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CHEMISTRY **0620/52**

Paper 5 Practical Test **February/March 2025**

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.

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[Turn over

1 You are going to investigate the temperature change when aqueous copper(II) sulfate reacts separately with two different metals, zinc and iron.

Read all of the instructions carefully before starting the experiments.

Instructions
You are going to do two experiments.

(a) Experiment 1

- Use the 50 cm^3 measuring cylinder to pour 30 cm^3 of aqueous copper(II) sulfate into the 100 cm^3 beaker.
- Use the thermometer to measure the temperature of the contents of the beaker.
- Record this temperature in Table 1.1 at time = 0 s.
- Add 3 g of zinc powder to the beaker. At the same time start the stop-watch.
- Using the thermometer, continually stir the mixture in the beaker.
- Measure the temperature of the mixture every 30 seconds for 210 seconds.
- Record the temperatures in Table 1.1.
- Complete Table 1.1 by calculating the temperature changes from the temperature at 0 s.
- Empty and rinse the beaker with distilled water.

Table 1.1

time in s	0	30	60	90	120	150	180	210
temperature in °C								
temperature change since time = 0 s in °C	0.0							

Experiment 2

- Repeat Experiment 1, using 3 g of iron powder instead of 3 g of zinc powder.
- Record your results in Table 1.2, and complete Table 1.2 by calculating the temperature changes from the temperature at 0 s.

Table 1.2

time in s	0	30	60	90	120	150	180	210
temperature in °C								
temperature change since time = 0 s in °C	0.0							

[5]

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(b) Complete a suitable scale on the *y*-axis, and plot your results for Experiment 1 and Experiment 2 on Fig. 1.1. The point at (0,0) has been plotted for you.

Draw **two** curves of best fit. Both curves must start at (0,0).

Label both curves.

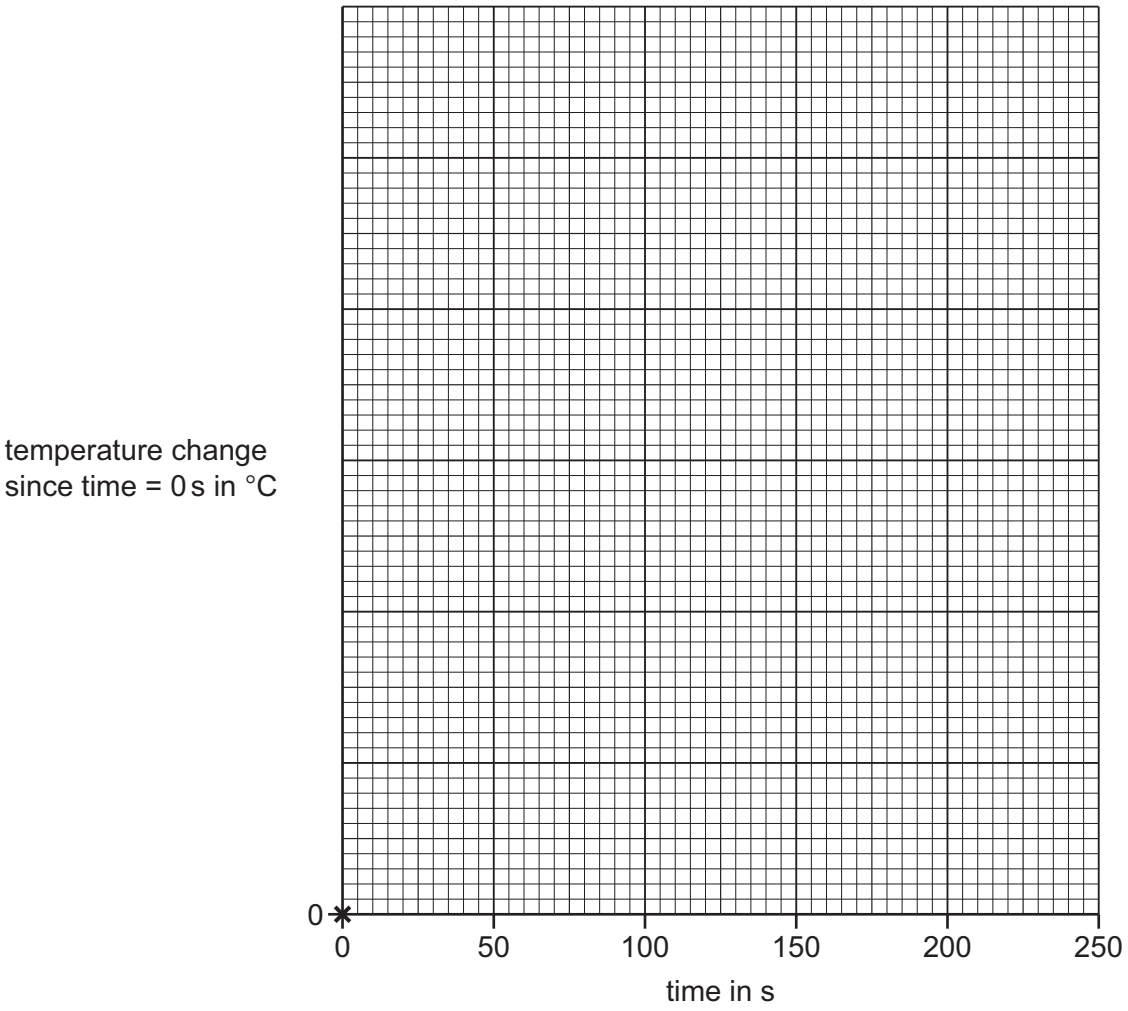


Fig. 1.1

[5]

(c) Extrapolate the curve for Experiment 1 on your graph in Fig. 1.1 to deduce the temperature change since time = 0 s in Experiment 1 after 240 seconds.

Show clearly **on Fig. 1.1** how you worked out your answer.

temperature change = ...

[3]

(d) State which experiment, Experiment 1 or Experiment 2, is the more exothermic. Explain your answer.

more exothermic experiment .....

explanation .....

.....

[1]

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(e) Predict the temperature of the solution in Experiment 1 after 3 hours.

temperature after 3 hours = ... °C [1]

(f) Explain why using a copper container instead of the beaker would **not** be an improvement in this investigation.

.....

..... [1]

(g) Describe **two** changes to the **apparatus** that will improve the results of this investigation. For each change, explain why it will improve the results.

change 1 .....

explanation 1 .....

.....

change 2 .....

explanation 2 .....

.....

[4]

[Total: 20]

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Question 2 starts on the next page.

2 You are provided with two substances: solution **A** and solid **B**.

Do the following tests on solution **A** and solid **B**. Record all of your observations at each stage.

Tests on solution A

Divide solution **A** into four approximately equal portions in one test-tube and three boiling tubes.

(a) To the first portion of solution **A** in a boiling tube, add about 3 cm depth of aqueous sodium carbonate.

Record your observations.

.....

..... [1]

(b) To the second portion of solution **A** in a boiling tube, add aqueous ammonia dropwise until it is in excess.

Record your observations.

.....

..... [2]

(c) To the third portion of solution **A** in a boiling tube, add aqueous sodium hydroxide dropwise until it is in excess.

Record your observations.

.....

..... [2]

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

Leave the mixture to stand for a few minutes.

Record your observations.

.....

..... [1]

(e) Identify solution **A**.

.....

..... [2]

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Tests on solid B

(f) Carry out a flame test on solid **B**.

Record your observations.

..... [1]

Transfer the remaining solid **B** to a boiling tube. Add about 5 cm depth of distilled water to the boiling tube. Place a stopper in the top of the boiling tube, and shake the boiling tube to dissolve solid **B**. The solution formed is solution **B**.

Divide solution **B** into three approximately equal portions in three test-tubes.

(g) To the first portion of solution **B**, add a few drops of acidified aqueous potassium manganate(VII).

Record your observations.

..... [1]

(h) To the second portion of solution **B**, add about 1 cm depth of aqueous sodium hydroxide.

Record your observations.

..... [1]

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

Record your observations.

..... [1]

(j) Identify solid **B**.

.....

..... [2]

[Total: 14]

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3 Metal spoons can be electroplated with silver.

Describe how a metal spoon can be electroplated with silver. Include in your answer how you could determine the mass of the silver electroplated onto the metal spoon.

You are provided with solid silver nitrate, a metal spoon, a piece of solid silver, distilled water and common laboratory apparatus.

You must include a diagram in your answer.

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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

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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

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