Cambridge Assessment International Education

Cambridge IGCSE™ (9–1)

CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

0123456789

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	
Total	

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^3 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^3 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^3		
initial burette reading / cm^3		
volume of dilute hydrochloric acid added / cm^3		

[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 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]

(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^3 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^3 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]

3 The label on a bottle of orange drink states ‘contains no artificial colours’.

A scientist thinks that the orange colour in the drink is a mixture of two artificial colours:

- Sunset Yellow E110
- Allura Red E129.

Plan an experiment to show that the orange colour in the drink does **not** contain these two artificial colours.

Your plan should describe the use of common laboratory apparatus and samples of E110, E129 and the orange colouring from the drink.

You may draw a diagram to help answer the question.

....

....

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....

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....

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....

....

[6]

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	grey-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

