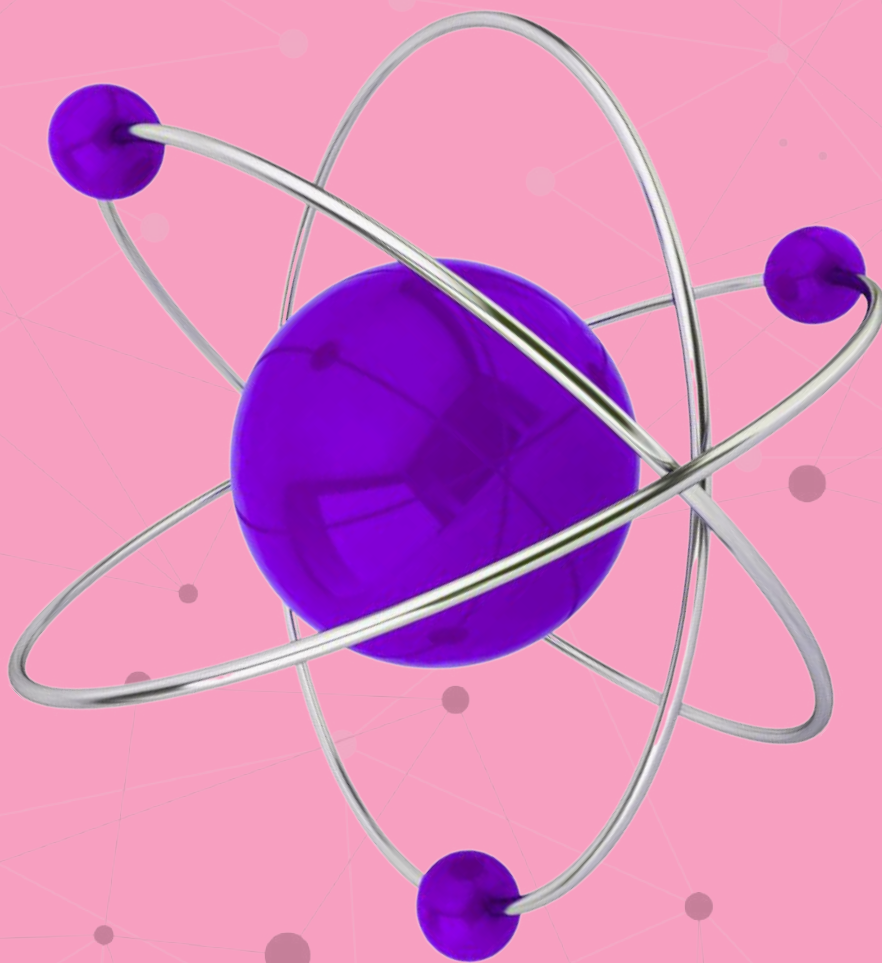


Cambridge IGCSE Chemistry



Fully Solved Exams Paper 6

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answers and
explanations](#)**



Cambridge IGCSE Chemistry

Paper 6 · Alternative to Practical

Questions and Answers by Topic

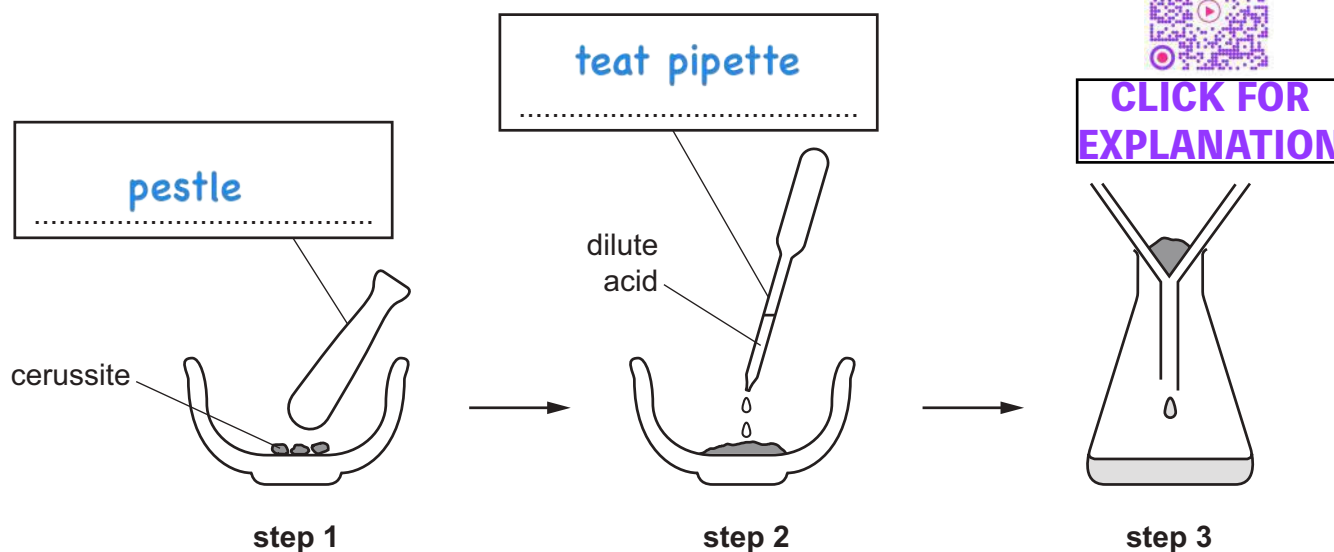
Model answers, mark schemes and examiner insight

144 questions from 10 sittings (2023-2026), grouped by practical skill.

Chapters

1. Apparatus, gas preparation and separation techniques
2. Titration and concentration
3. Rates of reaction
4. Energy changes and calorimetry
5. Electrolysis
6. Qualitative analysis: identifying ions and gases
7. Experimental planning (the 6-mark questions)

- 1 Cerussite is a lead ore which contains lead(II) carbonate. A student obtained a solution of lead(II) nitrate from cerussite using the apparatus shown.



(a) Complete the boxes to name the apparatus. [2]

(b) Why was the cerussite crushed in **step 1**?

to increase surface area and make it dissolve faster

[1]

(c) Name the dilute acid used in **step 2**.

nitric acid

[1]

(d) What is the general name given to an insoluble solid left on a filter paper after filtration?

residue

[1]

(e) Suggest how a sample of lead could be obtained from the solution of lead(II) nitrate.

add Mg

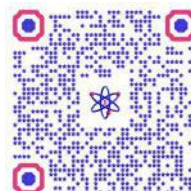
filter out lead

[2]

[Total: 7]



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● 1 (d)

Describe · [3 marks]

Describe how crystals of calcium chloride can be obtained from the mixture left in the flask after the reaction has stopped.

Model answer

✓ First filter the mixture to remove the leftover (insoluble) calcium carbonate - the calcium chloride solution passes through as the filtrate. ✓ Heat the filtrate to evaporate off some of the water. ✓ Stop heating at the point of crystallisation (when crystals just start to form, or the solution is saturated), then leave it to cool so the crystals of calcium chloride form. Do NOT heat to dryness.

Mark scheme 3 marks

- ✓ filter (to remove calcium carbonate) (1)
- ✓ heat (to evaporate water) (1)
- ✓ until crystals start to form / point of crystallisation / until saturated then leave to cool / until half evaporated (1)

Where marks are lost

Using the residue (the calcium carbonate) instead of the filtrate; writing only 'crystallise the solution' (the question asks HOW it is done); or heating all the way to dryness.

Examiner's insight

Many filtered correctly; some then used the residue by mistake, and answers such as 'crystallise it' did not gain credit as the question asked for a description of the method.

Revise from your notes

- Separating mixtures - filtration and crystallisation 2.2
 - Rate of reaction followed by mass loss
-

- 2 A student investigated what happened to the temperature when two different solids, **W** and **X**, dissolved in water.

Two experiments were carried out.

Experiment 1

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- Using a measuring cylinder, 30 cm^3 of distilled water were poured into a polystyrene cup. The initial temperature of the water was measured at time = 0 seconds.
- Solid **W** was added to the water, a timer was started and the solution was stirred with a thermometer.
- The temperature of the solution was measured every 10 seconds for 90 seconds.

(a) Use the thermometer diagrams to record the temperatures in the table.

time / s	0	10	20	30	40	50	60	70	80	90
thermometer diagram										
temperature of the solution / °C	23	16	14	13	12	11	11	11	11	11

[2]

Experiment 2

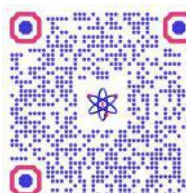
- The polystyrene cup was emptied and rinsed with water.
- Experiment 1 was repeated using solid **X**.
- The temperature of the solution was measured every 10 seconds for 90 seconds.

(b) Use the thermometer diagrams to record the temperatures in the table.

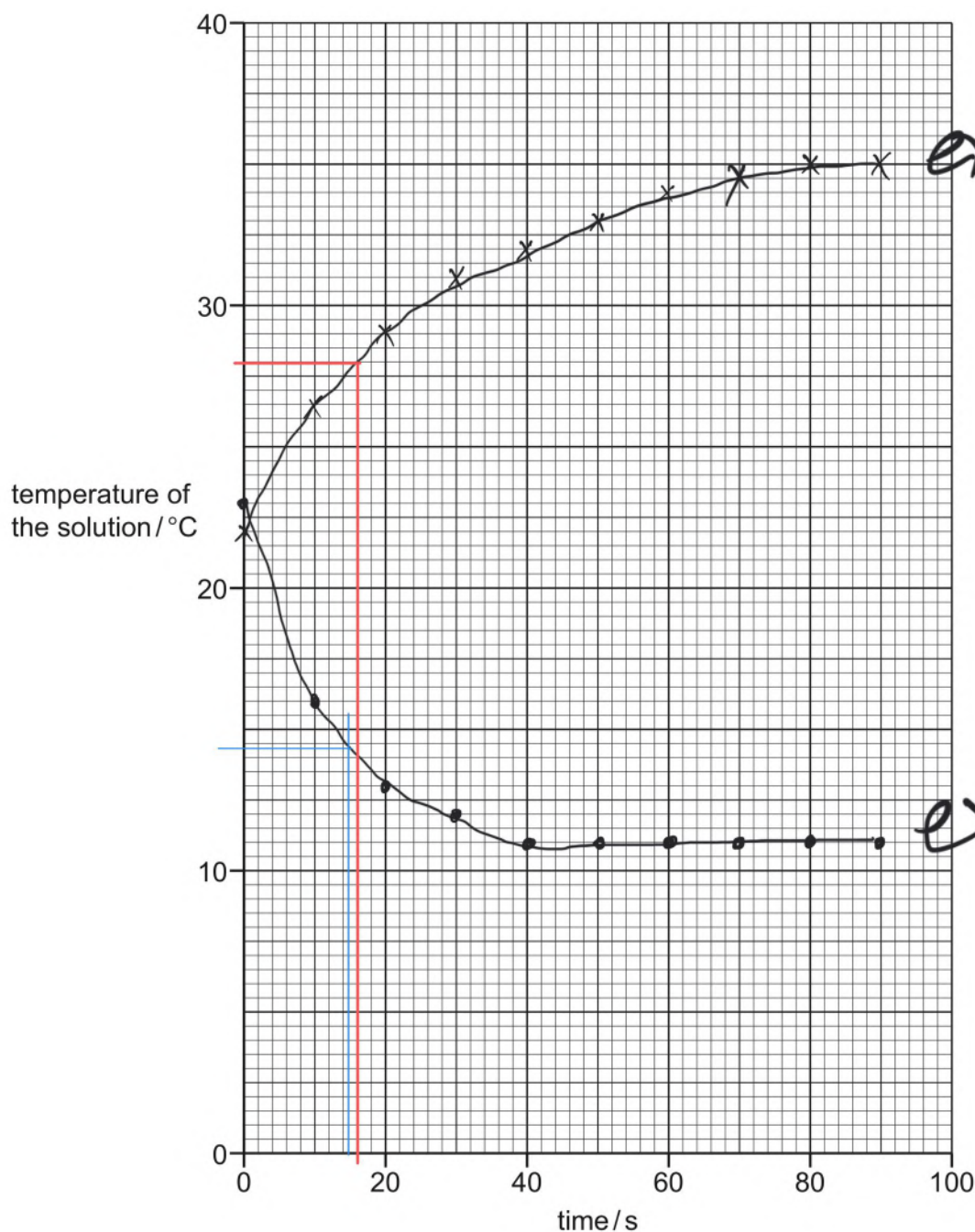
time / s	0	10	20	30	40	50	60	70	80	90
thermometer diagram										
temperature of the solution / °C	22	26	29	31	32	33	34	35	35	35

[2]

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- (c) Plot the results for Experiments 1 and 2 on the grid. Draw **two** smooth line graphs. Clearly label your lines.



exp2 Solid X



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exp1 solid W

[4]

- (d) (i) From your graph, deduce the temperature of the solution in Experiment 1 after 15 seconds. Show clearly on the grid how you worked out your answer.

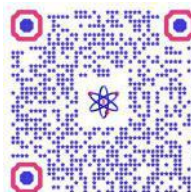
14 °C [2]

- (ii) From your graph, deduce the time taken for the temperature of the solution in Experiment 2 to change by 6 °C from the initial temperature. Show clearly on the grid how you worked out your answer.

27 s [2]



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3



Where marks are lost

Answering 'carbon dioxide' - that is the gas collected in B, not the liquid. The liquid at X is condensed water.

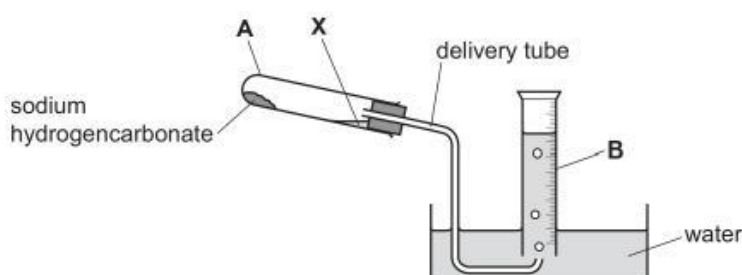
Examiner's insight

Most candidates realised the colourless liquid was water.

1 (c)

Draw · [1 mark]

On the diagram draw one arrow to show where the apparatus should be heated during the experiment.



The decomposition apparatus. A is the tube holding the sodium hydrogencarbonate; the gas is collected over water in B; a colourless liquid collects at X.

What the arrow mark needs

✓ One arrow pointing UP at the tube, with its head between the two short lines marked on the tube (at the sodium hydrogencarbonate) - the heat must be aimed at the solid that is decomposing.

Mark scheme 1 mark

✓ arrow head points towards the tube AND the arrowhead is between the two lines shown (1)

Do not accept: do not accept an arrow aimed at the water in the trough or under the trough

Where marks are lost

Aiming the arrow at the water in the trough (or under it) instead of at the tube of solid. The head must sit on the tube, between the two marks shown.

Examiner's insight

The heating arrow was generally drawn in the correct place, pointing at the solid; a few aimed it at the water or under the trough.

1 (d)

State · [1 mark]

State an observation that would indicate the sodium hydrogencarbonate had stopped reacting.

Model answer

✓ There are no more bubbles of gas (the volume of gas in B stops changing) - once no more gas is given off, the decomposition has finished.

- (e) Use the results to identify the type of energy change that occurs when solid **X** dissolves in water.

Exothermic

[1]

- (f) Predict the temperature of the solution in Experiment 2 after 1 hour. Explain your answer.

22 oC same as room temperature

because the reaction is finished

[1]

- (g) State **two** sources of error in these experiments. Give **one** improvement to reduce each of these sources of error.

source of error 1

measuring cylinder was used

improvement 1

use a pipette

source of error 2

heat loss

improvement 2

put a lid on polystyrene cup

[4]

- (h) When carrying out the experiments, what would be a disadvantage of taking the temperature readings only every 30 seconds?

less data are taken

graph will not be good enough to determine

temperature change

[1]

[Total: 19]



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EXPLANATION



Examiner's insight

Most used the information given and stated a fume cupboard is needed because the gas made is toxic.

1 (e)

Identify · [2 marks]

Identify the two errors in the way the apparatus has been set up.

Model answer

✓ Error 1: the two tubes in the right-hand flask are the wrong length. The tube bringing gas IN (from the reaction flask) should dip into the concentrated sulfuric acid so the gas bubbles through and is dried, while the tube taking gas OUT to the gas jar should be above the acid – here they are the wrong way round. ✓ Error 2: the gas jar should not be inverted. Sulfur dioxide is denser than air, so it must be collected in an upright gas jar (downward delivery), not an upside-down one.

Mark scheme 2 marks

- ✓ MP1 the linking tube should go into the sulfuric acid / the tube to the gas jar should not go into the acid (1)
- ✓ MP2 the gas jar should not be inverted (1)
Do not accept: do not accept 'seal / bung the gas jar' - a sealed jar would let pressure build up and spray the acid out of the flask

Where marks are lost

Saying the gas jar should be covered or bunged - sealing it lets pressure build up. Also wrong: leaving the tube lengths as they are. The gas must bubble THROUGH the drying acid, and be collected upright because it is denser than air.

Examiner's insight

Many identified one error. The most common wrong answer was to cover or bung the inverted jar; stronger candidates gave the un-inverted jar and the wrong tube lengths.

Revise from your notes

- Preparation, drying and collection of gases
 - Laboratory apparatus and safety
-

- 3 Two solutions, Y and Z, were analysed.
Solution Y was aqueous chromium(III) nitrate.
Tests were carried out on both solutions.

tests on solution Y

Complete the expected observations.

The solution was divided into two equal portions in two test-tubes.

- (a) (i) A few drops of aqueous sodium hydroxide were added to the first portion of solution Y and the test-tube shaken to mix the solutions.

observations green precipitate [2]

- (ii) An excess of aqueous sodium hydroxide was then added to the mixture.

observations precipitate dissolves [1]

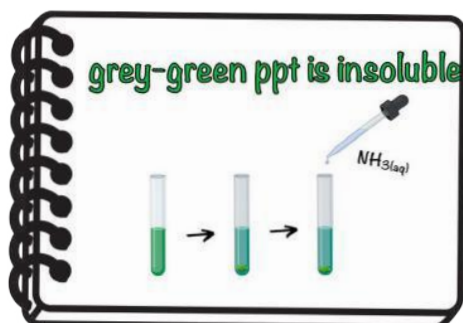
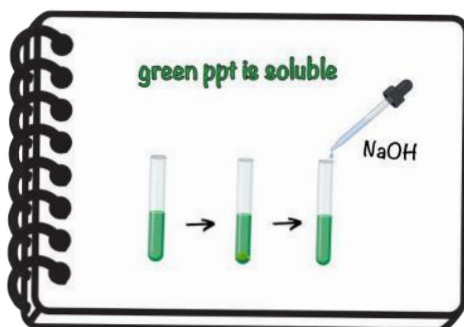
- (iii) The mixture from (a)(ii) was poured into a boiling tube and a small piece of aluminium foil was added.

The mixture was heated and the gas produced was tested.

observations red litmus paper turn blue [3]

- (b) Identify the gas produced in (a)(iii).

..... ammonia [1]



tests on solution Z

Tests were carried out and the following observations made.

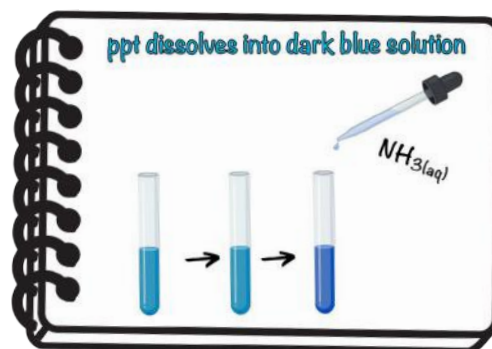
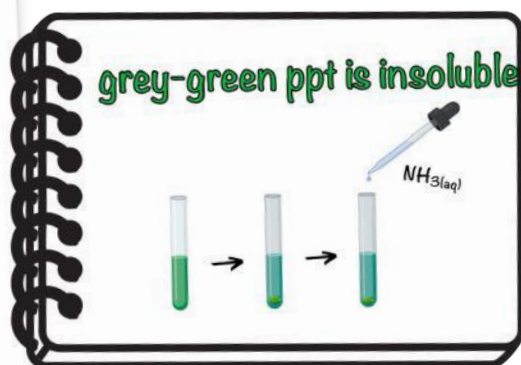
tests on solution Z	observations
Solution Z was divided into three equal portions in three test-tubes. test 1 The pH of the first portion of solution Z was tested.	pH 10
test 2 A few drops of aqueous copper(II) sulfate were added to the second portion of solution Z. An excess of aqueous copper(II) sulfate was then added to the mixture.	dark blue solution formed light blue precipitate formed
test 3 The second portion of solution Y was added to the third portion of solution Z.	grey-green precipitate formed

(c) Identify solution Z.

(aqueous) ammonia

[1]

[Total: 8]



- 4 Washing soda crystals are crystals of hydrated sodium carbonate, $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$. When exposed to the air, some of the water is lost from the crystals and a new substance is formed. This process occurs faster in hotter climates.

Plan an experiment to determine the percentage of water by mass present in the new substance.

You are provided with common laboratory apparatus.

measure the mass of a sample of crystals using a balance

heat in a crucible

allow to cool down

then re-weigh

repeat until mass is constant

calculate $\% = \text{final mass} \div \text{initial mass} \times 100$



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EXPLANATION

.....

.....

..... [6]

[Total: 6]



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Examiner's insight

Most used the information given and stated a fume cupboard is needed because the gas made is toxic.

1 (e)

Identify · [2 marks]

Identify the two errors in the way the apparatus has been set up.

Model answer

✓ Error 1: the two tubes in the right-hand flask are the wrong length. The tube bringing gas IN (from the reaction flask) should dip into the concentrated sulfuric acid so the gas bubbles through and is dried, while the tube taking gas OUT to the gas jar should be above the acid – here they are the wrong way round. ✓ Error 2: the gas jar should not be inverted. Sulfur dioxide is denser than air, so it must be collected in an upright gas jar (downward delivery), not an upside-down one.

Mark scheme 2 marks

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Where marks are lost

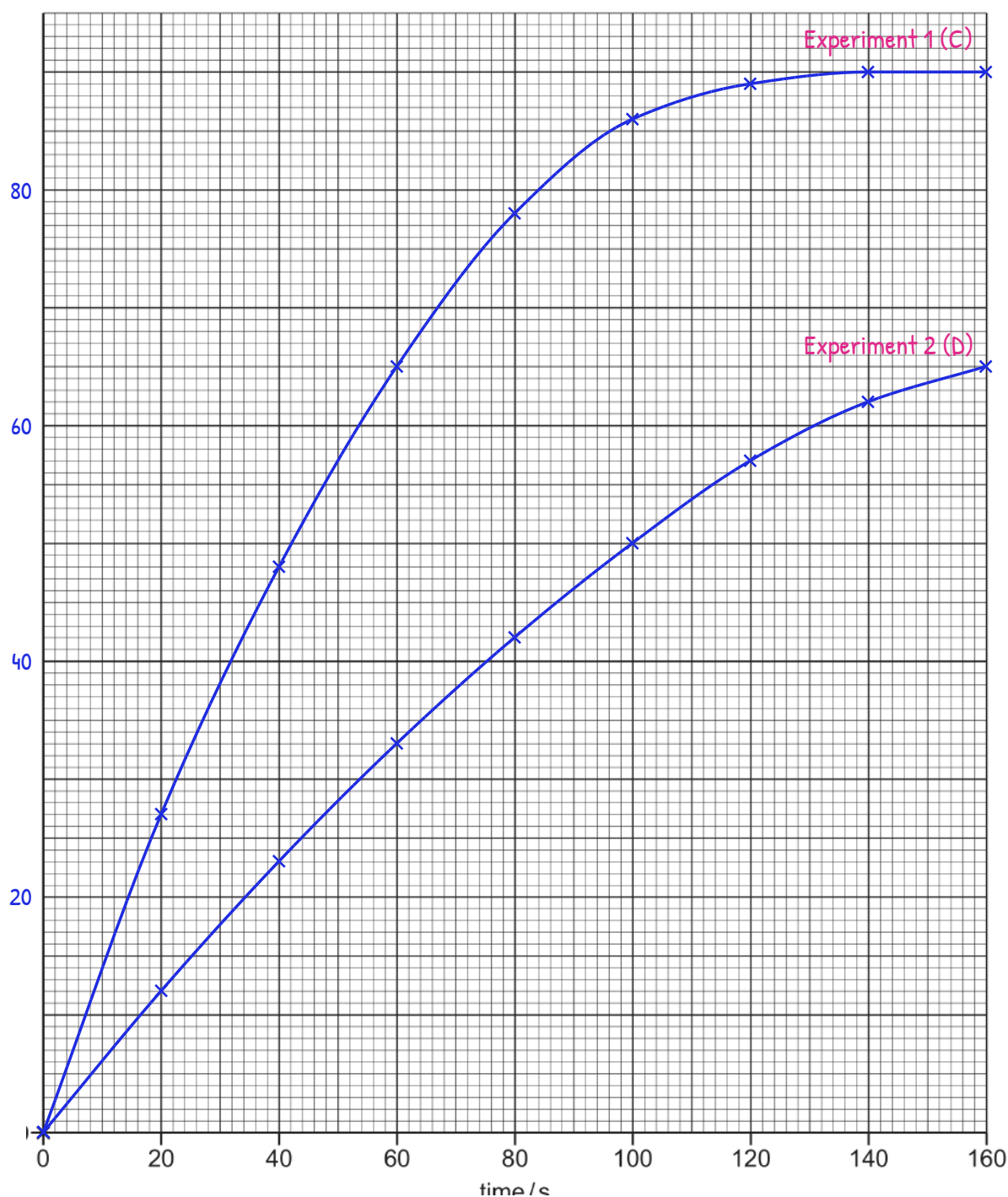
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Examiner's insight

Many identified one error. The most common wrong answer was to cover or bung the inverted jar; stronger candidates gave the un-inverted jar and the wrong tube lengths.

Revise from your notes

- Preparation, drying and collection of gases
 - Laboratory apparatus and safety
-



The y-axis is scaled 10 cm³ per large square (0 to about 95), so the higher curve fills over nine-tenths of the grid; each set of eight points, plus (0,0), is joined by one smooth curve and the two lines are labelled C and D.

How the 5 marks are awarded

✓ M1 - the y-axis has a linear scale (10 cm³ per large square) and the points rise over halfway up the grid. ✓ M2 - the Experiment 1 points are plotted correctly. ✓ M3 - the Experiment 2 points are plotted correctly. ✓ M4 - each set of points is joined by a single smooth best-fit curve (no ruled straight sections). ✓ M5 - both curves are taken back through (0,0) and are clearly labelled.

Mark scheme 5 marks

✓ y-axis scale linear and points extend over halfway up the scale (1)

experiment	mass of lithium chloride / g	initial temperature / °C	temperature after 30 s / °C	temperature change / °C
3	2.0	21.0	30.0	9.0
4	2.5	21.5	32.5	11.0
5	3.0	21.5	34.0	12.5
6	4.0	21.5	39.5	18.0

How the 5 marks are awarded

✓ M1 – all six initial temperatures read correctly: 21.0, 21.0, 21.0, 21.5, 21.5, 21.5 C. ✓ M2 – all six final temperatures read correctly: 25.5, 27.5, 30.0, 32.5, 34.0, 39.5 C (first of the two final-temperature marks). ✓ M2 – the two final-temperature marks are given only when every one of the six is right (second final-temperature mark). ✓ M3 – all six temperature changes worked out correctly: 4.5, 6.5, 9.0, 11.0, 12.5, 18.0 C. ✓ M4 – every reading and change written to a consistent 1 decimal place (30.0, not 30).

Mark scheme 5 marks

- ✓ all six initial temperatures correct (21.0, 21.0, 21.0, 21.5, 21.5, 21.5) (1)
- ✓ all six final temperatures correct (25.5, 27.5, 30.0, 32.5, 34.0, 39.5) (2)
- ✓ all six temperature changes calculated correctly (4.5, 6.5, 9.0, 11.0, 12.5, 18.0) (1)
- ✓ all readings and changes shown to 1 dp (1)

Where marks are lost

Mixing whole numbers and half-degrees - every reading from a thermometer must be to the same resolution (0.5 C here), so 30.0 not 30. Subtracting the wrong way for the change also loses a mark.

Examiner's insight

Most read the thermometers and calculated the changes well; readings should be to the nearest half division, and all from the same thermometer to the same resolution (all ending .0 or .5).

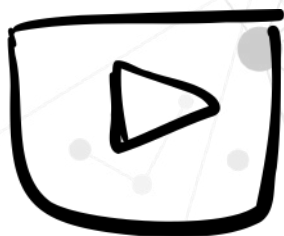
● 2 (b)

Plot · [5 marks]

Complete a suitable linear scale on the y-axis, plot the results from Experiments 1 to 6, and draw a straight line of best fit that passes through (0,0).

The completed graph

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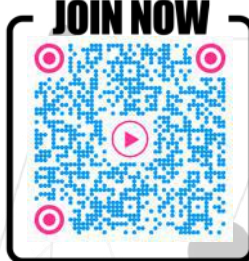


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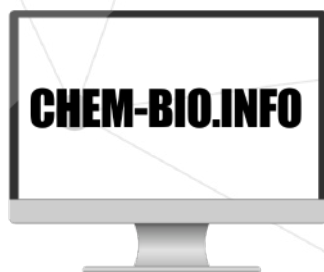
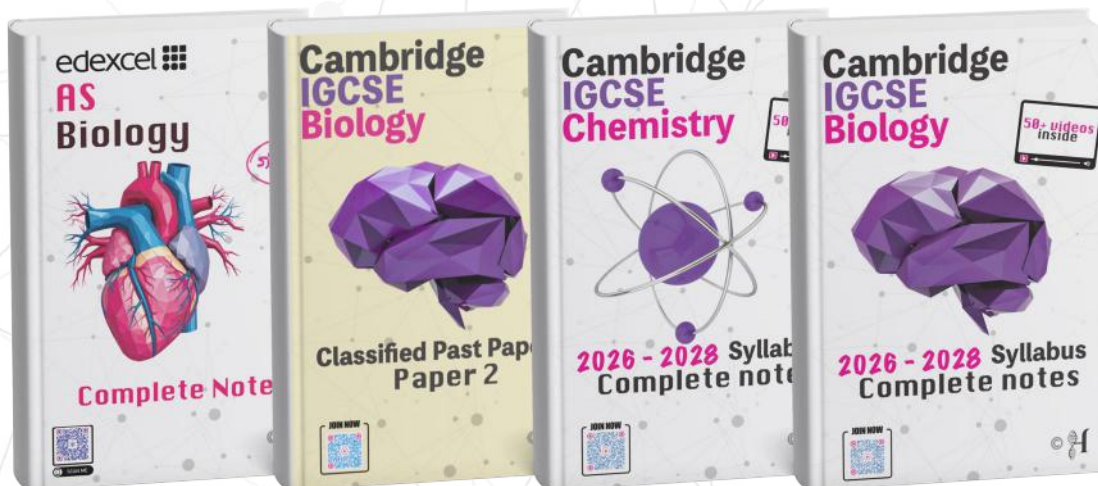


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