OCR
Oxford Cambridge and RSA

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# Friday 26 November 2021 – Morning

## GCSE (9–1) Combined Science B (Twenty First Century Science)

**J260/08** Combined Science (Higher Tier)

**Time allowed: 1 hour 45 minutes**

*8350638672*

**You must have:**
- a ruler (cm/mm)
- the Data Sheet for GCSE (9-1) Combined Science B (inside this document)

**You can use:**
- an HB pencil
- a scientific or graphical calculator

*J260/08*

Please write clearly in black ink. **Do not write in the barcodes.**

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

First name(s) _____

Last name _____

**INSTRUCTIONS**
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

**INFORMATION**
- The total mark for this paper is **75**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **20** pages.

**ADVICE**
- Read each question carefully before you start your answer.

Answer **all** the questions.

**1** Beth plans an investigation to help her estimate the population of buttercup plants in her garden.

**(a)** This is part of Beth's method:

1. Divide the garden into four equal sections.
2. Count the number of buttercup plants in the section that has the most buttercup plants.
3. Multiply the number of buttercup plants counted by four.

Describe how Beth could improve her method.

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**[4]**

**(b)** Beth thinks three factors are having an effect on the growth of buttercup plants in her garden.

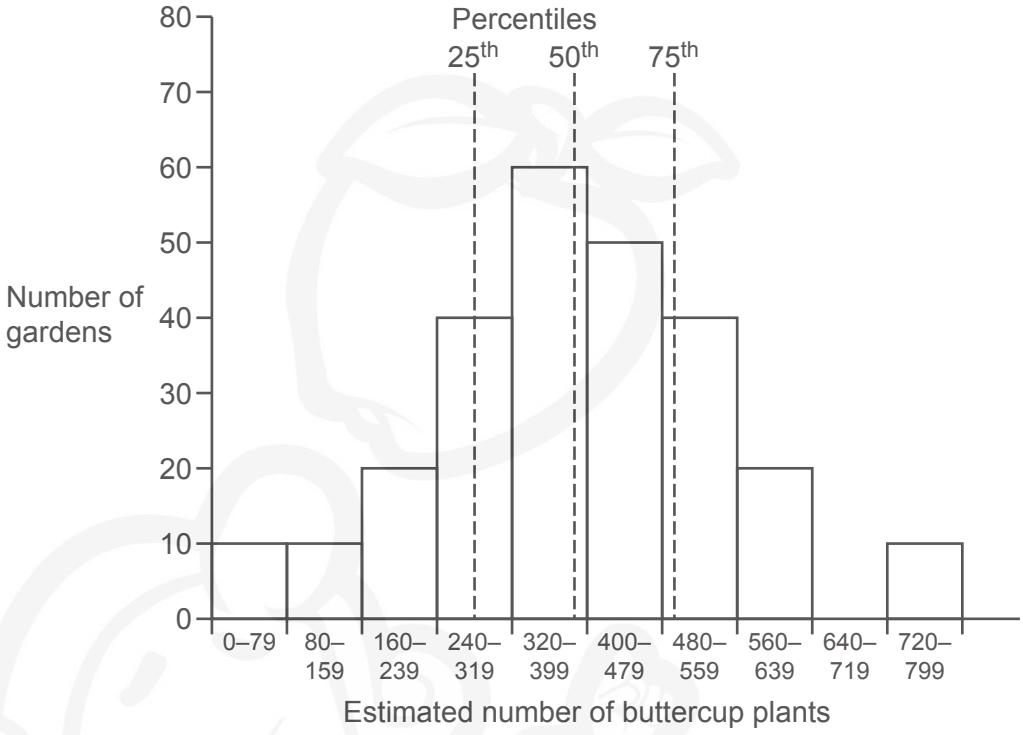
Draw lines to connect each factor with the correct explanation of its effect on buttercup plants.

| **Factor** | **Explanation of its effect on buttercup plants** |
|---|---|
| Shade from trees | Less sunlight is available for photosynthesis |
| Waterlogged soil | Fewer leaves to absorb light |
| More slugs to eat plants | Less oxygen is available for respiration in root cells |

**[2]**

**(c)** A group of students plot the estimated number of buttercup plants in their gardens.

The graph shows the students' results.




**(i)** How many gardens are sampled to produce the graph?

..... **[1]**

**(ii)** Kai estimates that he has 450 buttercup plants in his garden.

Which percentile of the students' data does Kai's estimation lie below?

Put a (ring) around the correct answer.

**25th** **50th** **75th** **[1]**

**2** **(a)** Sea water is a solution of salts in water.

James has three sets of equipment. They are shown in **Fig. 2.1**.

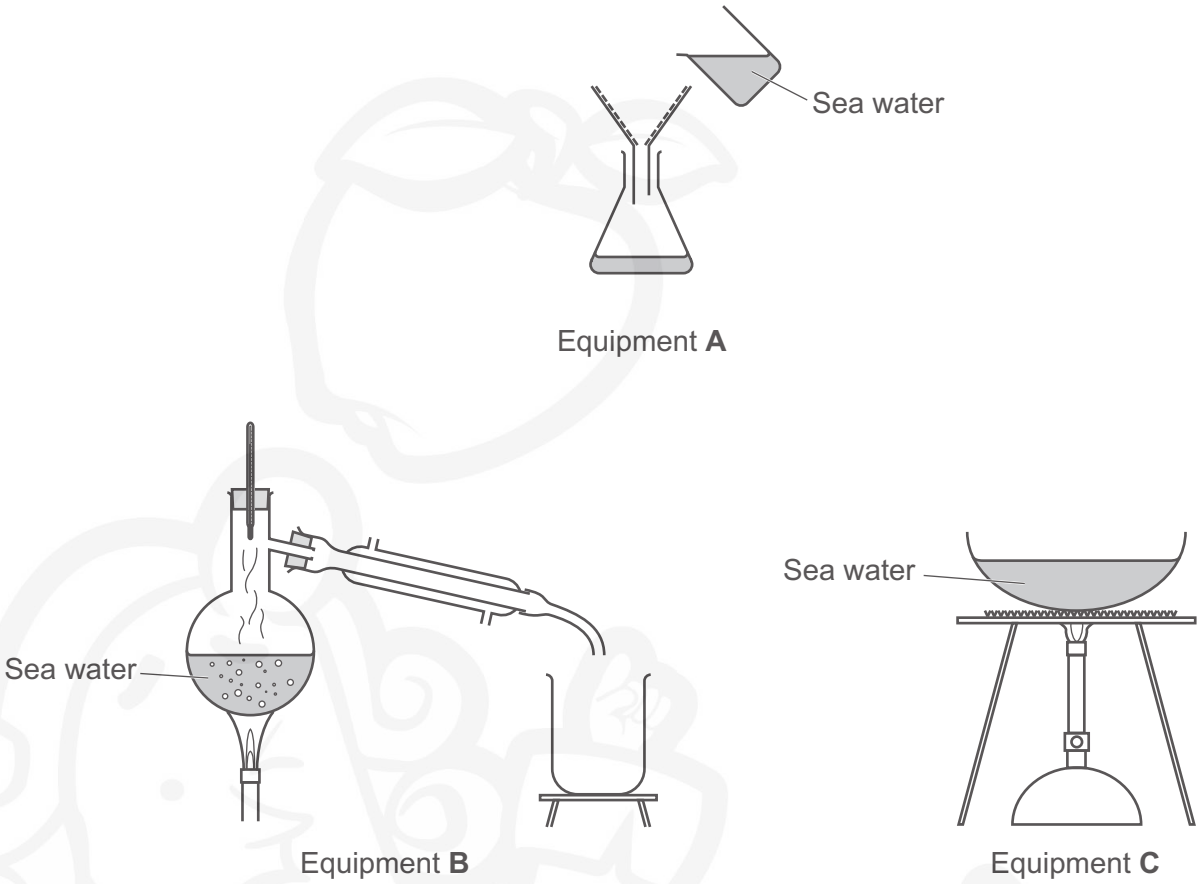



**Fig. 2.1**

Explain which set of equipment James should use to separate and collect **water** from sea water.

Include in your answer why the other sets of equipment are unsuitable.

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..... **[3]**

**(b)** Crude oil is a mixture of hydrocarbons. The mixture can be separated into fractions.

The table shows the number of carbon atoms in the hydrocarbon chains of three fractions of crude oil.

| Fraction | Number of carbon atoms in hydrocarbon chains |
|---|---|
| Diesel oil | 16–20 |
| Kerosene | 10–16 |
| Petrol | 5–8 |

Fractional distillation is used to separate the different fractions of crude oil.

**(i)** Complete **Fig. 2.2** to show where the three fractions **diesel oil**, **kerosene** and **petrol** would be collected in the fractionating tower.

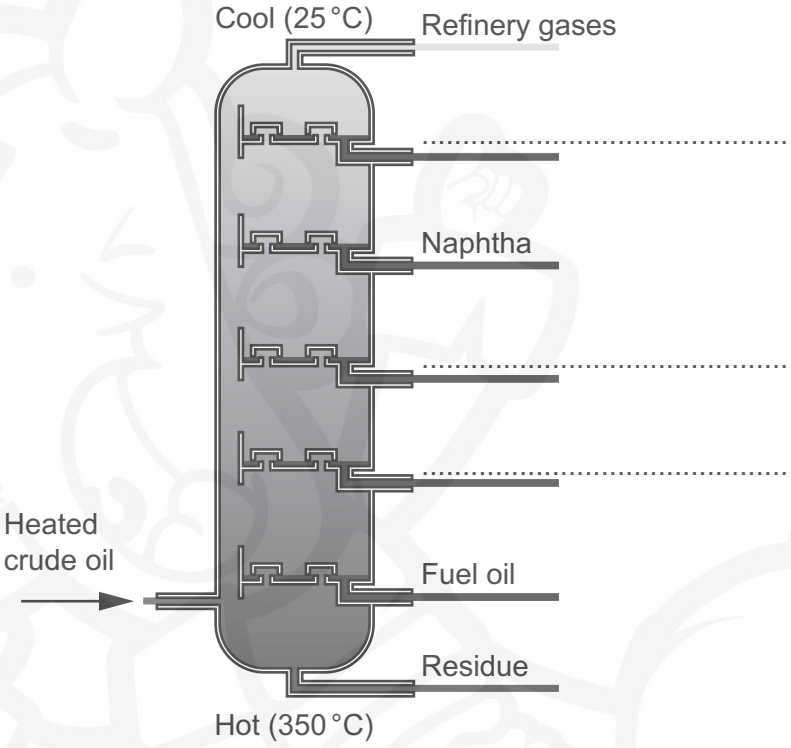


**Fig. 2.2** **[2]**

**(ii)** Explain why naphtha is collected above fuel oil in the fractionating tower.

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..... **[2]**

**3** **(a)** **(i)** Complete the sentences about typical speeds.

Put a (ring) around the correct answers.

The typical speed for walking is **0.5 m/s** / **1.5 m/s** / **8 m/s**.

The typical speed for cycling is **7 m/s** / **20 m/s** / **35 m/s**.

The typical speed for a car is **9 km/h** / **90 km/h** / **150 km/h**.

**[3]**

**(ii)** Sarah cycles 20 km to work each day.

It takes her 49 minutes and 45 seconds to get to work.

Calculate Sarah's average speed, in **m/s**.

Average speed = ..... m/s **[4]**

**(iii)** Sarah and her bike have a combined mass of 60 kg.

Calculate Sarah's momentum when she is cycling downhill at 12 m/s.

Momentum = ..... kg m/s **[2]**

**(b)** Large decelerations when cycling can be dangerous. Sarah decides to wear a bike helmet.

Complete each sentence about how a bike helmet can reduce head injuries in a collision.

Use the words.

You can use each word once, more than once, or not at all.

**decreases** **distance** **duration** **force** **increases** **mass** **speed**

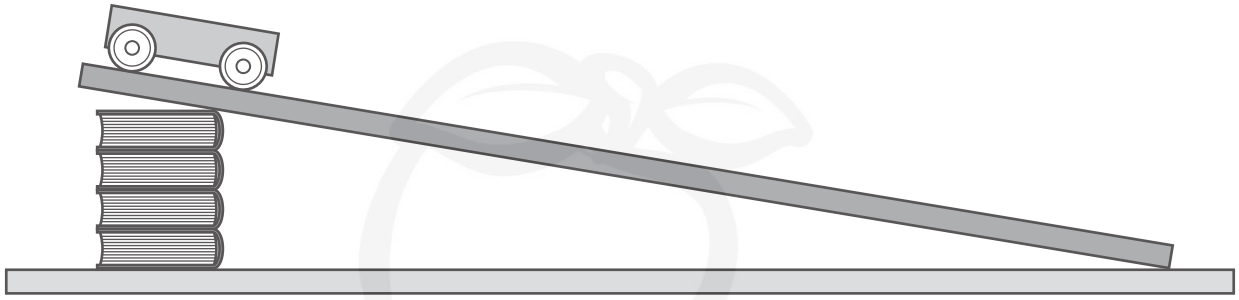
The cycle helmet ..... the ..... of the impact.

This reduces the ..... on the cyclist's head and helps to prevent head injuries.

**[3]**

**(c)** Sarah is using the equipment in the diagram to investigate how the speed of a trolley is affected by the gradient of the ramp.

She measures the time it takes for the trolley to travel a certain distance, using a stopwatch.



How can Sarah improve her investigation to get more accurate **and** precise values for the speed down the ramp?

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..... **[3]**

**4** In some countries, scientists regularly collect data on blood cholesterol levels for men and women.

Some typical data is shown in the table.

| | | Years | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1960–1962 | 1971–1974 | 1976–1980 | 1988–1994 | 1999–2002 | 2007–2010 |
| **Mean blood cholesterol level (mg/dL)** | **Men** | 220 | 215 | 213 | 204 | 202 | 194 |
| | **Women** | 225 | 217 | 216 | 207 | 204 | 198 |

**(a) (i)** Give **two** conclusions that can be made from the data in the table.

1 .....

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2 .....

..... **[2]**

**(ii)** Suggest what scientists should do to ensure that any conclusion they make is representative of the whole population of a country.

.....

..... **[1]**

**(iii)** Calculate the percentage change in mean blood cholesterol level for **men** between 1960–1962 and 2007–2010.

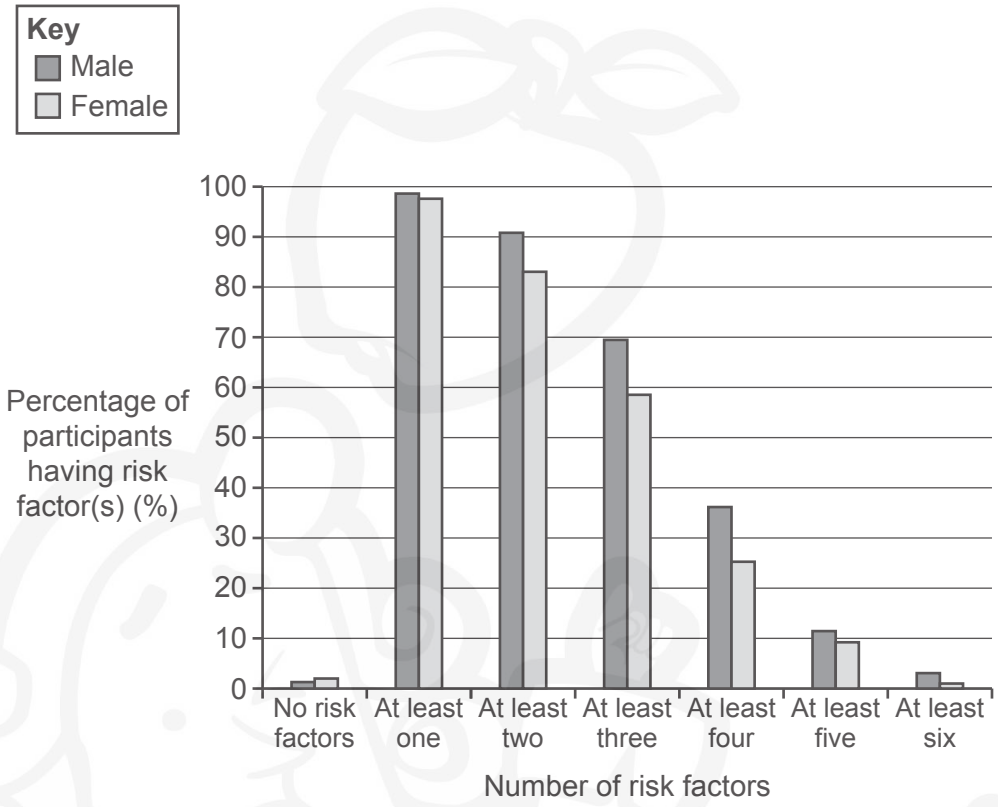
Give your answer to **2** significant figures.

Use the equation: percentage change = $\frac{\text{difference}}{\text{original}} \times 100\%$

Percentage change = ..... % **[3]**

**(b)** High blood cholesterol has been identified as one risk factor for developing cardiovascular disease.

Scientists conducted a study on a sample of men and women who had cardiovascular disease, to see how many risk factors they had. The data is shown in the graph.




**(i)** Give **two** conclusions that can be made from the data shown in the graph.

1 .....

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2 .....

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**[2]**

**(ii)** Suggest **one** way in which an individual could lower their risk of developing cardiovascular disease.

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..... **[1]**

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**5** Group 1 elements react with Group 7 elements.

**(a)** Complete the sentences to explain how the reaction between potassium and bromine is related to their electron arrangements.

Use the words and numbers.

You can use each word and each number once, more than once, or not at all.

**–1 –2 +1 +2 atom electron ions**

**isotopes neutron one proton two**

Potassium loses one ..... from the outer shell of its atoms to form

..... with a charge of ..... Bromine gains one

..... to fill the outer shell of its atoms to form ..... with a charge of

..... .

**[3]**

**(b)** Give **one** property of Group 1 elements and **one** property of Group 7 elements.

Property of Group 1 elements .....

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Property of Group 7 elements .....

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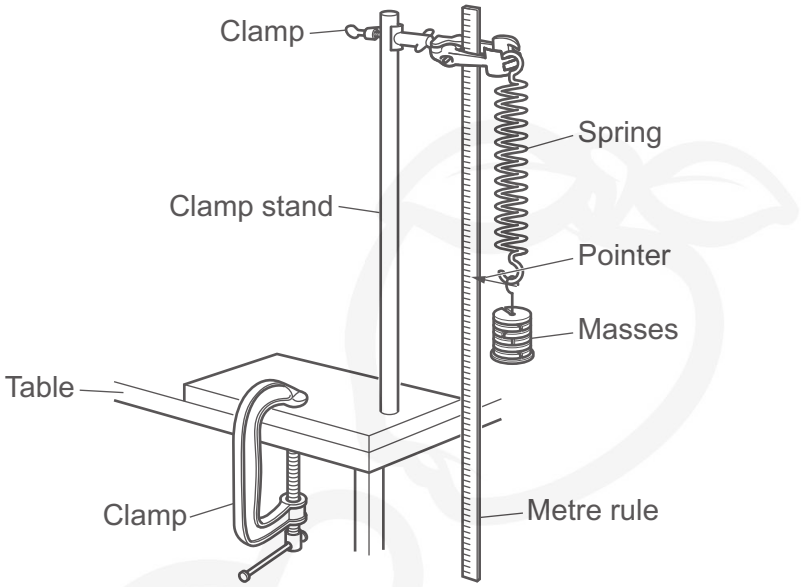
**[2]**

**6** Ling is investigating the extension of a spring with different forces, using the equipment shown in the diagram.




**(a)** Describe how Ling can use the equipment in the diagram to produce **accurate** results.

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..... **[4]**

**(b)** When a 0.02 kg mass is attached to the spring, the spring extends by 50 mm.

Calculate the spring constant.

Use the equation: weight = mass × gravitational field strength

Gravitational field strength = 10 N / kg.

Give your answer in **N / m**.

Spring constant = ..... N / m **[4]**

**(c)** When a 20 g mass is removed, the spring returns to its original length.

Suggest why the spring does **not** return to its original length when a mass of 30 g is used.

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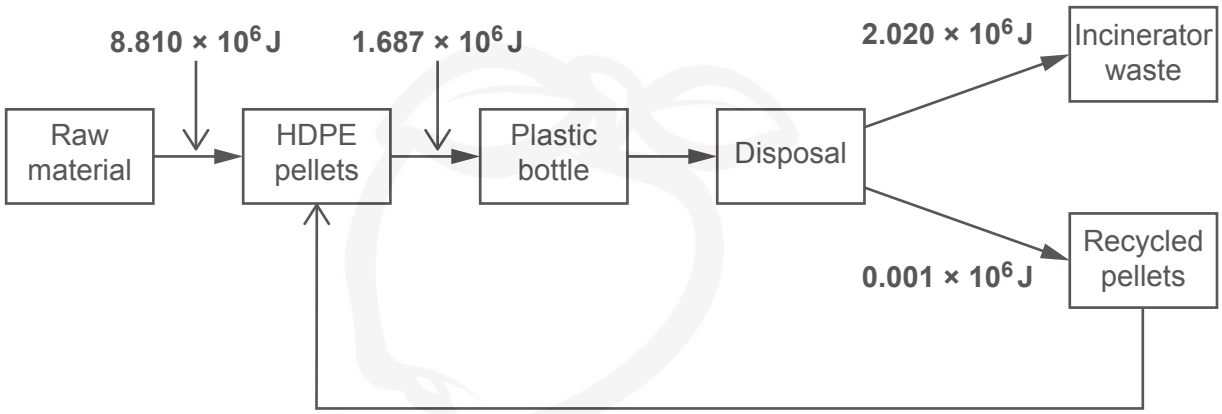
..... **[3]**

**7*** Beth is looking at a life-cycle assessment diagram for a plastic bottle made from the polymer HDPE.

The energy used in the life-cycle of one plastic bottle is shown in the diagram.




Explain the factors that should be considered when deciding if plastic bottles should be made from raw materials or from recycled pellets.

Use calculations to support your answer.

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..... **[6]**

**8** **(a)** Amaya is investigating the effect of light intensity on the rate of photosynthesis in pondweed.

She uses the equipment in **Fig. 8.1**.

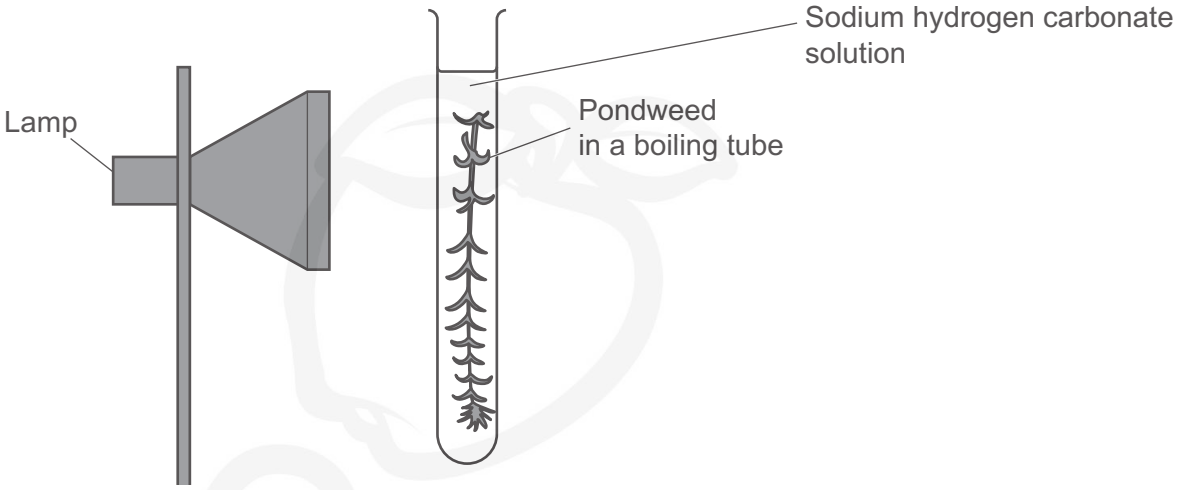



**Fig. 8.1**

**(i)** Identify **two** control variables that are needed to ensure Amaya collects valid data.

1 .....

2 .....

**[2]**

**(ii)** Describe how to change the independent variable in Amaya's investigation.

.....

..... **[1]**

**(b)** Complete the sentence to explain why the rate of photosynthesis changes when the distance from the light source changes.

Use the words.

You can use each word once, more than once or not at all.

**directly** **distance** **speed** **inversely** **root** **square** **sum**

Light intensity is ..... proportional to the ..... of the

..... from the light source. **[2]**

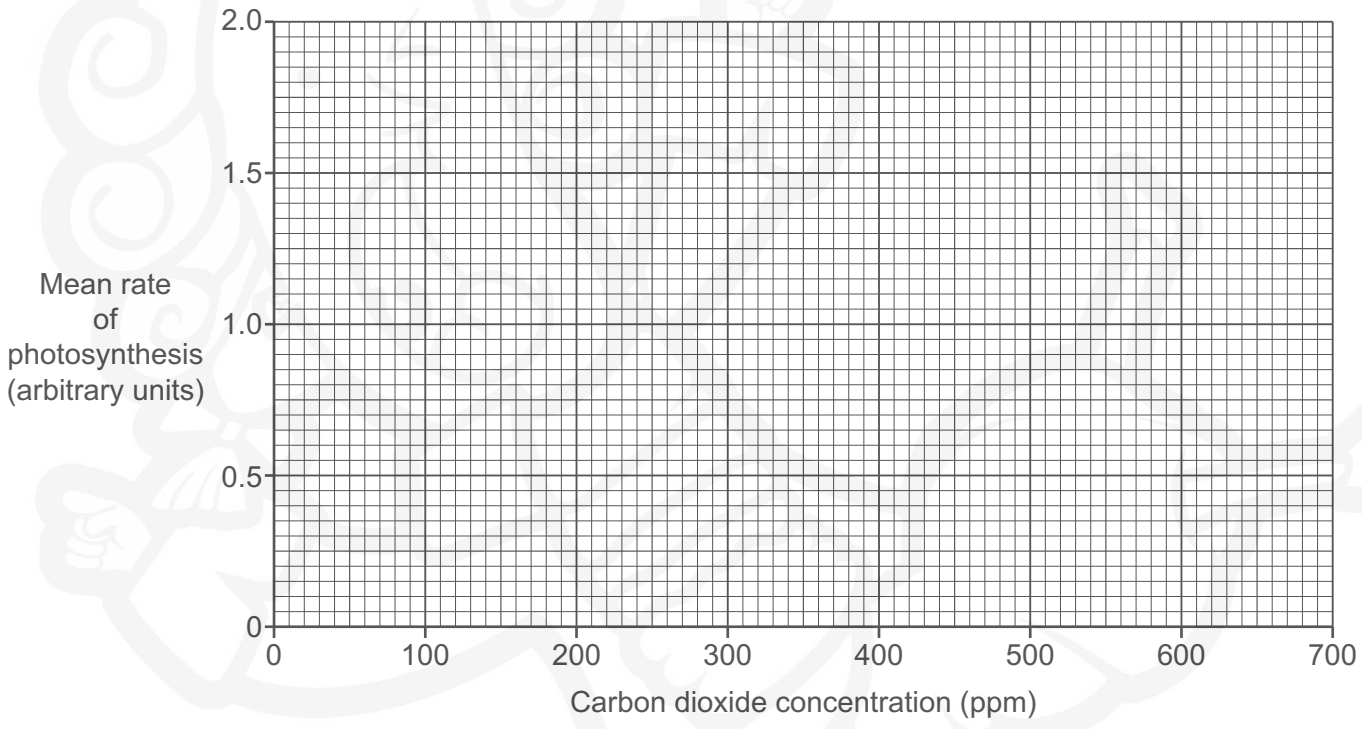
**(c)** In a second experiment Amaya investigates the effect of carbon dioxide concentration on the rate of photosynthesis.

Amaya's results are shown in the table.

PPM = parts per million

| Carbon dioxide concentration (ppm) | Mean rate of photosynthesis (arbitrary units) |
|---|---|
| 200 | 0.5 |
| 300 | 1.0 |
| 400 | 1.2 |
| 500 | 1.4 |
| 600 | 1.6 |
| 700 | 1.6 |

**(i)** Plot Amaya's results on the graph, **and** draw a line of best fit. **[2]**



**(ii)** Explain the pattern shown in the data for a carbon dioxide concentration of **over** 600 ppm.

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..... **[3]**

**(d)** **Fig. 8.2** shows observations that scientists have made of global temperature change over time.

The natural factors band in **Fig. 8.2** shows the estimated contribution of natural factors to global temperature change over time. The size of the band represents uncertainty in the scientists' estimates.

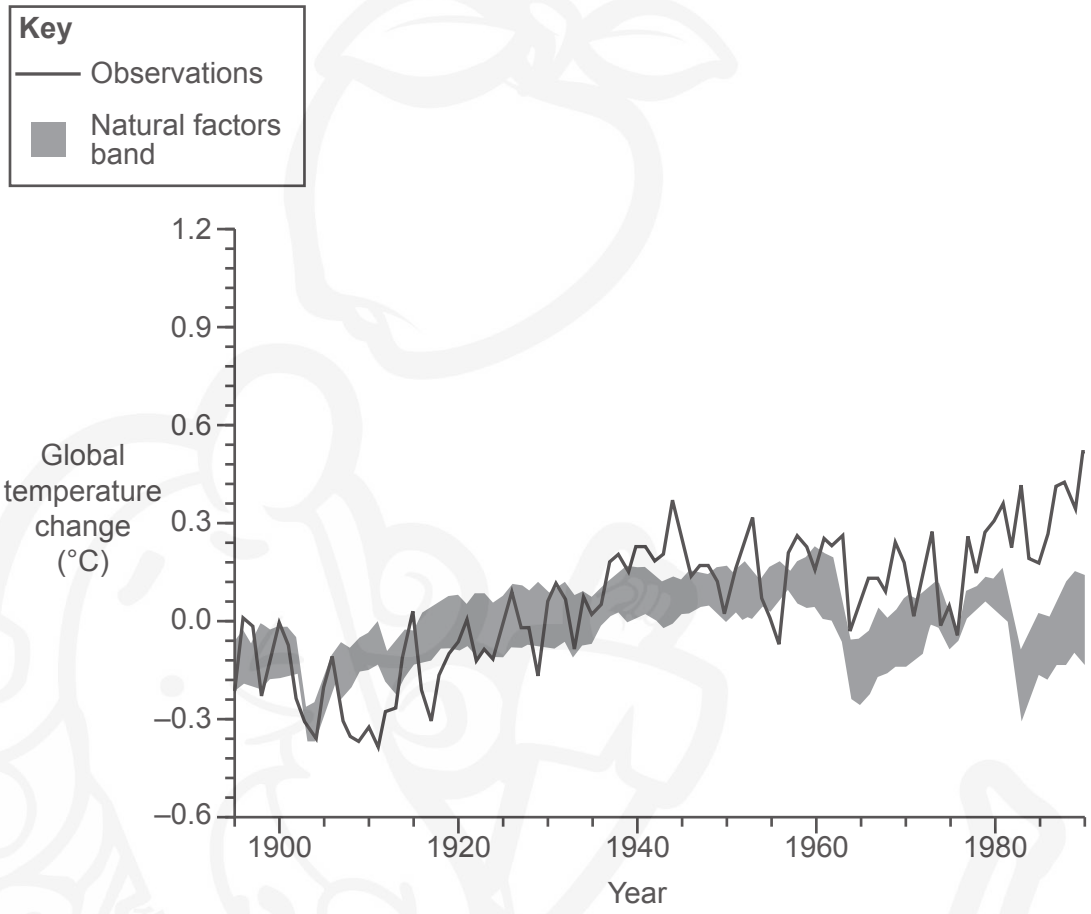


**Fig. 8.2**

**(i)** Give **two** conclusions that can be made about global temperature change over time.

1. .....

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2. .....

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**[2]**

**(ii)** Suggest what **Fig. 8.2** shows about the role of humans in global temperature change over time.

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..... **[2]**

**END OF QUESTION PAPER**

## ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).