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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CHEMISTRY

Paper 4 Alternative to Practical

5070/04

October/November 2004

1 hour

Candidates answer on the Question Paper.
No Additional Materials are required.

Candidate Name

Centre Number

Candidate Number

READ THESE INSTRUCTIONS FIRST

Write your name, Centre number and candidate number in the spaces at the top of this page.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a pencil for any diagrams, graphs, or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.
You should use names, not symbols, when describing all reacting chemicals and products formed.
You may use a calculator.

DO NOT WRITE IN THE BARCODE.

DO NOT WRITE IN THE GREY AREAS BETWEEN THE PAGES.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given on this page.

Stick your personal label here, if provided.

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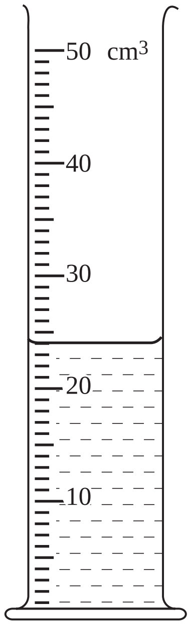
1 What is the volume, to the nearest cm^3, of liquid in the measuring cylinder?



[1]

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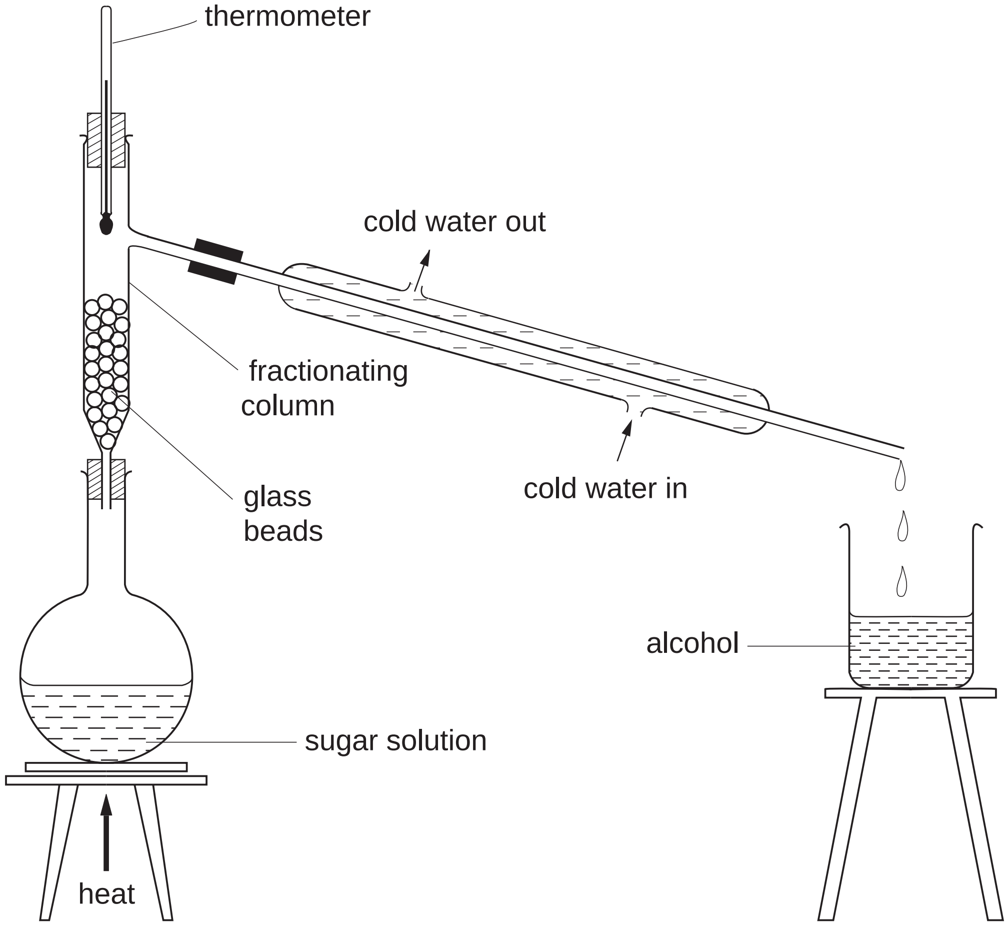
2 A student used the apparatus below to produce a solvent (alcohol) from fermented solution.



(a) Name and give the formula of the alcohol.

(i) name ....

(ii) formula .... [2]

(b) What must also be present in the original sugar solution to cause fermentation to take place?

.... [1]

(c) How did the student know when all the alcohol had been distilled?

....[1]

Half of the alcohol was transferred to a flask and some acidified potassium dichromate(VI) ... added. The mixture was warmed.

(d) **(i)** What was the colour change during the reaction?

from .... to ....

(ii) What was the organic product of this reaction?

.... [3]

The compound from **(d)(ii)** was separated from the reaction mixture. It was added to the other half of the alcohol from **(c)**. A few drops of concentrated sulphuric acid were added and the mixture was warmed.

(e) **(i)** Name and give the formula of the organic compound formed.

name ....

formula ....

(ii) To which group of organic compounds does this product belong?

.... [3]

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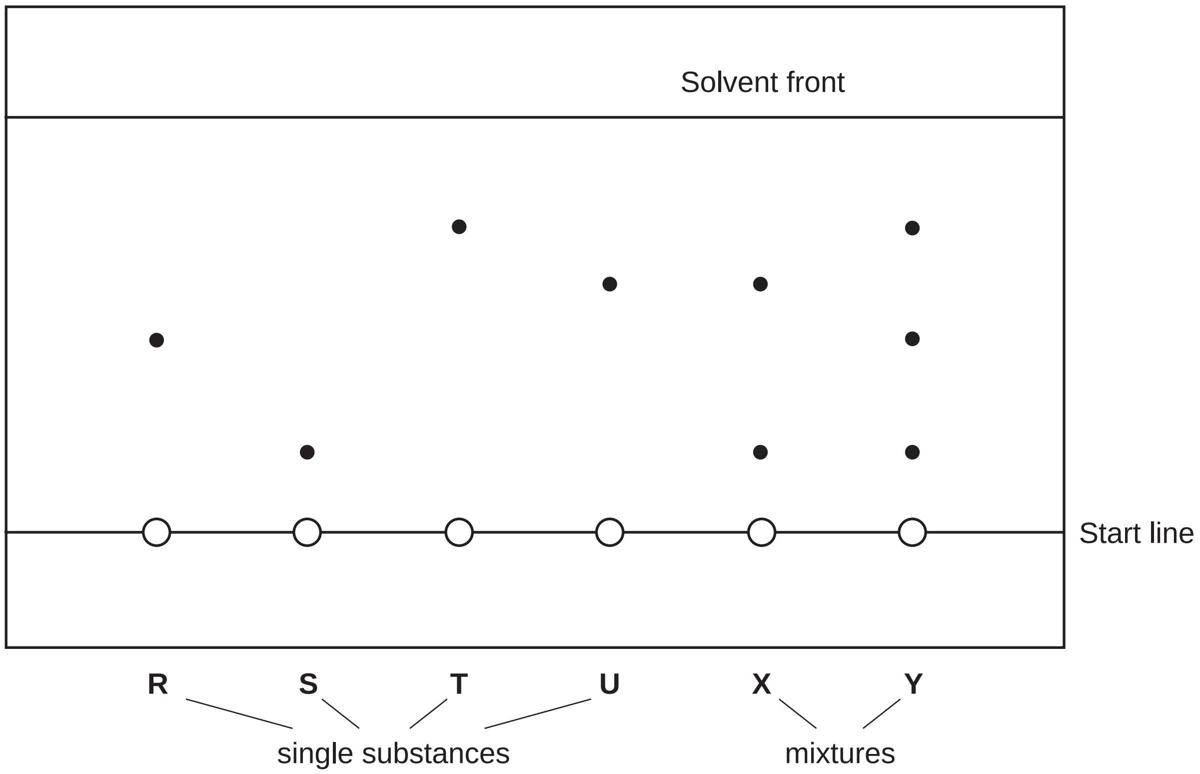
3 The diagram below shows the results of an experiment to identify the compone[…] mixtures **X** and **Y**.



(a) What is the name given to this type of experiment?

.... [1]

(b) Draw a line on the diagram to show the solvent level at the beginning of the experiment. [1]

(c) A pencil was used to draw the start line. Why was a pen not used for this purpose?

....

....[2]

(d) Use the diagram to deduce which of the substances **R**, **S**, **T**, and **U** were present in

(i) mixture **X**, ...

(ii) mixture **Y**. .... [2]

(e) Using a ruler to measure the distances travelled by substance **T** and the solvent front, calculate the R_f value of **T**.

distance travelled by **T** ....

distance travelled by solvent front ....

R_f value of **T** = [2]

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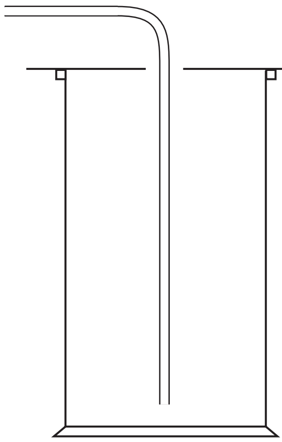
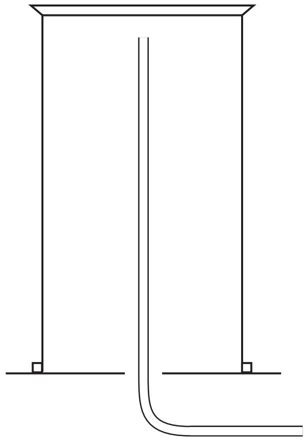
In questions **4** to **7** inclusive, place a tick in the box against the best answer.

4 A student made some chlorine by the reaction between concentrated hydrochloric acid and potassium manganate(VII).

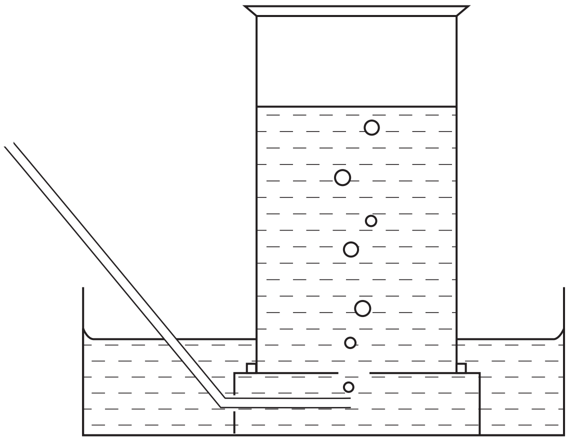
Chlorine is more dense than air and soluble in water.
Which of the following methods of collection is most suitable for chlorine?



(a) ☐



(b) ☐



(c) ☐

[1]

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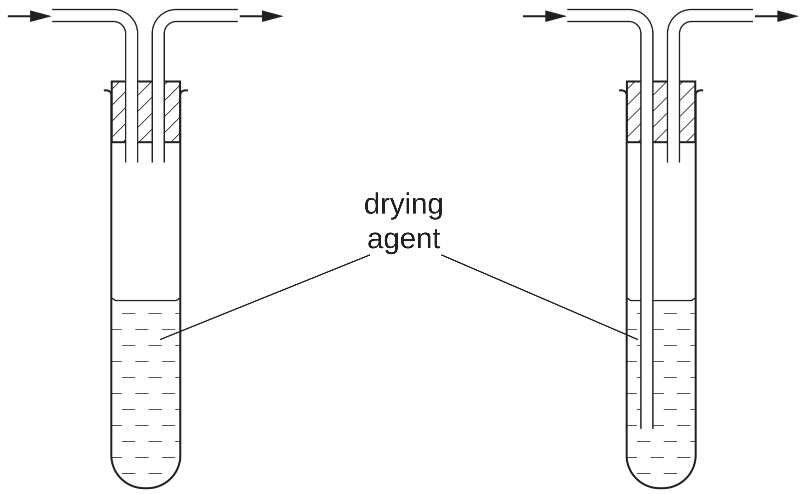
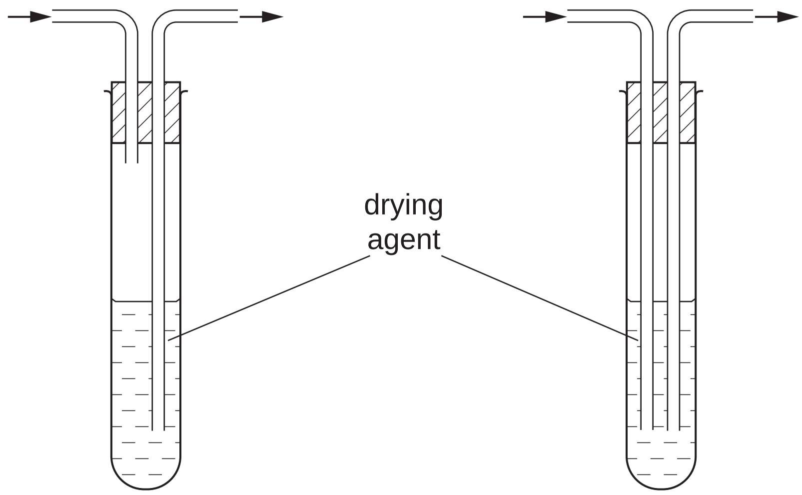
5 The student was asked to produce a dry sample of a gas by passing it through a
agent.
Which apparatus should be used to dry the gas?



(a) ☐ **(b)** ☐



(c) ☐ **(d)** ☐

[1]

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6 A student prepared some salts by adding two substances together. Which of the following produced a salt that could be collected by filtration?

(a) aqueous barium nitrate and sulphuric acid ☐

(b) aqueous sodium hydroxide and nitric acid ☐

(c) calcium carbonate and hydrochloric acid ☐

(d) aqueous magnesium chloride and aqueous potassium nitrate ☐ [1]

7 In an experiment to find the formula of the oxide formed of the element **M**, 5.5 g of **M** was burnt in oxygen. The mass of the oxide was 8.7 g.
[A_r: **M**, 55; O, 16.]

What is the formula of the metal oxide?

(a) MO ☐

(b) M_2O ☐

(c) MO_2 ☐

(d) MO_3 ☐ [1]

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8 A student was given a sample of marble, which is impure calcium carbonate. The s
was asked to determine the percentage of calcium carbonate in the sample.

The sample of marble was added to a previously weighed container, which was then reweighed.

Mass of container + marble = 9.40 g
Mass of container = 7.85 g

(a) Calculate the mass of marble used in the experiment.

.... g [1]

The sample was placed in a volumetric flask and 50.0 cm^3 of 1.00 mol/dm^3 hydrochloric acid (an excess) was added. The stopper was placed in the top of the flask and the mixture was allowed to react. The stopper had to be frequently loosened.

(b) Why was the stopper frequently loosened?

....[1]

When the reaction had finished the solution was made up to 250 cm^3 with distilled water. This was solution **G**.
25.0 cm^3 of solution **G** was transferred to a titration flask and a few drops of methyl orange indicator was added.

0.100 mol/dm^3 sodium hydroxide was added to the solution from a burette until an endpoint was reached.

(c) What was the colour change of the methyl orange?

The colour changed from .... to ....[1]

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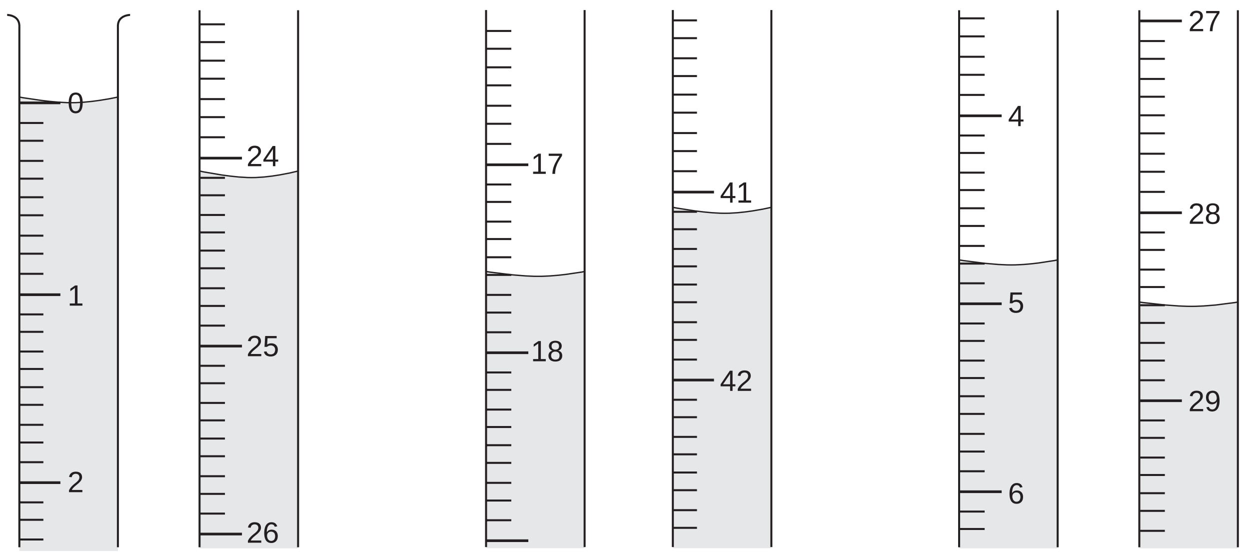
Three titrations were done. Parts of the burette with liquid levels before and after each titration are shown below.

1st titration　　　　2nd titration　　　　3rd titration



(d) Use the diagrams to complete the following results table.

titration number	1	2	3
final burette reading / cm^3			
initial burette reading / cm^3			
volume of 0.100 mol/dm^3 sodium hydroxide / cm^3			
best titration results (✓)			

Summary

Tick the best titration results. Using these results, the average volume of 0.100 mol/dm^3

sodium hydroxide was .... cm^3. [4]

(e) Calculate how many moles of sodium hydroxide are in the average volume of 0.100 mol/dm^3 sodium hydroxide in **(d)**.

.... moles [1]

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(f) Using the equation, calculate how many moles of hydrochloric acid are in 25.0 cm^3 of solution **G**.

$$NaOH + HCl \longrightarrow NaCl + H_2O$$

.... moles [1]

(g) Calculate how many moles of hydrochloric acid are in 250 cm^3 of solution **G**.

.... moles [1]

(h) How many moles of hydrochloric acid were contained in the original 50.0 cm^3 of 1.00 mol/dm^3 hydrochloric acid?

.... moles [1]

(i) By subtracting your answer in **(g)** from your answer in **(h)**, calculate how many moles of hydrochloric acid reacted with the calcium carbonate in the sample of marble.

.... moles [1]

(j) Using the equation, calculate how many moles of calcium carbonate react with the number of moles of hydrochloric acid in your answer **(i)**.

$$CaCO_3 + 2HCl \longrightarrow CaCl_2 + CO_2 + H_2O$$

.... moles [1]

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(k) **(i)** Calculate the mass of one mole of $CaCO_3$.

A_r: Ca, 40; C, 12; O, 16.

.... g

(ii) Using your answers to parts **(j)** and **(k)(i)** calculate the mass of calcium carbonate in the sample of marble.

.... g

(iii) Using your answers to parts **(a)** and **(k)(ii)** calculate the percentage of calcium carbonate in the sample of marble.

.... % [3]

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9 The following table shows the tests a student did on a substance **W** and the conclusions made from the observations. Complete the table by describing these observations and suggest the test and observations which led to the conclusion from test **4**.

test	observations	conclusion
1 **W** was dissolved in water and the solution was divided into three parts for tests 2, 3, and 4		**W** probably does not contain a transition metal.
2 **(a)** To the first part aqueous sodium hydroxide was added until a change was seen. **(b)** An excess of aqueous sodium hydroxide was added to the mixture from (a).		**W** may contain Al^{3+} ions.
3 **(a)** To the second part aqueous ammonia was added until a change was seen. **(b)** An excess of aqueous ammonia was added to the mixture from (a).		The presence of Al^{3+} ions is confirmed.
4		**W** contains NO_3^- ions.

Conclusions: The formula for substance **W** is .... [10]

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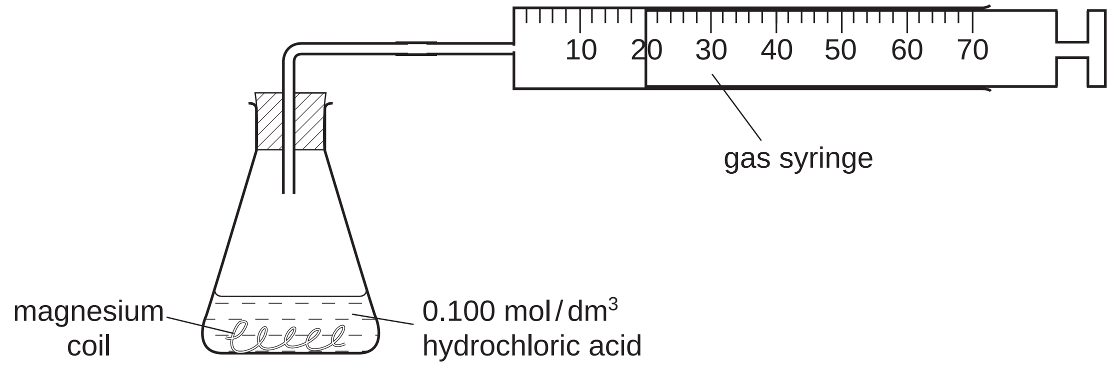
10 A student did two experiments to investigate the rate of reaction between magnesiu... dilute hydrochloric acid using the apparatus shown below.

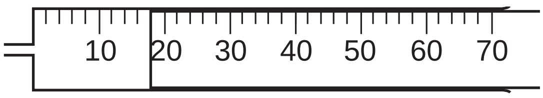


During the reaction a gas was produced.

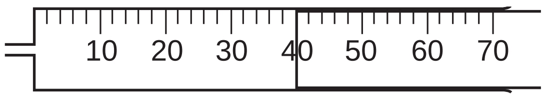
(a) Name this gas.

....[1]

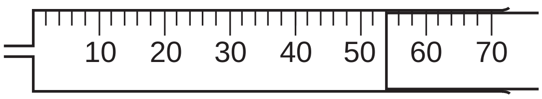
(b) 50 cm^3 of 0.10 mol/dm^3 hydrochloric acid was added to an excess of magnesium ribbon. The diagrams below show the volume of gas collected in the syringe at the stated times.



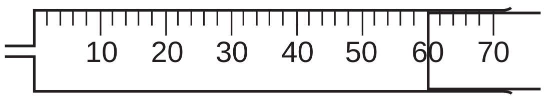
1 min



3 min



5 min



7 min

Use the diagrams to complete the table below for experiment **1**.
The results for experiment **2** are shown in the table.

	time / mins			
	1	3	5	7
volume of gas collected in experiment **1** / cm^3				
volume of gas collected in experiment **2** / cm^3	35	52	59	60

[2]

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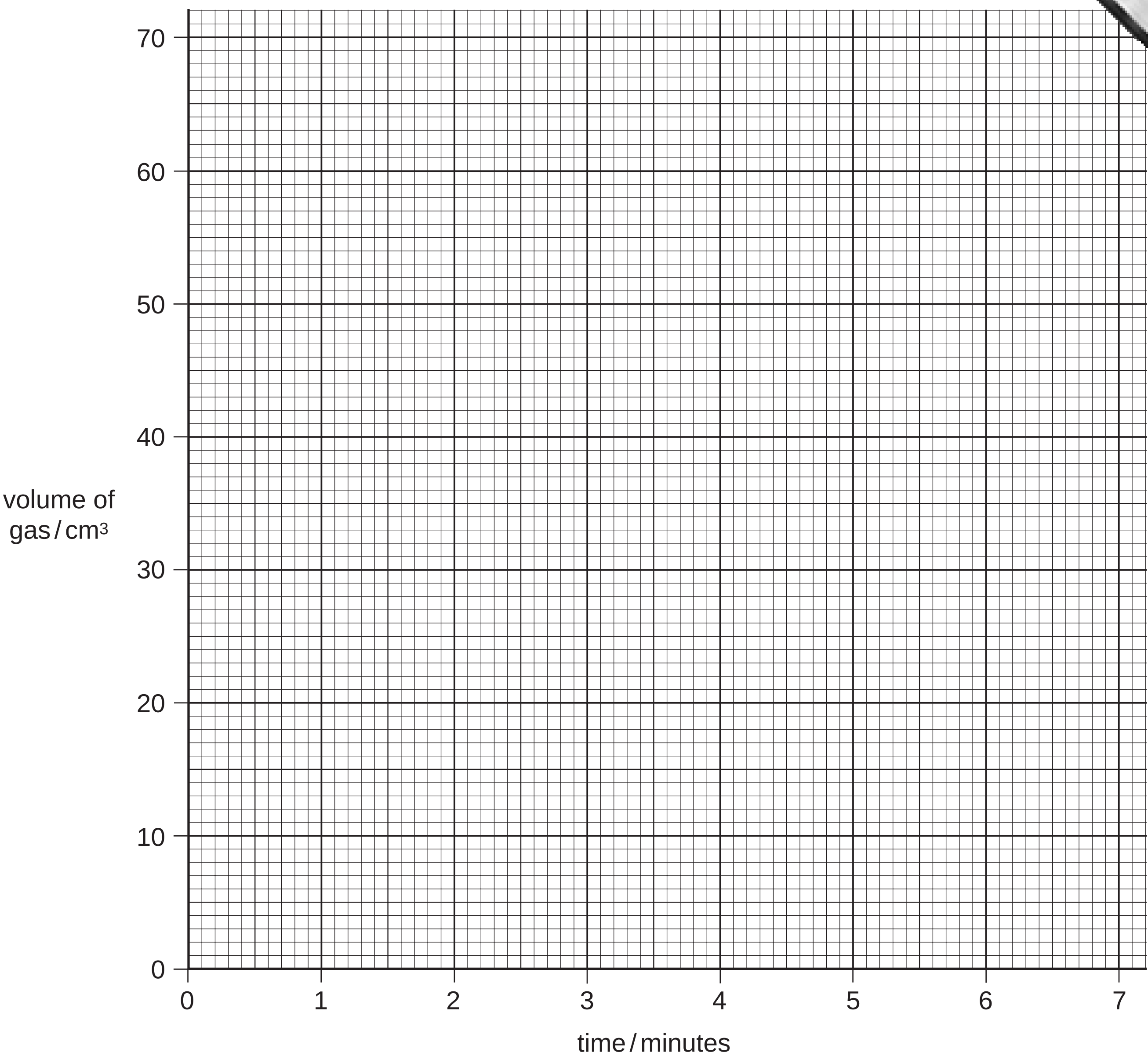
(c) Plot these results on the grid below. Join each set of points with a smooth cu
label the curves **1** and **2**, corresponding to experiments **1** and **2**.



[3]

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(d) **(i)** What was the total volume of gas produced after 4 minutes in experiment **1**?

.... cm^3

(ii) How long did it take to produce 50 cm^3 of gas in experiment **2**?

.... minutes [2]

(e) In experiment **1**, 50 cm^3 of 0.10 mol/dm^3 hydrochloric acid was added to an excess of magnesium ribbon. **Either** the physical condition of the magnesium **or** the volume and concentration of the acid used could be changed to produce the graph for experiment **2**.

Suggest how

(i) the physical state of the magnesium should be changed,

....

(ii) the volume and concentration of the acid should be changed.

....

....[3]