OCR GCSE GATEWAY CHEMISTRY A · J248

# CHEMISTRY



EXAM QUESTION PACK

## M4 GRAPHS

| SCORE | PERCENTAGE |
| --- | --- |
| /55 | % |

STEMUP

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# Gateway Chemistry A (9-1)

## Maths 4: Graphs

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

**OCR supplied materials:**
Additional resources may be supplied with this paper.

**Other materials required:**
- Pencil
- Ruler (cm/mm)

**Duration:** Not set

| Candidate forename | | Candidate surname | |
|---|---|---|---|

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

## INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

## INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **55**.
- The total number of marks may take into account some 'either/or' question choices.

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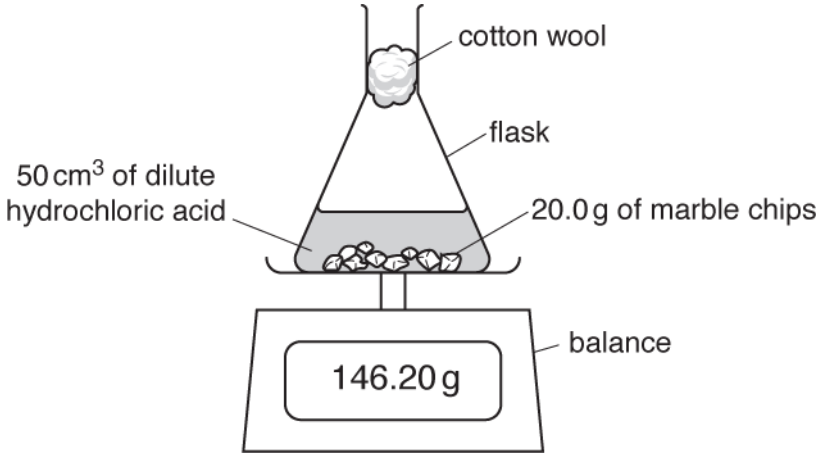
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1 Harry and Ann investigate the reaction between marble chips (calcium carbonate) and hydrochloric acid.

Carbon dioxide is given off during the reaction. Calcium chloride and water are also made.

Harry and Ann use 20.0 g of marble chips and 50 $cm^3$ of dilute hydrochloric acid.
The temperature of the acid is 25 °C.

Look at the diagram. It shows the apparatus they use.




Harry and Ann measure the mass every minute until the reaction stops.

They calculate the total mass of carbon dioxide made.

They do the experiment again. They use the same volume of dilute acid and the same mass of marble.

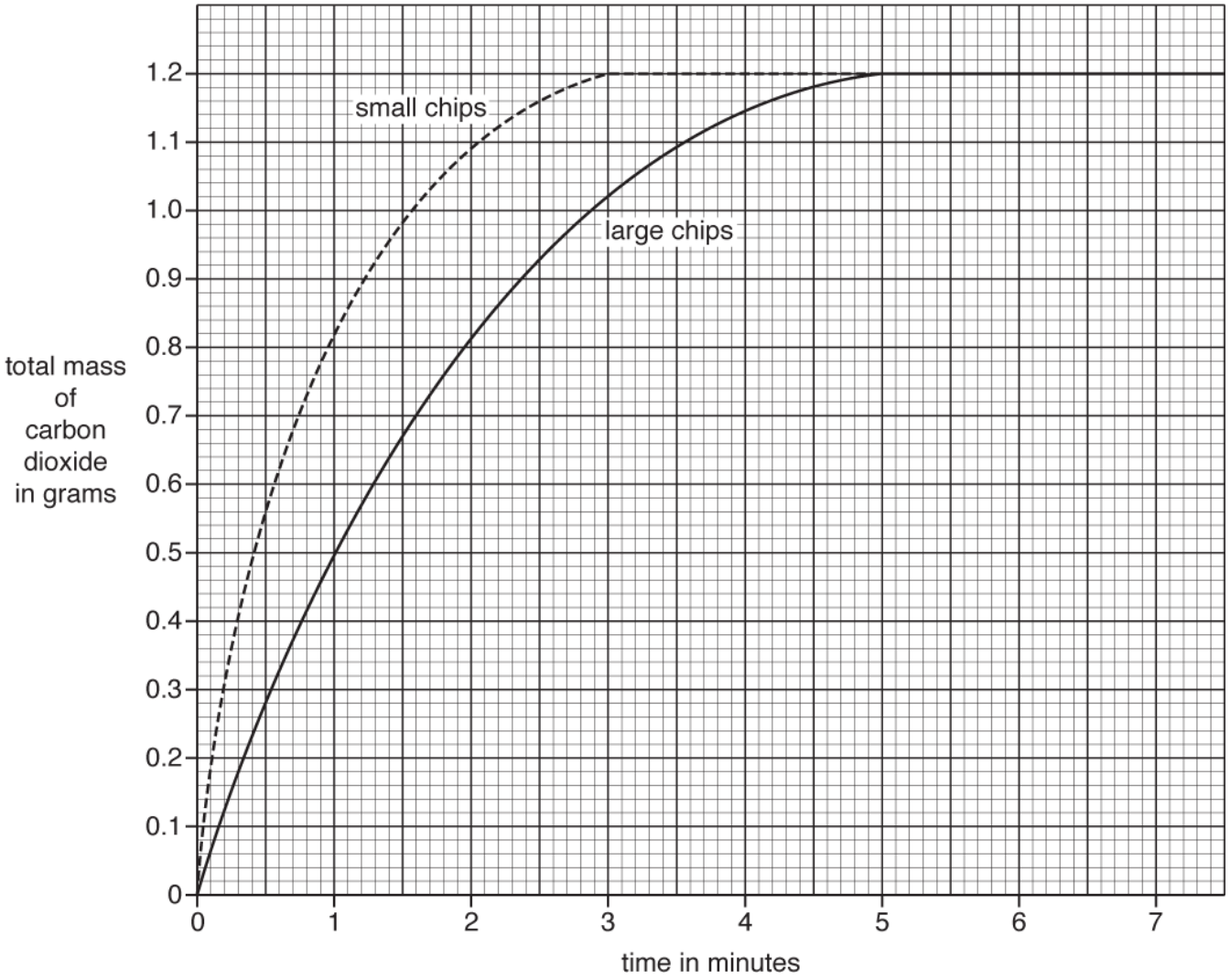
This time they use **smaller** marble chips.

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Look at the graph. It shows their results.




(i) Look at the graph for the **large** marble chips.

What is the total mass of carbon dioxide made after 1 minute?

---------- g

[1]

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(ii) Look at the curve for the **small** marble chips.

How long does it take for the reaction to finish?

---------- minutes

[1]

(iii) The reaction using small marble chips is faster than the reaction using large marble chips.

How can you tell from the **two curves**?

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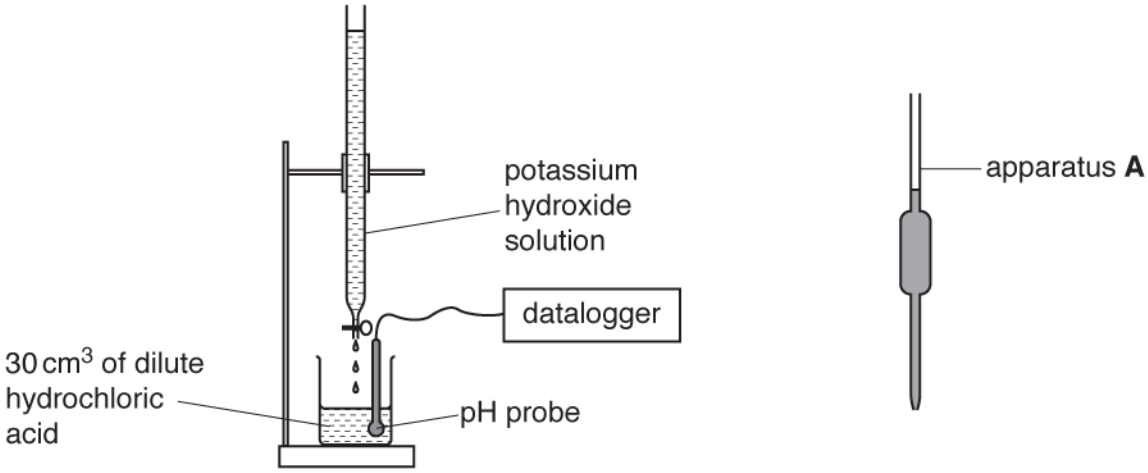
[1]



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2 Sara is neutralising dilute hydrochloric acid with potassium hydroxide solution.

Look at the diagram of the apparatus she uses.



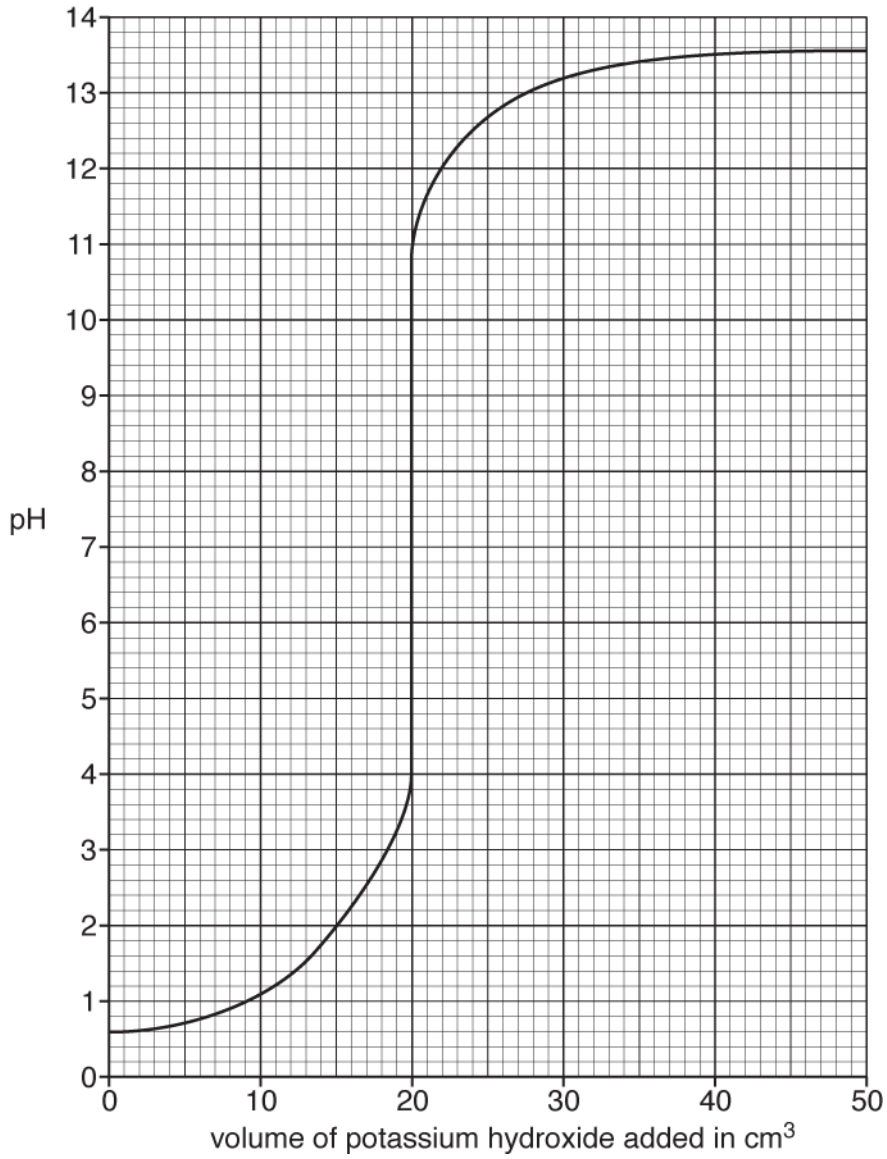

Sara slowly adds 50 $cm^3$ of potassium hydroxide solution to 30 $cm^3$ of dilute hydrochloric acid.

She measures the pH of the solution in the flask as the potassium hydroxide solution is added.

Look at the graph of her results.



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(i) What volume of potassium hydroxide solution must be added to get a pH of 2?

---------- $cm^3$ [1]

(ii) What volume of potassium hydroxide solution is needed to exactly neutralise the hydrochloric acid?

---------- $cm^3$ [1]

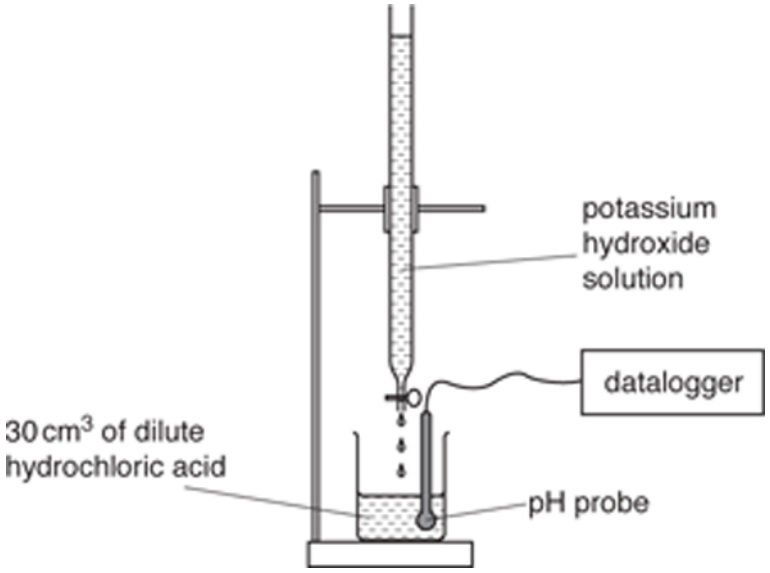
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3(a) Sara is neutralising dilute hydrochloric acid with potassium hydroxide solution.

Look at the diagram of the apparatus she uses.




Sara slowly adds 50 cm$^3$ of potassium hydroxide solution to 30 cm$^3$ of dilute hydrochloric acid.

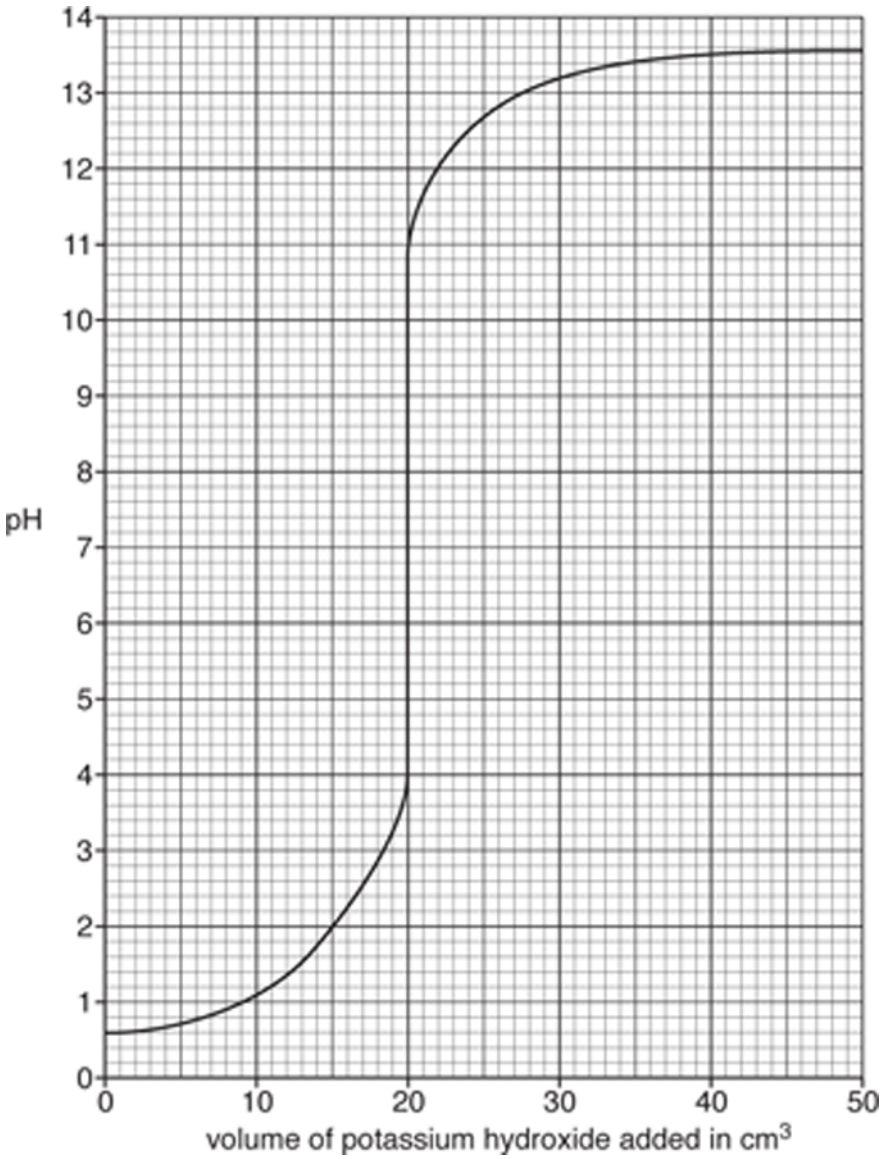
She measures the pH of the solution in the flask as the potassium hydroxide solution is added.

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Look at the graph of her results.




(i) What volume of potassium hydroxide solution must be added to get a pH of 12?

---------- $cm^3$ **[1]**

(ii) What volume of potassium hydroxide solution is needed to exactly neutralise the hydrochloric acid?

---------- $cm^3$ **[1]**

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(b)

(i) The concentration of the hydrochloric acid is 0.30 mol / $dm^3$.

Show that 30 $cm^3$ of this solution contains 0.009 moles of hydrochloric acid.

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[1]

(ii) Look at the equation for the reaction.

$$HCl + KOH \rightarrow KCl + H_2O$$

Use your answers to parts **(a)(ii)** and **(b)(i)** to calculate the concentration of the potassium hydroxide solution.

concentration of potassium hydroxide solution = ---------- mol / $dm^3$ **[2]**

4 Harry and Ann investigate the reaction between marble chips (calcium carbonate) and hydrochloric acid.

Carbon dioxide is given off during the reaction.

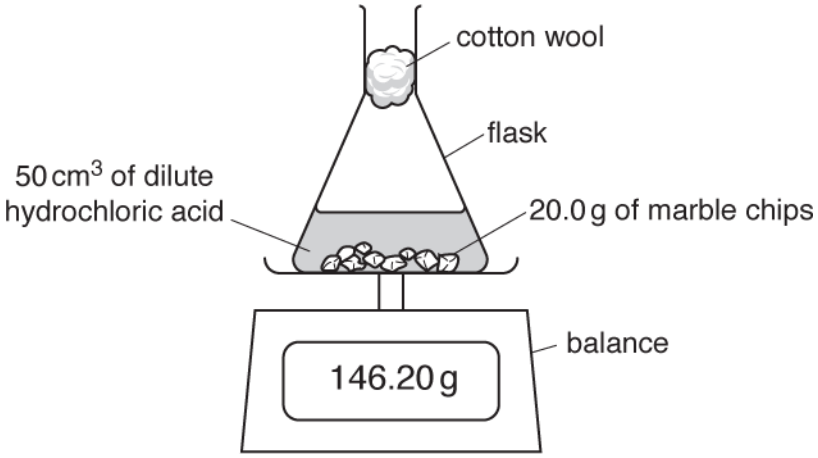
Harry and Ann use 20.0 g of marble chips and 50 $cm^3$ of dilute hydrochloric acid.

The temperature of the acid is 25 °C.



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Look at the diagram. It shows the apparatus they use.




Harry and Ann measure the mass every minute until the reaction stops.

They calculate the total mass of carbon dioxide made.

They do the experiment again. They use the same volume of dilute acid and the same mass of marble.

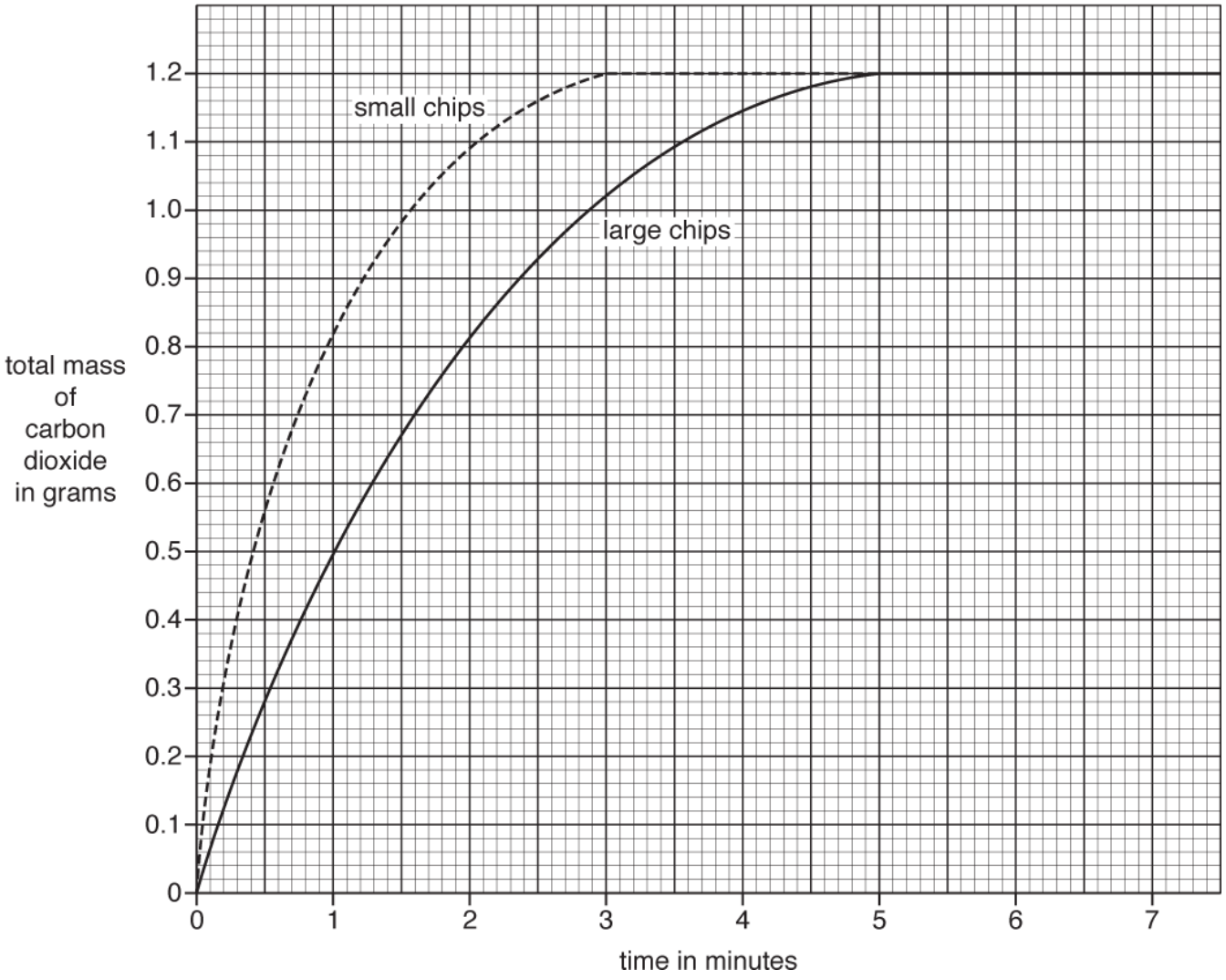
This time they use **smaller** marble chips.

Look at the graph. It shows their results.

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(i) Look at the curve for the **small** marble chips.

How long does it take for the reaction to finish?

---------- minutes [1]

(ii) The reaction using small marble chips is faster than the reaction using large marble chips.

How can you tell from the **two curves**?

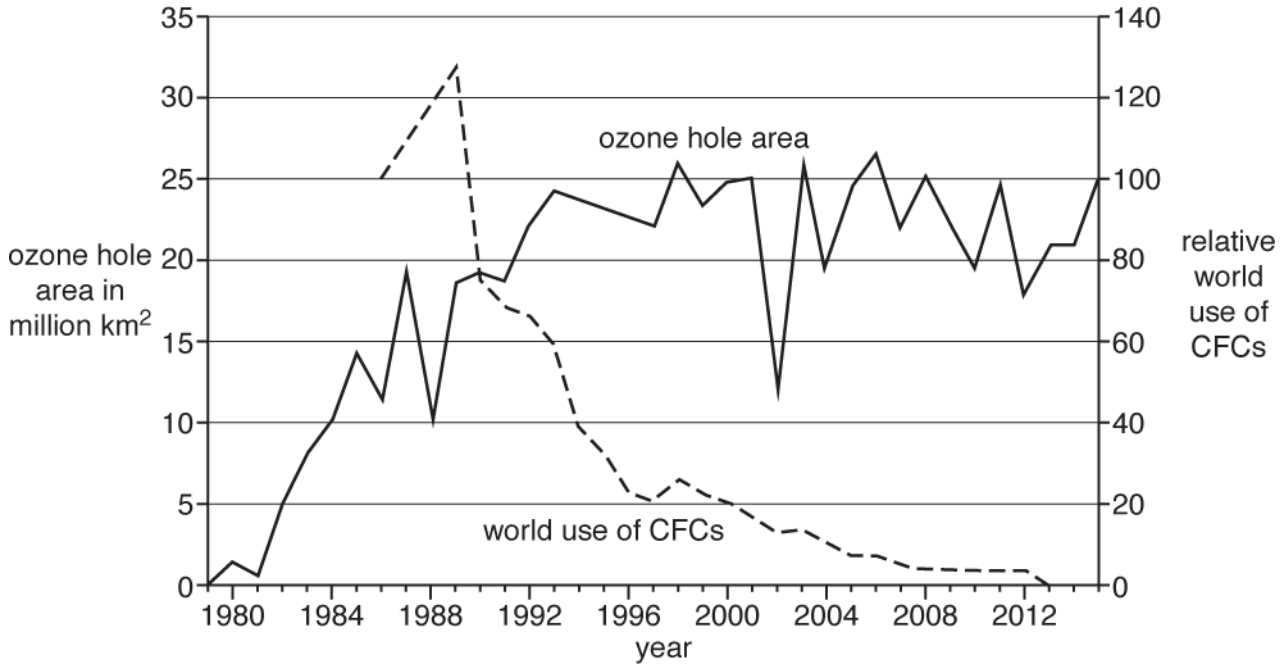
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5 Look at the graph.

It shows how the size of the hole in the ozone layer has changed between 1979 and 2015.
It also shows how the use of CFCs has changed.




Phil and Julie are scientists.

Julie thinks that CFCs will continue to deplete the ozone layer for a long time after they have stopped being used.

Phil thinks that the hole in the ozone layer in 2015 was much smaller than it was in 1989 when the use of CFCs was banned.

Write about whether Julie's opinion and Phil's opinion are correct.

Use information from the graph to help you.

[2]



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6(a) The acidity of sea water is increasing.

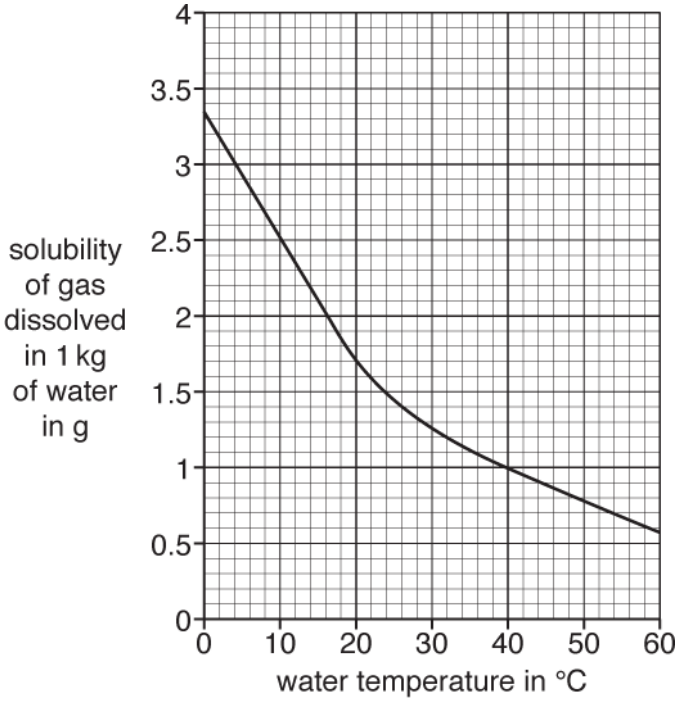
Scientists think that increased levels of carbon dioxide and sulfur dioxide in the air cause this increase.

Both these gases dissolve in water to make acidic solutions.

The solubility of these gases in water changes with temperature.

Look at graph 1.
It shows the solubility of carbon dioxide in water at different temperatures.

**Graph 1 – solubility of carbon dioxide**




(i) At what temperature is the solubility of carbon dioxide 1 g dissolved in 1 kg of water?

answer _____ [1]

(ii) Describe what happens to the solubility of carbon dioxide as the temperature increases.

_____

_____ [1]

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(iii) Julie has 3.0 kg of water at 10 °C.

She predicts she can dissolve 7.5 g of carbon dioxide in this water.

Is she correct?

Explain your answer using information from the graph.

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[2]

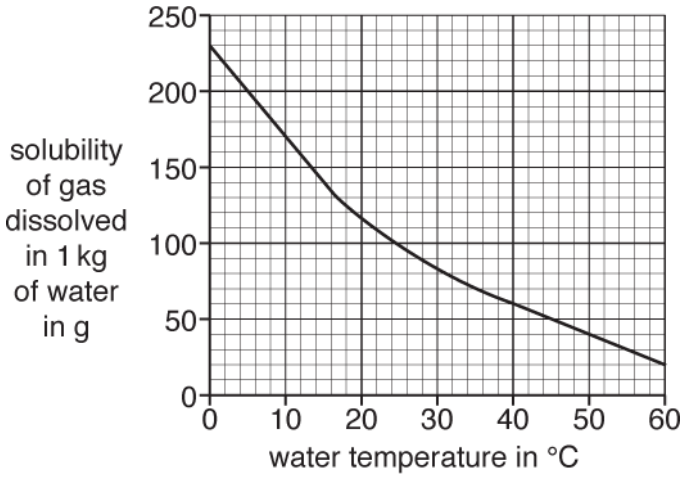


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(b) Look at graph 2.

It shows the solubility of sulfur dioxide in water at different temperatures.

**Graph 2 – solubility of sulfur dioxide**




Sulfur dioxide is **more soluble** in water than carbon dioxide.

Explain how you can tell from graphs **1 and 2**.

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--- [2]

7(a) The acidity of sea water is increasing.

Scientists think that increased levels of carbon dioxide and sulfur dioxide in the air cause this increase.

Both these gases dissolve in water to make acidic solutions.

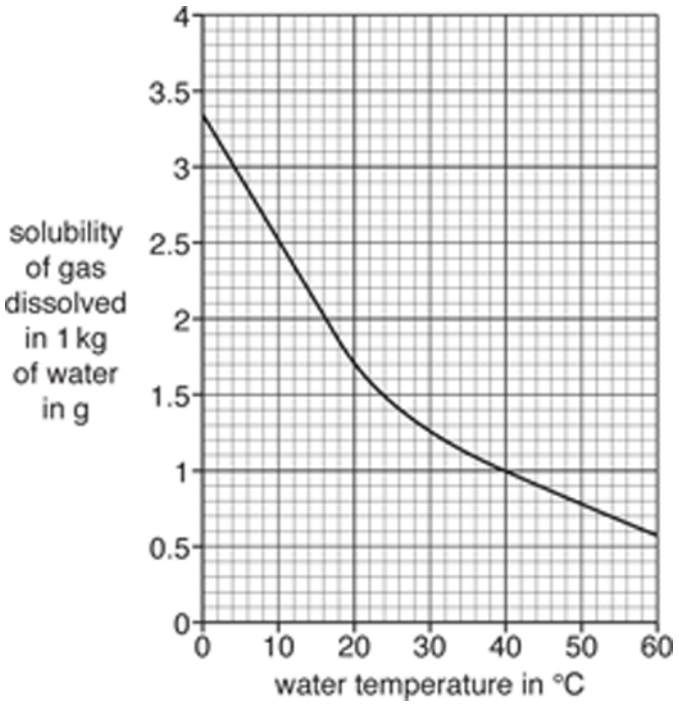
The solubility of these gases in water changes with temperature.

The more gas that dissolves in water the more acidic the solution.

Look at graph 1.

It shows the solubility of carbon dioxide in water at different temperatures.

**Graph 1 – solubility of carbon dioxide**




(i) At what temperature is the solubility of carbon dioxide 1.4 g dissolved in 1 kg of water?

----------°C **[1]**

(ii) Julie has 3.0 kg of water at 10 °C.

She predicts she can dissolve 7.5 g of carbon dioxide in this water.

Is she correct?

Explain your answer using information from the graph.

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[2]

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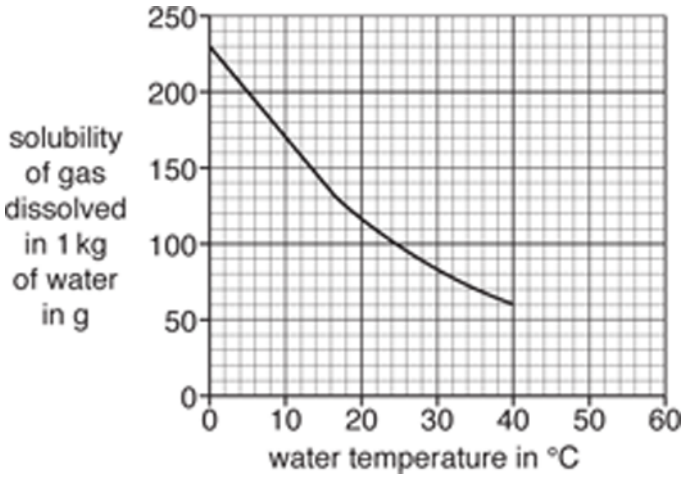
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(b) Look at graph **2**.

It shows the solubility of sulfur dioxide in water at different temperatures.

**Graph 2 – solubility of sulfur dioxide**




(i) Sulfur dioxide is at least fifty times more soluble in water than carbon dioxide.

Explain how you can tell from graphs **1** and **2**.

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**[2]**

(ii) Use the graph to estimate the solubility of sulfur dioxide at 60 °C.

---g of gas dissolved per kg of water **[1]**

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(iii) The Arctic Ocean is very cold.

The Indian Ocean is quite warm.

Suggest why the Arctic Ocean is more acidic than the Indian Ocean.

Use information from graphs **1** and **2**.

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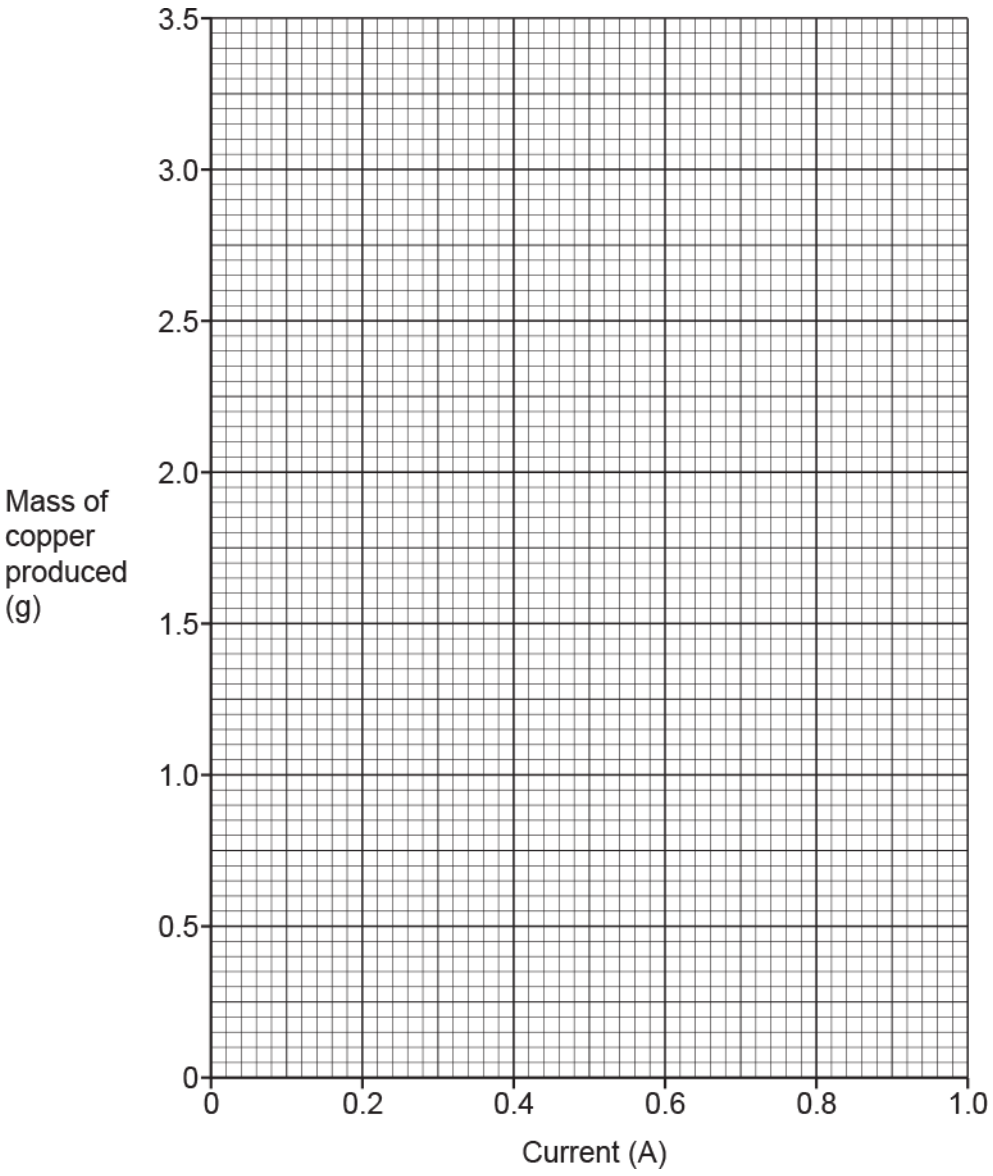
[1]

8 A student investigates the mass of copper made during the electrolysis of aqueous copper chloride.

The student varies the electric current and passes the current for the same time in each experiment. Here is a table of their results.

| Current (A) | Mass of copper produced (g) |
|---|---|
| 0.2 | 0.6 |
| 0.4 | 1.3 |
| 0.6 | 1.8 |
| 0.8 | 2.5 |
| 1.0 | 3.1 |

(i) Plot a graph of the student's results and draw a line of best fit.




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[3]

(ii) Use your graph to **estimate** the current needed to make 2.25 g of copper.

Current = ..... A **[1]**

(iii) Use your graph, and a calculation, to find the mass of copper that would be produced using 15 A.

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

Mass of copper produced = ..... g **[2]**

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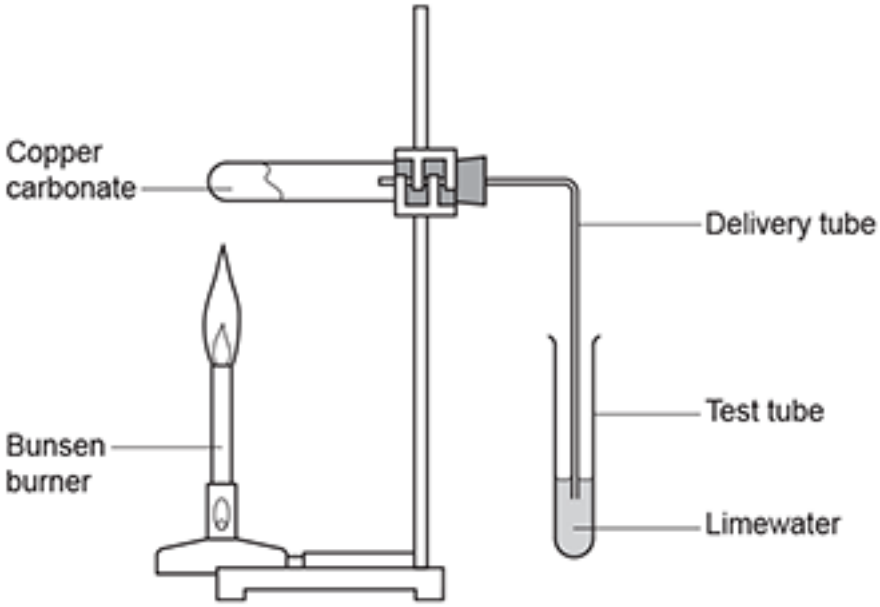
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9 A student investigates the thermal decomposition of copper carbonate.

copper carbonate → copper oxide + carbon dioxide

Here is the set-up of the apparatus she uses.




The student measures the mass of copper carbonate at the start of the experiment. She then measures the mass of copper oxide made.

She does the experiment five times using a different mass of copper carbonate each time.

Look at her results.

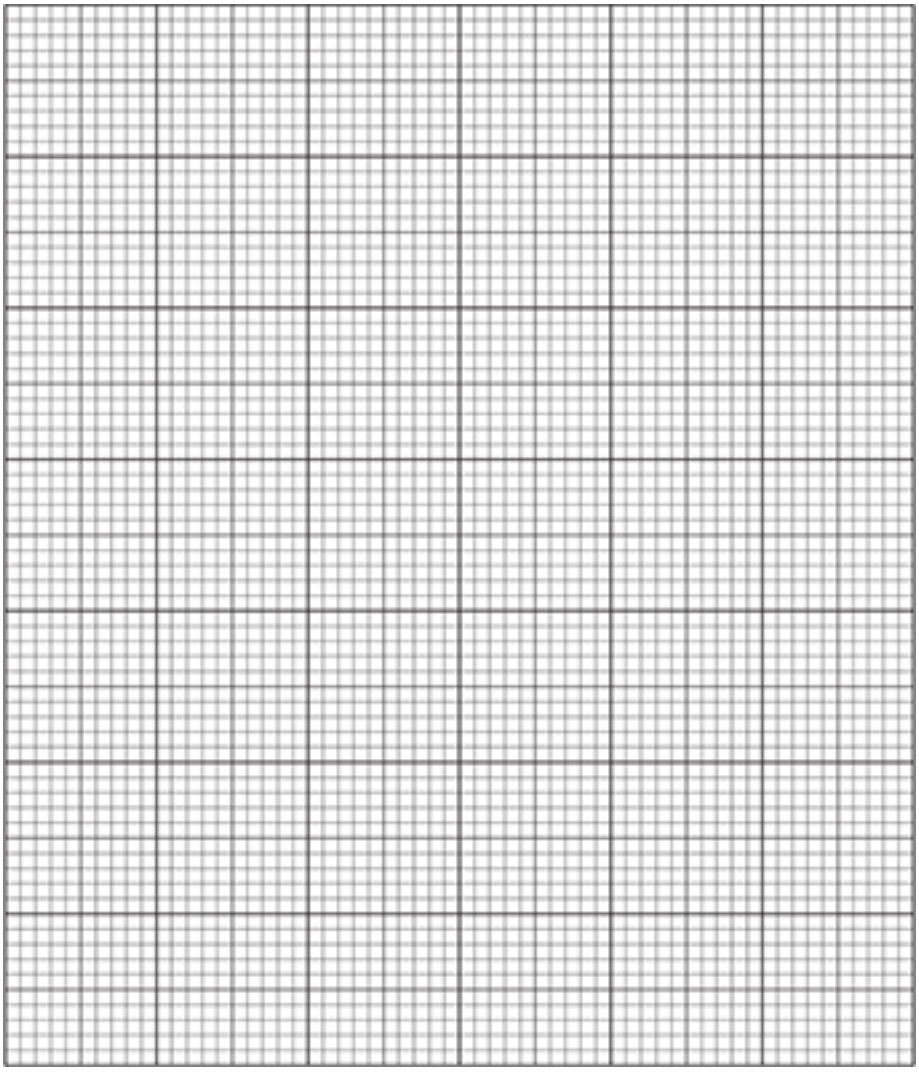
| Mass of copper carbonate (g) | Mass of copper oxide (g) |
|---|---|
| 1.00 | 0.70 |
| 2.00 | 1.35 |
| 3.00 | 1.95 |
| 4.00 | 2.65 |
| 5.00 | 3.30 |

(i) Plot a graph of the student's results and draw a line of best fit.

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**[4]**

(ii) What is the mass of copper carbonate that needs to be heated to produce 2.50 g of copper oxide?

Use your graph in your answer.

Mass of copper carbonate = ..... g **[1]**

(iii) The mass of copper oxide made in the reaction is less than the mass of the copper carbonate heated.

Suggest why.

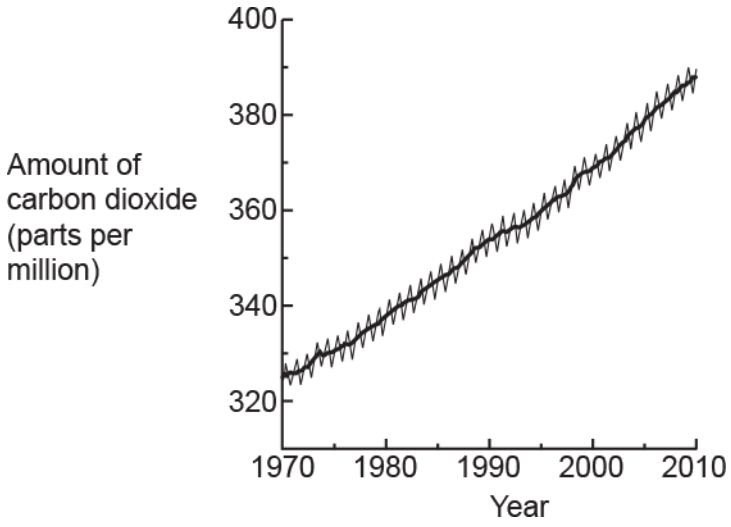
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**[1]**

10 The graph shows the amount of carbon dioxide in the Earth's atmosphere from 1970 to 2010.




Describe the trend in the amount of carbon dioxide in the Earth's atmosphere from 1970 to 2010.

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**[1]**

11 Some students investigate the reaction between sodium thiosulfate and dilute hydrochloric acid.

They want to find out how **temperature** changes the rate of reaction.

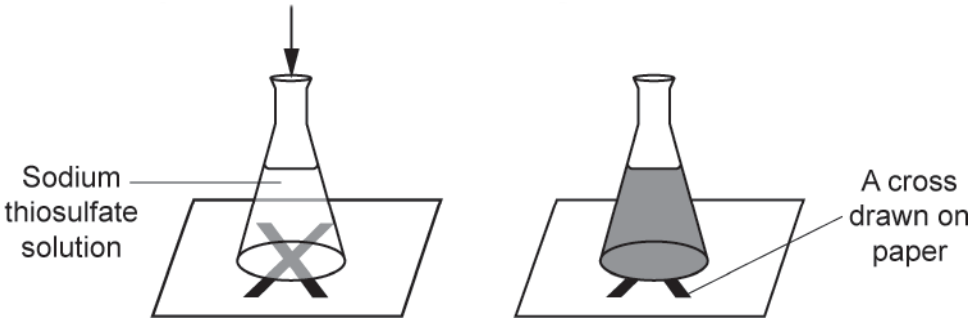
Look at the diagram of their experiment.

Add dilute hydrochloric acid and start timing

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A yellow solid is made during the reaction.

The students time how long it takes for the cross to disappear. This is the reaction time.

Look at their results.

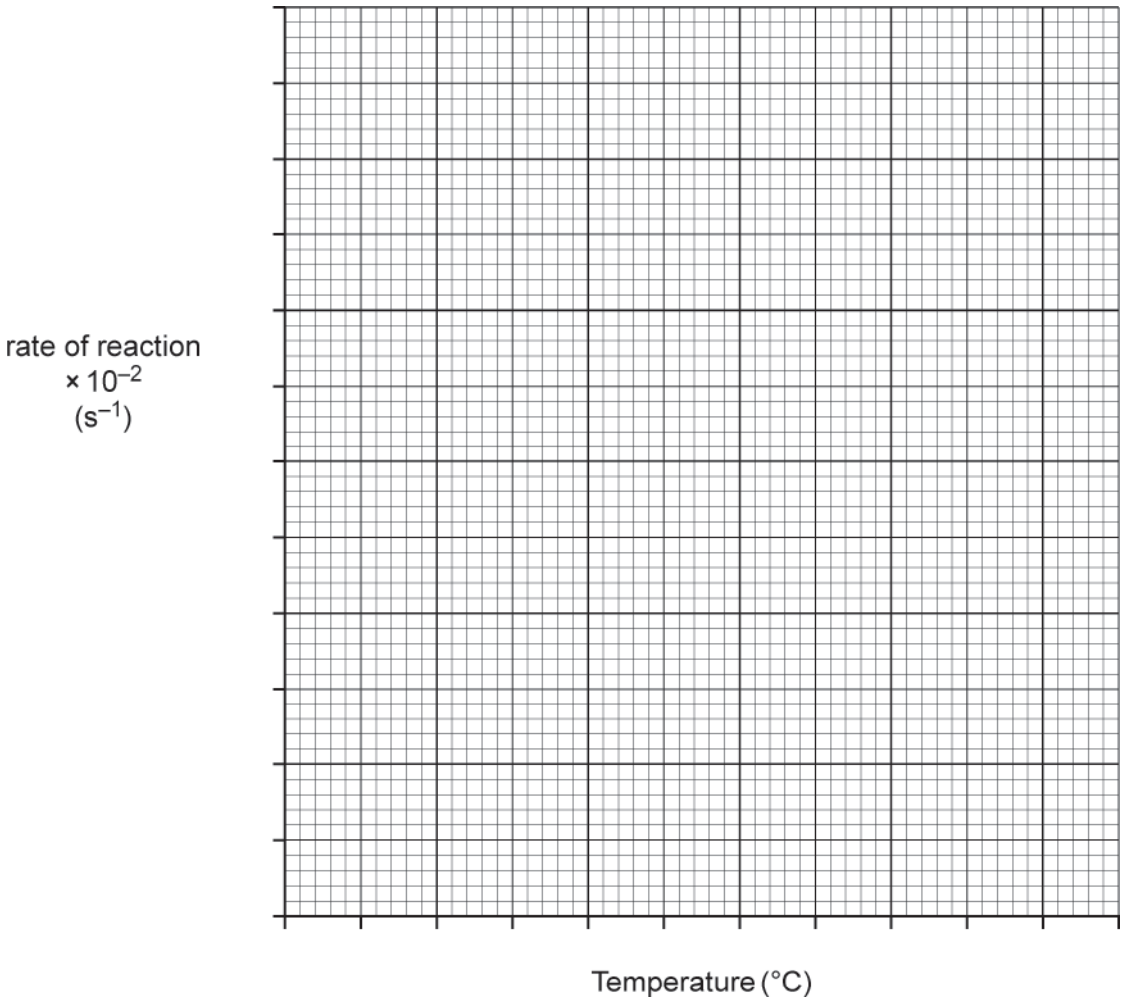
| Temperature (°C) | Reaction time (s) | Rate of reaction ($s^{-1}$) |
|---|---|---|
| 10 | 140 | $7 \times 10^{-3}$ |
| 20 | 56 | $2 \times 10^{-2}$ |
| 30 | 34 | $3 \times 10^{-2}$ |
| 40 | 26 | $4 \times 10^{-2}$ |
| 50 | 22 | $5 \times 10^{-2}$ |

(i) Plot a graph of the results on the grid. Draw a line of best fit.

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[4]

(ii) What happens to the **rate of reaction** as the temperature increases?

[1]

(iii) Explain your answer to **(ii)**.

Use ideas about collisions between particles in your answer.

[3]

12 Some students investigate the reaction between sodium thiosulfate and dilute hydrochloric acid.

They want to find out how **temperature** changes the rate of reaction.

**Fig. 18.3** is a diagram of their experiment.

Add dilute hydrochloric acid and start timing

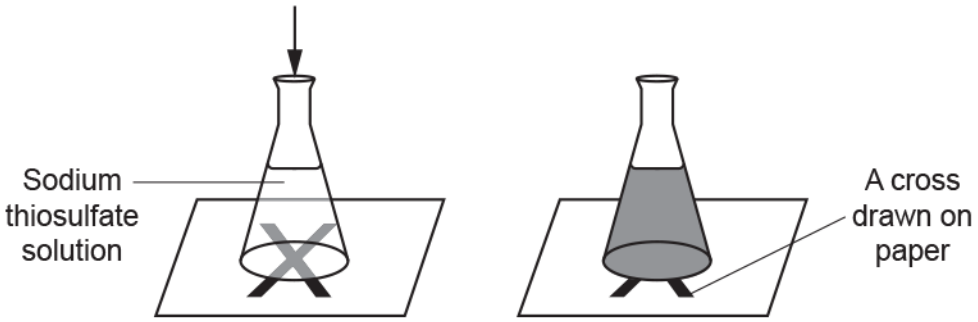



**Fig. 18.3**

A yellow solid is made during the reaction.

The students time how long it takes for the cross to disappear. This is the reaction time.

Look at their results.

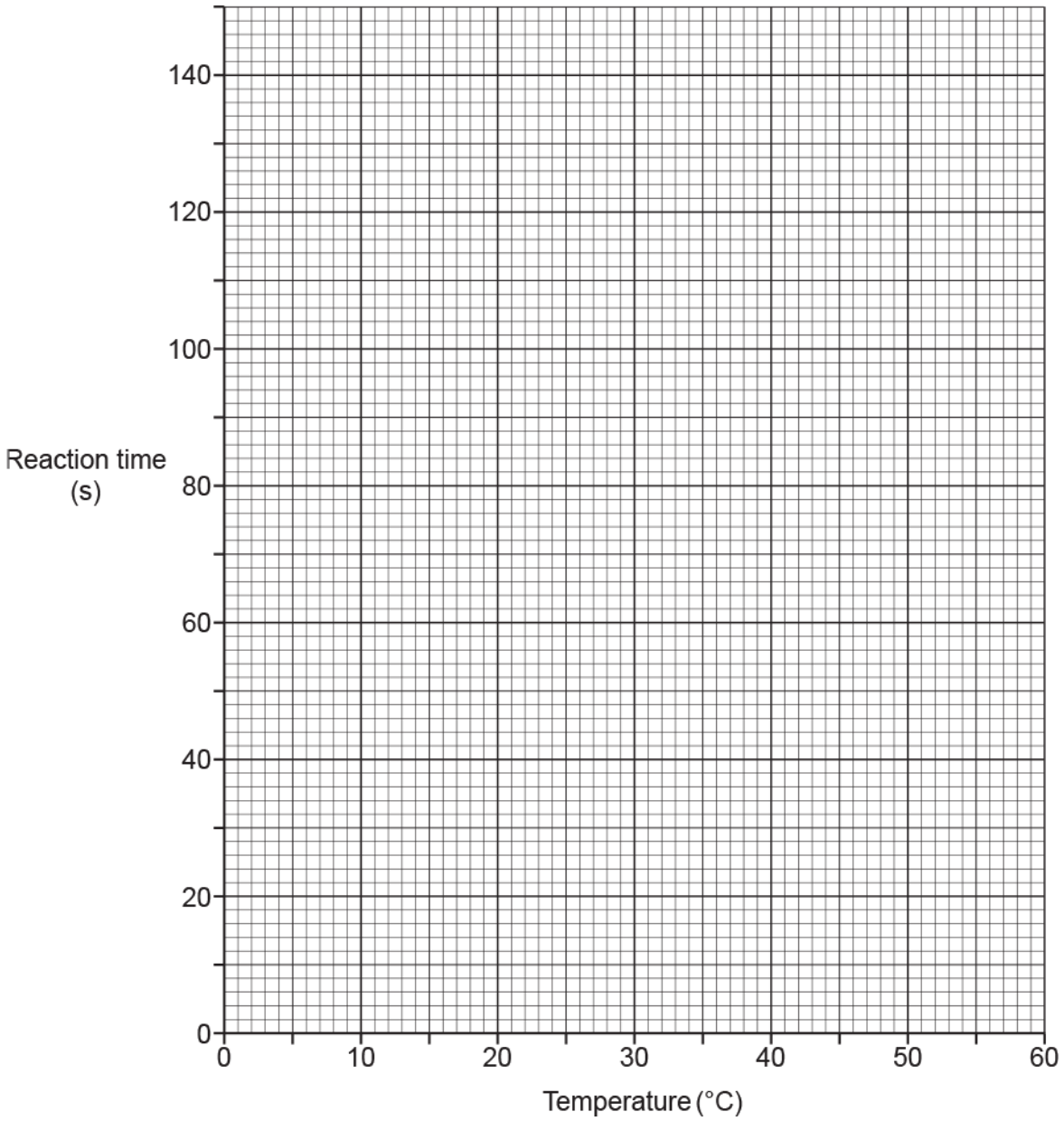
| Temperature (°C) | Reaction Time (s) |
|---|---|
| 10 | 140 |
| 20 | 56 |
| 30 | 34 |
| 40 | 26 |
| 50 | 22 |

(i) Plot a graph of the results on the grid. Draw a line of best fit.

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[3]

(ii) What is the reaction time at **25 °C**?

Reaction time = ..... s **[1]**

(iii) What happens to the **rate of reaction** as the temperature increases?

**[1]**

(iv) Explain your answer to **(iii)**. Include ideas about collisions between particles in your answer.

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[2]

END OF QUESTION PAPER

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