

# 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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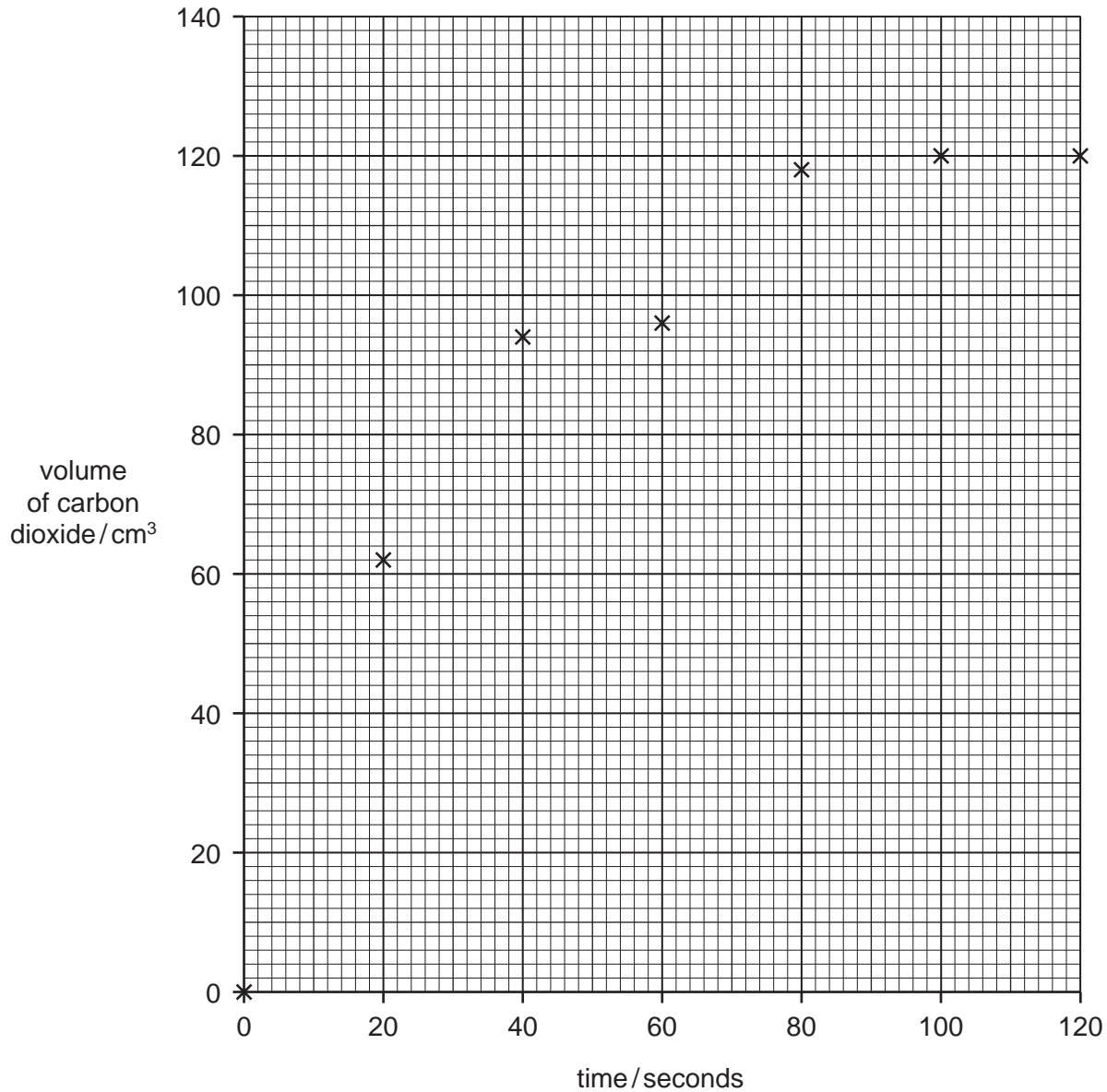
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[6]

- 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?

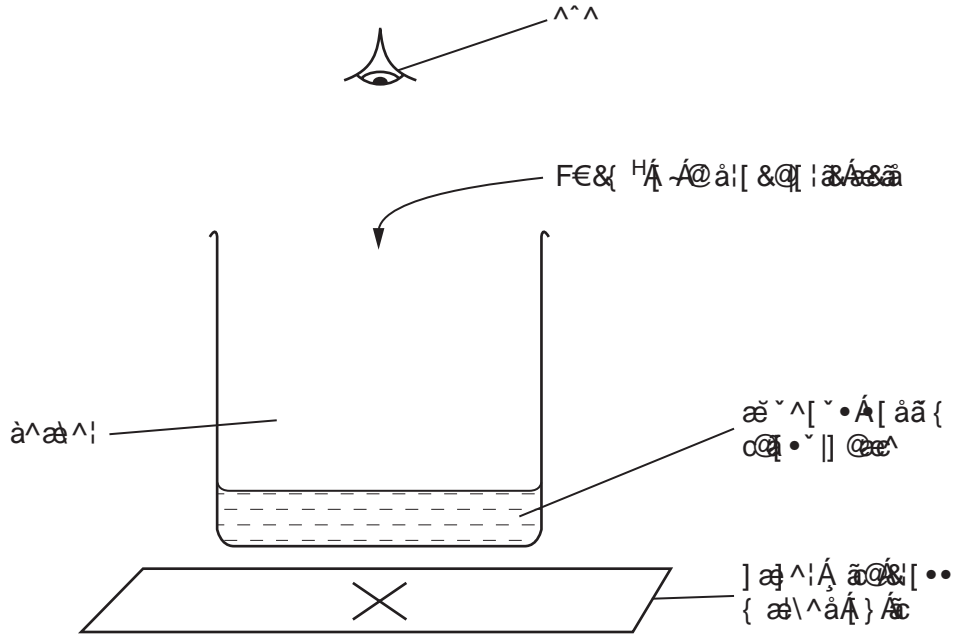
..... [1]

3.  $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$



Experiment 1

1. A gas is collected over water in a test tube. The gas is then passed through a solution of calcium hydroxide. The solution turns milky. The gas is then passed through a solution of sodium hydroxide. The solution turns milky. The gas is then passed through a solution of potassium manganate(VII). The solution is decolourised. The gas is then passed through a solution of potassium dichromate(VI). The solution is decolourised. The gas is then passed through a solution of potassium permanganate(VII). The solution is decolourised. The gas is then passed through a solution of potassium dichromate(VI). The solution is decolourised. The gas is then passed through a solution of potassium permanganate(VII). The solution is decolourised.



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Experiments 2, 3, 4 and 5

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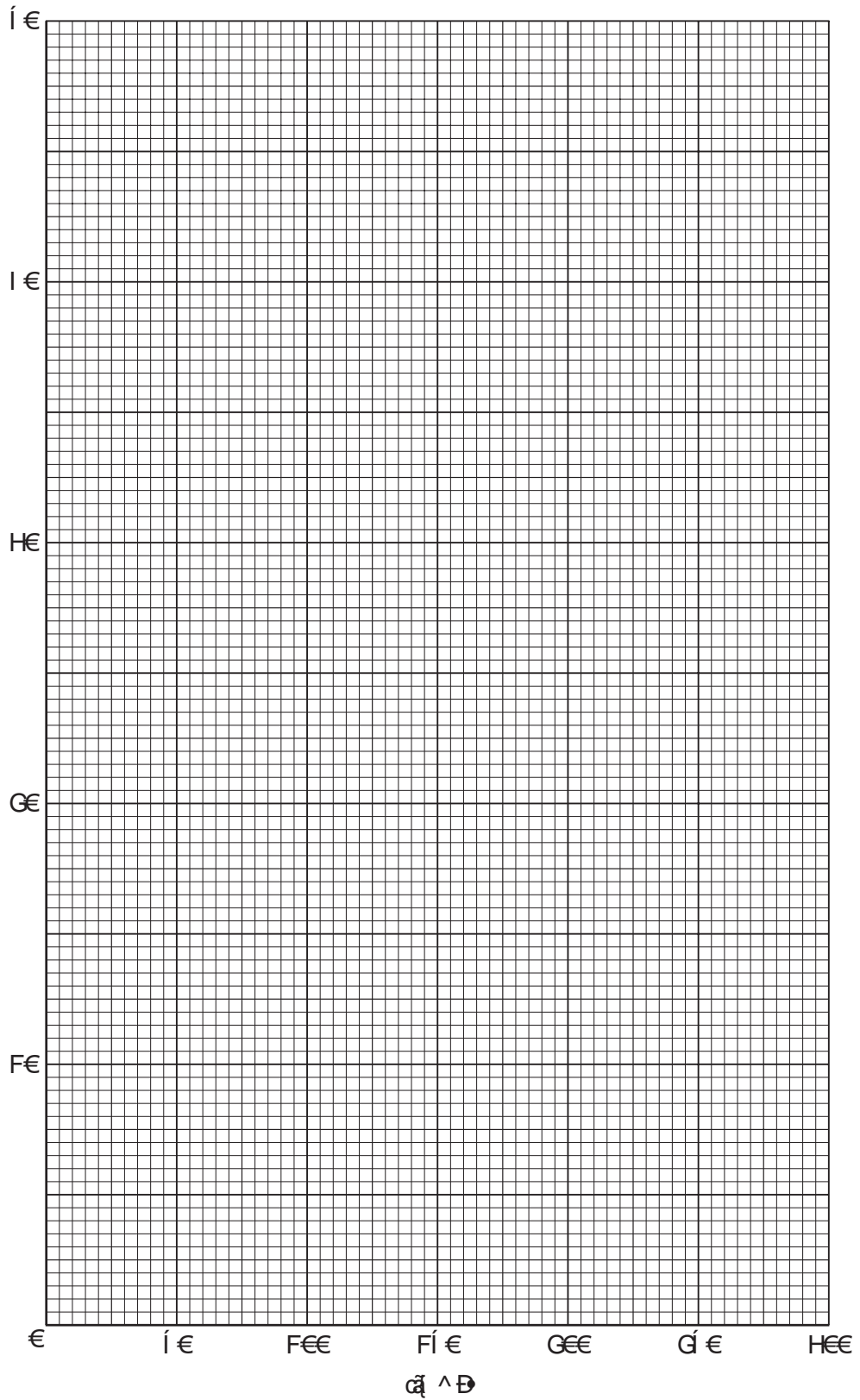
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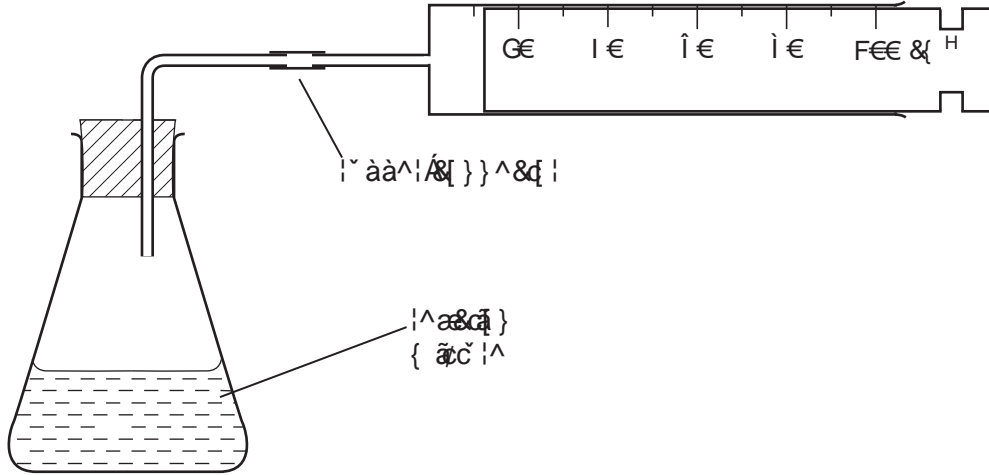


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Handwriting practice lines consisting of four rows of dashed lines on a grid background.

4. The diagram shows a gas syringe connected to a flask containing a liquid. The gas syringe is initially at 0 cm<sup>3</sup>. The flask is placed in a water bath. The gas syringe is connected to the flask by a delivery tube. The gas syringe is used to collect the gas produced during the reaction.



The flask is placed in a water bath. The gas syringe is used to collect the gas produced during the reaction. The gas syringe is initially at 0 cm<sup>3</sup>. The gas syringe is connected to the flask by a delivery tube. The gas syringe is used to collect the gas produced during the reaction.

**1.1** The gas syringe is used to collect the gas produced during the reaction. Zá

**1.2** The gas syringe is used to collect the gas produced during the reaction.

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**1.3** The gas syringe is used to collect the gas produced during the reaction.

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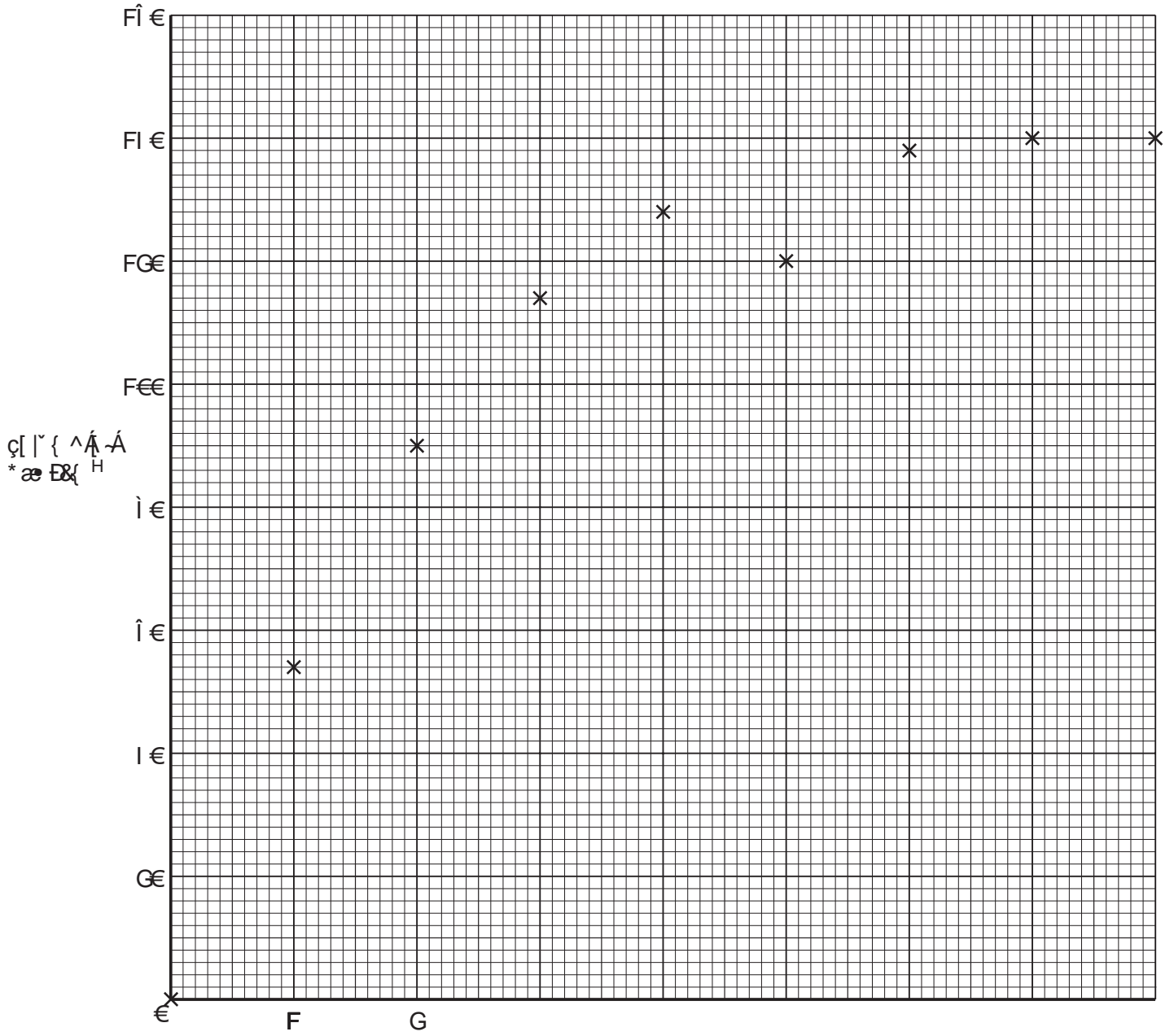
**1.4** The gas syringe is used to collect the gas produced during the reaction.

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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 cm<sup>3</sup> mark with aqueous potassium iodide.

To each of 5 test-tubes was added 6 cm<sup>3</sup> of aqueous potassium iodide to be used in the 5 following experiments.

#### *Experiment 1*

By using a measuring cylinder 12 cm<sup>3</sup> of aqueous potassium bromate was poured into a small beaker. To this solution was added 4 cm<sup>3</sup> of water, 2 cm<sup>3</sup> of hydrochloric acid, 5 cm<sup>3</sup> of starch solution and 1 cm<sup>3</sup> of sodium thiosulphate solution.

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

From one of the test-tubes 6 cm<sup>3</sup> 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 cm<sup>3</sup> of potassium bromate solution was poured into a beaker. The instructions were repeated exactly as given for Experiment 1, but 6 cm<sup>3</sup> of water was added to the beaker.

Use the diagram to record the time in the table.

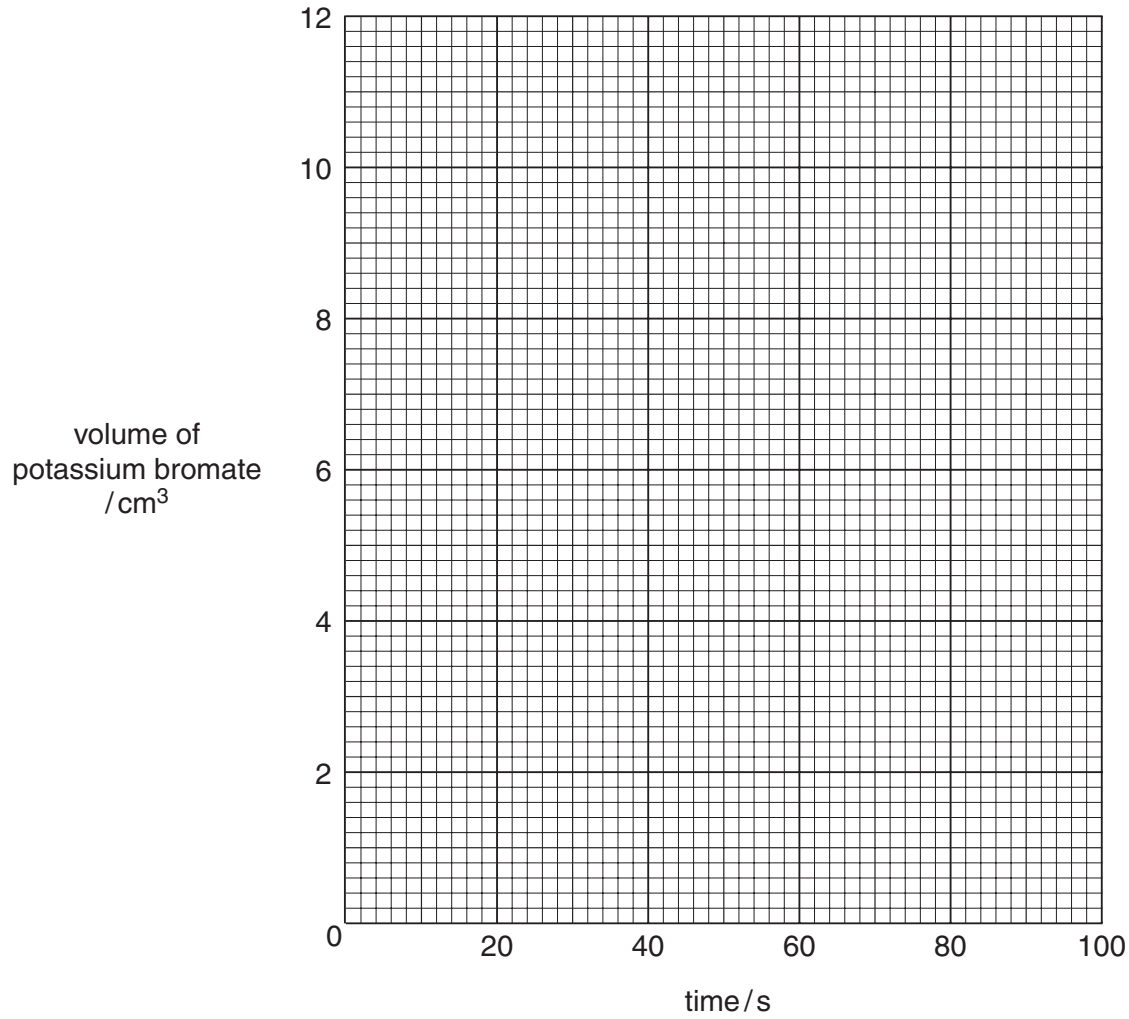
#### *Experiments 3, 4 and 5*

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
	potassium bromate/cm <sup>3</sup>	water/cm <sup>3</sup>		
1	12	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.

1 .....

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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]