Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

1059413392

CHEMISTRY **0620/53**

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.

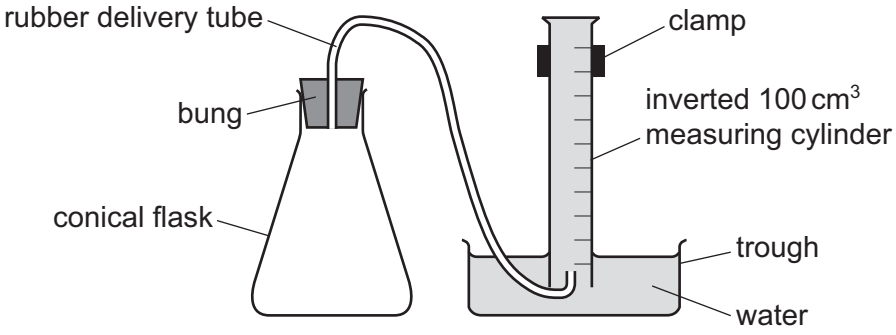
For Examiner's Use	
1	
2	
3	
Total	

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

1 You are going to investigate the rate at which hydrogen gas is made 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 a 25 cm^3 measuring cylinder to pour 25 cm^3 of dilute sulfuric acid into the conical flask.
- Use a 50 cm^3 measuring cylinder to pour 30 cm^3 of distilled water into the conical flask.
- Set up the apparatus as shown in the diagram. Ensure the inverted measuring cylinder is full of water.
- Remove the bung from the conical flask.
- Add a coiled length of magnesium ribbon to the conical flask, immediately replace the bung and start the timer.
- Measure the volume of gas collected in the inverted measuring cylinder after 30 seconds. Record the volume of gas collected in the table in **(a)**.

Experiment 2
- Empty the conical flask and rinse it with distilled water.
- Repeat Experiment 1 using 20 cm^3 of distilled water instead of 30 cm^3. Measure the water using the second 25 cm^3 measuring cylinder.

Experiment 3
- Repeat Experiment 2 using 10 cm^3 of distilled water instead of 20 cm^3.

Experiment 4
- Repeat Experiment 3 using 5 cm^3 of distilled water instead of 10 cm^3.

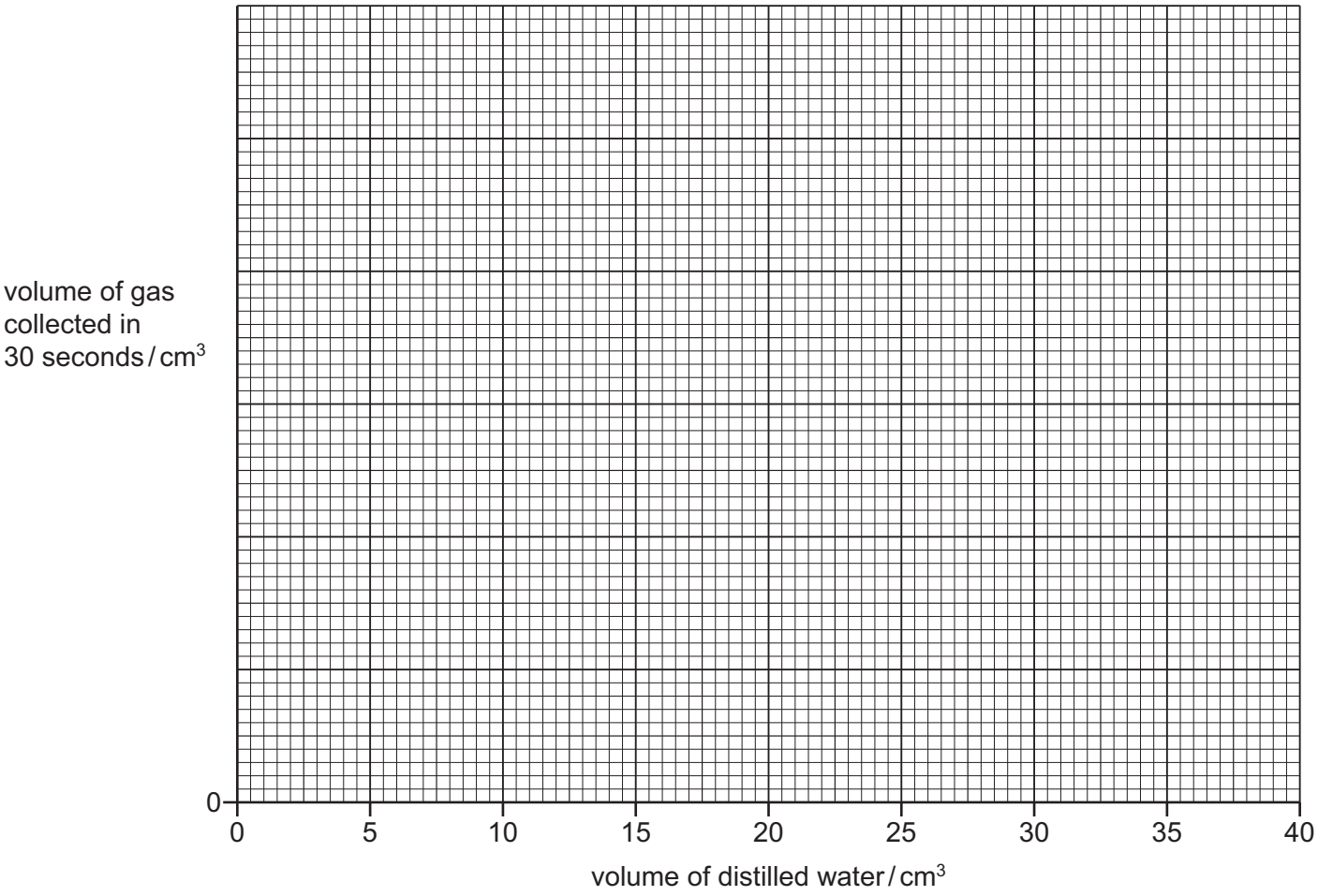
Experiment 5
- Repeat Experiment 4 but do not add any distilled water to the dilute sulfuric acid.

(a) Complete the table.

experiment	volume of dilute sulfuric acid / cm^3	volume of distilled water / cm^3	volume of gas collected in 30 seconds / 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 smooth curve of best fit.



[4]

(c) Extrapolate (extend) the line on your graph and deduce the volume of gas that would be collected in 30 seconds if 35 cm^3 of distilled water was added to the dilute sulfuric acid.

..... cm^3
[2]

(d) 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 3. Give the units for the rate you have calculated.

rate = ...

units = ...
[2]

(ii) State which Experiment, 1, 2, 3, 4 or 5, had the highest rate of reaction.

..... [1]

(e) The volume of the dilute sulfuric acid was measured using a measuring cylinder. A 25 cm^3 pipette can be used instead of a measuring cylinder.

(i) State **one** advantage of using a 25 cm^3 pipette instead of a measuring cylinder.

..... [1]

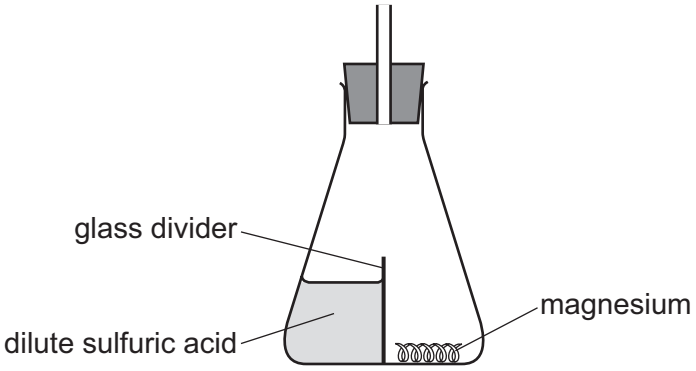
(ii) State **one** disadvantage of using a 25 cm^3 pipette instead of a measuring cylinder.

..... [1]

(f) Name another item of apparatus, which can be used instead of an inverted measuring cylinder, to collect and measure the volume of gas made in the reaction.

..... [1]

(g) The diagram shows a modified conical flask that can be used in this investigation.



Explain the advantage of using this type of conical flask instead of the type you used in the investigation.

.....

..... [2]

[Total: 18]

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

tests on solid I

Place solid **I** 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 **I** and form solution **I**.
Divide solution **I** into four approximately equal portions in four test-tubes.

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

.....

.....

..... [2]

(b) To the second portion of solution **I**, add aqueous ammonia gradually until there is no further change.
Record your observations.

.....

..... [2]

(c) To the third portion of solution **I**, add about 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate. Leave the mixture to stand for about 5 minutes.
Record your observations.

..... [1]

(d) To the fourth portion of solution **I**, add about 2 cm depth of aqueous sodium carbonate.
Record your observations.

..... [1]

(e) Use your observations from **(a)**, **(b)** and **(c)** to identify solid **I**.

.....

..... [2]

tests on solid J

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

..... [1]

(g) **(i)** Place approximately half of solid **J** in a boiling tube. Add about 10 cm^3 of dilute sulfuric acid to solid **J** in the boiling tube. Test any gas produced.
Record your observations.

.....

..... [2]

(ii) Identify the gas produced in **(g)(i)**.

..... [1]

(h) Place the remaining solid **J** 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 **J** and form solution **J**.

Divide solution **J** into two approximately equal portions in two test-tubes.

(i) To the first portion of solution **J**, add about 1 cm depth of aqueous sodium hydroxide.
Record your observations.

.....

..... [1]

(ii) To the second portion of solution **J**, add about 2 cm depth of aqueous copper(II) sulfate.
Record your observations.

.....

..... [1]

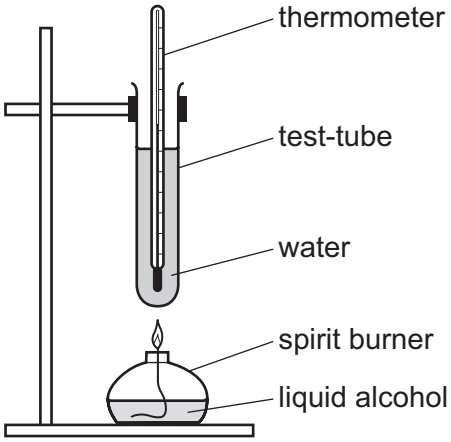
(i) Use your observations from **(f)** and **(g)** to identify solid **J**.

.....

..... [2]

[Total: 16]

3 The energy given out when different liquid alcohols are burned can be compared using the apparatus shown.



Describe how the apparatus shown can be used to compare the amount of energy given out by three different liquid alcohols, ethanol, propanol and butanol. Your answer should include how the results can be used to determine which fuel gives out the most energy.

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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