



# Cambridge IGCSE™ (9–1)

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**CHEMISTRY**

**0971/05**

Paper 5 Practical Test

**For examination from 2023**

SPECIMEN PAPER

**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	
<b>Total</b>	

This document has **10** pages. Any blank pages are indicated.

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

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

### Instructions

You are going to do **two** experiments.

#### (a) Experiment 1

- Rinse a burette with dilute hydrochloric acid.
- Fill the burette with dilute hydrochloric acid.
- Run some of the dilute hydrochloric acid out of the burette so that the level of dilute hydrochloric acid is on the burette scale.
- Record the initial burette reading in Table 1.1.
- Use a measuring cylinder to pour 25 cm<sup>3</sup> of solution **A** into a conical flask.
- Add five drops of thymolphthalein indicator to the conical flask.
- While swirling the conical flask, slowly add the dilute hydrochloric acid from the burette to the flask until the solution just changes colour.
- Record the final burette reading in Table 1.1 and complete the table.

#### Experiment 2

- Fill the burette with dilute hydrochloric acid.
- Run some of the dilute hydrochloric acid out of the burette so that the level of 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<sup>3</sup> of solution **B** into the conical flask.
- Add five drops of thymolphthalein indicator to the conical flask.
- While swirling the conical flask, slowly add the dilute hydrochloric acid from the burette to the flask until the solution just changes colour.
- Record the final burette reading in Table 1.1 and complete the table.

**Table 1.1**

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

[4]

- (b) State the colour change observed in Experiment 1.

from ..... to ..... [1]

- (c) (i) State which solution of sodium hydroxide, solution **A** or solution **B**, is the more concentrated.

Explain your answer.

.....  
 ..... [1]

- (ii) Deduce the simplest whole number ratio of concentration of solution **A** : concentration of solution **B**.

..... [1]

- (d) State the volume of hydrochloric acid needed if Experiment 1 is repeated using  $10\text{ cm}^3$  of solution **A**.

..... [2]

- (e) In Experiment 2 the conical flask is rinsed with distilled water.

- (i) Suggest why the conical flask is rinsed with distilled water.

..... [1]

- (ii) The conical flask is **not** dried after it is rinsed with distilled water.

Suggest why the conical flask is **not** dried.

..... [1]

- (f) State the effect, if any, on the volume of dilute hydrochloric acid used in Experiment 1 if the solution of sodium hydroxide is warmed before adding the dilute hydrochloric acid.

Give a reason for your answer.

effect on volume .....

reason .....

[2]

- (g) (i) Suggest how the reliability of the results from Experiment 1 and Experiment 2 can be confirmed.

..... [1]

- (ii) Suggest a more accurate method of measuring the volume of the solution of sodium hydroxide.

..... [1]

4

- (h) Aqueous sodium hydroxide reacts with aqueous barium chloride to form a white precipitate of barium hydroxide.

Use this information to suggest a different method of finding out which of the solutions of sodium hydroxide, solution **A** or solution **B**, is more concentrated.

In your answer, state how your results show which solution of sodium hydroxide, solution **A** or solution **B**, is more concentrated.

.....

.....

.....

..... [3]

[Total: 18]

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- 2 You are provided with two solids, solid **C** and solid **D**.

Do the following tests on solid **C** and solid **D**, recording all of your observations at each stage.

**tests on solid C**

- (a) Describe the appearance of solid **C**.

..... [1]

- (b) Place about half of solid **C** in a hard-glass test-tube. Heat the solid gently then strongly.

Record your observations.

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

Add the rest of solid **C** to about 10 cm<sup>3</sup> of distilled water in a boiling tube. Stopper the boiling tube and shake it to dissolve solid **C** and form solution **C**.

Divide solution **C** into four approximately equal portions in four test-tubes.

- (c) Test the pH of the first portion of solution **C**.

pH = ..... [1]

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

Record your observations.

..... [1]

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

Record your observations.

..... [1]

- (f) To the fourth portion of solution **C**, add aqueous ammonia dropwise and then in excess.

Record your observations.

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

(g) Identify solid **C**.

..... [2]

**tests on solid D**

(h) Do a flame test on solid **D**.

Record your observations.

..... [1]

Add the rest of solid **D** to about 10 cm<sup>3</sup> of distilled water in a boiling tube. Stopper the boiling tube and shake it to dissolve solid **D** and form solution **D**.

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

(i) To the first portion of solution **D**, add aqueous sodium hydroxide dropwise and then in excess.

Record your observations.

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

(j) To the second portion of solution **D**, add about 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate.

Record your observations.

..... [1]

(k) Identify solid **D**.

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

[Total: 16]





## 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	grey-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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