



## Cambridge IGCSE™

CANDIDATE  
NAME

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**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**

<b>1</b>	
<b>2</b>	
<b>3</b>	
<b>Total</b>	

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

## 2

- 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  $25\text{ cm}^3$  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  $25\text{ cm}^3$  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 / $\text{cm}^3$			
initial burette reading / $\text{cm}^3$			
volume of dilute hydrochloric acid added / $\text{cm}^3$			

[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<sup>3</sup> 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]



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## Notes for use in qualitative analysis

### Tests for anions

anion	test	test result
carbonate, $\text{CO}_3^{2-}$	add dilute acid, then test for carbon dioxide gas	effervescence, carbon dioxide produced
chloride, $\text{Cl}^-$ [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
bromide, $\text{Br}^-$ [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	cream ppt.
iodide, $\text{I}^-$ [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	yellow ppt.
nitrate, $\text{NO}_3^-$ [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
sulfate, $\text{SO}_4^{2-}$ [in solution]	acidify with dilute nitric acid, then add aqueous barium nitrate	white ppt.
sulfite, $\text{SO}_3^{2-}$	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, $\text{Al}^{3+}$	white ppt., soluble in excess, giving a colourless solution	white ppt., insoluble in excess
ammonium, $\text{NH}_4^+$	ammonia produced on warming	—
calcium, $\text{Ca}^{2+}$	white ppt., insoluble in excess	no ppt. or very slight white ppt.
chromium(III), $\text{Cr}^{3+}$	green ppt., soluble in excess	green ppt., insoluble in excess
copper(II), $\text{Cu}^{2+}$	light blue ppt., insoluble in excess	light blue ppt., soluble in excess, giving a dark blue solution
iron(II), $\text{Fe}^{2+}$	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), $\text{Fe}^{3+}$	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc, $\text{Zn}^{2+}$	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, $\text{NH}_3$	turns damp red litmus paper blue
carbon dioxide, $\text{CO}_2$	turns limewater milky
chlorine, $\text{Cl}_2$	bleaches damp litmus paper
hydrogen, $\text{H}_2$	'pops' with a lighted splint
oxygen, $\text{O}_2$	relights a glowing splint
sulfur dioxide, $\text{SO}_2$	turns acidified aqueous potassium manganate(VII) from purple to colourless

**Flame tests for metal ions**

metal ion	flame colour
lithium, $\text{Li}^+$	red
sodium, $\text{Na}^+$	yellow
potassium, $\text{K}^+$	lilac
calcium, $\text{Ca}^{2+}$	orange-red
barium, $\text{Ba}^{2+}$	light green
copper(II), $\text{Cu}^{2+}$	blue-green

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