Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

0123456789

CHEMISTRY **5070/03**

Paper 3 Practical Test **For examination from 2023**

SPECIMEN PAPER **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 **10** pages. Any blank pages are indicated.

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

Read all the instructions carefully before starting the experiments.

Instructions
You are going to do **three** experiments.

(a) Experiment 1

- Use a volumetric pipette to add 25.0 cm^3 of aqueous sodium carbonate to a conical flask.
- Add ten drops of thymolphthalein indicator to the conical flask.
- Fill the burette with solution **A**.
- Record the initial burette reading in Table 1.1.
- Add solution **A** from the burette to the conical flask while swirling the flask, until the solution turns colourless.
- Record the final burette reading in Table 1.1.

Experiment 2

- Empty the conical flask and rinse it with distilled water.
- Repeat the method in Experiment 1 with methyl orange indicator instead of thymolphthalein indicator.

Complete Table 1.1 with the volume used in each experiment.

Table 1.1

	Experiment 1	Experiment 2
final burette reading / cm^3		
initial burette reading / cm^3		
volume used / cm^3		

[4]

(b) Experiment 3

- Empty the conical flask and rinse it with distilled water.
- Empty the burette.
- Repeat the method in Experiment 1 with solution **B** instead of solution **A**. Use thymolphthalein indicator.
- Record the initial and final burette readings for Experiment 3 in Table 1.2.
- Complete Table 1.2 with the volume used in Experiment 3.

Table 1.2

	Experiment 3
final burette reading / cm^3	
initial burette reading / cm^3	
volume used / cm^3	

[2]

(c) State the colour change observed in Experiment 2.

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

(d) State **one** observation, other than colour change, during the reaction in Experiment 2.

..... [1]

(e) Complete the sentence.

Experiment ..... uses the largest volume of dilute hydrochloric acid to change the colour of the indicator. [1]

(f) State the effect on the volume of solution **B** used in Experiment 3 if the aqueous sodium carbonate is warmed before adding solution **B**.

Give a reason for your answer.

effect on volume used .....

reason .....
[2]

(g) **(i)** Calculate the simplest whole number ratio of volume of solution **A** used in Experiment 1 : volume of solution **B** used in Experiment 3.

..... [1]

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

..... [1]

(h) The burette is emptied and re-used in Experiment 3.

Suggest an additional step after emptying the burette which would improve the accuracy of the results.

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..... [2]

(i) Titrations often give inaccurate results if done only once.

Suggest how repeating each experiment several times produces more accurate values.

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..... [2]

[Total: 17]

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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.

(a) State the colour of each solid.

solid **C** .....

solid **D** .....
[1]

tests on solid C

(b) Place a spatula measure of solid **C** in a hard-glass test-tube. Heat the solid gently until no further changes are observed.

Record your observations.

.....

..... [2]

(c) **(i)** Place a spatula measure of solid **C** in a test-tube and add approximately 2 cm depth of dilute sulfuric acid.

Test the gas given off. Keep the mixture in the test-tube for use in **(c)(ii)**.

Record your observations.

.....

.....

..... [3]

(ii) Transfer the contents of the test-tube from **(c)(i)** to a boiling tube.

To this boiling tube, add aqueous ammonia dropwise and then in excess.

Record your observations.

.....

.....

..... [3]

(d) Do a flame test on solid **C**.

Record your observations.

..... [1]

(e) Identify solid **C**.

..... [2]

tests on solid D

Place approximately half of solid **D** in a test-tube. Add approximately 4 cm depth of distilled water and shake the test-tube until solid **D** completely dissolves to form solution **D**.

Divide solution **D** into two equal portions in two test-tubes and test as instructed.

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

Record your observations.

..... [1]

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

Record your observations.

..... [1]

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

Record your observations.

..... [1]

(h) Identify solid **D**.

..... [2]

[Total: 17]

3 Plant leaves contain a mixture of coloured substances.

Plan an experiment to find the R_f values of the coloured substances present in plant leaves.

Your plan should describe the use of common laboratory apparatus, plant leaves, sand, ethanol as the solvent and absorbent paper.

You may draw a diagram to help answer the question.

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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
copper(II), Cu^{2+}	blue-green
calcium, Ca^{2+}	orange-red
barium, Ba^{2+}	light green