Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

8469504760

CHEMISTRY **5070/31**

Paper 3 Practical Test **May/June 2020**

1 hour 30 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	
Total	

This document has **8** pages. Blank pages are indicated.

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[Turn over

1 Magnesium reacts with dilute hydrochloric acid to form magnesium chloride and hydrogen.

The equation for this reaction is shown.

$$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$$

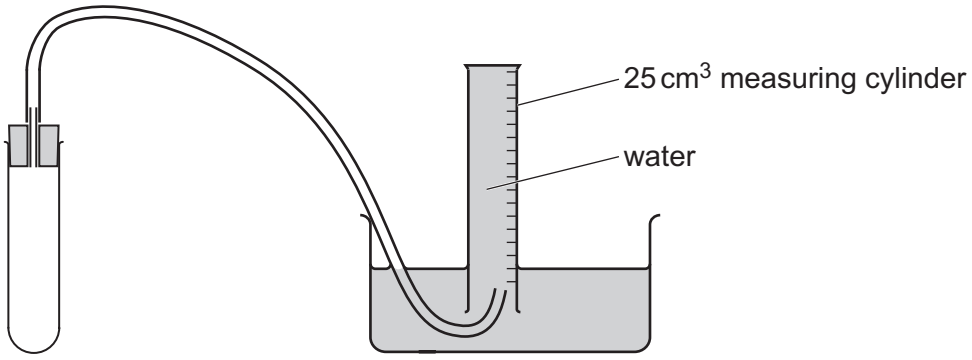
You are going to investigate the effect of the concentration of hydrochloric acid on the rate of the reaction.

P is 2.0 mol / dm^3 hydrochloric acid.

Q is magnesium ribbon.

(a) Use the apparatus shown with the boiling tube in a rack and the measuring cylinder supported with a stand and clamp.

Fill the trough and measuring cylinder with water.



Remove the bung from the boiling tube.

Place one strip of **Q** into the boiling tube.

In experiment **1** add 4.0 cm^3 of water and then 6.0 cm^3 of **P** to the boiling tube.
Quickly insert the bung back into the boiling tube.

Immediately start timing.

Stop timing when 18 cm^3 of hydrogen has been collected. Record the time taken to the nearest second in the table.

Repeat the experiment four more times using the volumes of **P** and water shown in the table.

experiment	**1**	**2**	**3**	**4**	**5**
volume of water / cm^3	4.0	3.0	2.0	1.0	0.0
volume of **P** / cm^3	6.0	7.0	8.0	9.0	10.0
time to produce 18 cm^3 gas / s					
concentration of **P** in mol / dm^3					2.0

[7]

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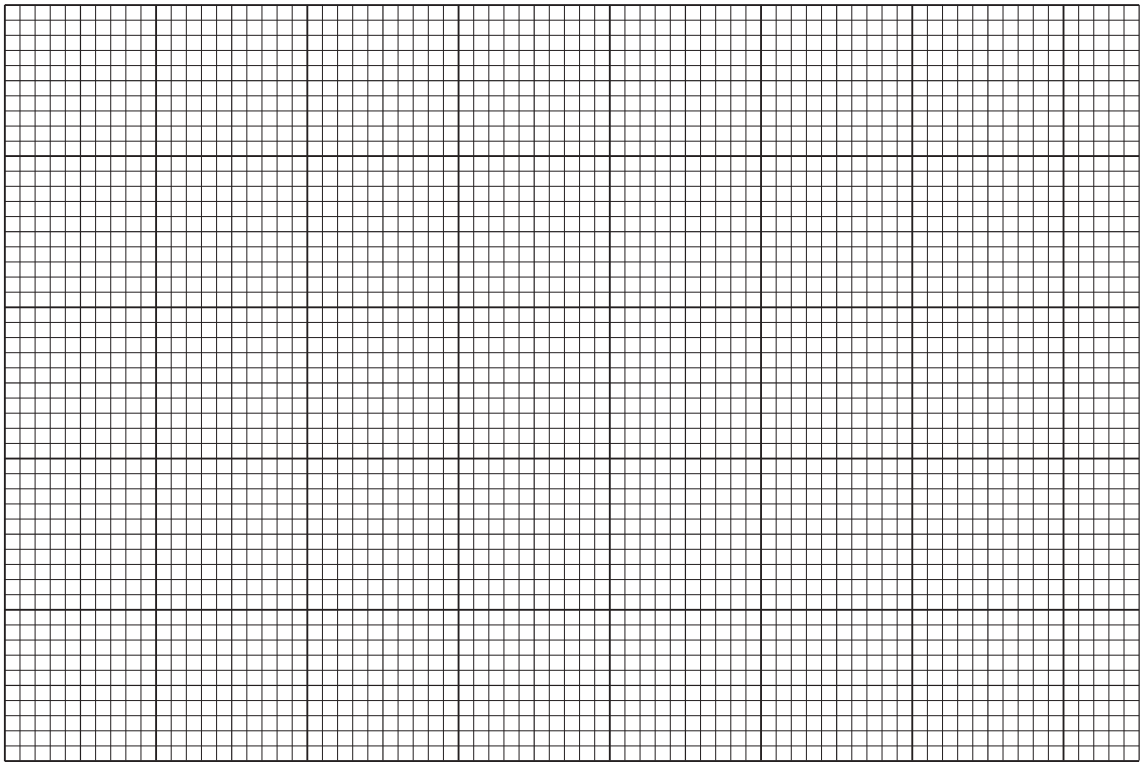
(b) **P** is 2.0 mol / dm^3 hydrochloric acid.

Calculate the concentration of hydrochloric acid in each experiment.

Write your answers in the table. [1]

(c) Use data from the table to plot a graph of the concentration of hydrochloric acid (*x*-axis) against the time taken to collect 18 cm^3 of hydrogen (*y*-axis).

Draw a curve of best fit.



[5]

(d) Calculate the number of moles of hydrogen, H_2, in 18 cm^3 of hydrogen at room temperature and pressure (r.t.p.).

[The volume of one mole of hydrogen is 24 000 cm^3 at r.t.p.]

number of moles of hydrogen ..... [1]

(e) Use your answer from **(d)** to calculate the number of moles of HCl that react to form 18 cm^3 of H_2 at r.t.p.

$$Mg(s) + 2HCl(aq) \longrightarrow MgCl_2(aq) + H_2(g)$$

number of moles of HCl ..... [1]

(f) Use data from the table and your answer from **(e)** to calculate the mean rate of reaction, in mol/s, of **P** in experiment **5**.

Give your answer to **two** significant figures.

mean rate of reaction in experiment **5** ..... mol/s [2]

[Total: 17]

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2 You are provided with solution **R** and solution **S**.

(a) (i) Do the tests shown in the table on **R**.

Record your observations in the table.

You should test and name any gases evolved.

test no.	test	observations
1	To 1 cm depth of **R** in a boiling tube, add aqueous sodium hydroxide drop by drop until a change is seen. Add excess aqueous sodium hydroxide. Keep the solution for use in test **2**.	
2	Gently warm the mixture from test **1**.	
3	To 1 cm depth of **R** in a test-tube, add aqueous ammonia drop by drop until a change is seen. Add excess aqueous ammonia.	
4	To 1 cm depth of **R** in a test-tube, add a few drops of dilute nitric acid. Add a 1 cm depth of aqueous barium nitrate.	

[9]

Conclusions

(ii) **R** contains two cations.

Identify the **two** cations in **R**.

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

(iii) **R** contains one anion.

Identify the anion in **R**.

..... [1]

(b) **(i)** Do the tests shown in the table on **S**.

Record your observations in the table.

You should test and name any gases evolved.

test no.	test	observations
1	To 1 cm depth of **S** in a boiling tube, add a 1 cm depth of aqueous sodium carbonate. Add dilute nitric acid until there is no further change.	
2	To 1 cm depth of **S** in a test-tube, add aqueous sodium hydroxide drop by drop until a change is seen. Add excess aqueous sodium hydroxide.	
3	To 1 cm depth of **S** in a test-tube, add a few drops of dilute nitric acid. Add a 1 cm depth of aqueous silver nitrate.	

[9]

Conclusions

(ii) **S** contains one cation.

Identify the cation in **S**.

..... [1]

(iii) **S** contains one anion.

Identify the anion in **S**.

..... [1]

[Total: 23]

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QUALITATIVE ANALYSIS NOTES

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.
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 add aluminium foil; warm carefully	ammonia produced
sulfate (SO_4^{2-}) [in solution]	acidify with dilute nitric acid, then add aqueous barium nitrate	white ppt., insoluble in excess dilute nitric acid

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.
chromium(III) (Cr^{3+})	green ppt., soluble in excess, giving a green solution	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

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