Cambridge Assessment International Education

# Cambridge IGCSE™

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| CANDIDATE NAME | | | | | | | | | |
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*9217316557*

**CHEMISTRY** **0620/52**

Paper 5 Practical Test **May/June 2021**

**1 hour 15 minutes**

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

**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 [ ].
- Notes for use in qualitative analysis are provided in the question paper.

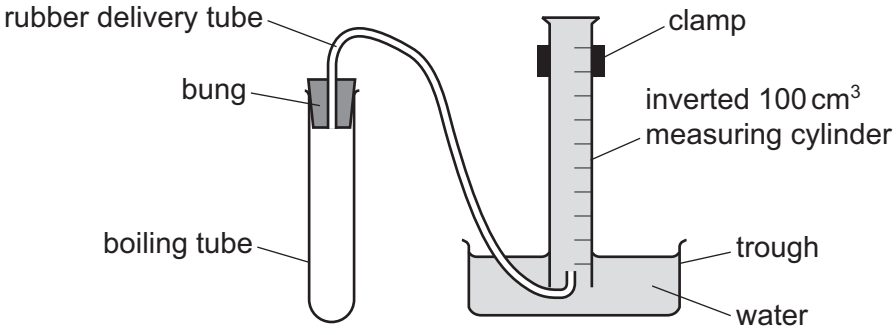
| For Examiner's Use | |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| Total | |

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

**1** You are going to investigate the volume of gas made when sodium carbonate reacts with dilute hydrochloric acid.

**Read all of the instructions carefully before starting the experiments.**

**Instructions**
You are going to do five experiments using the apparatus shown.




*Experiment 1*
- Use a 25 $cm^3$ measuring cylinder to pour 16 $cm^3$ of dilute hydrochloric acid into a boiling tube.
- Set up the apparatus as shown in the diagram. Ensure the inverted measuring cylinder is full of water.
- Remove the bung from the boiling tube.
- Add a 2.5 g sample of sodium carbonate to the boiling tube and immediately replace the bung.
- When the volume of gas in the measuring cylinder stops changing, measure the volume of gas in the measuring cylinder. Record the volume in the table in **(a)**.

*Experiment 2*
- Repeat Experiment 1 using 14 $cm^3$ of dilute hydrochloric acid instead of 16 $cm^3$.

*Experiment 3*
- Repeat Experiment 2 using 12 $cm^3$ of dilute hydrochloric acid instead of 14 $cm^3$.

*Experiment 4*
- Repeat Experiment 3 using 10 $cm^3$ of dilute hydrochloric acid instead of 12 $cm^3$.
- Use a 10 $cm^3$ measuring cylinder to measure the volume of the acid.

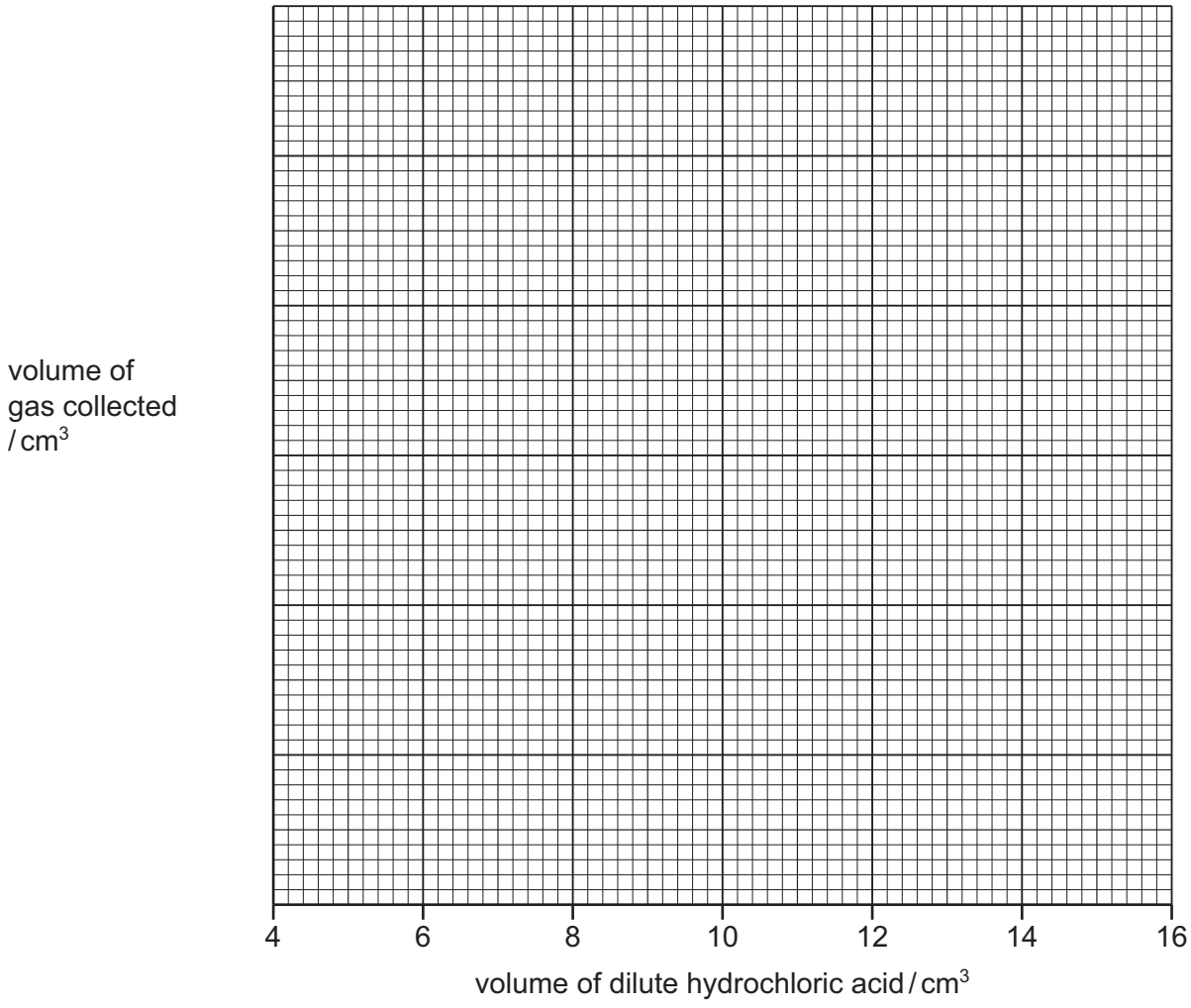
*Experiment 5*
- Repeat Experiment 4 using 6 $cm^3$ of dilute hydrochloric acid instead of 10 $cm^3$.

**(a)** Complete the table.

| experiment | volume of dilute hydrochloric acid / $cm^3$ | volume of gas collected / $cm^3$ |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

[4]

**(b)** Write a suitable scale on the *y*-axis and plot your 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]

**(d)** The bung is removed and then replaced immediately after the sodium carbonate is 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: 17]

**2** You are provided with one solution, solution **G**, and one solid, solid **H**.
Do the following tests on the substances, recording all of your observations at each stage.

**tests on solution G**

Divide solution **G** into four approximately equal portions in three test-tubes and one boiling tube.

Keep one portion in a test-tube for use in the tests on solid **H**.

**(a)** To the first portion of solution **G** in a test-tube, add aqueous sodium hydroxide dropwise and then in excess.
Record your observations.

.....

..... [2]

**(b)** To the second portion of solution **G** in a test-tube, add about 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate.
Record your observations.

..... [1]

**Keep the third portion of solution G for use in (i).**

**(c)** To the portion of solution **G** in a boiling tube, add approximately 15 $cm^3$ of aqueous hydrogen peroxide. Test any gas produced.
Record your observations.

.....

.....

..... [3]

**(d)** Identify the gas formed in **(c)**.

..... [1]

**(e)** Use the results of **(a)** and **(b)** to identify solution **G**.

.....

.....

..... [2]

**tests on solid H**

**(f)** Carry out a flame test on solid **H**.
Record your observations.

..... [1]

Place solid **H** in a boiling tube. Add about 10 $cm^3$ of distilled water to the boiling tube. Place a stopper in the boiling tube and shake the tube to dissolve solid **H** and form solution **H**.

Divide solution **H** into three approximately equal portions in three test-tubes.

**(g)** To the first portion of solution **H** add aqueous ammonia dropwise and then in excess.
Record your observations.

.....

.....

..... [3]

**(h)** To the second portion of solution **H** add approximately 1 cm depth of dilute nitric acid followed by a few drops of aqueous barium nitrate.
Record your observations.

.....

..... [1]

**(i)** To the third portion of solution **H** add your remaining portion of solution **G**.
Record your observations.

.....

..... [1]

**(j)** Identify solution **H**.

.....

..... [2]

[Total: 17]

**3** 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.

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..... [6]

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**Notes for use in qualitative analysis**
**Tests for anions**

| anion | test | test result |
|---|---|---|
| carbonate ($CO_3^{2-}$) | add dilute acid | effervescence, carbon dioxide produced |
| chloride ($Cl^-$) [in solution] | acidify with dilute nitric acid, then add aqueous silver nitrate | white ppt. |
| bromide ($Br^-$) [in solution] | acidify with dilute nitric acid, then add aqueous silver nitrate | cream ppt. |
| iodide ($I^-$) [in solution] | acidify with dilute nitric acid, then add aqueous silver nitrate | yellow ppt. |
| nitrate ($NO_3^-$) [in solution] | add aqueous sodium hydroxide, then aluminium foil; warm carefully | ammonia produced |
| sulfate ($SO_4^{2-}$) [in solution] | acidify, then add aqueous barium nitrate | white ppt. |
| sulfite ($SO_3^{2-}$) | add dilute hydrochloric acid, warm gently and test for the presence of sulfur dioxide | sulfur dioxide produced will turn acidified aqueous potassium manganate(VII) from purple to colourless |

**Tests for aqueous cations**

| cation | effect of aqueous sodium hydroxide | effect of aqueous ammonia |
|---|---|---|
| aluminium ($Al^{3+}$) | white ppt., soluble in excess, giving a colourless solution | white ppt., insoluble in excess |
| ammonium ($NH_4^+$) | ammonia produced on warming | – |
| calcium ($Ca^{2+}$) | white ppt., insoluble in excess | no ppt., or very slight white ppt. |
| chromium(III) ($Cr^{3+}$) | green ppt., soluble in excess | grey-green ppt., insoluble in excess |
| copper(II) ($Cu^{2+}$) | light blue ppt., insoluble in excess | light blue ppt., soluble in excess, giving a dark blue solution |
| iron(II) ($Fe^{2+}$) | green ppt., insoluble in excess | green ppt., insoluble in excess |
| iron(III) ($Fe^{3+}$) | red-brown ppt., insoluble in excess | red-brown ppt., insoluble in excess |
| zinc ($Zn^{2+}$) | white ppt., soluble in excess, giving a colourless solution | white ppt., soluble in excess, giving a colourless solution |

**Tests for gases**

| gas | test and test result |
|---|---|
| ammonia ($NH_3$) | turns damp red litmus paper blue |
| carbon dioxide ($CO_2$) | turns limewater milky |
| chlorine ($Cl_2$) | bleaches damp litmus paper |
| hydrogen ($H_2$) | 'pops' with a lighted splint |
| oxygen ($O_2$) | relights a glowing splint |
| sulfur dioxide ($SO_2$) | turns acidified aqueous potassium manganate(VII) from purple to colourless |

**Flame tests for metal ions**

| metal ion | flame colour |
|---|---|
| lithium ($Li^+$) | red |
| sodium ($Na^+$) | yellow |
| potassium ($K^+$) | lilac |
| copper(II) ($Cu^{2+}$) | blue-green |