GCSE
SCIENCE A 2

F

Foundation Tier   Unit 6

Wednesday 25 May 2016   Afternoon   Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- a ruler
- a calculator
- the Chemistry Data Sheet and Physics Equations Sheet booklet (enclosed).

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 90.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 13 should be answered in continuous prose.
  In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

Advice

- In all calculations, show clearly how you work out your answer.
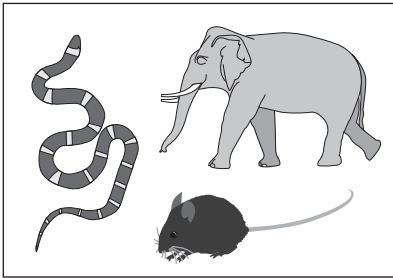
Answer **all** questions in the spaces provided.

Biology Questions

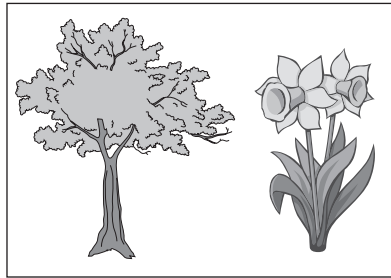**1** Living things are classified into three main groups.

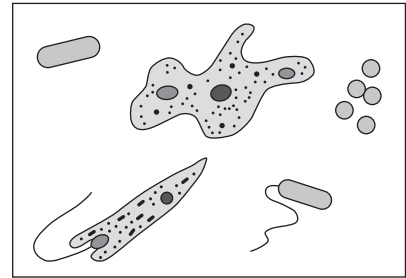**Figure 1** shows some examples of organisms found in each of these three groups.

Figure 1

Group 1	Group 2	Group 3

(Not to scale)

1 (a) Name the **three** main groups of organisms shown in **Figure 1**.

[3 marks]

Group 1 _____

Group 2 _____

Group 3 _____

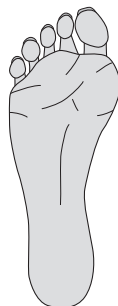**1 (b)** Humans and gorillas are primates.

All primates evolved from a common ancestor.
Evidence for this can be seen in the similarities between different primates.
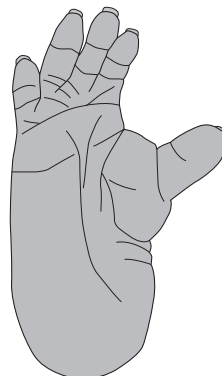
Figure 2 shows the foot of a human and the foot of a gorilla.

Figure 2

Human foot   **Gorilla foot**

1 (b) (i)   Give **one** similarity between the foot of the human and the foot of the gorilla.

[1 mark]

_____

_____

1 (b) (ii)   Gorillas have longer toes than humans and their big toe sticks out to the side.

Suggest what these features allow gorillas to do.
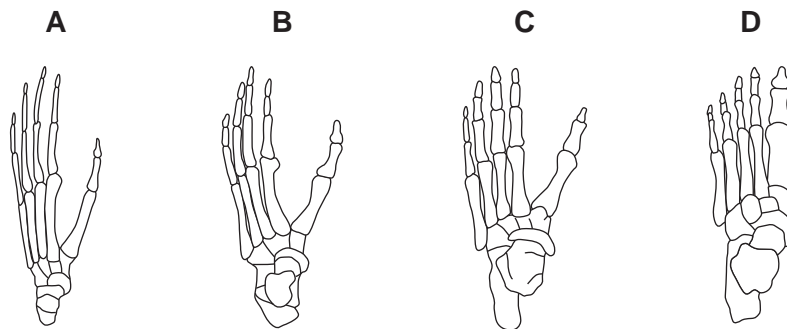
[1 mark]

_____

_____

1 (b) (iii) **Figure 3** shows the skeletons of the feet of four different primates.

Figure 3

| A | B | C | D |

Look at **Figure 2** and **Figure 3**.

Which skeleton, **A**, **B**, **C** or **D**, is the skeleton of a human foot?

[1 mark]

Write the correct answer in the box. ☐

6

Turn over ▶

2 **Figure 4** shows a simple method that gardeners use to produce new plants from a parent plant.

Figure 4
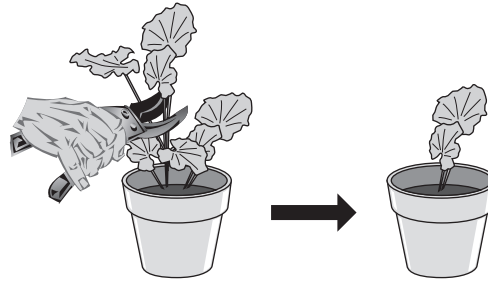
2 (a) Complete the following sentences to describe the method shown in **Figure 4**.

[3 marks]

Draw a ring around each correct answer.

The method shown in **Figure 4** is called

genetic engineering. **taking cuttings.** **tissue culture.**

This method is a type of

asexual reproduction. **natural selection.** **sexual reproduction.**

The new plant is identical to the parent plant because it has identical

gametes. **genes.** **embryos.**

2 (b)   A gardener produced five new plants from one parent plant.

Each new plant was the same height.

The plants were grown in pots placed around the gardener's patio.

After three weeks the gardener noticed that all his new plants looked similar, but were different heights.

The heights of his plants are shown in **Table 1**.

Table 1

Plant	Height in cm
1	9.2
2	8.8
3	9.8
4	11.2
5	9.5

2 (b) (i)   Calculate the mean height of the **five** new plants.

[1 mark]

_____

_____

Mean height = _____ cm

2 (b) (ii)   **Plant 4** grew much taller than the other plants.

Suggest **one** reason for this.

[1 mark]

_____

_____

Turn over ▶

5

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

3 Lichens grow on rocks and the bark of trees.

Lichens can be used as indicators of air pollution.

3 (a) Which pollutant gas are lichens very sensitive to?

[1 mark]

Tick (✓) **one** box.

Carbon dioxide ☐

Oxygen ☐

Sulfur dioxide ☐

Question 3 continues on the next page

Turn over ▶

3 (b) **Figure 5** shows four lichens that can survive different levels of air pollution.

Figure 5
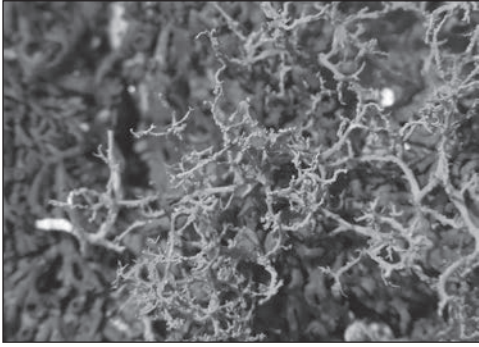
Lichen **W** can only survive in unpolluted air

Lichen **X** can only survive in quite clean air

Lichen **Y** can survive medium levels of pollution

Lichen **Z** can survive high levels of pollution

Figure 6 shows a map divided into four zones around a coal-burning power station.

Figure 6

Zone **A**

Zone **D**

Zone **B**

Zone **C**

Wind direction

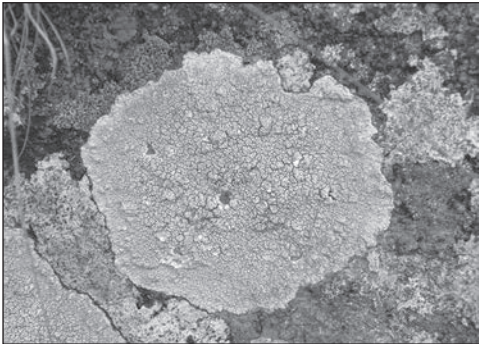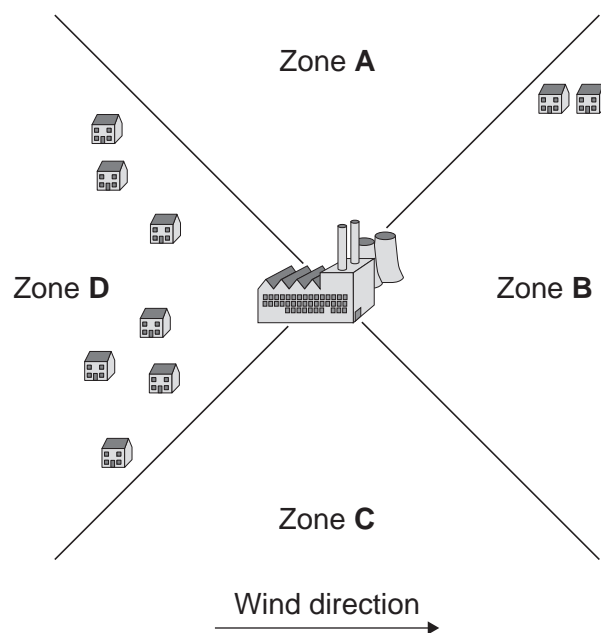**3 (b) (i)** Which zone, **A**, **B**, **C** or **D**, would have the highest level of air pollution?

[1 mark]

Draw a ring around the correct answer.

Zone A   **Zone B**   **Zone C**   **Zone D**

3 (b) (ii) Which lichen shown in **Figure 5** would be most likely to be found in the zone with the highest air pollution?

[1 mark]

Tick (✓) **one** box.

Lichen **W**   ☐

Lichen **X**   ☐

Lichen **Y**   ☐

Lichen **Z**   ☐

3 (c) There is more lichen growing in the UK today than there was 50 years ago.

Give **one** reason for this change.

[1 mark]

Tick (✓) **one** box.

Fewer pollutant gases are released today.   ☐

More coal is burnt today.   ☐

There are more cars on the road today.   ☐

4

Turn over for the next question

Turn over ▶

4 A scientist investigated the effect of temperature on the rate of decay of leaves.

The scientist put 5 g of dead leaves into each of four mesh bags.

One bag is shown in **Figure 7**.

Figure 7

Mesh bag

5 g dead leaves
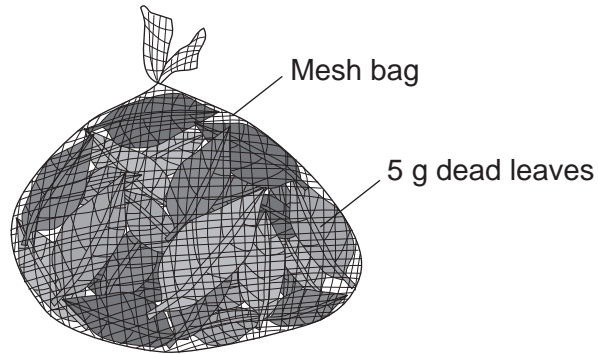
Each bag of leaves was put on soil in a different place and left to decay.

Each place was at a different temperature.

After three months the leaves were weighed again and the loss in mass was calculated.

4 (a) What was the independent variable in this investigation?

[1 mark]

Tick (✓) **one** box.

Mass of dead leaves ☐

Size of holes in the mesh bag ☐

Temperature ☐

4 (b) The results of the investigation are shown in **Figure 8**.
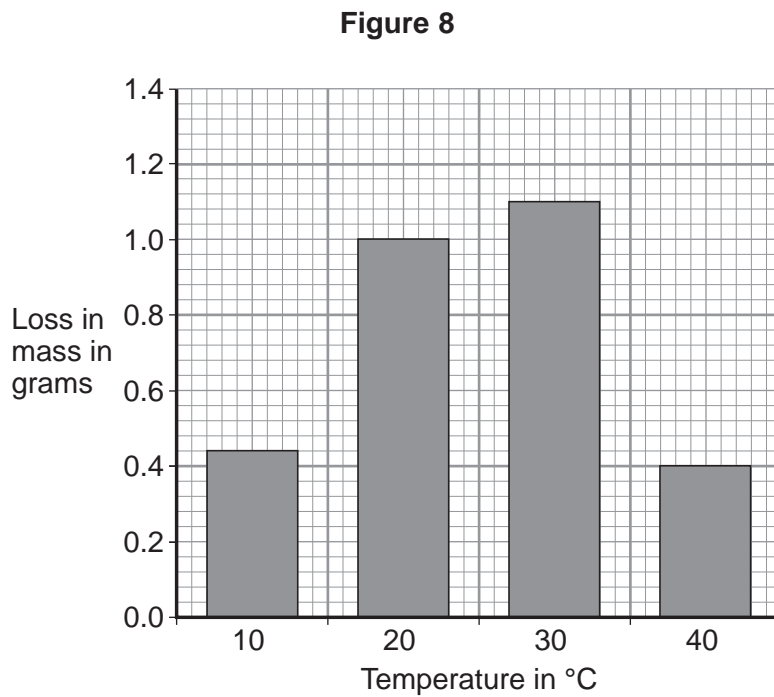
Figure 8

4 (b) (i) What was the loss in mass at 30 °C?

[1 mark]

Loss in mass at 30 °C = _____ g

4 (b) (ii) The greater the loss in mass, the faster the rate of decay.

Use the results in **Figure 8** to give **one** conclusion about the rate of decay.

[1 mark]

_____

_____

4 (c) The holes in the mesh bags help the decay process.

Living organisms and chemical substances move through the holes.

Name **three** things that move through the holes during the decay process.

[3 marks]

_____

_____

_____

Turn over ▶

Chemistry Questions

5 This question is about the substances used to make plastic bags.

5 (a) Most plastic bags are made from a polymer produced from crude oil.

Figure 9 shows part of the polymer structure.

Figure 9

```
    H   H   H   H   H   H   H   H
    |   |   |   |   |   |   |   |
 — C — C — C — C — C — C — C — C —
    |   |   |   |   |   |   |   |
    H   H   H   H   H   H   H   H
```
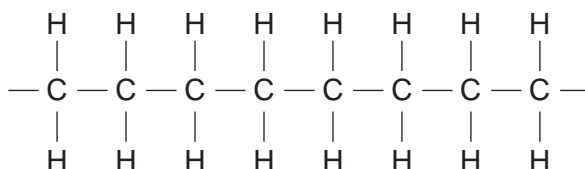
5 (a) (i) Name the **two** elements in the polymer.

[2 marks]

1 _____

2 _____

5 (a) (ii) Ethene is the monomer used to produce the polymer shown in **Figure 9**.

Complete the name of the polymer.

[1 mark]

poly(_____)

5 (b) Ethene is produced in a process called cracking.

The process is shown by the equation below.
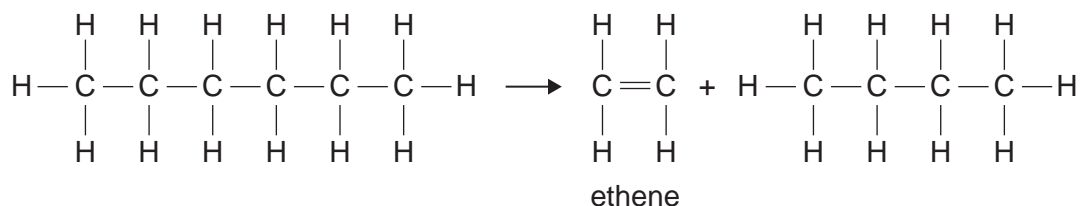

ethene

5 (b) (i) Describe what happens to the molecules during cracking.

[2 marks]

_____

_____

_____

_____

5 (b) (ii) Ethene is an alkene.

What is the general formula of an alkene?

[1 mark]

Draw a ring around the correct answer.

C_nH_n C_nH_{2n} $C_{2n}H_n$

5 (b) (iii) What does C = C represent in the displayed formula for ethene?

[1 mark]

_____

_____

5 (c) Some plastic bags are made from biodegradable plastics produced from cornstarch.

Give **one** advantage of biodegradable plastic bags.

[1 mark]

_____

_____

Turn over ▶

8

6   This question is about gases in the atmosphere.

Table 2 shows the percentages of three gases in the atmospheres of Earth and Mars.

Table 2

Gas	Percentage (%) of gas in the atmosphere of Earth	Percentage (%) of gas in the atmosphere of Mars
Carbon dioxide	0.04	95.3
Nitrogen	78.0	2.7
Oxygen	21.0	0.13

6 (a)   Use the information in **Table 2** to compare the atmospheres of Earth and Mars.

[3 marks]

_____

_____

_____

_____

_____

_____

6 (b)   Scientists think Earth's early atmosphere was mainly carbon dioxide and water vapour.

The percentages of the gases in the atmosphere today have changed from the early atmosphere.

Draw **one** line from each gas to the main reason for the change in percentage.

[3 marks]

Gas	**Main reason for change**
	Condensed to form oceans
Carbon dioxide	
	Locked up in fossil fuels
Oxygen	
	Produced from ammonia
Water vapour	
	Produced during photosynthesis

6 (c)   Some scientists believe life started about 3.5 billion years ago.

Suggest **one** reason why other scientists do **not** agree with this theory.

[1 mark]

_____

_____

7

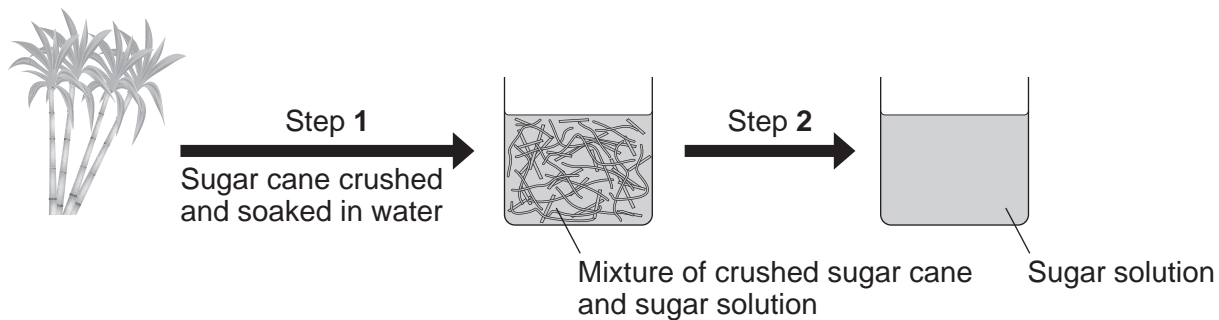**Turn over for the next question**

Turn over ▶

7 In some countries ethanol produced from sugar cane is used as fuel for cars.
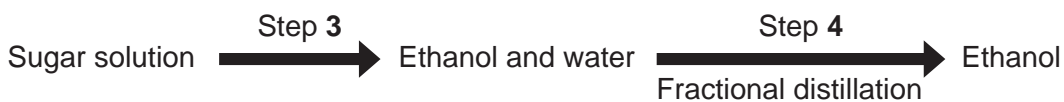
7 (a) **Figure 10** shows the steps in the production of ethanol from sugar cane.

Figure 10

Sugar solution is obtained from sugar cane plants.

Step **1**
Sugar cane crushed
and soaked in water

Step **2**

Mixture of crushed sugar cane
and sugar solution

Sugar solution

Then ethanol is produced from the sugar solution.

Step **3**

Sugar solution → Ethanol and water

Step **4**
Fractional distillation → Ethanol

7 (a) (i) What method is used in Step **2** to separate the mixture?

[1 mark]

_____

_____

7 (a) (ii) What is added in Step **3** to the sugar solution to produce ethanol?

[1 mark]

Draw a ring around the correct answer.

carbon **steam** **yeast**

7 (b) What is **one** advantage of producing the fuel ethanol from sugar cane?

[1 mark]

Tick (✓) **one** box.

An unsaturated oil is produced. ☐

No crude oil is used. ☐

Sugar crops can be used for food. ☐
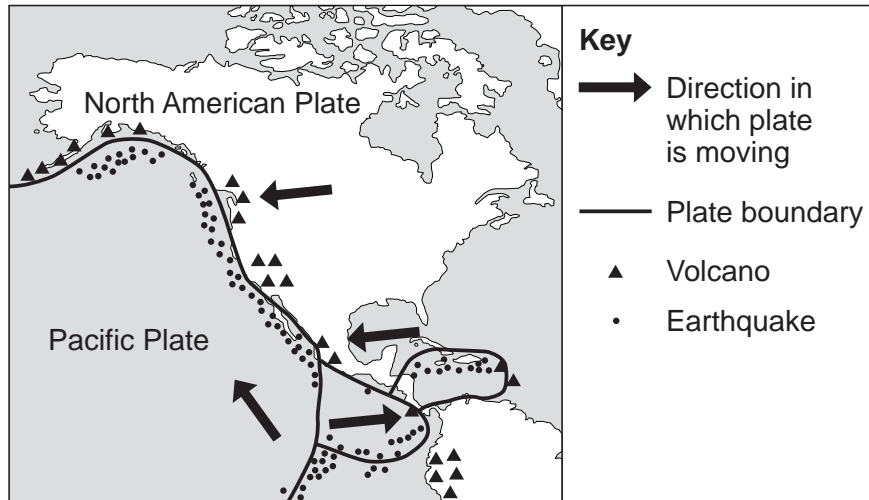
Turn over for the next question

3

Turn over ▶

8 This question is about tectonic plates.

Figure 11 shows the movement of tectonic plates in North America.

Figure 11

8 (a) Tectonic plates move slowly.

Use the correct word from the box to complete the sentence.

[1 mark]

centimetres	kilometres	metres

Tectonic plates move a few _____ a year.

8 (b) A student concluded:

'Movement of tectonic plates causes earthquakes and volcanoes.'

Give **two** pieces of evidence from **Figure 11** which support the student's conclusion.

[2 marks]

_____

_____

_____

_____
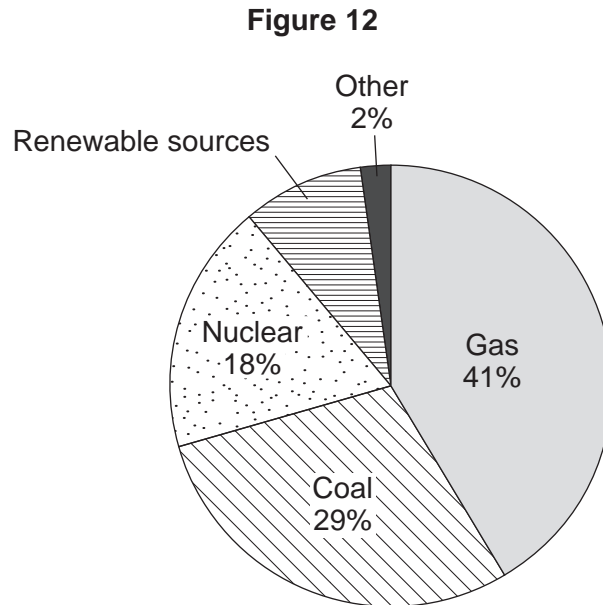
3

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Turn over ▶

Physics Questions

9   **Figure 12** shows the percentage (%) of electrical energy from different sources in the UK in 2011.

Figure 12

9 (a)   What percentage of electrical energy was obtained from renewable sources?

[1 mark]

_____

_____

Percentage obtained from renewable sources = _____ %

9 (b) Draw **one** line from each type of power station to the correct source of energy.

[3 marks]

Power station	Source of energy

Falling water

Geothermal

Hot rocks in the Earth

Hydroelectric

Plants

Solar

The Sun

9 (c) Wind is a renewable energy source.

Give **one** advantage of using wind as an energy source.

[1 mark]

Tick (✓) **one** box.

The wind is a reliable energy source. ☐

The wind does not produce polluting gases. ☐

The wind is a concentrated energy source. ☐

5

Turn over ▶

10 **Figure 13** shows part of the electromagnetic spectrum.

Figure 13

Visible light	Infrared radiation	Microwaves	Radiowaves

10 (a) Electromagnetic waves are used in communication.

Choose the correct wave from **Figure 13** for each use given below.

[3 marks]

Television remote controls _____

Satellite communication _____

Photography _____

10 (b) Many people communicate using mobile phones. Mobile phones use microwaves.

All mobile phones have a measured SAR (specific absorption rate).

The higher the SAR rating, the more radiation is absorbed into the head.

The SARs of four mobile phones are given in **Table 3**.

Table 3

Mobile phone	SAR
A	1.13
B	0.97
C	0.33
D	0.49

10 (b) (i) Which mobile phone, **A**, **B**, **C** or **D**, is likely to be the safest to use?

Give a reason for your answer.

[2 marks]

Mobile phone _____

Reason _____

_____

10 (b) (ii) Why is it important that customers should have information about the SAR when buying a mobile phone?

[1 mark]

Tick (✓) **one** box.

So mobile phones are safer to use. ☐

So customers can make an informed choice. ☐

To encourage customers to use mobile phones. ☐

10 (c) Complete the sentences about the properties of electromagnetic waves.

[3 marks]

Electromagnetic waves do **not** travel as longitudinal waves. They travel as

_____ waves.

Electromagnetic waves can travel through space which is a _____ .

Electromagnetic waves can be diffracted, refracted or _____ .

9

Turn over for the next question

Turn over ▶

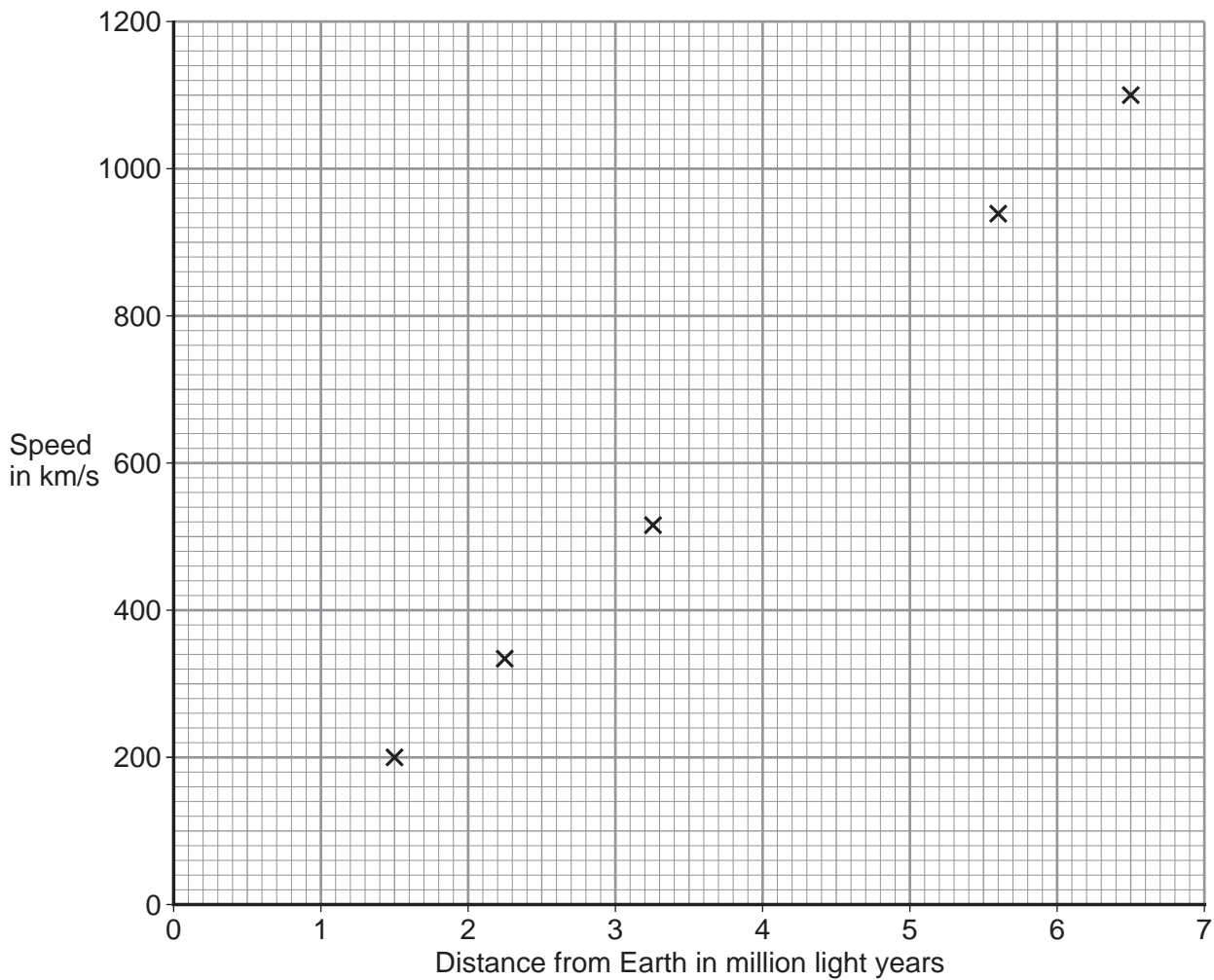**11** Some scientists study the stars and space to find out more about the universe.

11 (a) Name the theory that describes the beginning of the universe.

[1 mark]

_____

11 (b) Scientists have studied the speed of galaxies at different distances from the Earth.
The results for five galaxies are plotted on the graph in **Figure 14**.

Figure 14

11 (b) (i) Draw a line of best fit through the points on the graph.

[1 mark]

11 (b) (ii) Describe the pattern shown in the graph.

[1 mark]

_____

_____

11 (b) (iii) A galaxy is 3 million light years from Earth.

Use **Figure 14** to predict what the speed of the galaxy is.

[1 mark]

Speed = _____ km/s

11 (c) Scientists measure red-shift and cosmic microwave background radiation (CMBR).

Use the correct answer from the box to complete each sentence.

[3 marks]

frequency	**speed**	**wavelength**

Red-shift is the observed increase in _____ of light from distant galaxies.

electromagnetic	**infrared**	**nuclear**

CMBR is a type of _____ radiation.

Earth	**Sun**	**universe**

CMBR comes from radiation that was present shortly after the beginning

of the _____ .

Turn over ▶

7

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Biology Questions

12   Greenflies are small insects that feed on rose bushes. Ladybirds eat greenflies.
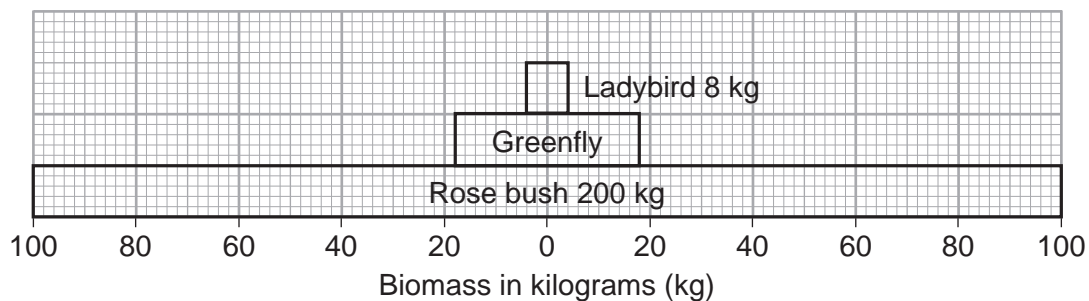
Rose bush ⟶ Greenfly ⟶ Ladybird

12 (a)   What is the source of energy for the food chain?

[1 mark]

_____

12 (b)   **Figure 15** shows a pyramid of biomass for this food chain.

Figure 15

12 (b) (i)   What is the biomass of the greenfly population shown in **Figure 15**?

[1 mark]

Biomass of greenfly population = _____ kilograms

12 (b) (ii)   The biomass of the ladybird population is less than the biomass of the greenfly population.

Give **one** reason for this.

[1 mark]

_____

_____

_____

3

Turn over ▶

13 Polar bears live in the Arctic. Seals are their main food source.

Figure 16 shows some adaptations of polar bears.

Figure 16

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Explain how the polar bear is adapted to survive in its environment.

Use information in **Figure 16** and your knowledge.

[6 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Extra space _____

_____

_____

_____

_____

_____

6
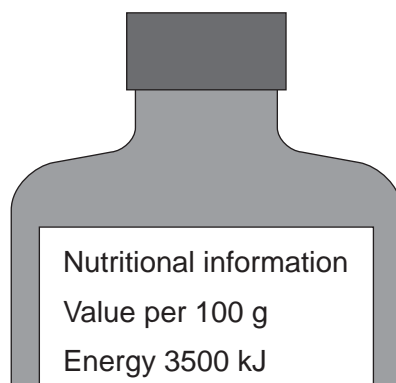
Turn over for the next question

Turn over ▶

Chemistry Questions

14 This question is about vegetable oils.

Figure 17 shows part of the label on a bottle of vegetable oil.

Figure 17

Nutritional information
Value per 100 g
Energy 3500 kJ
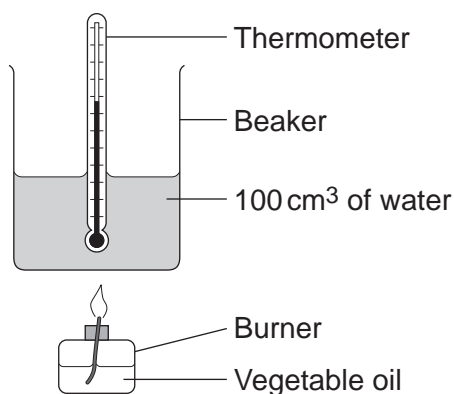
14 (a) A student investigated the energy released by burning the vegetable oil.

Figure 18 shows the apparatus the student used.

Figure 18

Thermometer

Beaker

100 cm^3 of water

Burner

Vegetable oil

The student:

- recorded the starting temperature of the water
- burned 1 g of the vegetable oil
- recorded the temperature of the water after burning the vegetable oil.

Table 4 shows the student's results for the investigation.

Table 4

Starting temperature of water in °C	Temperature of water after burning 1 g of vegetable oil in °C
19	34

14 (a) (i) Calculate the energy released when 1 g of the vegetable oil was burned.

Use the equation: Energy released in joules = 100 × 4.2 × temperature change

[2 marks]

_____

_____

_____

_____

Energy released when 1 g of vegetable oil was burned = _____ J

14 (a) (ii) Use your answer to part **(a)(i)** to calculate the energy released by 100 g of vegetable oil.

Convert your answer to kilojoules.

[1 mark]

_____

_____

Energy released when 100 g of vegetable oil was burned = _____ kJ

14 (a) (iii) The student did **not** get an accurate value for the energy released by 100 g of the vegetable oil. Suggest **two** reasons why.

[2 marks]

_____

_____

_____

_____

Question 14 continues on the next page

Turn over ▶

14 (b) The student compared the cooking of potatoes in vegetable oil and in water.

The potatoes cooked in vegetable oil were a different colour and texture to the potatoes cooked in water.

Give **two** other differences between the potatoes cooked in vegetable oil and those cooked in water.
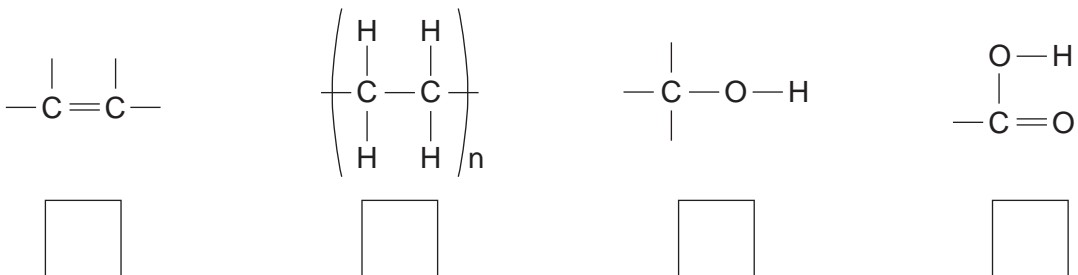
[2 marks]

_____

_____

_____

_____

14 (c) The student added bromine water to the vegetable oil.

Which structure turns bromine water from orange to colourless?

[1 mark]

Tick (✓) **one** box.

$$-\overset{|}{C}=\overset{|}{C}- \qquad \left(\begin{array}{cc} H & H \\ | & | \\ -C & -C- \\ | & | \\ H & H \end{array}\right)_n \qquad -\overset{|}{\underset{|}{C}}-O-H \qquad \begin{array}{c} O-H \\ | \\ -C=O \end{array}$$

☐ ☐ ☐ ☐

14 (d) Suggest **one** reason why information about energy is shown on food labels.

[1 mark]

_____

_____

9

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Turn over ▶

Physics Questions

15 Sound travels through the air as a wave.

15 (a) A sound wave has a frequency of 250 Hz and a wavelength of 1.32 m.

Calculate the speed of sound in air.

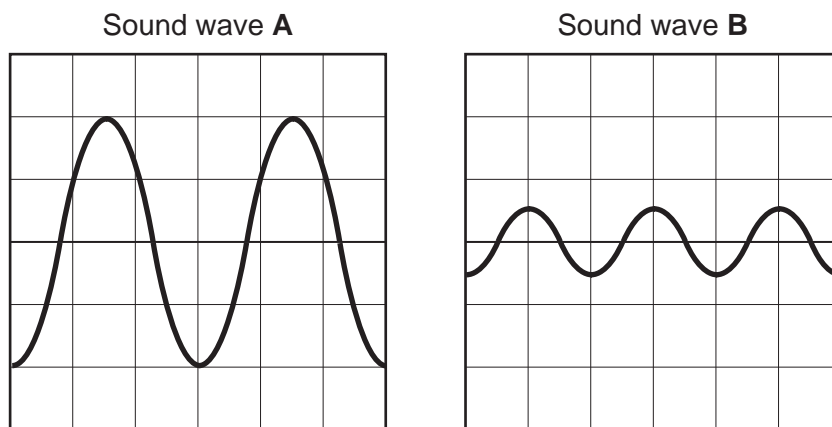Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

Speed of sound in air = _____ m/s

15 (b) **Figure 19** shows the traces produced on an oscilloscope by two sound waves, **A** and **B**.

The oscilloscope settings are the same for each trace.

Figure 19

Sound wave **A**   Sound wave **B**

How do the sounds produced by sound waves **A** and **B** differ?

Use information from **Figure 19** to give reasons for your answers.

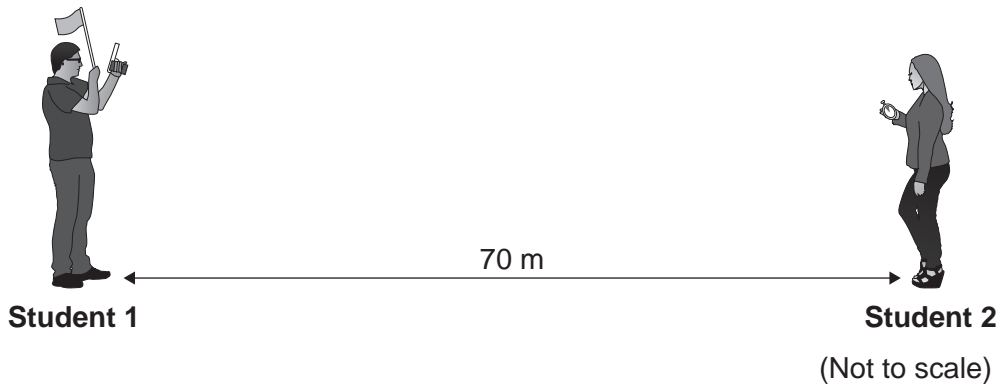**[4 marks]**

_____

_____

_____

_____

_____

_____

_____

_____

15 (c) **Figure 20** shows two students measuring the time it takes a sound wave to travel a known distance. They use their measurements to calculate the speed of sound through air.

Figure 20

70 m

Student 1

Student 2

(Not to scale)

The students use the following method:

- Student 1 has a starting gun and a flag.

- When Student 1 fires the starting gun, he moves the flag.

- When Student 2 sees the flag move, she starts a stopwatch.

- When Student 2 hears the sound, she stops the stopwatch.

Question 15 continues on the next page

Turn over ▶

Do not write outside the box

15 (c) (i) The time recorded on the stopwatch is 0.29 seconds.

What is the resolution of the stopwatch?

[1 mark]

Draw a ring around the correct answer.

0.1 s   **0.01 s**   **0.001 s**

15 (c) (ii) Suggest **two** ways to obtain a more accurate result.

[2 marks]

_____

_____

_____

_____

9

END OF QUESTIONS