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Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1830647532

CHEMISTRY **5070/32**

Paper 3 Practical Test **October/November 2024**

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	
3	
Total	

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

[Turn over

1 You are provided with:

- 0.500 mol / dm^3 dilute hydrochloric acid, HC*l*, **X**
- 150 cm^3 of an aqueous solution of sodium carbonate, **Y**.

You are going to investigate the reaction between **X** and **Y**.

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

Instructions
You are going to do **four** titration experiments.

Rinse and fill a burette with **X**.

(a) Experiment 1

- Use a volumetric pipette to add 25.0 cm^3 of **Y** to a conical flask.
- Add five drops of methyl orange indicator to the conical flask.
- Place the conical flask on a white tile.
- Record the initial burette reading in Table 1.1.
- Add **X** from the burette while swirling the flask, adding drop by drop near the end-point, until the solution just changes colour.
- Record the final burette reading in Table 1.1.

Experiments 2, 3 and 4

- Empty the conical flask and rinse it with distilled water.
- Refill the burette if necessary.
- Repeat Experiment 1.

Calculate the volume used in each experiment and record your values in Table 1.1.

Table 1.1

	experiment number			
	1	2	3	4
final burette reading / cm^3				
initial burette reading / cm^3				
volume of **X** used / cm^3				
best titration results (✓)				

[5]

(b) Tick (✓) the two best titration results in Table 1.1.

Explain your choice.

.....

..... [2]

(c) Use the ticked (✓) titration results in Table 1.1 to calculate the average volume of **X** needed to neutralise 25.0 cm^3 of **Y**.

volume ..... cm^3 [1]

(d) Use your answer from **(c)** to calculate the number of moles of HC*l* in the average volume of **X** needed to neutralise 25.0 cm^3 of **Y**.

number of moles ..... [1]

(e) The equation for the reaction between hydrochloric acid and sodium carbonate is shown.

$$2HCl + Na_2CO_3 \rightarrow 2NaCl + H_2O + CO_2$$

Use your answer from **(d)** to calculate the concentration of sodium carbonate in **Y**.

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

concentration ..... mol/dm^3 [3]

(f) Use your answer to **(e)** to calculate the mass of Na_2CO_3 in 150 cm^3 of **Y**.

[A_r: C, 12; O, 16; Na, 23]

mass ..... g [3]

(g) State why the conical flask is swirled while **X** is added from the burette.

..... [1]

(h) State why **X** is added drop by drop from the burette near the end-point.

..... [1]

[Total: 17]

Question 2 starts on page 6.

2 You are provided with solution **P** and solution **Q**.

You will do a series of tests on **P** and **Q**.

Tests on solution P

You should:

- record your observations for each of these tests
- test and identify any gases evolved
- describe the gas test used that identifies any gas evolved.

(a) Do a flame test on **P**.

flame colour ..... [1]

(b) Use the result from test **(a)** to identify the cation in **P**.

..... [1]

(c) To 2 cm depth of **P** in a boiling tube, add 2 cm depth of aqueous sodium hydroxide.

Add a piece of aluminium foil and warm the mixture carefully.

.....

.....

..... [3]

(d) Use the result from test **(c)** to identify the anion in **P**.

..... [1]

(e) Some gases have distinctive smells.

Suggest why gases should **not** be identified by smell.

..... [1]

Tests on solution Q

(f) To 2 cm depth of **Q** in a test-tube, add aqueous sodium hydroxide drop by drop until a change is seen.

Then add excess aqueous sodium hydroxide.

Record your observations.

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..... [3]

(g) To 2 cm depth of **Q** in a test-tube, add aqueous ammonia drop by drop until a change is seen.

Then add excess aqueous ammonia.

Record your observations.

.....

.....

..... [2]

(h) To 2 cm depth of **Q** in a test-tube, add 1 cm depth of dilute nitric acid.

Record your observations.

.....

Then add aqueous silver nitrate drop by drop until a change is seen.

Record your observations.

.....

..... [3]

(i) Identify the cation and the anion in **Q**.

cation ..... anion ..... [2]

[Total: 17]

3 You are not expected to do any practical work for this question.

Muntz metal is an alloy that contains zinc and copper.

Zinc reacts with dilute sulfuric acid. Copper does **not** react with dilute sulfuric acid.

Plan an investigation to find the percentage by mass of zinc in a powdered sample of Muntz metal which contains only zinc and copper.

Your plan must include the use of common laboratory apparatus, Muntz metal and sulfuric acid. No other chemicals should be used.

Your plan must include:

- the apparatus needed
- the method to use and the measurements to take
- procedures to ensure that the percentage determined is as accurate as possible
- how the measurements are used to determine the percentage by mass of zinc in the sample of Muntz metal.

You may draw a diagram to help answer the question.

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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, then test for carbon dioxide gas	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 with dilute nitric acid, then add aqueous barium nitrate	white ppt.
sulfite, SO_3^{2-}	add a small volume of acidified aqueous potassium manganate(VII)	the acidified aqueous potassium manganate(VII) changes colour 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	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, ppt. turns brown near surface on standing	green ppt., insoluble in excess, ppt. turns brown near surface on standing
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
calcium, Ca^{2+}	orange-red
barium, Ba^{2+}	light green
copper(II), Cu^{2+}	blue-green