Cambridge Assessment International Education

Cambridge IGCSE™ (9–1)

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

5081703836

CHEMISTRY **0971/62**

Paper 6 Alternative to Practical **May/June 2021**

1 hour

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

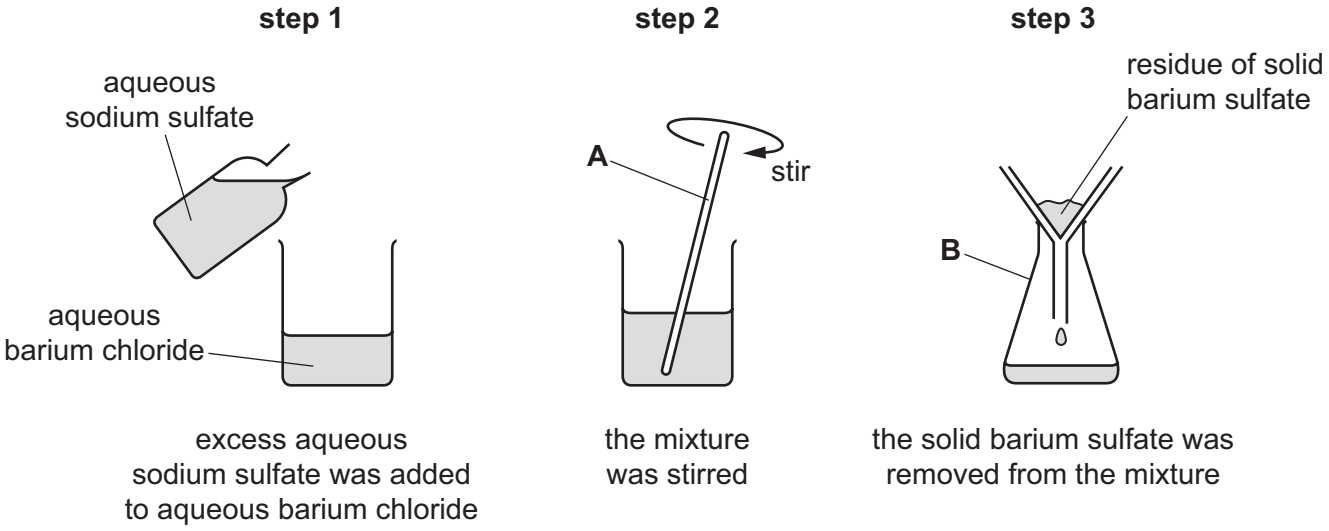
- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages. Any blank pages are indicated.

1 Barium sulfate is an insoluble salt. Barium sulfate can be made by reacting excess aqueous sodium sulfate with aqueous barium chloride.

sodium sulfate + barium chloride → sodium chloride + barium sulfate

A student made a sample of barium sulfate using the following steps.



(a) Name the items of apparatus labelled **A** and **B**.

A .....

B .....
[2]

(b) Name the process shown in **step 3**.

..... [1]

(c) The general name for the solid in **step 3** is residue.

State the general name for the solution obtained from the process in **step 3**.

..... [1]

(d) Two more steps, **step 4** and **step 5**, are needed to obtain a pure sample of barium sulfate. In each of these steps something is removed from the residue.

State what is done in each of **step 4** and **step 5** and identify the substance removed from the barium sulfate.

step 4 .....

.....

substance removed .....

step 5 .....

.....

substance removed .....

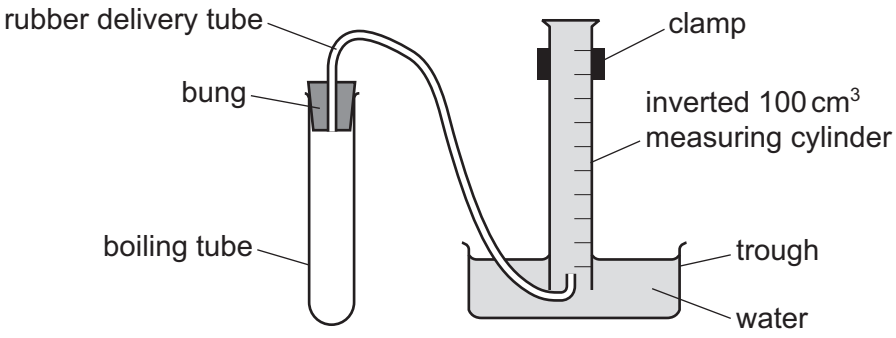
[4]

[Total: 8]

BLANK PAGE

2 A student investigated the volume of gas made when sodium carbonate reacts with dilute hydrochloric acid.

Five experiments were carried out using the apparatus shown.



Experiment 1

- Using a measuring cylinder, 16 cm^3 of dilute hydrochloric acid was poured into a boiling tube.
- The apparatus was set up as shown in the diagram.
- The bung was removed from the boiling tube.
- 2.5 g of sodium carbonate was added to the boiling tube and the bung was immediately replaced.
- When no more gas was being collected, the volume of gas in the measuring cylinder was measured.

Experiment 2

- Experiment 1 was repeated using 14 cm^3 of dilute hydrochloric acid instead of 16 cm^3.

Experiment 3

- Experiment 2 was repeated using 12 cm^3 of dilute hydrochloric acid instead of 14 cm^3.

Experiment 4

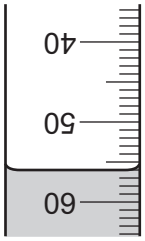
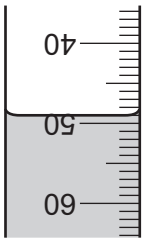
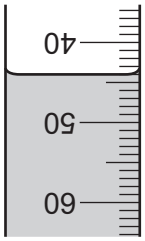
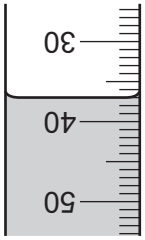
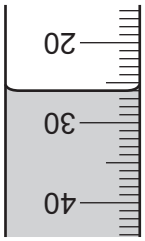
- Experiment 3 was repeated using 10 cm^3 of dilute hydrochloric acid instead of 12 cm^3.

Experiment 5

- Experiment 4 was repeated using 6 cm^3 of dilute hydrochloric acid instead of 10 cm^3.

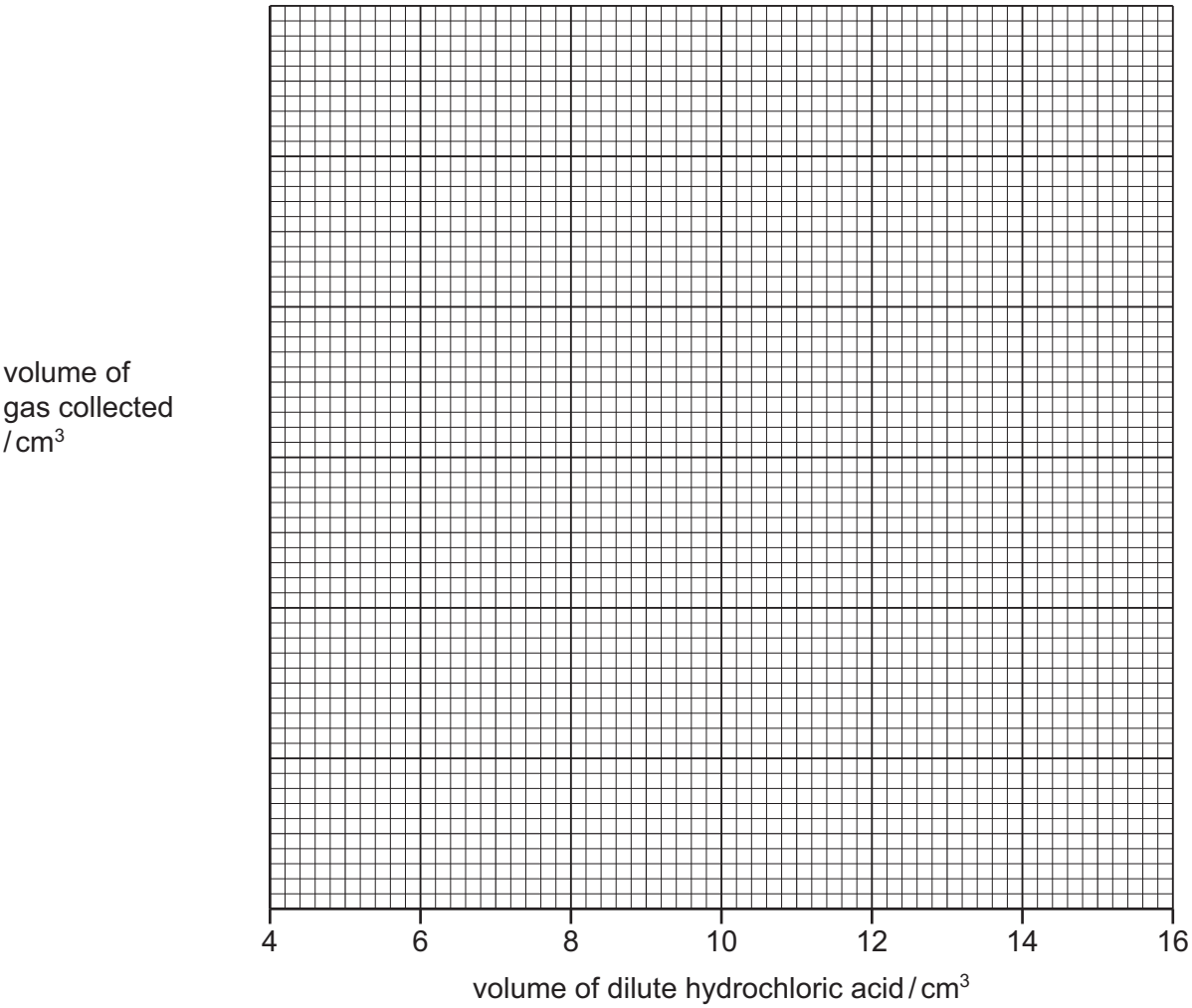
[Turn over

(a) Use the information in the description of the experiments and the inverted measuring cylinder diagrams to complete the table.

experiment	volume of dilute hydrochloric acid / cm^3	inverted measuring cylinder diagram	volume of gas collected / cm^3
1			
2			
3			
4			
5			

[3]

(b) Write a suitable scale on the *y*-axis and plot the results from Experiments 1 to 5 on the grid. Draw a straight line of best fit.



[4]

(c) (i) **From your graph**, deduce the volume of gas that would be collected if 7 cm^3 of dilute hydrochloric acid was used.

Show clearly **on the grid** how you worked out your answer.

..... cm^3
[2]

(ii) The volume of gas made per cm^3 of dilute hydrochloric acid can be calculated using the equation shown.

$$\text{volume of gas per cm}^3\text{ of acid} = \frac{\text{volume of gas collected in cm}^3}{\text{volume of acid in cm}^3}$$

Use this equation and your answer to **(c)(i)** to calculate the volume of gas made per cm^3 of dilute hydrochloric acid.

..... [1]

[Turn over

(d) The bung was removed and then replaced immediately after the sodium carbonate was added to the boiling tube.

(i) Explain why the bung must be replaced immediately after the sodium carbonate is added to the boiling tube.

.....

..... [1]

(ii) Explain how the apparatus could be altered so that the bung does **not** have to be removed. You may draw a diagram to explain your answer.

.....

..... [2]

(e) State **one** advantage of using a burette rather than a measuring cylinder to measure the volume of the dilute hydrochloric acid.

..... [1]

(f) In Experiments 1 to 5, the sodium carbonate was in excess.

Sketch **on the grid** the graph you would expect if all of the experiments were repeated using dilute hydrochloric acid of half the concentration.

Label your line **F**. [2]

[Total: 16]

3 Solution **G** and solid **H** were analysed.

tests on solution G

tests	observations
Solution **G** was divided into three equal portions in three test-tubes. **test 1** Sodium hydroxide was added dropwise and then in excess to the first portion of solution **G**.	white precipitate which did not dissolve in excess
test 2 About 1 cm^3 of dilute nitric acid followed by a few drops of aqueous silver nitrate were added to the second portion of solution **G**.	yellow precipitate
test 3 About 10 cm^3 of aqueous hydrogen peroxide was added to the third portion of solution **G**. The gas produced was tested.	the mixture became brown and bubbled; the gas relit a glowing splint

(a) Identify the gas produced in **test 3**.

..... [1]

(b) Use the results of **test 1** and **test 2** to identify solution **G**.

.....

.....

..... [2]

[Turn over

tests on solid H

Solid **H** was hydrated copper(II) sulfate.

Complete the expected observations.

(c) About half of solid **H** was placed in a boiling tube and heated using a Bunsen burner.

observations .....

..... [2]

(d) A flame test was carried out on solid **H**.

observations ..... [1]

The remaining solid **H** was placed in a boiling tube. About 10 cm^3 of distilled water was added to the boiling tube. The tube was shaken to dissolve solid **H** and form solution **H**.

Solution **H** was divided into two approximately equal portions in two test-tubes.

(e) Aqueous ammonia was added dropwise and then in excess to the first portion of solution **H**.

observations .....

.....

..... [3]

(f) Approximately 1 cm^3 of dilute nitric acid followed by a few drops of aqueous barium nitrate were added to the second portion of solution **H**.

observations ..... [1]

[Total: 10]

4 The mineral epsomite contains hydrated magnesium sulfate. When epsomite is heated strongly, it loses water and eventually becomes anhydrous magnesium sulfate.

Plan an investigation to find the percentage by mass of water in a sample of epsomite. Your plan should include how you would calculate the percentage by mass of water in epsomite.
You have access to common laboratory apparatus.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [6]

BLANK PAGE