Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

5151884402

CHEMISTRY **0620/53**

Paper 5 Practical Test **May/June 2023**

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.

1 You are going to investigate the temperature change when solid citric acid reacts with solid sodium carbonate.

Read all of the instructions carefully before starting the experiments.

Instructions
You are going to do six experiments.

(a) Experiment 1

- Place 5.0 g of solid sodium carbonate in a 100 cm^3 beaker.
- Use a thermometer to stir the solid sodium carbonate for 30 seconds. Measure the temperature of the solid sodium carbonate and record the temperature in Table 1.1.
- **Keep the sodium carbonate in the beaker for Experiment 2.**

Experiment 2

- Add 1.0 g of solid citric acid to the sodium carbonate in the beaker from Experiment 1.
- Use the thermometer to stir the mixture for 30 seconds. Measure the temperature of the mixture and record the temperature in Table 1.1.
- Rinse the beaker and thermometer with water.

Experiment 3

- Place 5.0 g of solid sodium carbonate in the 100 cm^3 beaker.
- Add 2.0 g of solid citric acid to the sodium carbonate in the beaker.
- Use the thermometer to stir the mixture for 30 seconds. Measure the temperature of the mixture and record the temperature in Table 1.1.
- Rinse the beaker and thermometer with water.

Experiment 4

- Repeat Experiment 3, using 4.0 g of solid citric acid instead of 2.0 g.

Experiment 5

- Repeat Experiment 4, using 5.0 g of solid citric acid instead of 4.0 g.

Experiment 6

- Repeat Experiment 5, using 6.0 g of solid citric acid instead of 5.0 g.

Complete Table 1.1.

Table 1.1

experiment	mass of solid sodium carbonate / g	mass of solid citric acid / g	temperature after 30 seconds / °C
1	5.0	0.0	
2	5.0	1.0	
3			
4			
5			
6			

[5]

(b) Complete a suitable scale on the *y*-axis and plot your results from Experiments 1 to 6 on Fig. 1.1.

Draw a line of best fit through your points.

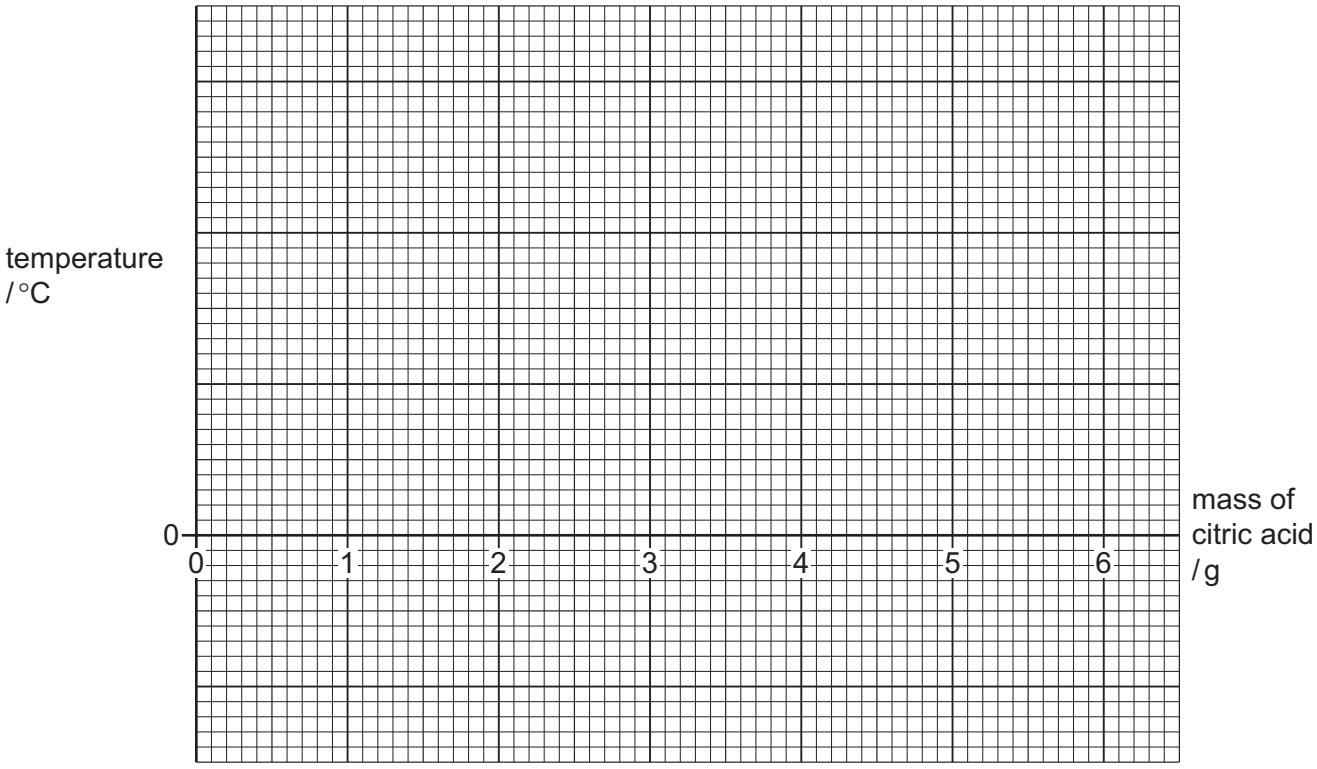

Fig. 1.1

[4]

(c) State whether the reaction between solid sodium carbonate and solid citric acid is exothermic or endothermic.

Explain your answer.

.....

..... [1]

(d) Deduce which experiment had the greatest temperature change compared to the temperature in Experiment 1.

..... [1]

(e) **From your graph**, deduce the temperature, after stirring for 30 seconds, that is obtained when 3.5 g of solid citric acid is added to 5.0 g of solid sodium carbonate.

Show clearly **on the grid** how you worked out your answer.

temperature = ... °C [2]

[Turn over

(f) Suggest why the solid sodium carbonate and solid citric acid are stirred before the temperature is measured.

.....

..... [2]

(g) Explain why using a polystyrene cup in place of the glass beaker would increase the accuracy of the results.

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..... [2]

[Total: 17]

Question 2 starts on the next page.

2 You are provided with solid **H**.
Do the following tests on solid **H**, recording all of your observations at each stage.

Tests on solid H

(a) Describe the appearance of solid **H**.

..... [1]

(b) Carry out a flame test on solid **H**.

Record your observations.

..... [1]

Divide the remaining solid **H** into two approximately equal portions in two boiling tubes.

(c) Gently heat the first portion of solid **H**.

Record your observations.

.....

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..... [3]

Add about 10 cm^3 of distilled water to the boiling tube containing the second portion of solid **H**. Place a stopper in the boiling tube and shake the tube for one minute to dissolve solid **H** and form solution **H**. If any undissolved solid **H** remains, pour solution **H** into a clean boiling tube, leaving the undissolved solid behind.

Divide solution **H** into five approximately equal portions in five test-tubes.

(d) To the first portion of solution **H**, add aqueous ammonia dropwise and then in excess.

Record your observations.

dropwise .....

in excess .....
[2]

(e) To the second portion of solution **H**, add aqueous sodium hydroxide dropwise and then in excess.

Record your observations.

dropwise .....

in excess .....
[2]

(f) **(i)** To the third portion of solution **H**, add a few drops of acidified aqueous potassium manganate(VII).

Record your observations.

.....

..... [1]

(ii) State what conclusion can be made from the result of **(f)(i)**.

..... [1]

(g) To the fourth portion of solution **H**, add about 1 cm depth of dilute nitric acid followed by a few drops of aqueous barium nitrate.

Record your observations.

.....

..... [1]

(h) To the fifth portion of solution **H**, add about 1 cm depth of aqueous sodium carbonate.

Record your observations.

.....

..... [2]

(i) Identify the **three** ions contained in solid **H**.

.....

.....

..... [3]

[Total: 17]

3 Oxalic acid is a white solid which is soluble in both water and ethanol to form colourless solutions.

Plan an experiment to determine if oxalic acid is more soluble in water or in ethanol, at room temperature.
Your answer should include how your results tell you if oxalic acid is more soluble in water or in ethanol, at room temperature.

You are provided with oxalic acid, water, ethanol 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