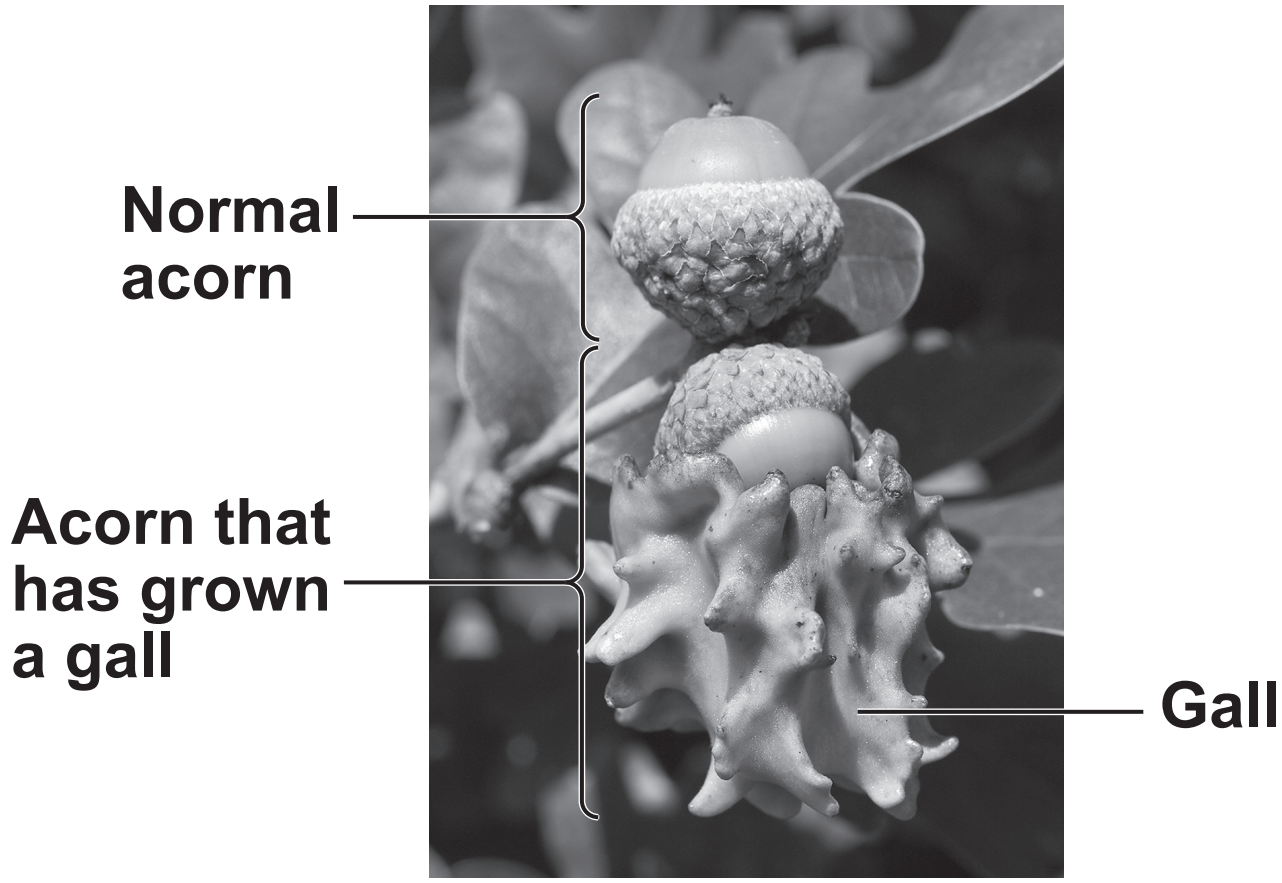
The insect eggs cause the acorn to grow abnormally.

The abnormal growth is called a gall.

Insect embryos grow inside the gall.

FIGURE 8 shows a normal acorn and an acorn that has grown a gall.

FIGURE 8



[Turn over]

0 6 . 5

The gall is made from oak tree cells that have divided.

The cells of the gall contain two sets of chromosomes.

Which process produces the cells of the gall? [1 mark]

Tick (✓) ONE box.

- ☐ **Circulation**
- ☐ **Digestion**
- ☐ **Mitosis**

0 6 . 6

The insects have changed over time and caused a gall to grow on acorns.

The gall increases the chance of survival of the insects inside the gall.

What name is given to the process of the insects changing over time? [1 mark]

Tick (✓) ONE box.

- ☐ **Clone production**
- ☐ **Evolution**
- ☐ **Inbreeding**

[Turn over]

The oak tree transports water and nutrients to the insect embryos inside the gall.

0 6 . 7

Complete the sentence.

Choose the answer from the list. [1 mark]

LEAF CELLS

STOMATA

XYLEM

Water is transported from the roots of the tree to the gall by the

_____ .

0 6 . 8

Complete the sentence.

Choose the answer from the list. [1 mark]

CHLOROPLASTS

GUARD CELLS

PHLOEM

Sugar is transported through the tree to the insect embryos by the

_____ .

[Turn over]

0 6 . 9

Water moves from the roots to the leaves.

Name the process that moves water from the roots to the leaves. [1 mark]

_____

_____

_____

9

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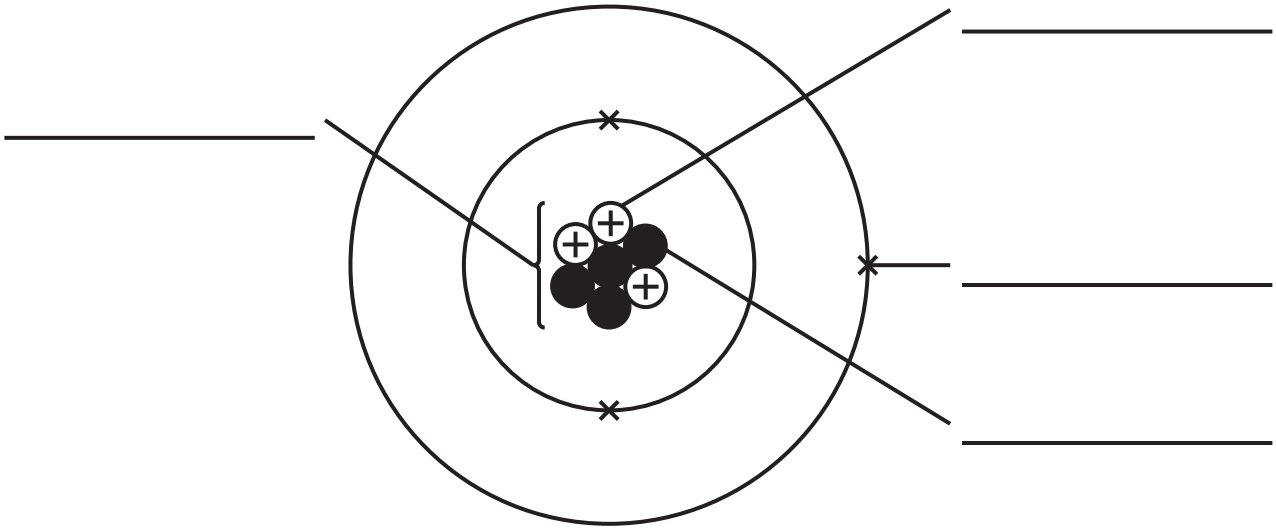
[Turn over]

0 7

This question is about atoms.

FIGURE 9 represents an atom.

FIGURE 9



0 7 . 1

Label FIGURE 9 on the opposite page.

Choose answers from the list. [4 marks]

ELECTRON

ION

MOLECULE

NEUTRON

NUCLEUS

PROTON

[Turn over]

0 7 . 2

Name the element represented by FIGURE 9 on page 66.

Use the periodic table. [1 mark]

0 7 . 3

Why does an atom have an overall electrical charge of zero? [1 mark]

0 7 . 4

Draw ONE line from each description of structure size to the correct structure.
[2 marks]

DESCRIPTION OF STRUCTURE SIZE	STRUCTURE
	A gold atom
Largest	A human skin cell
Smallest	A protein molecule
	The nucleus of a helium atom

[Turn over]

0 7 . 5

An atom of one element has a radius of 0.000 000 348 mm.

How should 0.000 000 348 mm be written in standard form? [1 mark]

Tick (✓) ONE box.

- ☐ 0.348×10^{-6} mm
- ☐ 0.348×10^{-7} mm
- ☐ 3.48×10^{-6} mm
- ☐ 3.48×10^{-7} mm

BLANK PAGE

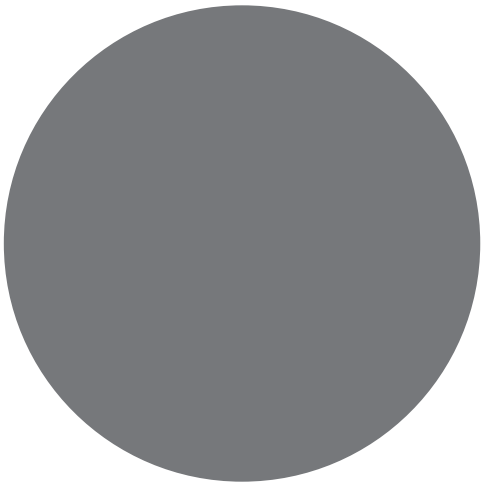
[Turn over]

Scientists have developed different models of the atom over time.

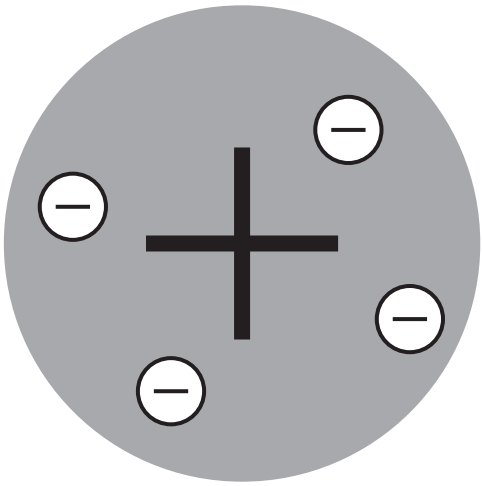
FIGURE 10 shows the Dalton model of the atom and a more recent model of the atom.

FIGURE 10

DALTON MODEL



MORE RECENT MODEL



0 7 . 6

Name the more recent model in FIGURE 10.
[1 mark]

0 7 . 7

Give ONE difference between the models of the atom shown in FIGURE 10 on the opposite page. [1 mark]

_____

_____

_____

11

[Turn over]

0 8

Bacteria can cause disease.

Bacterial cells do NOT have a nucleus.

0 8 . 1

Which term describes bacterial cells?
[1 mark]

Tick (✓) ONE box.

☐ **Eukaryotic**

☐ **Fungal**

☐ **Prokaryotic**

0 8 . 2

Bacterial cells have no nucleus and are smaller than animal cells.

Give ONE OTHER difference between bacterial cells and animal cells. [1 mark]

_____

_____

_____

[Turn over]

Escherichia coli (*E. coli*) is a type of bacterium.

E. coli causes symptoms of food poisoning.

0 8 . 3

Water companies sterilise rain water to produce drinking water.

The drinking water is then transported to homes in underground pipes.

Flooding can cause contamination of the drinking water by *E. coli*.

Suggest how people should treat drinking water AT HOME if there is a risk of *E. coli* contamination. [1 mark]

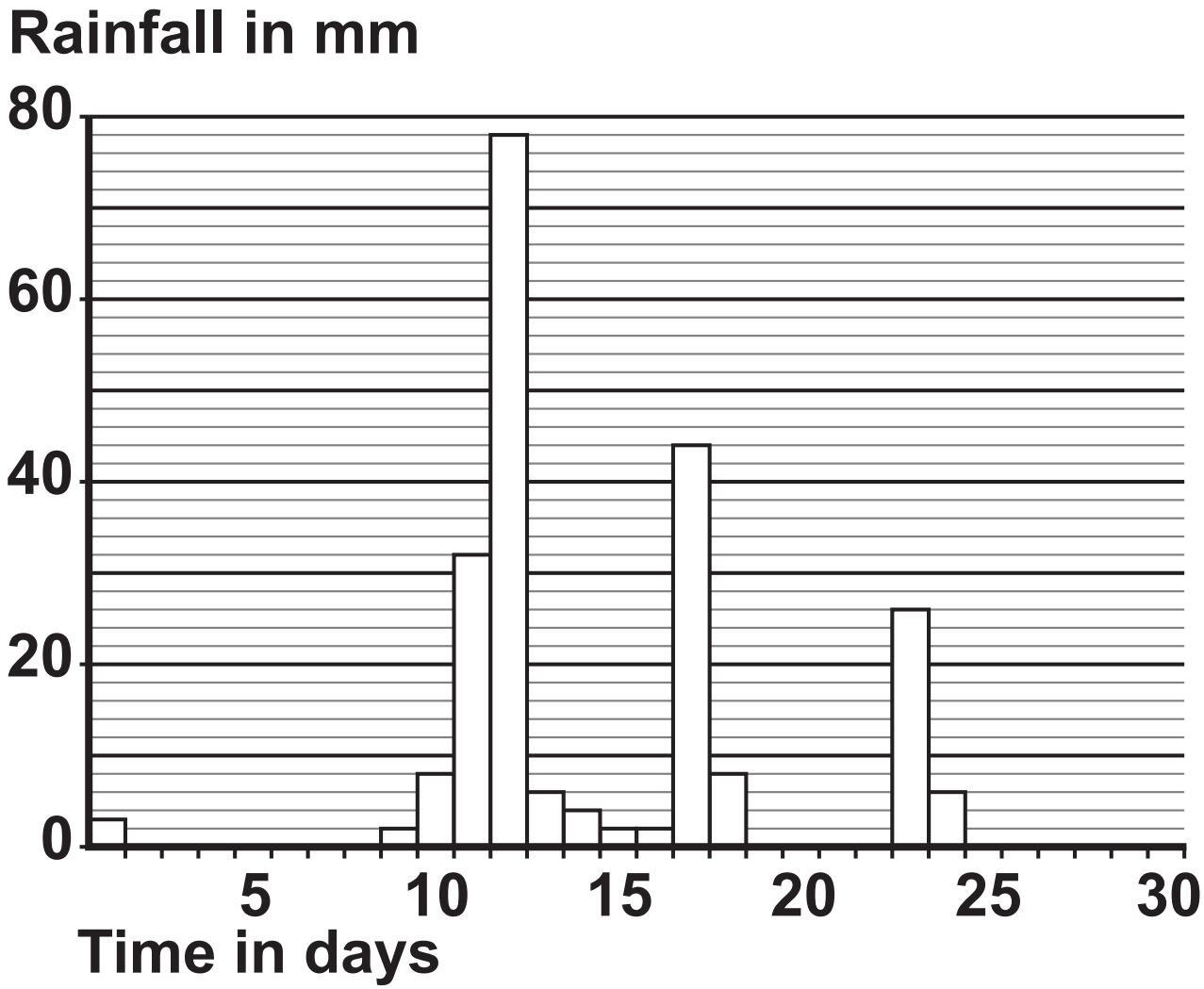
BLANK PAGE

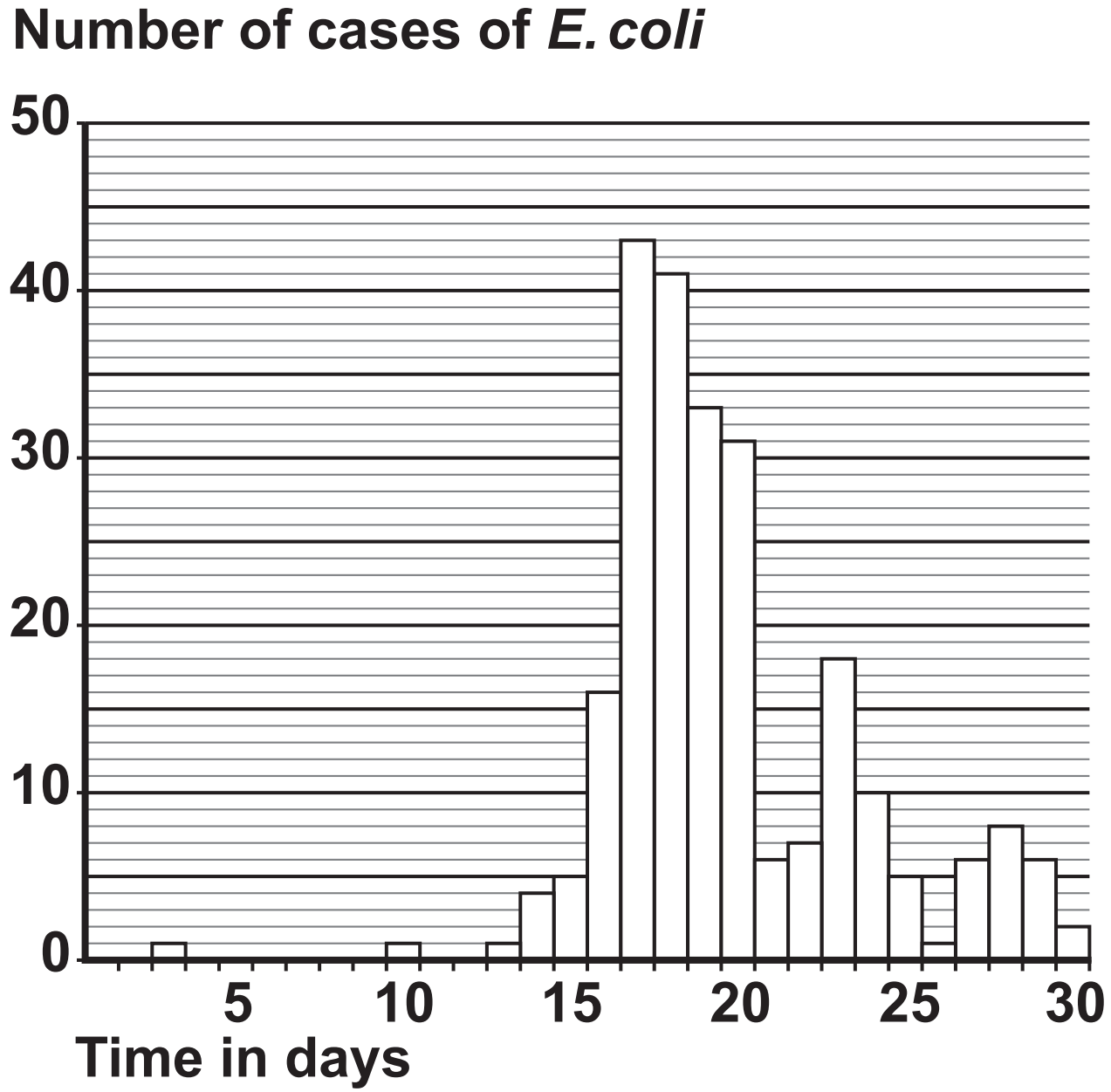
[Turn over]

FIGURE 11, below and on the opposite page, shows two graphs:

- **The rainfall in one town in one month.**
- **The number of cases of *E. coli* in the town in the same month.**

FIGURE 11




Number of cases of *E. coli*
50
40
30
20
10
0
5
10
15
20
25
30
Time in days

[Turn over]

0 8 . 4

The RAINFALL on day 12 was greater than on day 10.

Calculate how many times greater.
[3 marks]

Number of times greater =

0 8 . 5

Symptoms of *E. coli* infection usually occur 5 days after infection.

A scientist stated:

‘Increased rainfall causes an increase in the number of cases of *E. coli*.’

Describe ONE piece of evidence from FIGURE 11, on pages 78 and 79, that supports the scientist’s statement.
[1 mark]

0 8 . 6

Why might the number of cases of *E. coli* infection increase in the future? [1 mark]

Tick (✓) ONE box.

- ☐ **Climate change is causing loss of habitats for wildlife.**
- ☐ **Climate change is causing more extreme rainfall.**
- ☐ **Climate change is causing sea-levels to be lower.**

Climate change is caused by an increase in the concentration of greenhouse gases in the atmosphere.

Carbon dioxide is a greenhouse gas.

0 8 . 7

Name TWO other greenhouse gases.

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

1 _____

_____

2 _____

_____

[Turn over]

0 8 . 8

Describe ONE way the rate of increase in carbon dioxide concentration in the atmosphere could be reduced. [1 mark]

11

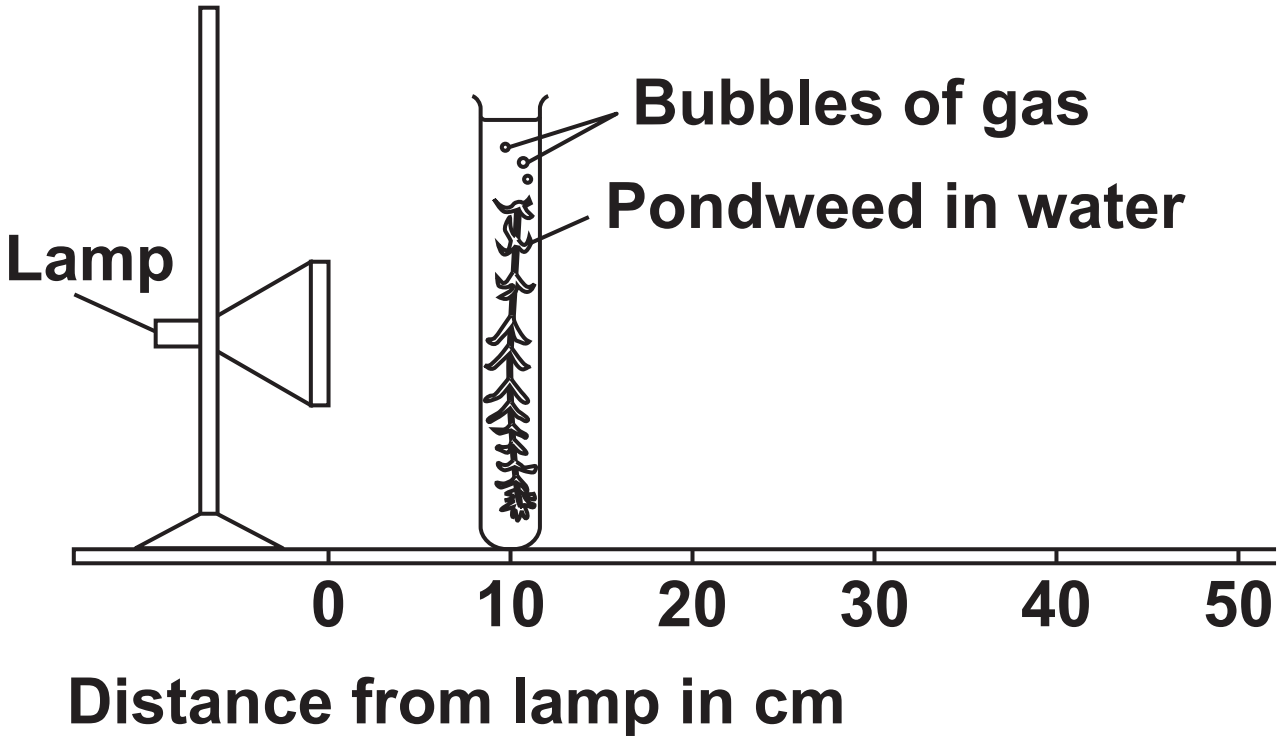
BLANK PAGE

[Turn over]

0 9

FIGURE 12 shows equipment used to investigate how light intensity affects photosynthesis.

FIGURE 12



The light intensity can be changed by moving the pondweed to different distances from the lamp.

Describe a method to investigate the effect of light intensity on the rate of photosynthesis in pondweed. [6 marks]

[Turn over]

6

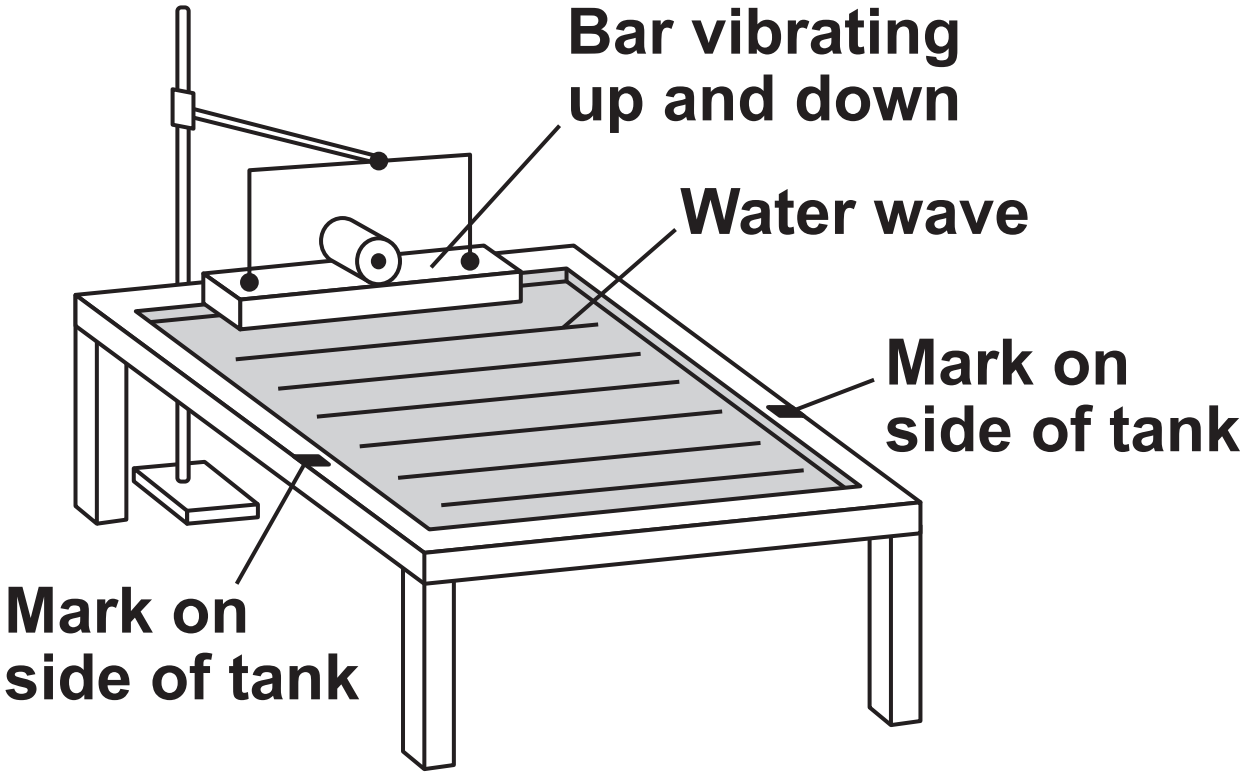
BLANK PAGE

[Turn over]

1 0

FIGURE 13 shows a ripple tank used to investigate the behaviour of water waves.

FIGURE 13



1 0 . 1

Water waves are transverse waves.

Complete the sentence.

Choose the answer from the list. [1 mark]

PARALLEL

PERPENDICULAR

THE SAME

In transverse waves, the direction of oscillation and the direction of energy transfer are

_____ .

[Turn over]

1 0 . 2

Describe a method a student could use to determine the frequency of the water waves. [4 marks]

[Turn over]

Use the Physics Equations Sheet to answer Questions 10.3 and 10.4.

1 0 . 3

Which equation links frequency (f), wavelength (λ) and wave speed (v)? [1 mark]

Tick (✓) ONE box.

☐ $v = \frac{f}{\lambda}$

☐ $v = f\lambda$

☐ $v = f^2\lambda$

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[Turn over]

1 0 . 4

FIGURE 14 shows the water waves in the ripple tank when viewed from above.

FIGURE 14

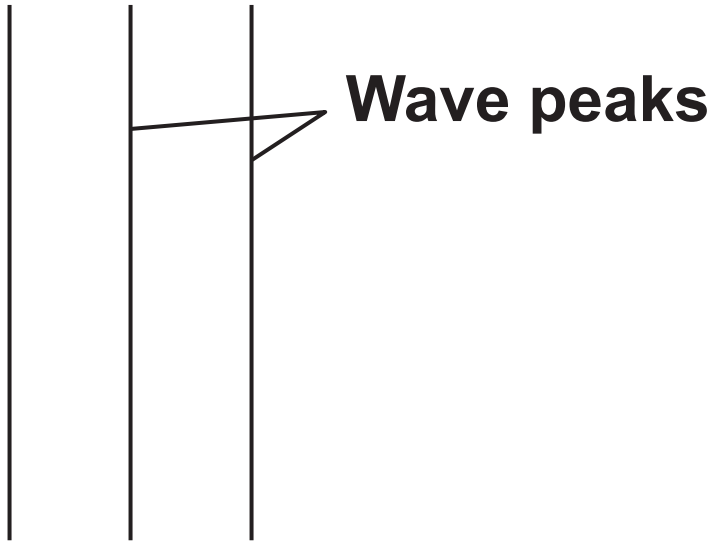

FIGURE 14 has been drawn to actual size.

The water waves have a frequency of 2.5 Hz.

Calculate the wave speed of the waves in FIGURE 14.

You should take measurements from FIGURE 14 on the opposite page. [4 marks]

Wave speed = _____ **m/s** 10

END OF QUESTIONS

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

Additional page, if required.
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For Examiner's Use	
Question	Mark
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