Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

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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	
Total	

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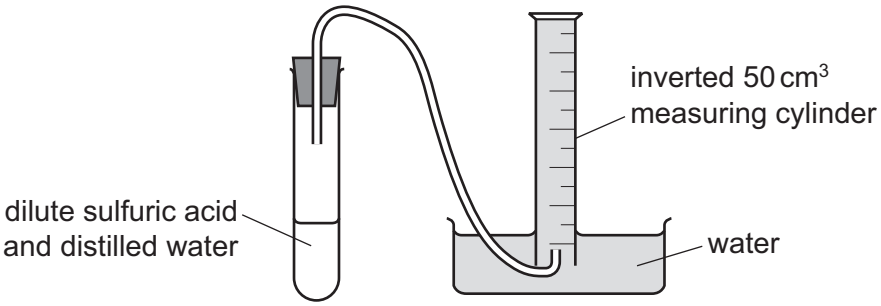
1 You are going to investigate the time taken to collect 40 cm^3 of hydrogen gas when magnesium reacts with dilute sulfuric acid.

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 cm^3 measuring cylinder to pour 8 cm^3 of dilute sulfuric acid into the boiling tube.
- Use the 25 cm^3 measuring cylinder to pour 12 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 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]

[Turn over

Experiment 2

- Rinse out the boiling tube with distilled water.
- Use a measuring cylinder to pour 10 cm^3 of dilute sulfuric acid and 10 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 cm^3 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^3 measuring cylinder to pour 12 cm^3 of dilute sulfuric acid into the boiling tube. Use the 10 cm^3 measuring cylinder to pour 8 cm^3 of distilled water into the boiling tube.

Experiment 4

- Repeat Experiment 3 using 16 cm^3 of dilute sulfuric acid and 4 cm^3 of distilled water.

Experiment 5

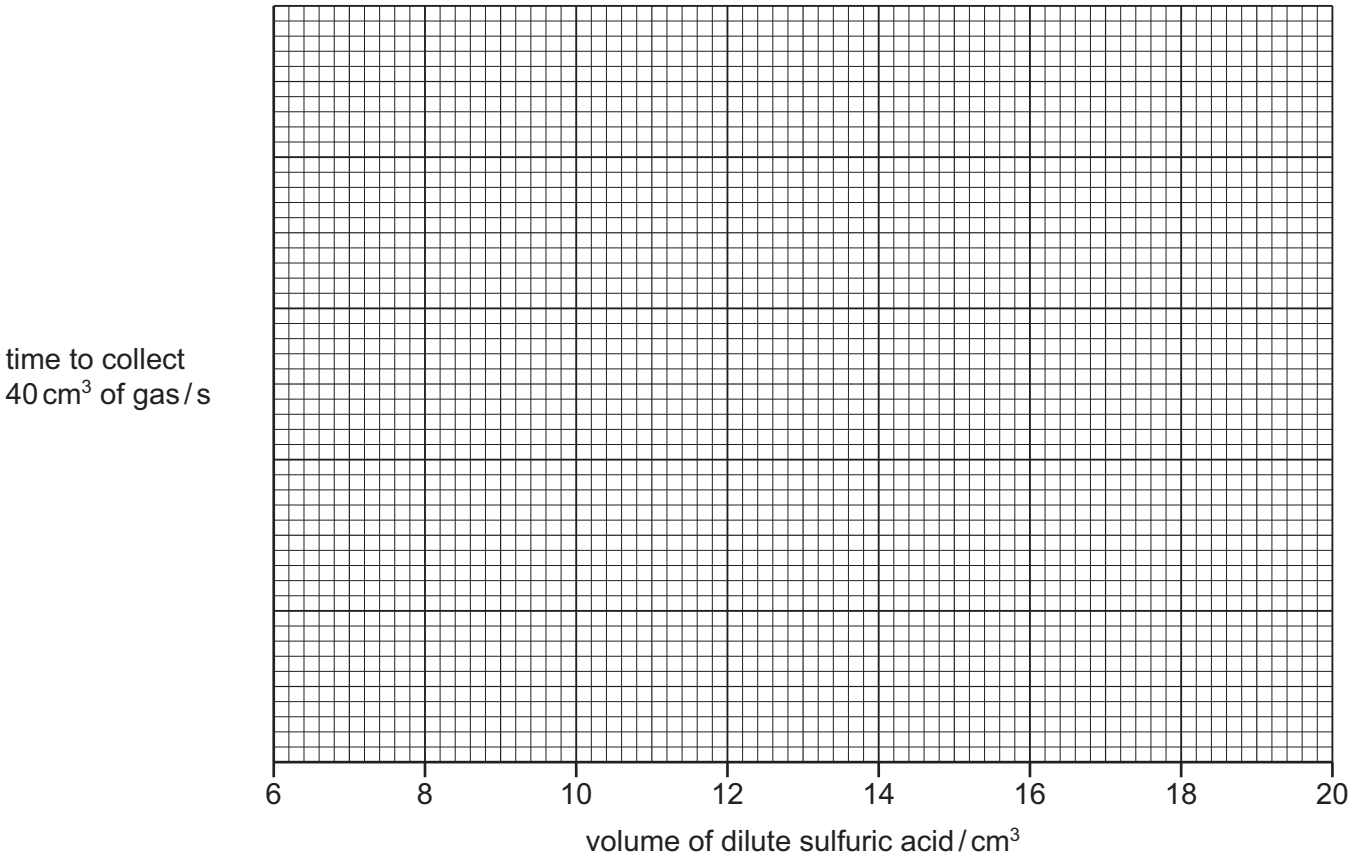
- Repeat Experiment 3 using 20 cm^3 of dilute sulfuric acid and no distilled water.

(b) Complete the table.

experiment	volume of dilute sulfuric acid / cm^3	volume of distilled water / cm^3	time to collect 40 cm^3 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.



[4]

(d) (i) **From your graph**, deduce the time taken to collect 40 cm^3 of gas if the experiment was repeated using 9 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 cm^3 of dilute sulfuric acid?

..... cm^3 [1]

[Turn over

(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^3 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^3 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^3 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]

3 A black dye can be obtained from some plant roots.

Plan an investigation to determine how many different coloured substances are contained in a black dye obtained from plant roots.

You must include how the results you obtain will tell you how many different coloured substances are contained in the black dye.

You have access to plant roots and all normal 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