



# Cambridge IGCSE™

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## CHEMISTRY

**0620/52**

Paper 5 Practical Test

**February/March 2020**

**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	
<b>Total</b>	

This document has **12** pages. Blank pages are indicated.

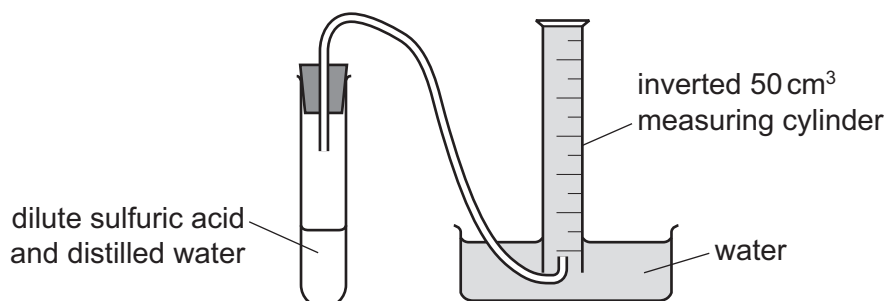


- 1 You are going to investigate the time taken to collect  $40\text{ cm}^3$  of hydrogen gas when magnesium reacts with dilute sulfuric acid.

**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 the  $10\text{ cm}^3$  measuring cylinder to pour  $8\text{ cm}^3$  of dilute sulfuric acid into the boiling tube.
- Use the  $25\text{ cm}^3$  measuring cylinder to pour  $12\text{ cm}^3$  of distilled water into the boiling tube.
- Set up the apparatus as shown in the diagram, ensuring the inverted measuring cylinder is full of water.
- Remove the bung from the boiling tube.
- Add a coiled length of magnesium ribbon to the boiling tube, immediately replace the bung and start the timer.
- Measure the time taken for  $40\text{ cm}^3$  of gas to be collected. Record the time **to the nearest second** in the table in **(b)**.
- Feel the outside of the boiling tube.

- (a) (i) What happens to the temperature of the contents of the boiling tube during the reaction?

..... [1]

- (ii) What does your answer to (a)(i) tell you about the type of reaction?

..... [1]

- (iii) Describe **one** change that could be made to the apparatus to help keep the temperature of the contents of the boiling tube constant during the reaction.

..... [1]

*Experiment 2*

- Rinse out the boiling tube with distilled water.
- Use a measuring cylinder to pour 10 cm<sup>3</sup> of dilute sulfuric acid and 10 cm<sup>3</sup> of distilled water into the boiling tube.
- Set up the apparatus as shown in the diagram, ensuring the inverted measuring cylinder is full of water.
- Remove the bung from the boiling tube.
- Add a coiled length of magnesium ribbon to the boiling tube, immediately replace the bung and start the timer.
- Measure the time taken for 40 cm<sup>3</sup> of gas to be collected. Record the time **to the nearest second** in the table in **(b)**.

*Experiment 3*

- Repeat Experiment 2 using the 25 cm<sup>3</sup> measuring cylinder to pour 12 cm<sup>3</sup> of dilute sulfuric acid into the boiling tube. Use the 10 cm<sup>3</sup> measuring cylinder to pour 8 cm<sup>3</sup> of distilled water into the boiling tube.

*Experiment 4*

- Repeat Experiment 3 using 16 cm<sup>3</sup> of dilute sulfuric acid and 4 cm<sup>3</sup> of distilled water.

*Experiment 5*

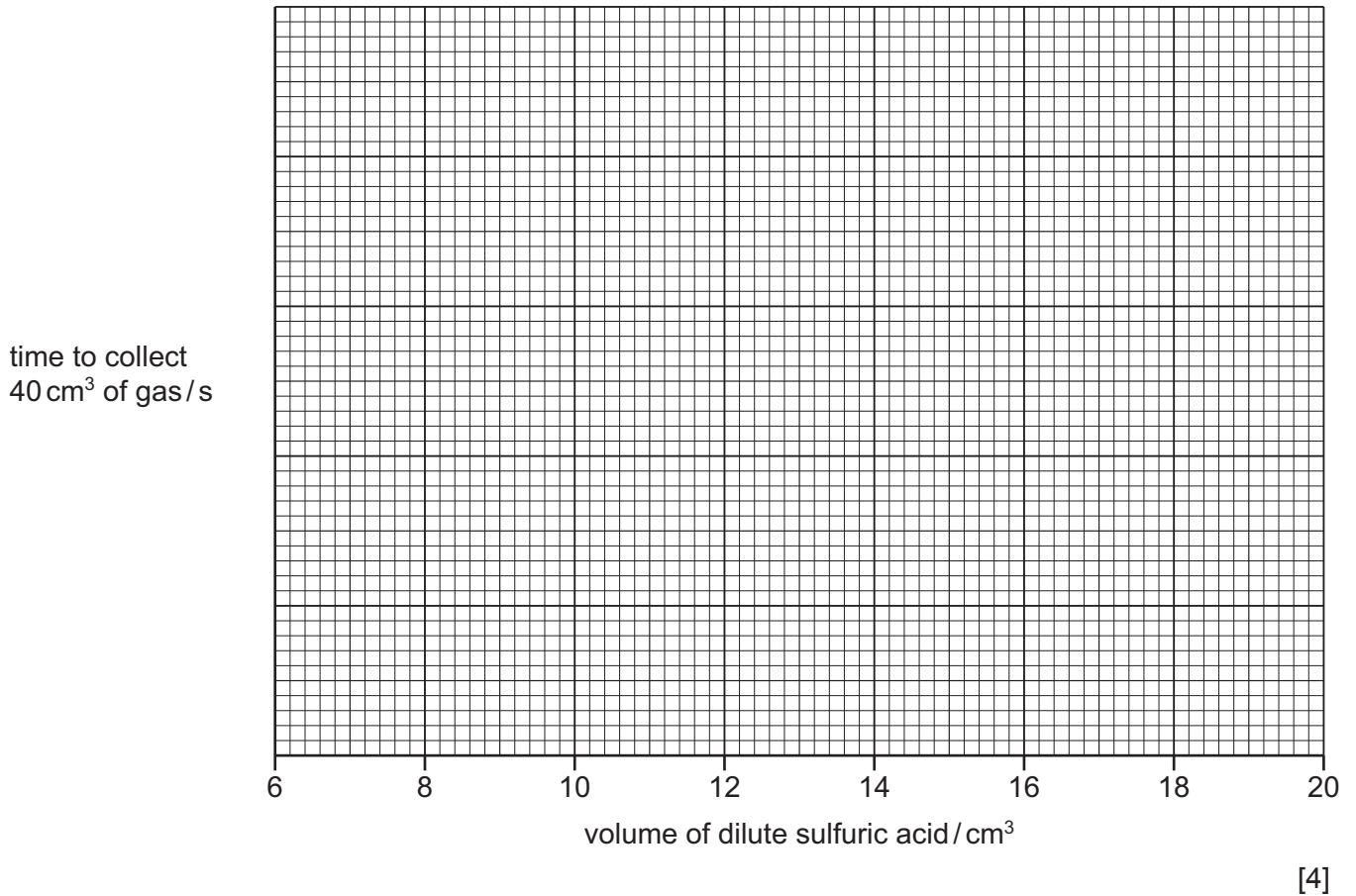
- Repeat Experiment 3 using 20 cm<sup>3</sup> of dilute sulfuric acid and no distilled water.

**(b)** Complete the table.

experiment	volume of dilute sulfuric acid / cm <sup>3</sup>	volume of distilled water / cm <sup>3</sup>	time to collect 40 cm <sup>3</sup> of gas / s
1	8		
2	10		
3	12		
4	16		
5	20		

[4]

- (c) Add a suitable scale to the  $y$ -axis and plot your results from Experiments 1 to 5 on the grid. Draw a smooth line graph.



- (d) (i) **From your graph**, deduce the time taken to collect  $40 \text{ cm}^3$  of gas if the experiment was repeated using  $9 \text{ cm}^3$  of dilute sulfuric acid.

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

..... s  
[2]

- (ii) What volume of distilled water would be needed if the experiment was repeated using  $9 \text{ cm}^3$  of dilute sulfuric acid?

.....  $\text{cm}^3$  [1]

(e) The rate of reaction can be calculated using the equation shown.

$$\text{rate of reaction} = \frac{\text{volume of gas collected}}{\text{time taken to collect the gas}}$$

(i) Use this equation to calculate the rate of reaction in Experiment 1. Give the units for the rate of reaction you have calculated.

rate of reaction = ..... units = ..... [2]

(ii) In which Experiment, 1, 2, 3, 4 or 5, was the rate of reaction greatest?

..... [1]

(f) Why would measuring the volume of dilute sulfuric acid with a burette rather than a measuring cylinder be an improvement?

.....  
 ..... [1]

(g) The magnesium starts to react with the dilute sulfuric acid as soon as it is added.

(i) Why does this decrease the accuracy of the investigation?

.....  
 ..... [1]

(ii) Describe **one** improvement that could be made to overcome this problem.

.....  
 .....  
 ..... [1]

(h) Sketch **on the grid** in (c) the graph you would expect if all of the experiments were repeated at a **higher** temperature. Clearly label your graph. [1]

[Total: 21]

- 2 You are provided with two substances, solution **J** and solid **K**.  
Do the following tests on solution **J** and solid **K**, recording all of your observations at each stage.

**tests on solution J**

Divide solution **J** into four approximately equal portions in four test-tubes. You will need to keep one portion for the tests on solid **K**.

- (a) Describe the appearance of solution **J**.

..... [1]

- (b) Test the pH of the first portion of solution **J**.

pH = ..... [1]

- (c) Add a spatula measure of sodium carbonate to the second portion of solution **J**.  
Test the gas produced.  
Record your observations.

.....  
.....  
..... [3]

- (d) Add about 1 cm<sup>3</sup> of dilute nitric acid and a few drops of aqueous silver nitrate to the third portion of solution **J**.  
Record your observations.

.....  
..... [1]

- (e) Identify solution **J**.

.....  
..... [2]

**tests on solid K**

- (f) Using a spatula, place approximately half of solid **K** in a test-tube. Add the fourth portion of solution **J** to this portion of solid **K**. Stopper the test-tube and shake the contents. Carefully smell the product.

Record your observations.

..... [1]

- (g) Add the remaining solid **K** to about 10 cm<sup>3</sup> of distilled water in a boiling tube. Stopper the boiling tube and shake it to dissolve solid **K** and form solution **K**.

- (i) Add 2 cm<sup>3</sup> of aqueous sodium hydroxide to solution **K**.

Record your observations.

..... [1]

- (ii) Warm the mixture formed in (g)(i) gently. Test any gas produced.

Record your observations.

.....

..... [2]

- (h) Identify **one** ion in solid **K**.

..... [1]

[Total: 13]







## Notes for use in qualitative analysis

## Tests for anions

anion	test	test result
carbonate ( $\text{CO}_3^{2-}$ )	add dilute acid	effervescence, carbon dioxide produced
chloride ( $\text{Cl}^-$ ) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
bromide ( $\text{Br}^-$ ) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	cream ppt.
iodide ( $\text{I}^-$ ) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	yellow ppt.
nitrate ( $\text{NO}_3^-$ ) [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
sulfate ( $\text{SO}_4^{2-}$ ) [in solution]	acidify, then add aqueous barium nitrate	white ppt.
sulfite ( $\text{SO}_3^{2-}$ )	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 ( $\text{Al}^{3+}$ )	white ppt., soluble in excess, giving a colourless solution	white ppt., insoluble in excess
ammonium ( $\text{NH}_4^+$ )	ammonia produced on warming	–
calcium ( $\text{Ca}^{2+}$ )	white ppt., insoluble in excess	no ppt., or very slight white ppt.
chromium(III) ( $\text{Cr}^{3+}$ )	green ppt., soluble in excess	grey-green ppt., insoluble in excess
copper(II) ( $\text{Cu}^{2+}$ )	light blue ppt., insoluble in excess	light blue ppt., soluble in excess, giving a dark blue solution
iron(II) ( $\text{Fe}^{2+}$ )	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) ( $\text{Fe}^{3+}$ )	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc ( $\text{Zn}^{2+}$ )	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 <sub>3</sub> )	turns damp red litmus paper blue
carbon dioxide (CO <sub>2</sub> )	turns limewater milky
chlorine (Cl <sub>2</sub> )	bleaches damp litmus paper
hydrogen (H <sub>2</sub> )	'pops' with a lighted splint
oxygen (O <sub>2</sub> )	relights a glowing splint
sulfur dioxide (SO <sub>2</sub> )	turns acidified aqueous potassium manganate(VII) from purple to colourless

**Flame tests for metal ions**

metal ion	flame colour
lithium (Li <sup>+</sup> )	red
sodium (Na <sup>+</sup> )	yellow
potassium (K <sup>+</sup> )	lilac
copper(II) (Cu <sup>2+</sup> )	blue-green

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