

# Rate(speed) of Reaction

## Question Paper 5

<b>Level</b>	IGCSE
<b>Subject</b>	Chemistry
<b>Exam Board</b>	CIE
<b>Topic</b>	Chemical Reactions
<b>Sub-Topic</b>	Rate (speed) of Reactions
<b>Paper Type</b>	Alternative to Practical
<b>Booklet</b>	Question Paper 5

**Time Allowed:** 53 minutes

**Score:** /44

**Percentage:** /100

1 **Is manganese(IV) oxide a catalyst?**

A catalyst is a substance that speeds up a chemical reaction and remains unchanged.

Hydrogen peroxide,  $H_2O_2$  breaks down to form oxygen. This reaction is very slow without a catalyst. Describe an experiment to show that manganese(IV) oxide is a catalyst for this reaction.

You are provided with the following items.

Hydrogen peroxide solution

Manganese(IV) oxide

Measuring cylinder

Balance

Beaker

Filtration apparatus

Splints/Bunsen burner

Distilled water

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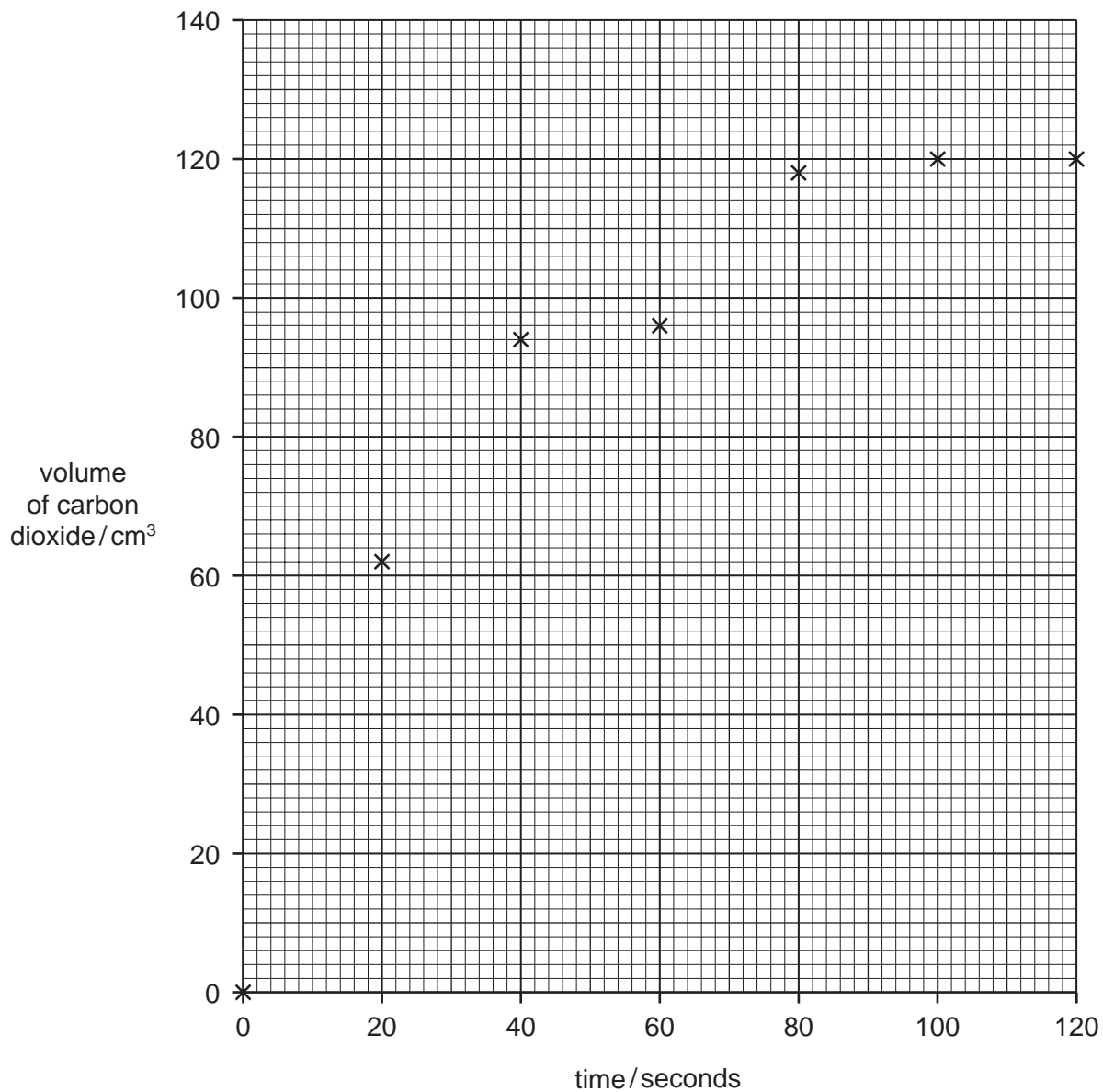
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[6]

- 2 The addition of calcium carbonate to excess dilute nitric acid produces carbon dioxide. The volume of carbon dioxide given off at 20 second intervals was recorded and plotted on the grid.



(a) Draw a smooth line graph on the grid. [1]

(b) Circle the result which appears to be incorrect? Why have you selected this result?

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 ..... [2]

(c) Why does the reaction slow down?

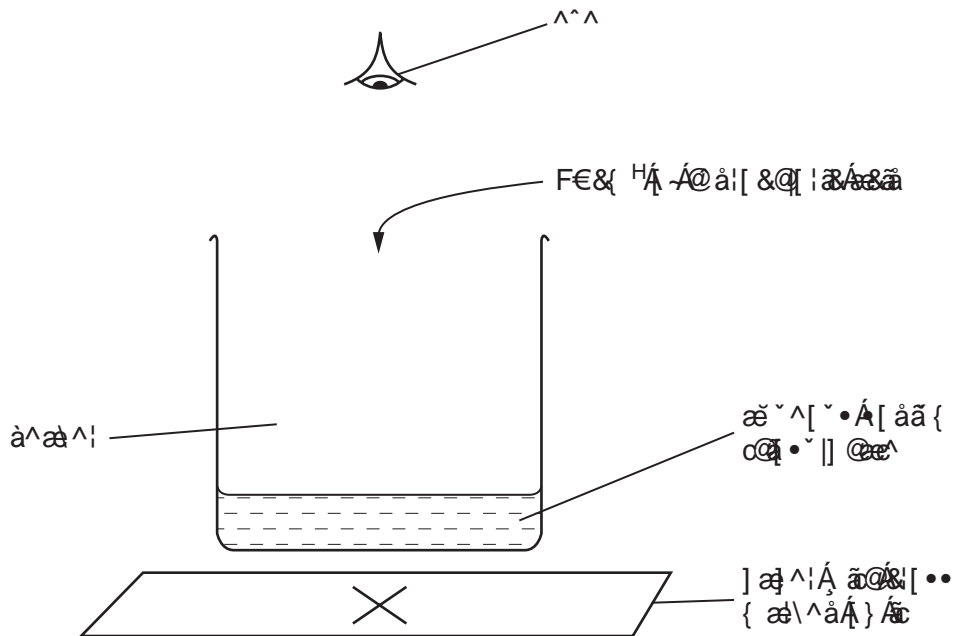
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3.  $\text{P}_{\text{a}}\text{e}\text{U}_{\text{G}}\text{H}\text{E}\text{A}\text{P}\text{O}\text{I} \longrightarrow \text{G}\text{p}\text{a}\text{e}\text{I}\text{E}\text{A}\text{U}\text{E}\text{A}\text{P}_{\text{G}}\text{U}\text{E}\text{A}\text{U}_{\text{G}}$



Experiment 1

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Experiments 2, 3, 4 and 5

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Table of results

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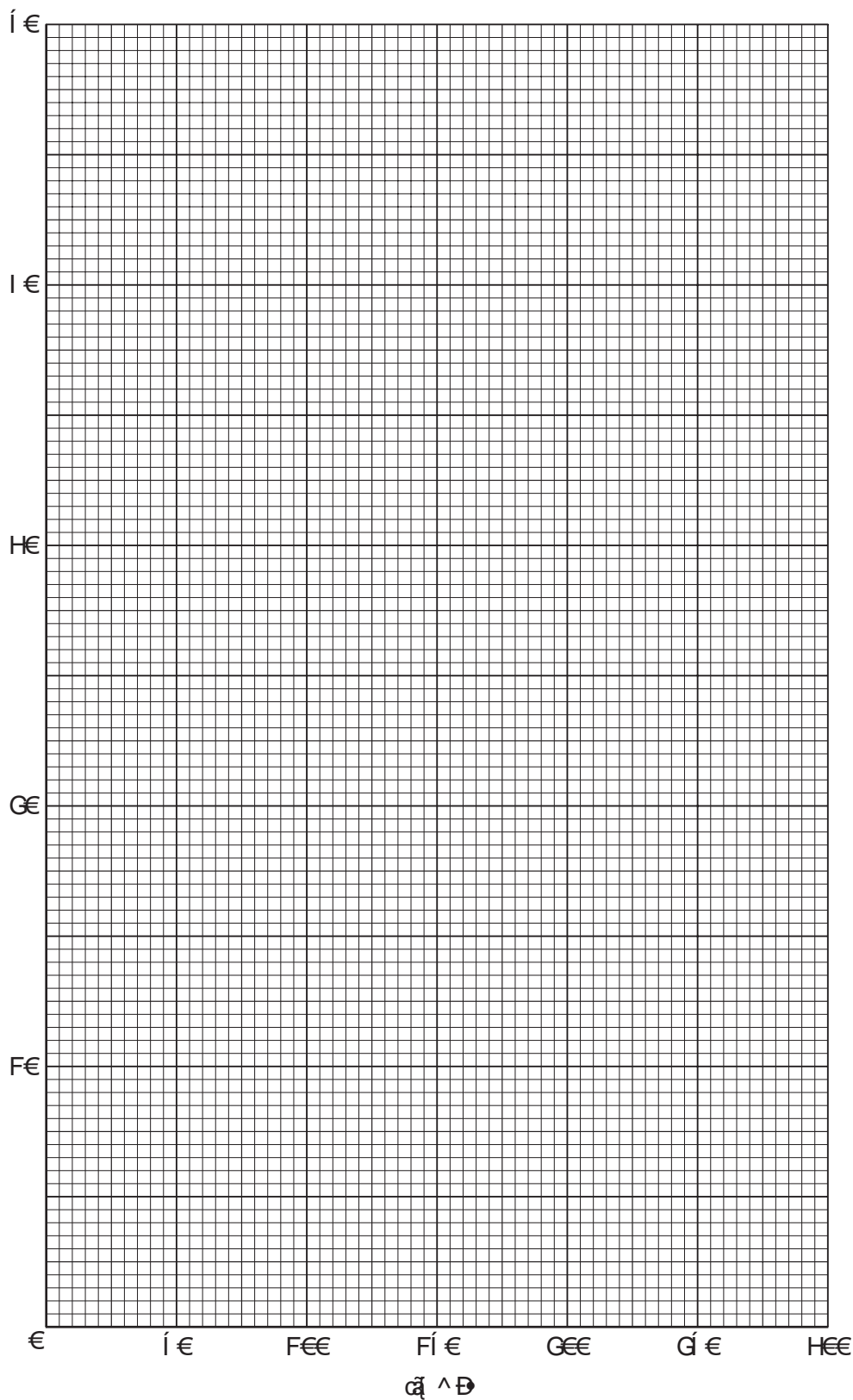
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1. The following table shows the number of people who attended a concert in each of the four categories of age group and gender.

Age Group	Male	Female
18-24	120	150
25-34	180	200
35-44	220	250
45-54	160	180

2. The following table shows the number of people who attended a concert in each of the four categories of age group and gender.

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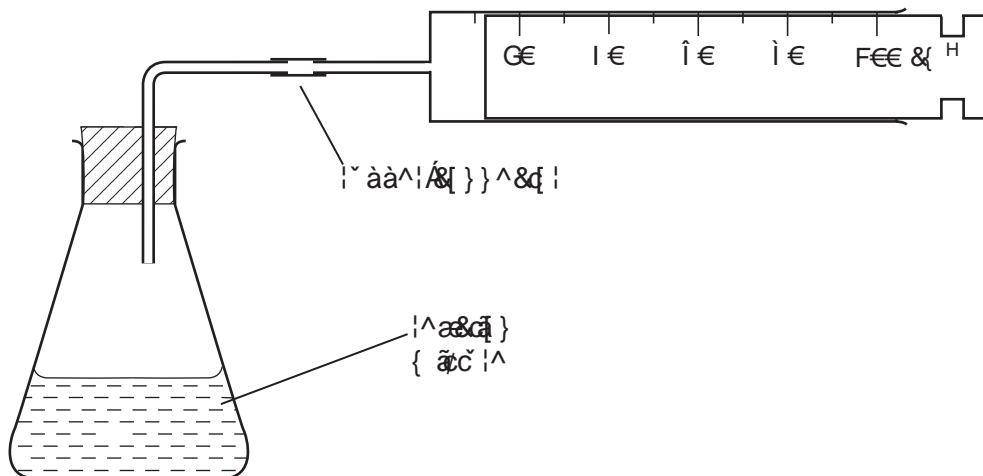
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4. 0.5 g of a solid is heated in a test tube. The gas evolved is collected in a gas jar inverted over water. The gas is found to be colourless and odourless. It is found to be soluble in water. The gas is found to be soluble in water. The gas is found to be soluble in water.



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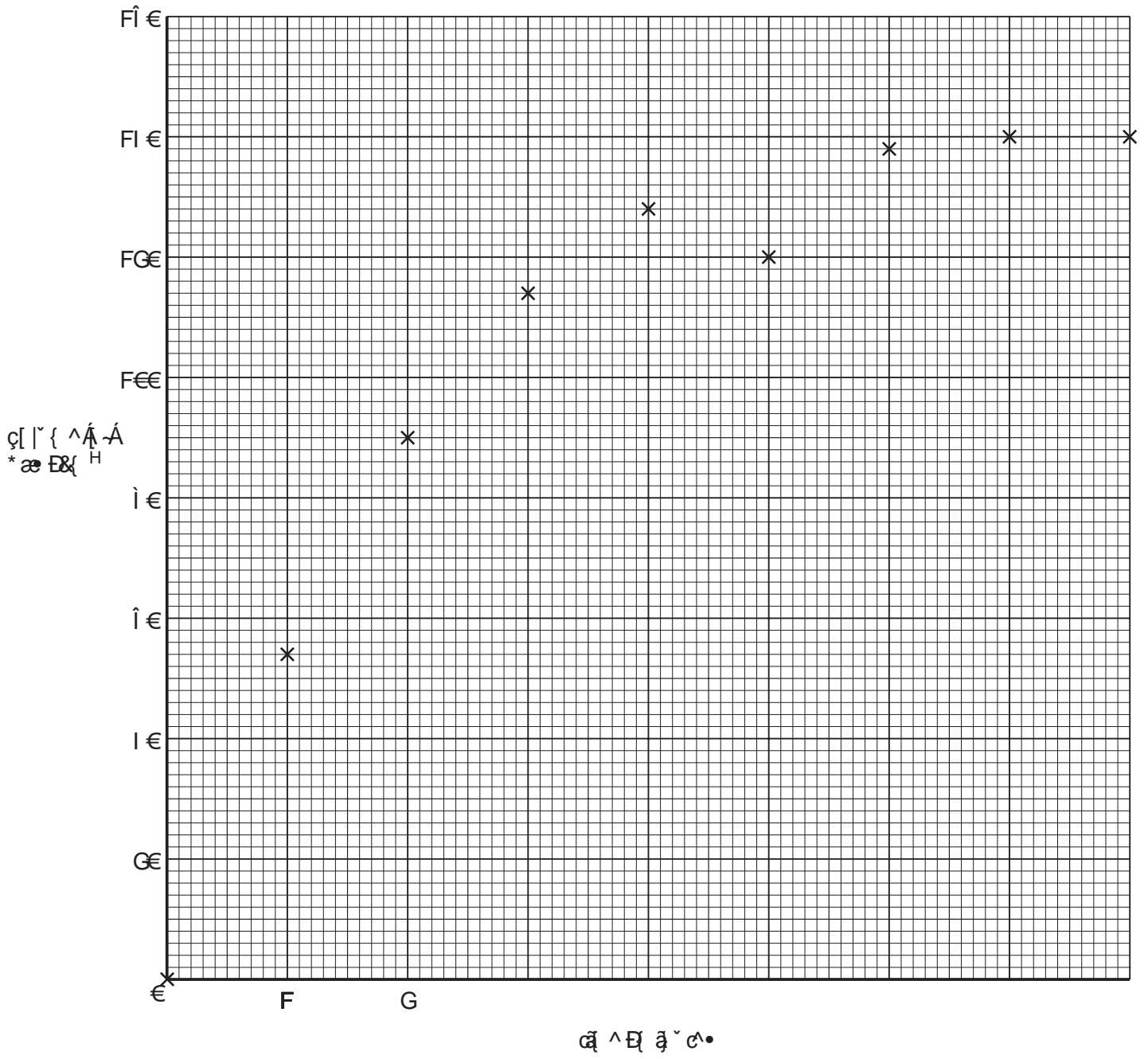


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- 5 A student investigated the speed of reaction between aqueous potassium bromate and potassium iodide solution.

A burette was filled up to the  $0.0 \text{ cm}^3$  mark with aqueous potassium iodide.

To each of 5 test-tubes was added  $6 \text{ cm}^3$  of aqueous potassium iodide to be used in the 5 following experiments.

*Experiment 1*

By using a measuring cylinder  $12 \text{ cm}^3$  of aqueous potassium bromate was poured into a small beaker. To this solution was added  $4 \text{ cm}^3$  of water,  $2 \text{ cm}^3$  of hydrochloric acid,  $5 \text{ cm}^3$  of starch solution and  $1 \text{ cm}^3$  of sodium thiosulphate solution.

The beaker was placed on a cross drawn on a piece of paper.

From one of the test-tubes  $6 \text{ cm}^3$  of aqueous potassium iodide was added to the mixture in the beaker and the timer started. A dark blue colour formed. The timer was stopped when the cross on the paper could not be seen.

Use the stop clock diagram to record the time in the table.

*Experiment 2*

By using a measuring cylinder  $10 \text{ cm}^3$  of potassium bromate solution was poured into a beaker. The instructions were repeated exactly as given for Experiment 1, but  $6 \text{ cm}^3$  of water was added to the beaker.

Use the diagram to record the time in the table.

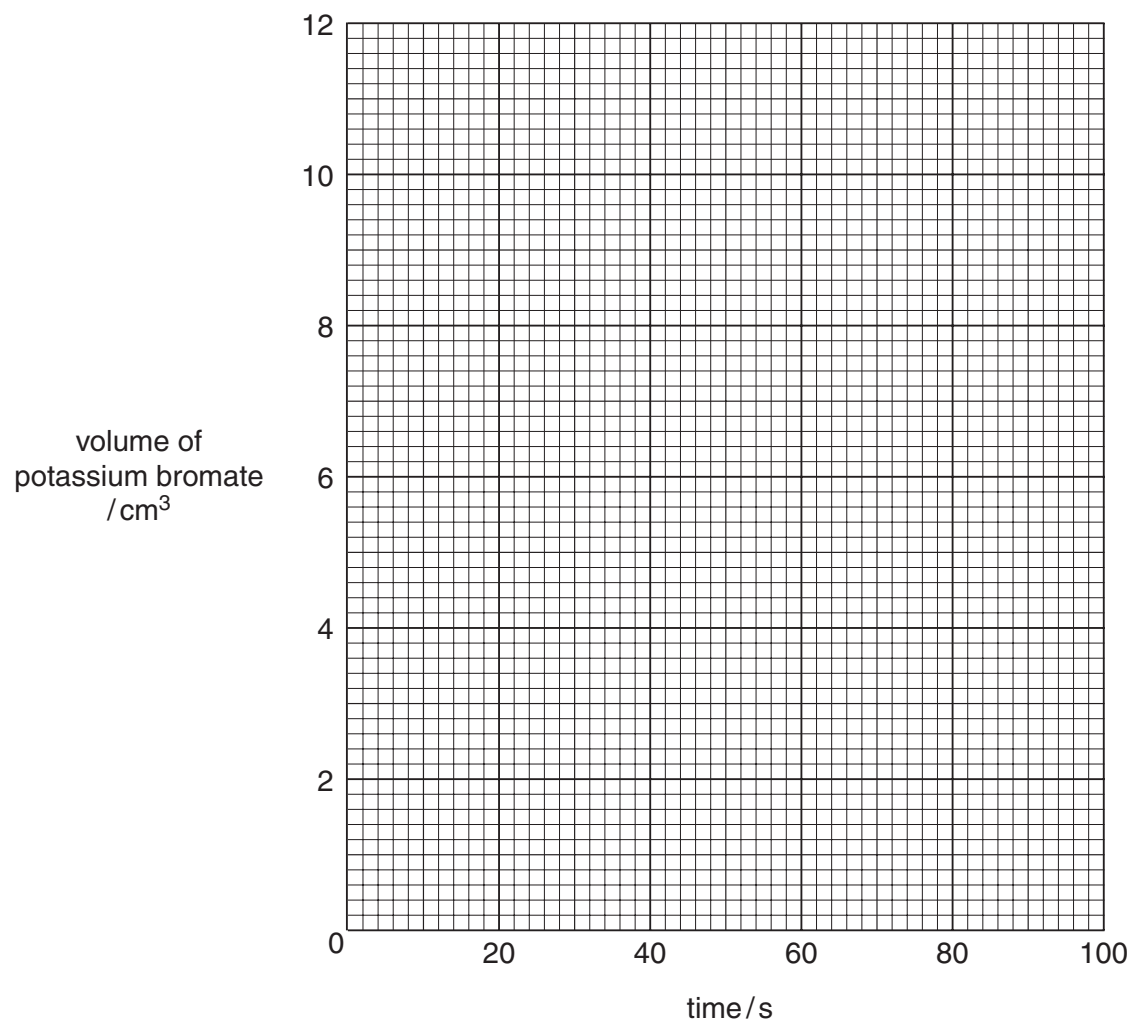
*Experiments 3, 4 and 5*

Experiment 1 was repeated using the volumes of aqueous potassium bromate and water specified in the table of results. Record the times in the table.

Table of results

Experiment	volume		clock diagram	time/s
1	potassium bromate/cm <sup>3</sup> 12	water/cm <sup>3</sup> 4		
2	10	6		
3	8	8		
4	6	10		
5	4	12		

(a) Plot the results on the grid. Draw a smooth line graph.



[4]

(b) From your graph estimate the time of the reaction if Experiment 1 was repeated using 5 cm<sup>3</sup> of potassium bromate and 11 cm<sup>3</sup> of water.

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Show clearly on your graph how you worked out your answers. [3]

(c) (i) Which experiment is the quickest?

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(ii) Explain why this experiment is the quickest.

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.....[3]

(d) (i) State **two** possible sources of error in the experiments.

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2 .....

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(ii) Suggest **two** improvements to reduce the sources of error in the experiments.

1 .....

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2 .....

.....[4]