CAMBRIDGE
International Education

Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4587895828

CHEMISTRY **5070/41**

Paper 4 Alternative to Practical **May/June 2026**

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. Do **not** use correction fluid or tape.
- 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.

DC (WW/TC) 355469/3
© Cambridge University Press & Assessment 2026

1 Figure 1.1 shows the apparatus a student uses to investigate some dyes.

A, **B**, **C**, **D** and **M** are dyes. The result for **M** is not shown.

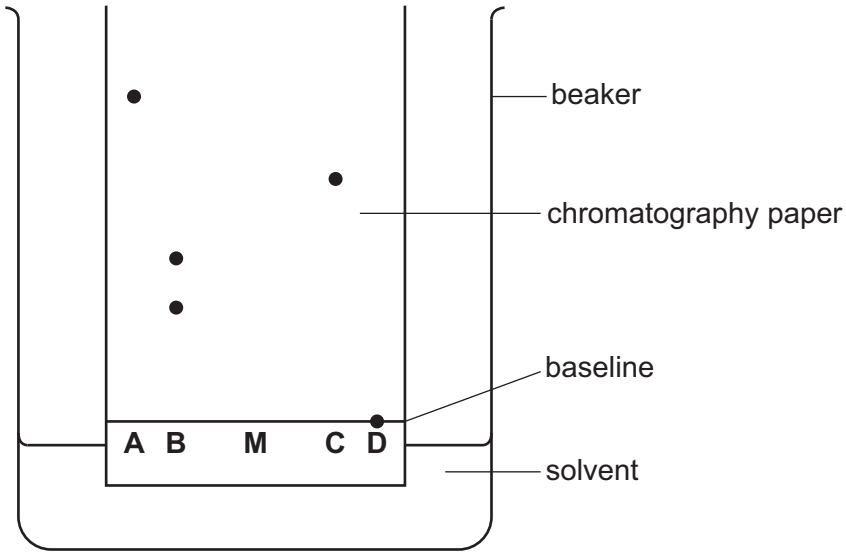


Figure 1.1

(a) Explain why the baseline must be above the solvent.

.....

..... [1]

(b) Suggest why there is only one spot for **A** and one spot for **C** but two spots for **B** on the chromatogram.

.....

..... [2]

(c) Suggest why dye **D** has **not** moved from the baseline.

.....

..... [1]

DO NOT WRITE IN THIS MARGIN

(d) The teacher says that a lid must be put on the beaker.

Explain how using a lid improves the experiment.

.....

..... [1]

(e) **M** is a mixture of dyes **A** and **C**.

Draw spots on Figure 1.1 to show what the chromatogram looks like for **M**. [1]

[Total: 6]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

2 A student investigates the effect of concentration on the rate of reaction between calcium carbonate and dilute hydrochloric acid.

calcium carbonate + hydrochloric acid → calcium chloride + water + carbon dioxide

The student:

- assembles the apparatus as shown in Figure 2.1

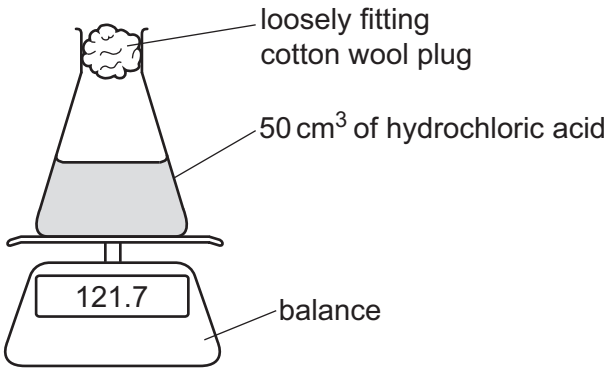


Figure 2.1

- records the mass
- removes the cotton wool plug
- adds 2.0 g of calcium carbonate to the conical flask
- immediately replaces the cotton wool plug and starts a stop-watch
- records in Table 2.1 the total mass of the conical flask and contents every 30 seconds.

Table 2.1

time / s	total mass / g
0	
30	122.9
60	122.5
90	122.2
120	122.1
150	122.1

(a) (i) State the mass of the conical flask and contents shown in Figure 2.1.

mass ..... g [1]

(ii) Calculate the total mass of the conical flask and contents at time 0 seconds. Write your answer in Table 2.1. [1]

© Cambridge University Press & Assessment 2026

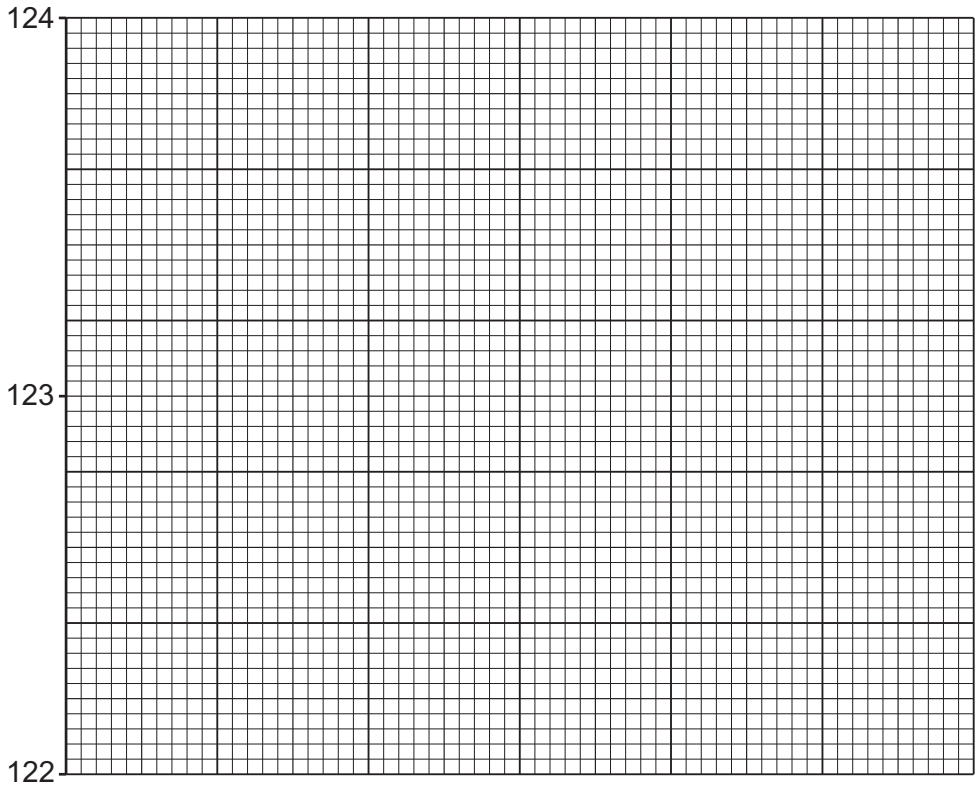
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

(iii) Explain why the total mass is the same at 120 s and 150 s.

..... [1]

(iv) Plot on the grid the total mass (*y*-axis) against time (*x*-axis).

Label the axes.



[2]

(v) Draw a curve of best fit. [1]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

(b) **(i)** Explain why the neck of the conical flask is not left open.

.....

..... [1]

(ii) Explain why a cotton wool plug is used instead of a bung.

.....

..... [1]

(iii) Suggest a source of error in the experiment.

.....

..... [1]

(c) Explain why the total mass decreases during the experiment.

.....

..... [1]

(d) Explain how the initial rate of reaction is calculated from the graph.

.....

.....

..... [2]

(e) The concentration of the hydrochloric acid decreases during the reaction.

State the relationship between the **concentration** of hydrochloric acid and the **rate** of this reaction.

Explain how the graph shows this relationship.

relationship .....

.....

explanation .....

.....

[2]

[Total: 14]

DO NOT WRITE IN THIS MARGIN

© Cambridge University Press & Assessment 2026

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

3 A student investigates aqueous solution, **W**, and a green solid, **Y**.

W contains an unsaturated carboxylic acid.

(a) The student puts some **W** into a test-tube and adds aqueous bromine.

Describe the observations the student makes.

.....

..... [2]

(b) The student adds a piece of zinc to **W**. A colourless gas and a colourless solution, **X**, are produced.

(i) Describe the observation the student makes that shows a gas is produced.

..... [1]

(ii) State the name of the gas produced.

Describe the test and the positive result of the test used to identify this gas.

name of gas .....

test .....

.....

positive result .....

.....
[2]

(c) The student tests the solution, **X**, produced in **3(b)**.

The student adds a few drops of aqueous sodium hydroxide and then adds excess aqueous sodium hydroxide to **X**.

Describe the observations the student makes.

few drops of aqueous sodium hydroxide .....

.....

excess aqueous sodium hydroxide .....

.....
[2]

© Cambridge University Press & Assessment 2026

(d) The student heats a dry sample of the green solid, **Y**.

A white solid and a gas are formed.

The gas turns anhydrous cobalt chloride paper pink.

(i) State the name of the gas.

..... [1]

(ii) The formation of this gas allows the student to make a conclusion about **Y**.

Suggest the conclusion the student makes.

.....

..... [1]

(e) The student heats the white solid from **3(d)** more strongly.

A red-brown solid and a gas that turns acidified aqueous potassium manganate(VII) from purple to colourless are formed.

(i) State the name of this gas.

..... [1]

(ii) The student suggests that **Y** contains sulfate ions.

Describe the test and the positive result that confirms this suggestion.

test .....

.....

positive result .....

.....

[2]

DO NOT WRITE IN THIS MARGIN DO NOT WRITE IN THIS MARGIN DO NOT WRITE IN THIS MARGIN DO NOT WRITE IN THIS MARGIN DO NOT WRITE IN THIS MARGIN

(f) The student adds a few drops of aqueous sodium hydroxide and then adds excess aqueous sodium hydroxide to an aqueous solution of **Y**.

A green precipitate that is insoluble in excess is formed.

(i) State the cation present in **Y**.

..... [1]

(ii) The green precipitate turns brown near the surface when it is left to stand.

Explain why the precipitate turns brown.

..... [1]

[Total: 14]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

4 When salt is added to ice, the temperature of the mixture decreases.

A student suggests that the greater the mass of salt that is mixed with ice the more the temperature of the mixture decreases.

Plan an investigation to find out if the student is correct.

Your plan should describe the use of common laboratory apparatus, crushed ice and salt.

No other chemicals should be used.

Your plan should include:

- the apparatus needed
- the method to use
- the variables to control
- how to use the results to decide whether the student is correct.

You may draw a diagram to help answer the question.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS MARGIN

.....

.....

.....

.....

[6]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

BLANK PAGE

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN



BLANK PAGE

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

© Cambridge University Press & Assessment 2026





BLANK PAGE

DO NOT WRITE IN THIS MARGIN DO NOT WRITE IN THIS MARGIN DO NOT WRITE IN THIS MARGIN DO NOT WRITE IN THIS MARGIN DO NOT WRITE IN THIS MARGIN

© Cambridge University Press & Assessment 2026



DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

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

© Cambridge University Press & Assessment 2026

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

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (Cambridge University Press & Assessment) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in our Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge International Education is the name of our awarding body and a part of Cambridge University Press & Assessment, which is a department of the University of Cambridge.

© Cambridge University Press & Assessment 2026