Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

0145458826

CHEMISTRY **0620/52**

Paper 5 Practical Test **February/March 2024**

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.

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1 You are going to investigate the reaction between aqueous sodium carbonate and two different solutions of dilute hydrochloric acid, labelled **A** and **B**.

Read all of the instructions carefully before starting the experiments.

Instructions
You are going to do three experiments.

(a) Experiment 1

- Rinse a burette with distilled water and then with dilute hydrochloric acid **A**.
- Rinse a conical flask with distilled water.
- Fill the burette with dilute hydrochloric acid **A**. Run some of the dilute hydrochloric acid out of the burette so that the level of the dilute hydrochloric acid is on the burette scale.
- Record the initial burette reading in Table 1.1.
- Use the measuring cylinder to pour 25 cm^3 of aqueous sodium carbonate into the conical flask.
- Add five drops of methyl orange indicator to the conical flask.
- Stand the conical flask on a white tile.
- Slowly add dilute hydrochloric acid **A** from the burette to the conical flask, while swirling the flask, until the solution becomes orange. Record the final burette reading in Table 1.1.

Experiment 2

- Refill the burette with dilute hydrochloric acid **A**. Run some of the dilute hydrochloric acid out of the burette so that the level of the dilute hydrochloric acid is on the burette scale.
- Record the initial burette reading in Table 1.1.
- Empty the conical flask and rinse it with distilled water.
- Use the measuring cylinder to pour 25 cm^3 of aqueous sodium carbonate into the conical flask.
- Add five drops of thymolphthalein indicator to the conical flask.
- Stand the conical flask on a white tile.
- Slowly add dilute hydrochloric acid **A** from the burette to the conical flask, while swirling the flask, until the solution becomes colourless. Record the final burette reading in Table 1.1.

Experiment 3

- Repeat Experiment 1, using dilute hydrochloric acid **B** instead of dilute hydrochloric acid **A**.

Complete Table 1.1.

Table 1.1

	Experiment 1	Experiment 2	Experiment 3
final burette reading / cm^3			
initial burette reading / cm^3			
volume of dilute hydrochloric acid added / cm^3			

[5]

(b) **(i)** State which solution of dilute hydrochloric acid, **A** or **B**, is the more concentrated. Explain your answer.

more concentrated solution of dilute hydrochloric acid ....

explanation ....

.... [1]

(ii) Deduce how many times more concentrated this solution of dilute hydrochloric acid is than the other solution of dilute hydrochloric acid.

....

.... [1]

(c) **(i)** Compare the volume of dilute hydrochloric acid **A** used in Experiment 1 to the volume of dilute hydrochloric acid **A** used in Experiment 2.

....

....

.... [2]

(ii) Deduce the volume of dilute hydrochloric acid **B** required to reach the end-point if Experiment 3 is repeated using thymolphthalein indicator instead of methyl orange indicator. Use your answer to **(c)(i)** to help you.

volume of dilute hydrochloric acid **B** = ... [2]

(d) At the start of Experiment 3 the burette is rinsed with distilled water and then with dilute hydrochloric acid **B**.

(i) Identify the substance removed from the burette when it is rinsed with distilled water at the start of Experiment 3.

.... [1]

(ii) Describe how the result of the titration would change if the burette was **not** rinsed with dilute hydrochloric acid **B** after it had been rinsed with water.

....

.... [1]

(iii) Explain why the conical flask is **not** rinsed with aqueous sodium carbonate after it is rinsed with water.

....

.... [1]

(e) Explain why a white tile is used during the titration.

....

.... [1]

(f) Describe the effect on the result of warming the aqueous sodium carbonate used in Experiment 1 before carrying out the titration. Explain your answer.

effect ....

explanation ....
[2]

[Total: 17]

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

Tests on solid C

Divide solid **C** into two approximately equal portions in two boiling tubes.

(a) Heat the first portion of solid **C gently** and test any gas given off with damp universal indicator paper.

Record your observations.

....

....

.... [3]

To the second portion of solid **C**, add about 10 cm^3 of distilled water. Place a stopper in the boiling tube and shake the boiling tube to dissolve solid **C** and form solution **C**.

Divide solution **C** into three approximately equal portions in two test-tubes and one boiling tube.

(b) To the first portion of solution **C** in a test-tube, add about 1 cm depth of dilute nitric acid followed by a few drops of aqueous barium nitrate.

Record your observations.

.... [1]

(c) To the second portion of solution **C** in a test-tube, add about 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate.

Record your observations.

.... [1]

(d) **(i)** To the third portion of solution **C** in a boiling tube, add about 1 cm depth of aqueous sodium hydroxide.

Keep the product for use in (d)(ii).

Record your observations.

.... [1]

(ii) Warm the product from **(d)(i)** and test any gas given off.

Record your observations.

.... [1]

(e) Identify solid **C**.

....

.... [2]

Tests on solid D

(f) Carry out a flame test on solid **D**.

Record your observations.

....

.... [1]

(g) To the boiling tube containing solid **D**, add about 5 cm depth of dilute nitric acid. Test any gas given off.

Keep the solution formed for use in (h).

Record your observations.

....

....

.... [2]

(h) Transfer about 1 cm depth of the solution formed in **(g)** to a test-tube.

To the solution in the test-tube, add aqueous sodium hydroxide gradually until there is no further change.

Record your observations.

....

.... [2]

(i) Identify **three** ions present in solid **D**.

....

....

.... [3]

[Total: 17]

3 When excess dilute sulfuric acid is added to solid zinc, hydrogen gas and aqueous zinc sulfate are made.

$$Zn(s) + H_2SO_4(aq) \rightarrow H_2(g) + ZnSO_4(aq)$$

Plan an experiment to show that copper is a catalyst for this reaction. Your plan should include how the results of the experiment will show that copper is a catalyst for this reaction.

You are provided with zinc powder, dilute sulfuric acid, copper powder and common 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, 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