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Cambridge Assessment International Education

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8881760581

CHEMISTRY **0620/62**

Paper 6 Alternative to Practical **February/March 2025**

1 hour

You must answer on the question paper.

No additional materials are needed.

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.

This document has **16** pages. Any blank pages are indicated.

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1 Inks contain different coloured substances called dyes.
A student used chromatography to investigate the coloured dyes contained in six different inks.

The student drew a baseline on a sheet of chromatography paper.
The student then placed a spot of each ink on the chromatography paper and set up the apparatus as shown in Fig. 1.1.

The student made two errors.

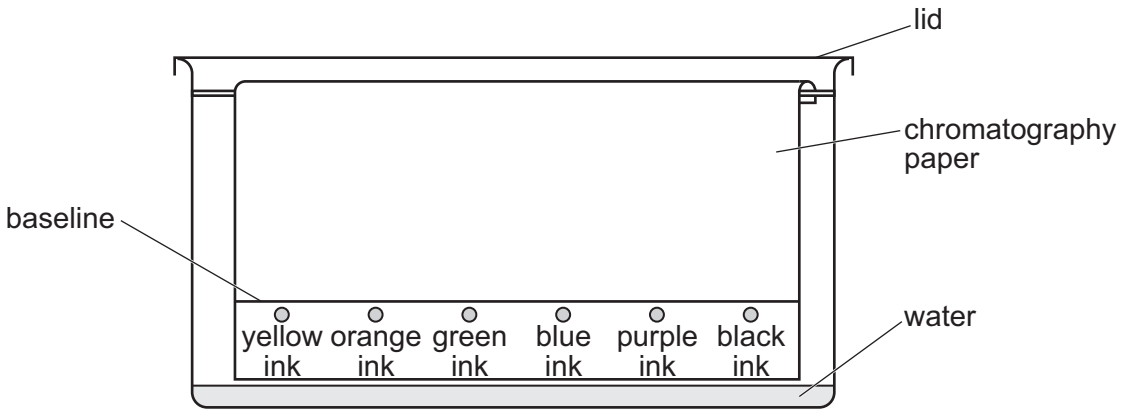


Fig. 1.1

(a) Identify the **two** errors the student made.

1 .....

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2 .....

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[2]

(b) State the name of the equipment used to draw a baseline on chromatography paper.

..... [1]

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(c) The student corrects the errors and then carries out the chromatography.

The chromatogram in Fig. 1.2 shows the student's results.

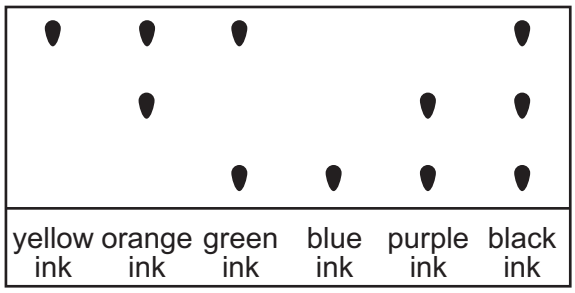


Fig. 1.2

(i) Identify an ink which could contain only **one** coloured dye.

..... [1]

(ii) Deduce which ink could be mixed with the blue ink to make the black ink.

..... [1]

(iii) Deduce the colour of **one** dye that is contained in all three of the orange, green and black inks.

..... [1]

[Total: 6]

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2 A student investigates the temperature change when aqueous copper(II) sulfate reacts separately with two different metals, zinc and iron.

The student does two experiments.

Experiment 1

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

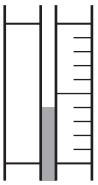
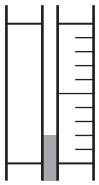
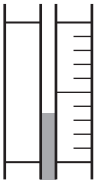
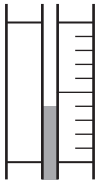
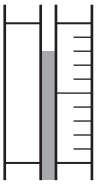
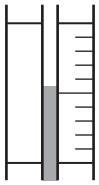
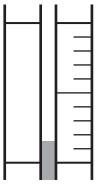
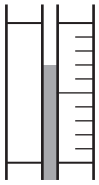
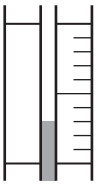
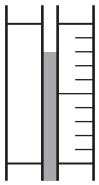
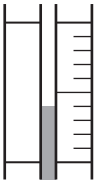
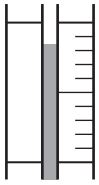
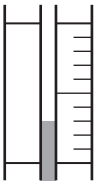
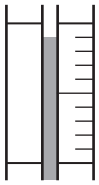
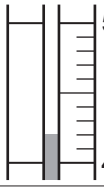
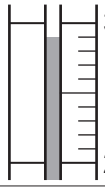
Experiment 2

- Repeat Experiment 1, using 3 g of iron powder instead of 3 g of zinc powder.

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(a) Complete Table 2.1 by using the thermometer diagrams and calculating the temperature changes from the temperature at 0 s.

Table 2.1

	Experiment 1			Experiment 2		
time in s	thermometer diagram	temperature in °C	temperature change since time = 0 s in °C	thermometer diagram	temperature in °C	temperature change since time = 0 s in °C
0		24.0	0.0		22.0	0.0
30						
60						
90						
120						
150						
180						
210						

[4]

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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. 2.1. 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.

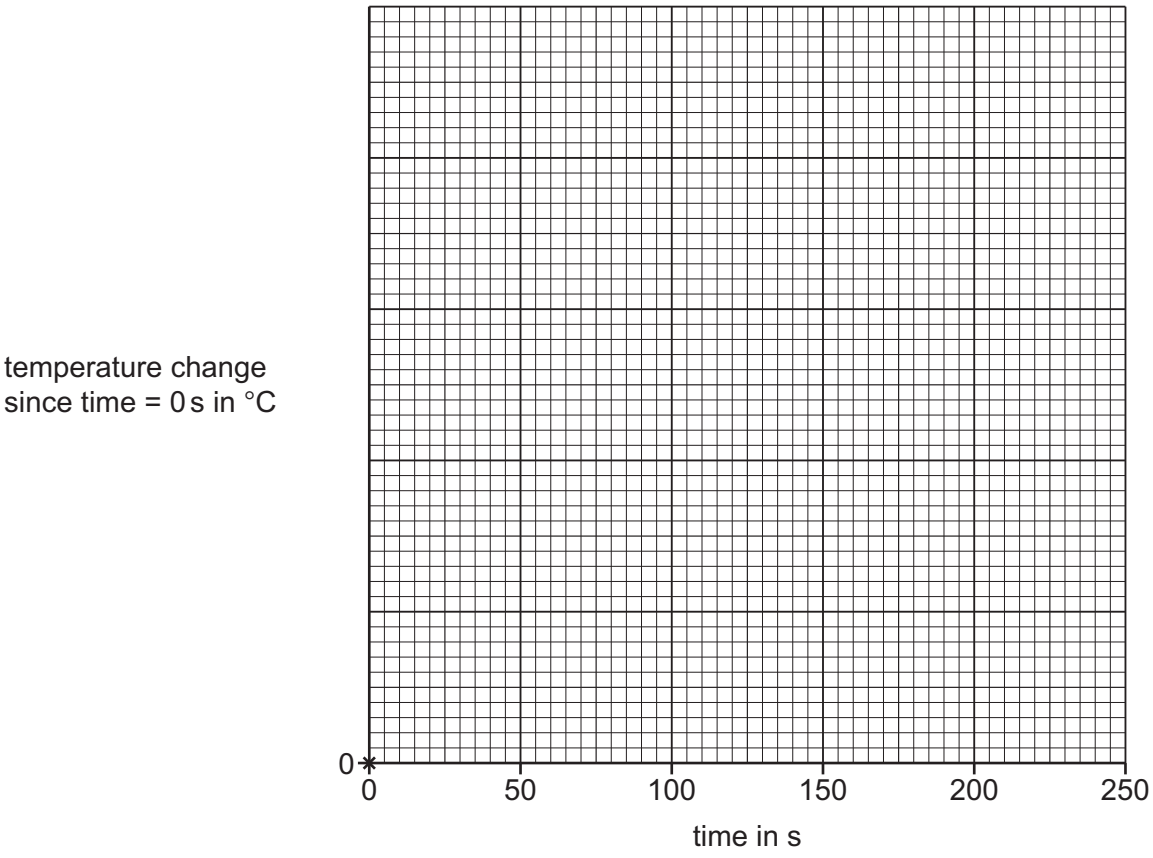


Fig. 2.1

[5]

(c) Extrapolate the curve for Experiment 1 on your graph in Fig. 2.1 to deduce the temperature change since time = 0 s in Experiment 1 after 240 seconds.

Show clearly **on Fig. 2.1** 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: 19]

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3 A student tests two substances: solution **A** and solid **B**.

Tests on solution A

Solution **A** is aqueous chromium(III) chloride.

The student divides solution **A** into three approximately equal portions.

Complete the expected observations.

(a) To the first portion of solution **A**, the student adds aqueous sodium hydroxide dropwise until it is in excess.

observations .....

.....

..... [2]

(b) To the second portion of solution **A**, the student adds about 1 cm^3 of dilute nitric acid followed by a few drops of aqueous barium nitrate.

observations .....

..... [1]

(c) To the third portion of solution **A**, the student adds about 1 cm^3 of dilute nitric acid followed by a few drops of aqueous silver nitrate.

observations .....

..... [1]

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Tests on solid B

Table 3.1 shows the tests and the student's observations for solid **B**.

Table 3.1

tests	observations
test 1 Carry out a flame test on solid **B**.	red coloured flame
test 2 Dissolve the remaining solid **B** in distilled water to form solution **B**. Divide solution **B** into three portions. To the first portion of solution **B**, add a few drops of acidified aqueous potassium manganate(VII).	pale purple solution
test 3 To the second portion of solution **B**, add about 1 cm^3 of aqueous sodium hydroxide.	solution remains colourless
test 4 Warm the product of **test 3** and test any gas given off with damp red litmus paper.	damp red litmus paper remains red
test 5 To the third portion of solution **B**, add about 1 cm^3 of dilute nitric acid followed by a few drops of aqueous barium nitrate.	white precipitate

(d) Describe how to carry out the flame test used in **test 1**.

.....

.....

..... [2]

(e) Identify the **ion** that is tested for in **test 4**.

..... [1]

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(f) Identify the **two** ions which are in solid **B**.

.....

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..... [2]

[Total: 9]

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4 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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