Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

2078971161

CHEMISTRY **5070/32**

Paper 3 Practical Test **October/November 2023**

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 **12** pages. Any blank pages are indicated.

1 Sulfuric acid, H_2SO_4, is neutralised when it is added to aqueous sodium hydroxide, NaOH.

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

The reaction is exothermic.

P is 1.25 mol / dm^3 aqueous sodium hydroxide.
Q is dilute sulfuric acid.

Read all the instructions carefully before starting the experiments.

Instructions

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

(a) Experiment 1

- Rinse and fill a burette with **Q**.
- Place the plastic cup into a beaker.
- Use a volumetric pipette to add 25.0 cm^3 of **P** to the plastic cup.
- Use a measuring cylinder to add 20 cm^3 of water to the plastic cup.
- Stir the mixture in the cup with the thermometer and measure its temperature to the nearest 0.5 °C.
- Record this initial temperature in column E of Table 1.1.
- Use the burette to add 5.0 cm^3 of **Q** to the plastic cup whilst stirring.
- Measure the highest temperature reached.
- Record this value in column F of Table 1.1.
- Empty the plastic cup and rinse it with water.

Experiments 2–6

- Repeat Experiment 1 using the volumes of water and **Q** shown in columns C and D of the table. Refill the burette as necessary.
- Calculate the temperature rise for each of Experiments 1–6 and record them in column G of Table 1.1.

Table 1.1

A	B	C	D	E	F	G
experiment number	volume of **P** / cm^3	volume of water / cm^3	volume of **Q** / cm^3	initial temperature of mixture / °C	highest temperature reached / °C	temperature rise / °C
1	25.0	20	5.0			
2	25.0	15	10.0			
3	25.0	10	15.0			
4	25.0	7	18.0			
5	25.0	5	20.0			
6	25.0	0	25.0			

[8]

(b) Draw a graph of temperature rise against volume of **Q** on the grid in Fig 1.1.

You should:
- plot the point (0,0) as there is no temperature rise when no **Q** is added
- plot temperature rise (column G) against volume of **Q** (column D) from Experiments 1–6
- draw a straight line of best fit for the first four points
- draw a straight line of best fit for the last three points
- extend the lines so that they intersect.

[3]

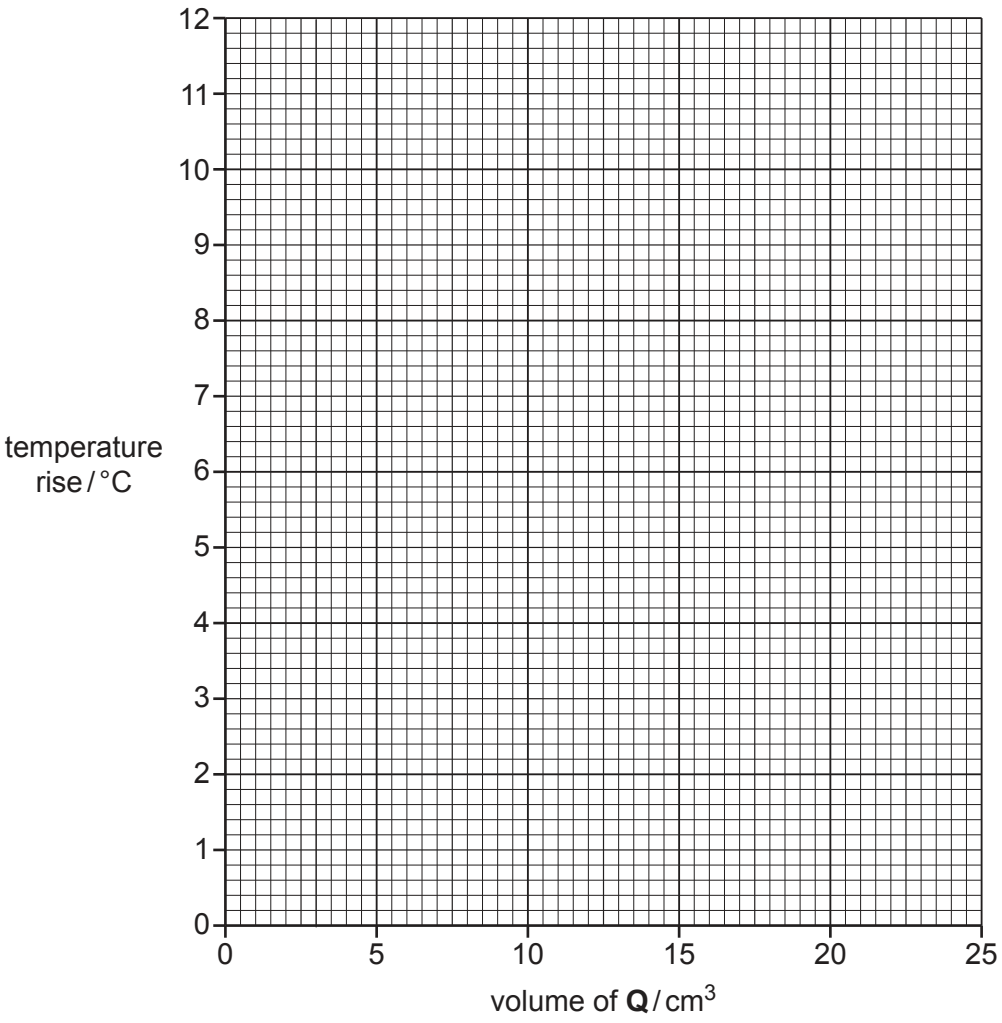

Fig 1.1

(c) The point where the two lines intersect indicates the volume of **Q** that exactly neutralises 25.0 cm^3 of **P**.

Determine the volume of **Q** where the two lines on the graph intersect.

volume of **Q** ..... cm^3 [1]

(d) **P** is 1.25 mol / dm^3 aqueous sodium hydroxide.

Use your answer to **(c)** to calculate the concentration of sulfuric acid in **Q**.

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

concentration of sulfuric acid in **Q** ..... mol / dm^3 [2]

(e) Describe and explain what happens to the gradient of the straight line for the first four points on the graph if a metal cup is used instead of a plastic cup.

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..... [2]

(f) A burette may be used instead of a measuring cylinder to measure the volume of water in these experiments.

Suggest how this improves the experiments.

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..... [1]

[Total: 17]

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2 You are provided with solid **Y** and solution **Z**.

Do the following tests on each substance, recording all of your observations at each stage.

Tests on solid Y

(a) Put the sample of **Y** in a boiling tube and use a measuring cylinder to add 8 cm^3 of dilute nitric acid.

Record your observations.

Test the gas given off.

Describe the test and its result.

Identify the gas.

Keep the mixture for use in **(b)** and **(c)**.

observations .....

.....

test for gas and result .....

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identity of gas .....

[4]

(b) Use a measuring cylinder to transfer 2 cm^3 of the mixture from **(a)** into a boiling tube.

Add aqueous sodium hydroxide drop by drop until a change is seen.

Then add more aqueous sodium hydroxide until a further change is seen.

Record your observations.

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..... [3]

(c) Use a measuring cylinder to transfer 2 cm^3 of the mixture from **(a)** into a boiling tube.

Add aqueous ammonia drop by drop until a change is seen.

Then add more aqueous ammonia until a further change is seen.

Record your observations.

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..... [2]

(d) Identify the cation **and** the anion in **Y**.

cation ..... anion ..... [2]

Tests on solution Z

(e) Put 1 cm depth of **Z** into a boiling tube. Add 1 cm depth of aqueous sodium hydroxide. Gently warm the mixture.

Test the gas given off.

Describe the test and its result.

Identify the gas.

Keep the mixture for use in **(f)**.

test for gas and result .....

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identity of gas .....
[3]

(f) Add 3 cm depth of dilute nitric acid to the mixture from **(e)**.

Then add 1 cm depth of aqueous silver nitrate.

Record your observations.

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..... [1]

(g) Identify the cation **and** the anion in **Z**.

cation ..... anion ..... [2]

[Total: 17]

3 You are not expected to do any experimental work for this question.

Copper(II) sulfate is a salt used to kill pests on plant leaves.

Copper(II) sulfate is prepared by neutralising dilute sulfuric acid with solid copper(II) oxide.

Plan an experiment to prepare pure dry crystals of copper(II) sulfate.

Your plan should include the use of:
- common laboratory apparatus
- dilute sulfuric acid
- solid copper(II) oxide.

No other chemicals should be used.

Your plan should include:
- the apparatus needed
- the method to use.

You may draw a diagram to help answer the question.

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