Cambridge
O Level

**Cambridge Assessment International Education**
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*4309073099*

**SCIENCE FOR ALL** **5031/03**

Paper 3 **October/November 2019**

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **15** printed pages and **1** blank page.




Cambridge Assessment International Education

**[Turn over**

Answer **all** the questions in the spaces provided.

**The extinction of the dinosaurs**

The dinosaurs were the dominant large animals on Earth from 245 million years ago until 65 million years ago. They then became extinct.

**Triceratops – a dinosaur**

**Fig. 1**

There have been different theories for this. Whatever the cause was, it had to affect the whole of the Earth. Dinosaur fossils from before 65 million years ago have been found all over the world. After this time, no dinosaur fossils have been found anywhere.

One theory for the death of the dinosaurs is that they were killed off by super-volcanoes. Immense eruptions in India about 66 million years ago will have polluted the atmosphere, producing huge clouds of dust. These dust clouds will have blocked off sunlight, and cooled the Earth.

Another theory, which is thought to fit the timing of the extinction of the dinosaurs much better, is that a huge asteroid hit the Earth near Mexico. This collision threw up clouds of dust which spread over the whole of the Earth.

**Avian dinosaurs**

The large extinct animals shown in Fig. 1 are often called 'non-avian dinosaurs' because we now know that descendants of some dinosaurs are still with us. These 'avian dinosaurs' have skeletons which are very similar to dinosaurs like velociraptors. Avian dinosaurs are found everywhere on Earth: they are birds.

**The Mauritius fody and the velociraptor – cousins?**

**Fig. 2**

Use information from the article to help you answer Question 1.

**1** **(a)** For how long were the dinosaurs the dominant large animals on Earth?

.....million years [1]

**(b)** Many species have become extinct over the Earth's history.

**(i)** Explain what the word *extinct* means.

.....

..... [1]

**(ii)** Name one other animal, not a dinosaur, which has become extinct.

..... [1]

**(c)** Most scientists believe that an asteroid killed off the dinosaurs.

Both asteroids and planets move around the Sun.

**(i)** How are asteroids different from planets?

.....

.....

..... [2]

**(ii)** Explain how the changes caused by an asteroid hitting the Earth could have killed off animals all over the world.

.....

.....

.....

.....

..... [3]

**(d)** Birds are now thought to be descendants of some dinosaurs.

Look at **Fig. 2**. Write down one way in which the Mauritius fody is similar to the velociraptor and one way in which it is different.

similarity .....

.....

difference .....

..... [2]

[Total: 10]

## Mauritius introduces meningitis vaccine

In 2016, a new vaccine became available in Mauritius. The vaccine contains 'dead' inactivated bacteria and provides immunity to children against several diseases, including the most common type of meningitis (bacterial meningitis). Meningitis can be a serious disease because if it is not treated quickly it can lead to blood poisoning which can lead to brain damage or even death.

### Symptoms of meningitis

Meningitis is most common in babies and children. Symptoms include:

- headache
- raised body temperature
- feeling sick
- sleepiness
- stiff neck
- a rash.

However, not all people show all symptoms. Doctors find it difficult to be sure that a baby has meningitis rather than a less serious disease. There are many cases worldwide where treatment has started too late to save a patient from brain damage or death.

### How is meningitis passed between people?

Like many infectious diseases, meningitis can be passed from one person to another by direct or indirect contact. Luckily, people have natural defences to stop pathogens such as the meningitis bacteria from entering the body.

The table shows some examples of how meningitis can be passed between people.

| **methods of passing meningitis between people** | |
|---|---|
| kissing |  |
| sneezing and coughing | |
| sharing cutlery | |
| shaking hands | |

### Other vaccinations

Vaccinations for many other diseases are also offered in Mauritius. Some of these diseases are caused by bacteria and some are caused by viruses.

| **disease** | **type of microorganism** |
|---|---|
| measles | virus |
| mumps | virus |
| rubella (German measles) | virus |
| TB | bacteria |
| bacterial meningitis | bacteria |

In general, doctors say that vaccinations are far more effective than antibiotics at protecting people from these diseases.

Use information from the article to help you answer Question 2.

**2** **(a)** The article says that infectious diseases are spread by direct and indirect contact.

Explain the difference between 'direct' and 'indirect' contact.

Use examples from the article to support your answer.

.....

.....

.....

..... [3]

**(b)** Give **two** reasons why doctors find it difficult to be sure whether a baby has meningitis or a less serious disease.

.....

.....

.....

..... [2]

**(c)** Explain, in terms of the changes that happen inside the body, how vaccinations lead to immunity.

.....

.....

.....

..... [2]

**(d)** The article lists some diseases for which vaccinations are available.

The article says that doctors think that vaccinations are more effective than antibiotics at protecting people from these diseases.

Suggest **three** reasons why doctors think this.

.....

.....

.....

..... [3]

[Total:10]



**[Turn over**

## Carbon monoxide: the silent killer

Carbon monoxide is a colourless gas with no smell. Worldwide, tens of thousands of people die every year from carbon monoxide poisoning. Danger to health from carbon monoxide depends not only on the concentration of the carbon monoxide in the air, but also on how long a person is exposed to it and the age and health of the person. The data in the table shows the effects of different concentrations of carbon monoxide on a healthy adult.

| exposure / hours | carbon monoxide concentration / ppm | | |
|---|---|---|---|
| | effect on healthy adult | | |
| | some noticeable effects | sickness | danger of death |
| 0.5 | 600 | 1000 | 2000 |
| 1 | 200 | 600 | 1600 |
| 2 | 100 | 300 | 1000 |
| 4 | 50 | 150 | 400 |
| 6 | 25 | 120 | 200 |
| 8 | 25 | 100 | 150 |

### How does carbon monoxide form?

Carbon monoxide forms when carbon-based fuels, such as methane, burn. Heaters and boilers which burn methane must have an air inlet pipe to make sure enough oxygen is available for complete combustion.

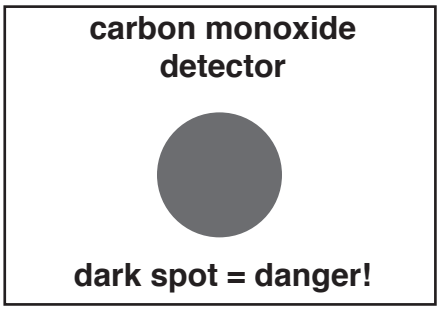
The equations show how methane burns in different amounts of oxygen.

**Equation 1** $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

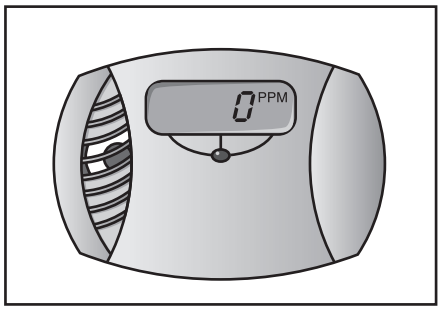
**Equation 2** $2CH_4 + 3O_2 \rightarrow 2CO + 4H_2O$

### Detecting carbon monoxide

Carbon monoxide detectors have been available for many years. The earliest detectors were chemical detectors. They were a card with a large coloured spot. The spot contained a chemical gel which changed colour as it reacted with carbon monoxide. More recent electronic detectors show the concentration of carbon monoxide in the air and can be set to give a loud alarm when it goes above a set level.




**A chemical carbon monoxide detector**




**An electronic carbon monoxide detector**

Use information from the article to help you answer Question 3.

**3** **(a)** The recommended safe maximum concentration for carbon monoxide in an office is 25 ppm.

**(i)** Use data from the article to explain why this concentration is chosen for the office.

.....

..... [1]

**(ii)** Household carbon monoxide detectors are usually set to detect carbon monoxide concentrations of less than 10 ppm.

Suggest reasons why household detectors are set at a much lower level than those in the office.

.....

.....

..... [2]

**(b)** Eva works in a car garage.

If the garage is not properly ventilated the concentration of carbon monoxide in the air can reach 300 ppm.

Use data from the table to explain how this concentration of carbon monoxide would affect Eva over time.

.....

.....

.....

..... [2]

**(c)** Look at the equations to show what happens when methane burns.

**(i)** The ratio of methane to oxygen in **equation 1** is 1 : 2.

What is the ratio of methane to oxygen in **equation 2**?

Put a (ring) around the correct answer.

**3 : 2** **1 : 1.5** **1 : 2** **1 : 3** [1]

**(ii)** Use the equations to explain why a blocked air inlet pipe causes carbon monoxide to form.

.....

..... [2]

**(d)** Give **two** advantages of using an electronic detector rather than a chemical detector to detect carbon monoxide.

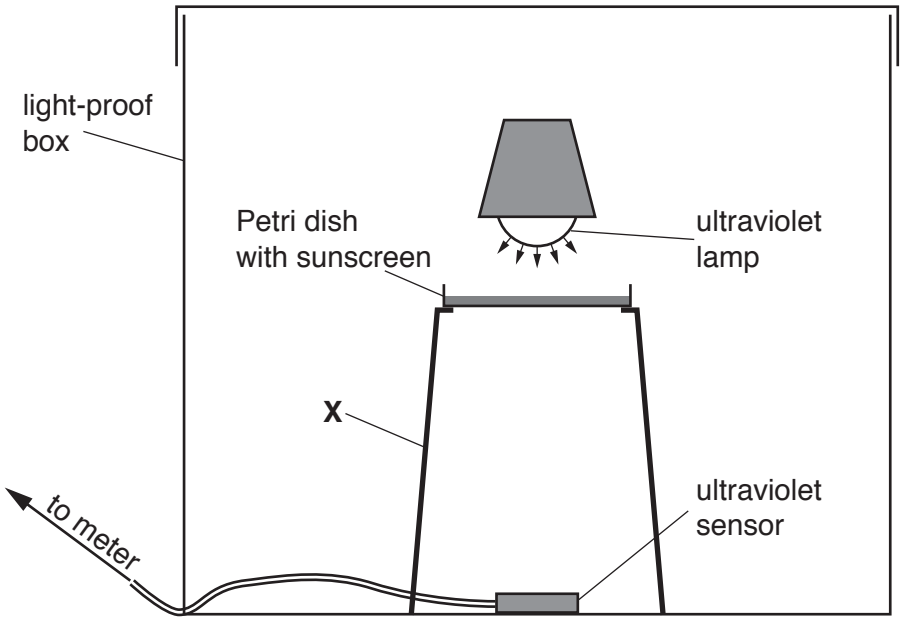
.....

..... [2]

[Total: 10]

**4** Emi investigates two different sunscreens, **A** and **B**, to find out which absorbs most ultraviolet radiation.

She spreads each sunscreen on a Petri dish and measures how much ultraviolet radiation gets through. She uses the apparatus shown.




**(a)** The piece of apparatus labelled **X** is used to hold the Petri dish between the ultraviolet lamp and the ultraviolet sensor.

Name the piece of apparatus labelled **X**.

..... [1]

**(b)** The ultraviolet sensor measures how much ultraviolet radiation gets through the Petri dish and sunscreen.

The experiment is set up in a light-proof box.

**(i)** Give one reason, related to **safety**, for using a light-proof box.

.....

..... [1]

**(ii)** Give one reason, related to getting **reliable results**, for using a light-proof box.

.....

..... [1]

**(c)** Emi spreads each dish with sunscreen at the start of each experiment.

Describe how Emi should do this to get reliable and accurate results.

.....

.....

..... [2]

**(d)** Emi's teacher says that she should also use an empty Petri dish as a *control*.

Explain what this means and why it will improve the experiments.

.....

.....

..... [2]

**(e)** Emi repeats each measurement four times.

The table shows the results she obtained and the average values that she calculated.

| | **empty Petri dish** | **Petri dish with sunscreen A** | **Petri dish with sunscreen B** |
|---|---|---|---|
| **ultraviolet meter readings** | 12 | 6 | 10 |
| | 11 | 8 | 10 |
| | 10 | 7 | 11 |
| | 11 | 7 | 9 |
| **averages** | 11 | 7 | 10 |

**(i)** What conclusions can be made from these results?

Give reasons for your answer.

.....

.....

.....

..... [2]

**(ii)** What else should Emi consider when she chooses a sunscreen for use on her skin?

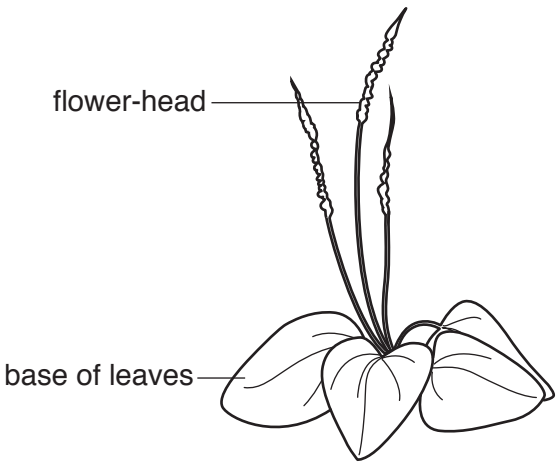
.....

..... [1]

[Total: 10]

**5** Plantains are weeds with small flower-heads.

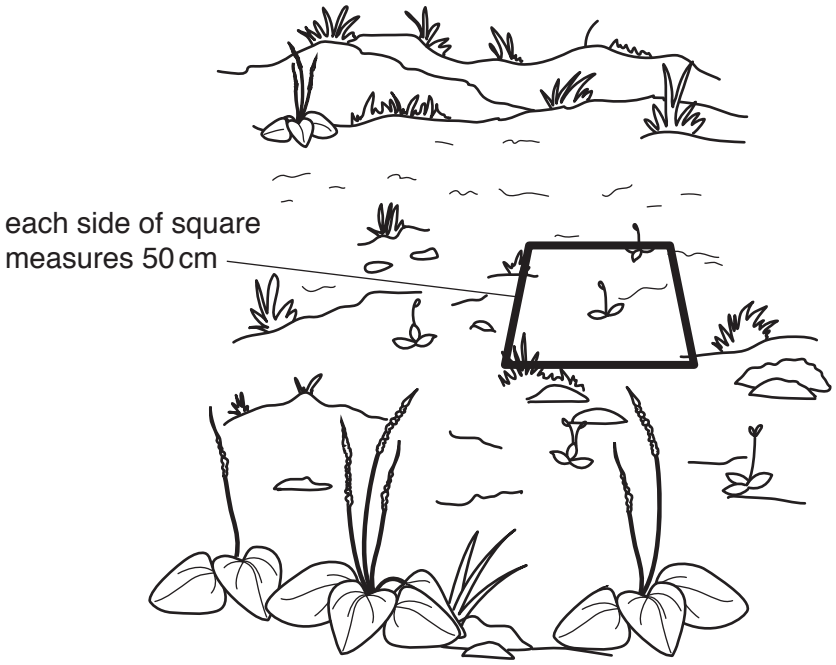
They have a large base of leaves to collect sunlight for photosynthesis.




A student investigates the number of plantains that grow in the grass near the main path in a park.

**(a)** To count the plantains, the student uses a wooden square.

She puts the square in different places on the grass and counts the number of plantains inside.




Explain why this is a good method for counting the number of plantains in different places.

.....

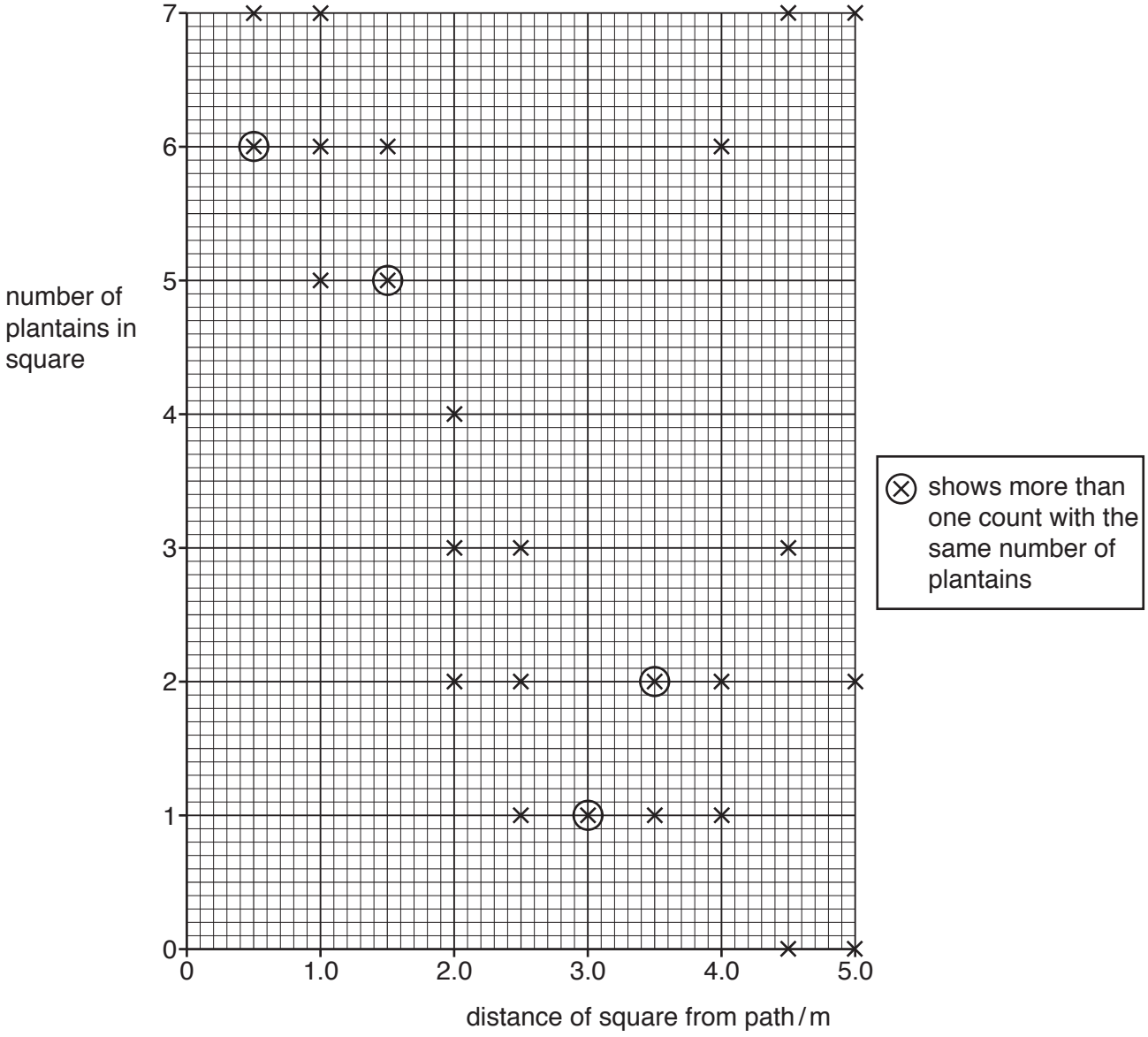
.....

..... [2]

**(b)** The student counts the number of plantains in the square 0.5 m from the main path.
She moves the square to other places 0.5 m from the main path and does a count.

She does other counts at different distances from the main path.
She does the same number of counts at each distance.

The graph shows her results.




**(i)** How many counts did she make at each distance?

..... [1]

**(ii)** Calculate the mean number of plantains 1.5 m from the main path.

Show your working.

..... [1]

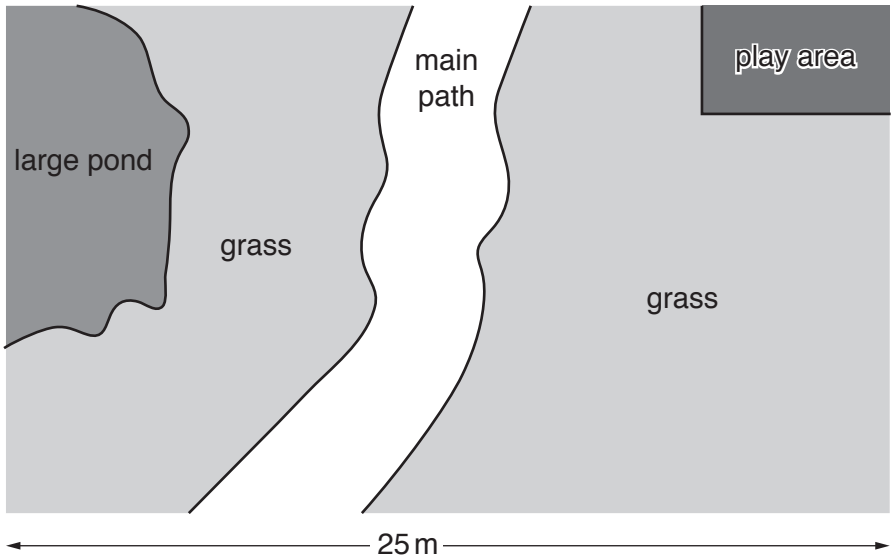
**(iii)** Describe the patterns that the results show.

.....

.....

..... [2]

**(c)** The map shows the area where she takes her samples.




**(i)** Suggest a reason for the large spread of data for the counts taken further from the path.

.....

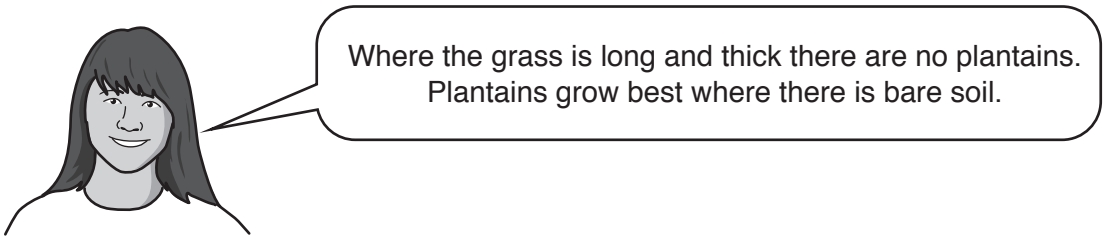
..... [1]

**(ii)** Suggest how she could change her investigation to improve the reliability of her results.

.....

..... [1]

**(d)** The student puts forward an idea to explain her data.




Suggest reasons why the amount of grass affects the population of plantains.

.....

.....

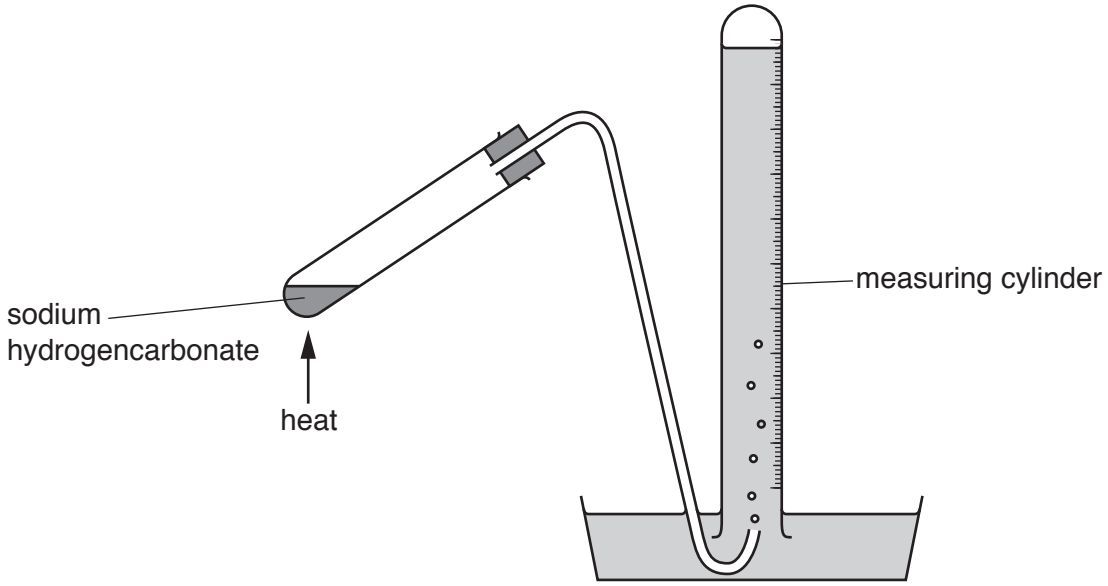
..... [2]

[Total: 10]

**6** Baking soda is used to make cakes rise.
Sodium hydrogencarbonate is the main ingredient in baking soda.
When heated, sodium hydrogencarbonate breaks down to make carbon dioxide gas.

$$\underset{\text{sodium hydrogencarbonate}}{2NaHCO_3} \rightarrow Na_2CO_3 + \underset{\text{carbon dioxide}}{CO_2} + H_2O$$

Bhaka did an experiment.
He measured the time taken to produce 10 $cm^3$ of gas when different masses of sodium hydrogencarbonate were heated.




Bhaka repeated the experiment five times for each mass of sodium hydrogencarbonate.

He recorded the **mean** and **range** of the repeats for each mass in a table.

| **set of repeats** | **mass of sodium hydrogencarbonate heated / g** | **range of time taken to make 10 $cm^3$ gas / s** | **mean of time taken to make 10 $cm^3$ gas / s** |
|---|---|---|---|
| **1** | 0.5 | 23.0–25.0 | 24.5 |
| **2** | 1.0 | 19.5–22.5 | 21.0 |
| **3** | 1.5 | 12.0–19.0 | 13.5 |
| **4** | 2.0 | 11.0–13.0 | 12.1 |
| **5** | 2.5 | 5.5–6.0 | 5.9 |

**(a)** Which two sets of repeats do **not** show a real difference in the time taken to produce 10 $cm^3$ gas?

Give a reason for your choice.

Sets of repeats ..... and .....

Reason .....

..... [2]

**(b) (i)** Which set of repeats is most likely to contain an outlier?

Give a reason for your choice.

Set of repeats .....

Reason .....

..... [2]

**(ii)** Bhaka thinks that he made a mistake so that his outlier was caused by human error.

Give **two** examples of human error that could cause an outlier in this experiment.

.....

.....

..... [2]

**(c)** Bhaka calculates the mean rate of reaction for each set of results in $cm^3/s$.

Calculate the mean rate of reaction when 0.5 g of sodium hydrogencarbonate is heated.

Show your working.

..... $cm^3/s$ [2]

**(d)** Sodium hydrogencarbonate slowly decomposes at room temperature.

This means that 'old' baking soda does not produce gas as quickly as fresh baking soda.

How could Bhaka adapt his experiment to show that this is true?

Include what results he should expect in your answer.

.....

.....

..... [2]

[Total: 10]

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