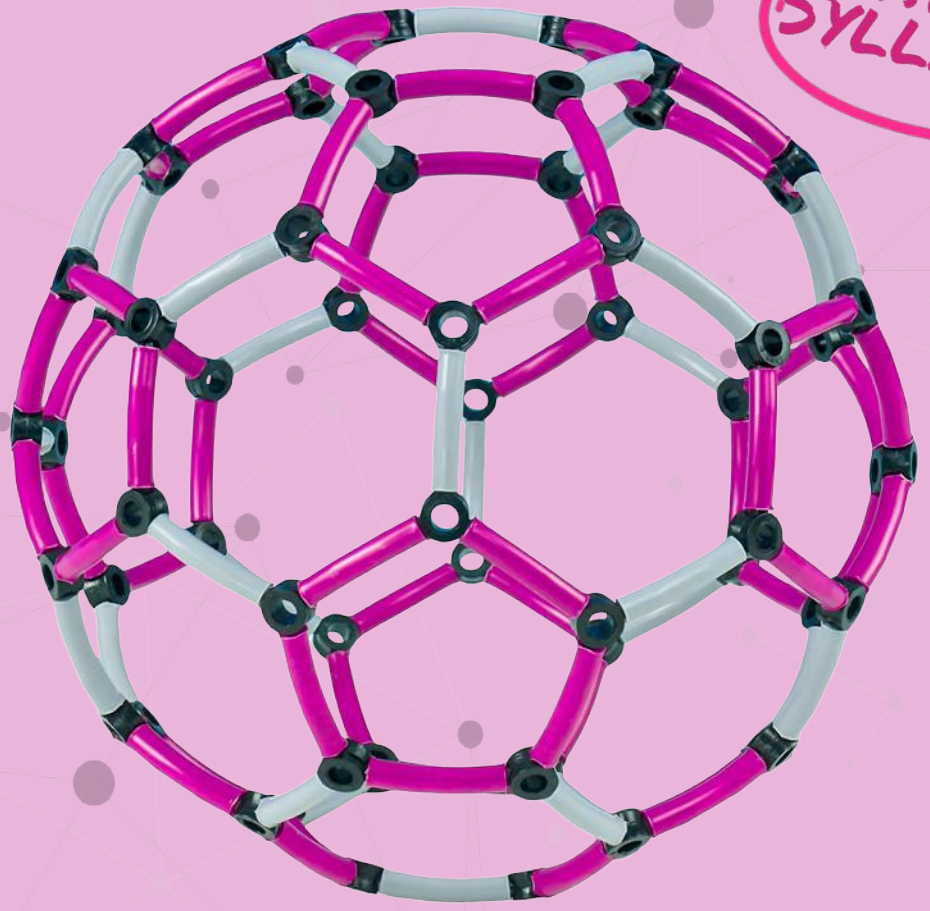
edexcel

AS Chemistry

LATEST SYLLABUS



Unit 3 Classified Past Papers

Click the topic to access it quickly

Tap any row to jump to that chapter.

6 A student carried out an experiment to determine the value of **x** in the formula of hydrated sodium bromide, $NaBr \cdot xH_2O$.

Hydrated sodium bromide is heated until all the water of crystallization is removed. Anhydrous sodium bromide, NaBr, is formed.

The student was given the following instructions.

- Weigh a sample of the hydrated sodium bromide crystals in a pre-weighed crucible.
- Heat the crucible containing the sample to remove the water of crystallization.
- Allow the crucible to cool and then reweigh the crucible.

The student's results are shown in the table below.

(a) Complete the table.

(2)

increases

stays the same

Mass of crucible empty / g	18.02
Mass of crucible + contents before heating / g	21.49
Mass of crucible + contents after heating / g	20.51
Mass of contents before heating / g	3.47
Mass of contents after heating / g **20.51 - 18.02 = 2.49**	
Mass of water removed / g **3.47 - 2.49 = 0.98**	

increases

decreases

(b) (i) Calculate the number of moles of water removed on heating the hydrated sodium bromide crystals.

(1)

0.98 / 18 = 0.054

(ii) Calculate the number of moles of anhydrous sodium bromide, NaBr, formed after heating.

(2)

2.49 / 102.9 = 0.024

Edexcel IAL - Solved Past Paper

October 2020 · Unit 3: Practical Skills in Chemistry I (WCH13/01) · Question 2 · Deduction from ion tests;

hard medium easy

2 (a)

Deduce · [3 marks]

Four bottles B, C, D and E each contain one of: hydrochloric acid, potassium carbonate, silver nitrate, sodium chloride. Mixing pairs gave: B+C white precipitate insoluble in dilute nitric acid; B+D precipitate dissolving with effervescence in nitric acid; B+E white precipitate insoluble in nitric acid; C+D effervescence, colourless gas; C+E and D+E no change. Deduce the identity of the compound in each bottle.

Model answer

B precipitates with three different partners, so B is the silver nitrate; D fizzes with the acid, so D is the carbonate; the acid is the one that fizzes with D — that is C; E is what remains. ✓ B = silver nitrate, $AgNO_3$ (gives AgCl with C and E, and Ag_2CO_3 — which dissolves with effervescence in HNO_3 — with D); ✓ C = hydrochloric acid, HCl (effervescence with the carbonate); D = potassium carbonate, K_2CO_3; ✓ E = sodium chloride, NaCl (white AgCl precipitate with B; no change with C or D).

Mark scheme 3 marks: any 1 correct = 1; any 2-3 correct = 2; all 4 correct = 3

- ✓ B = silver nitrate (1)
- ✓ C = hydrochloric acid and D = potassium carbonate (1)
- ✓ E = sodium chloride (1)

Accept: names or correct formulae (incorrect formulae penalised once only)

How to reach full marks

Anchor the two distinctive results first - B makes precipitates with everyone (silver nitrate) and D fizzes with acid (carbonate) - then the other two fall out. Annotating the results table is a sensible exam strategy.

Where marks are lost

Swapping HCl with K_2CO_3 (both give 'something' with B) - the tiebreak is C+D: the pair acid + carbonate is the only one that fizzes.

Examiner's insight

Most identified at least two compounds; the common confusions were HCl with K_2CO_3 and $AgNO_3$ with NaCl. Annotating the table or writing equations, then crossing out neatly, served candidates well.

2 (b)

Give · [6 marks]

A flame-test method: Step 1 - solid NaCl on a watch glass, a few drops of concentrated NITRIC acid mixed to a paste; Step 2 - a length of COPPER wire dipped in the paste; Step 3 - a Bunsen with the air-hole CLOSED, wire placed in the flame; Step 4 - repeat for potassium carbonate. For each of Steps 1, 2 and 3 give an improvement, explaining why the change is necessary.

(c) **Z** is a colourless organic liquid with only one functional group. **Z** is completely miscible with water to form a neutral solution.

	Test	Observation	Inference
(i)	Add bromine water to **Z**	No colour change	No C=C (1)
(ii)	Add solid phosphorus(V) chloride, PCl_5, to **Z**	Misty fumes (of hydrogen chloride)	-OH present (1)
(iii)	Warm **Z** with potassium dichromate(VI) solution and dilute sulfuric acid	Colour changes from orange to green	**Z** could be Primary alcohol or Secondary alcohol (2)

(d) The composition by mass of **Z** is C 60.0%, H 13.3%, O 26.7%.

(i) Calculate the empirical formula of **Z**.

(2)

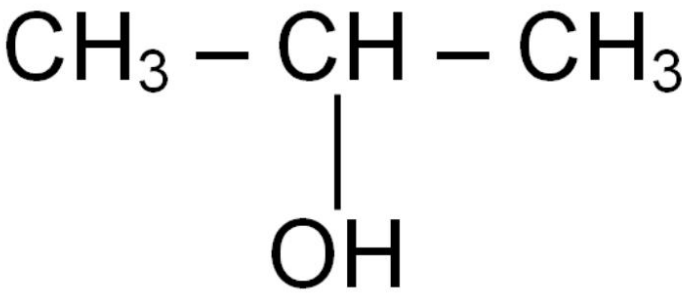
60 / 12 = 5 :3

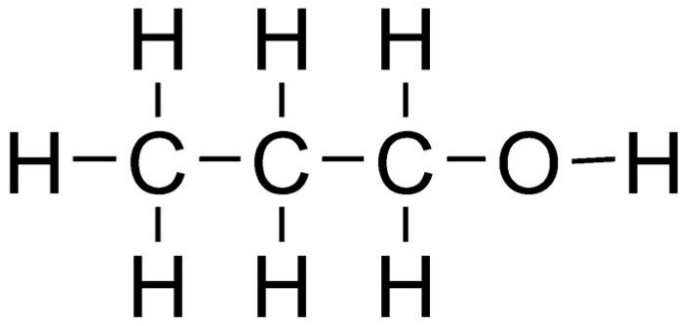
13.3 / 1 = 13.3 :8 C3H8O

26.7 / 16 = 1.67 :1

(ii) The molecular formula of **Z** is the same as its empirical formula. Give the **displayed** formulae of the two possible isomers of **Z**.

(2)





(Total for Question 4 = 18 marks)

Edexcel IAL - Solved Past Paper

January 2026 · Unit 3: Practical Skills in Chemistry I (WCH13/01) · Question 3

hard medium easy

3 (a)(i)

Write · [1 mark]

Write the equation for the oxidation of propan-1-ol to propanoic acid, using [O] for oxygen from the oxidising agent. State symbols not required.

Model answer

✓ $CH_3CH_2CH_2OH + 2[O] \longrightarrow CH_3CH_2COOH + H_2O$

Mark scheme 1 mark

✓ structural formulae, 2[O], and water as the product (1)

Ignore: molecular formulae; O_2

Where marks are lost

Three checkpoints: [O] as instructed, TWO of them (alcohol ⟶ acid is a two-step oxidation), and the water. Structural formulae, not C_3H_8O.

Examiner's insight

Fully correct answers were rare: [O] not used at all, unbalanced (1[O]), water missing - some even invented H_2 as a product.

3 (a)(ii)

State · [2 marks]

State, using name or formula, the two reagents in the oxidising agent.

Model answer

✓ Potassium (or sodium) dichromate(VI), $K_2Cr_2O_7$; ✓ and sulfuric acid, H_2SO_4.

Mark scheme 2 marks - if name AND formula given, both must be correct

✓ $K_2Cr_2O_7$ / $Na_2Cr_2O_7$ (1)

✓ H_2SO_4 (1)

Do not accept: hydrochloric acid; alkali

Accept: 1 mark for 'acidified dichromate(VI)'

Where marks are lost

A banker - 'acidified' means SULFURIC acid specifically; and if you add a formula to a name, it must be right.

Examiner's insight

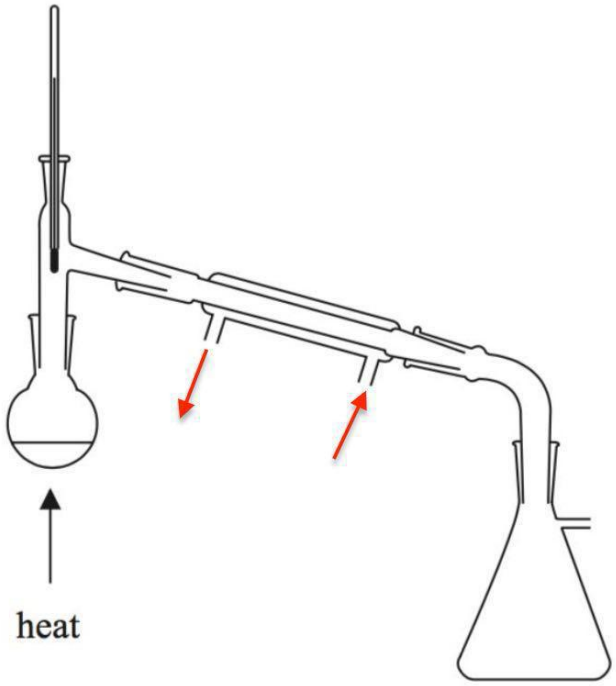
Fewer than half took both marks - the acid was misnamed, and correct names were undone by wrong formulae written next to them.

3 (b)

The oxidising agent sits in a pear-shaped flask in an ice-water bath; 1 cm^3 of propan-1-ol is added a few drops at a time down the open-topped vertical condenser.

(iii) Draw the apparatus that is used in **step 6** for distillation.

(3)



(iv) Suggest why the first washing of the product in **step 7** is with dilute sodium thiosulfate solution rather than with water alone.

(1)

to remove iodine

(v) State why calcium chloride used in **step 8** must be anhydrous.

(1)

dehydrating agent to remove water

(vi) To complete the preparation, after decanting the mixture from the calcium chloride, there should be a **step 9**. What is this step?

(1)

Redistillation

over a narrow range of temperatures

Working

✓ mass of calcium = 1.783 − 1.657 = 0.126 g

✓ moles of Ca = 0.126 / 40.1 = 3.14 x 10^{-3} mol (= moles of H_2, 1:1)

✓ molar volume = 72.0 / 3.14 x 10^{-3} = 22 914 cm^3 mol^{-1}

✓ = 22.9 dm^3 mol^{-1} (3 s.f.)

molar volume of H_2 = 22.9 dm^3 mol^{-1}

Mark scheme 4 marks - TE throughout

- ✓ mass of calcium (0.126 g) (1)
- ✓ moles of calcium (1)
- ✓ volume of one mole (22 914 cm^3) (1)
- ✓ units + 2-3 s.f. (23 / 22.9 dm^3 mol^{-1}) (1)

Accept: correct answer with or without working scores 4

How to reach full marks

The last mark is pure bookkeeping: UNITS (dm^3 mol^{-1} or cm^3 mol^{-1}) and 2-3 significant figures.

Where marks are lost

Leaving the answer as a bare 22 914 with no unit, or quoting 22 914.28 - the s.f./units mark is a quarter of the question.

4 (b)(i)

Calculate · [1 mark]

A second student obtained 21.8 dm^3 mol^{-1}. Calculate the percentage error. [Data-book value: 23.9 dm^3 mol^{-1}]

Working

✓ percentage error = (23.9 − 21.8) / 23.9 x 100 = 8.79%

percentage error = 8.79%

Mark scheme 1 mark

- ✓ (23.9 - 21.8)/23.9 x 100 = 8.79% (1)

Do not accept: 9% / 8.7% / 8.78% (incorrect rounding penalised here)

Where marks are lost

Divide by the DATA-BOOK value, and round properly: 8.7866 ⟶ 8.79, not 8.78. A banker (percentage error).

4 (b)(ii)

Give · [2 marks]

Give two possible reasons why this student's value was below the data-book value. Assume the method was followed correctly, with no measurement errors.

(c) (i) On the diagram of the separating funnel used in Stage **4**, show the 1-bromobutane and aqueous layers. Label each layer.

(1)

aq layer on top
bromobutane lower

(ii) The product is washed with concentrated hydrochloric acid in Stage **5** to remove any unreacted butan-1-ol. The acid donates a proton to the butan-1-ol.
Suggest why this makes washing with acid more effective than washing with water.

(1)

The acid protonates butan-1-ol forming an ionic product that is much more soluble in water

(iii) What is the purpose of adding anhydrous solid calcium chloride in Stage **7**?

(1)

drying agent

(iv) How can you tell when Stage **7** is complete?

(1)

Turns from cloudy to clear

(e) The experimental value for the enthalpy change of combustion for methanol is less negative than the Data Booklet value.

Identify **two** improvements that could be made, either to the apparatus shown in the diagram or to the procedure which would give an enthalpy change closer to the Data Booklet value. Justify your suggested changes.
Do **not** include repeating the experiment or using more accurate measuring equipment.

(4)

Improvement 1 Use screens around the apparatus

Add cap to the spirit burner

Justification to reduce heat loss

To prevent evaporation of methanol

Improvement 2 Use copper calorimeter add lid to the beaker

Reweigh the spirit burner immediately

Justification to improve heat conduction to the water

to reduce heat loss / prevent evaporation of wter

reduce evaporation of methanol

(f) State and explain the effect, if any, on the value obtained for the enthalpy change of combustion if the water in the beaker was not stirred.

(1)

Temperature at the bottom of the beaker would be higher

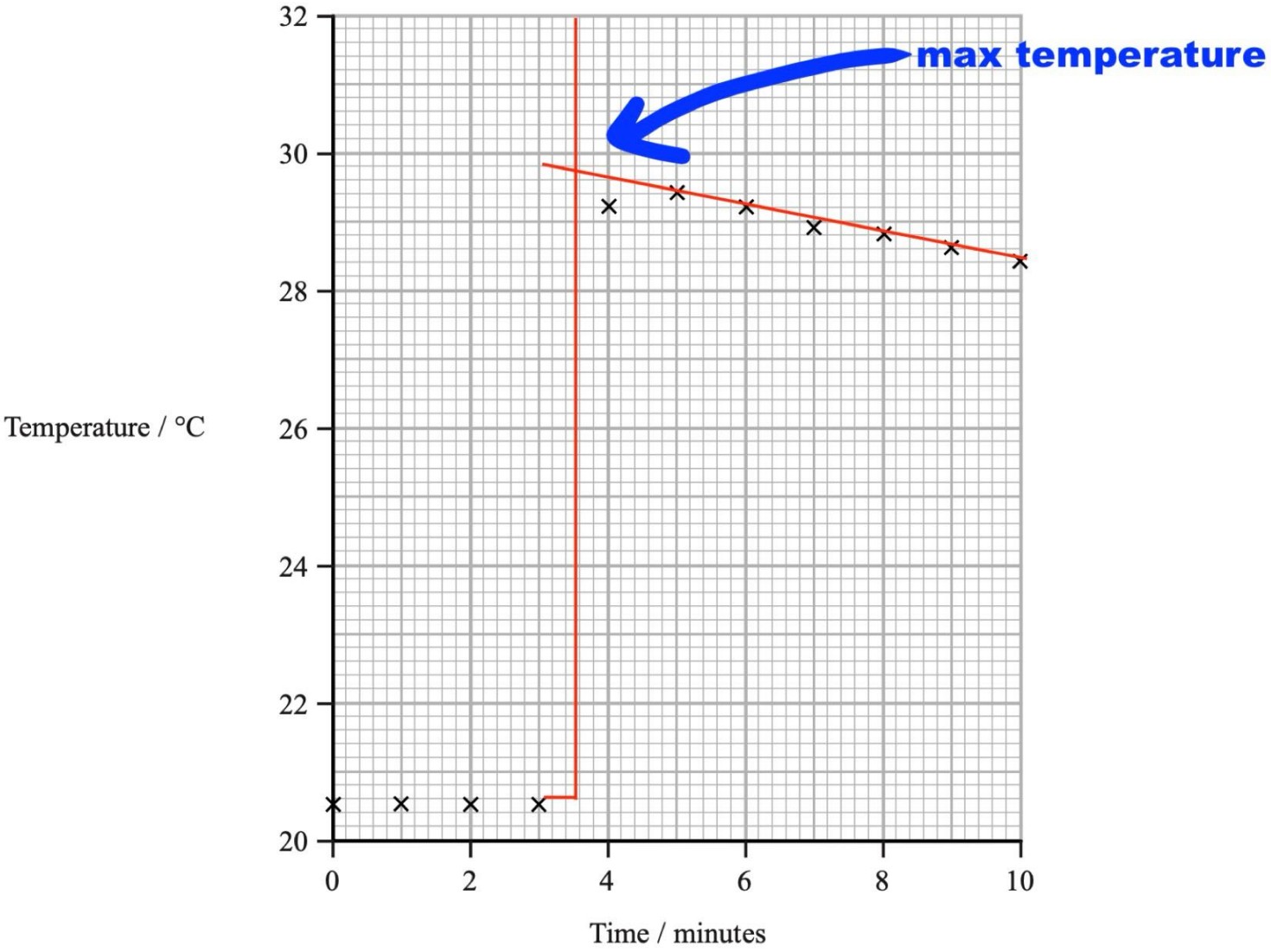
if not stirred and so the enthalpy change would be more negative

(g) If there is insufficient oxygen for the complete combustion of methanol, what is observed on the underside of the beaker?

(1)

Soot deposited on the underside of the beaker

(Total for Question 4 = 11 marks)



(i) Use this graph to calculate the maximum temperature change. Show your working on the graph.

(2)

Maximum temperature change = 29.7 - 20.5 = 9.1 - 9.5 °C

(ii) Why does this method give a more accurate result than the original procedure?

(1)

Corrects for loss of heat during cooling and ensures that the original solution is at equilibrium with surrounding

(Total for Question 8 = 16 marks)

Where marks are lost

'Corrosive' or 'harmful' undersell it (chlorine is TOXIC), and 'flammable' is flatly wrong; the fix is a fume cupboard, not a mask.

Examiner's insight

Generally well answered; chlorine was occasionally called corrosive or flammable, and 'chamber' is not a fume cupboard.

4 (b)(ii)

Give · [1 mark]

Give a reason why the concentrated hydrochloric acid is added 'drop by drop' to the pear-shaped flask.

Model answer

✓ To control the rate of chlorine generation — a steady, gentle stream of gas rather than a sudden rush.

Mark scheme 1 mark

✓ to give a steady stream of chlorine / prevent it being produced too quickly (1)

Accept: 'to control the rate of production'; 'so the reaction is not too fast'

Ignore: explosions; breaking the flask; pressure build-up; spray; exothermic; completeness; titration talk

Where marks are lost

Drama ('explosion', 'flask breaks') scores nothing - the point is a CONTROLLED, steady supply of gas to the aluminium.

Examiner's insight

Many invoked explosions or apparatus damage; 'drop by drop' even sent some off into titration territory - context reading again.

4 (c)

Suggest · [1 mark]

Suggest why the heating of the aluminium in Step 3 is delayed by 20 s after the initial production of chlorine gas.

Model answer

✓ To let the chlorine flush all the air out of the apparatus first — otherwise the hot aluminium would react with the oxygen in the air, forming aluminium oxide instead of pure $AlCl_3$.

Mark scheme 1 mark

✓ chlorine displaces the air / prevents O_2 reacting with Al / prevents Al_2O_3 forming (1)

Accept: 'to fill the apparatus with chlorine'; 'so only chlorine reacts with the aluminium'

Ignore: 'so the chlorine reaches the aluminium first'

(i) Give **two** advantages of using an electrical compensation calorimeter compared to carrying out the reaction in a polystyrene cup.

(2)

No energy is lost to the surrounding

Energy change is measured directly without considering heat capacity and mass of solutions so no need to calculate energy change

(ii) In this experiment, 1260 J was required to produce the same rise in temperature. Calculate the enthalpy change of solution for dissolving 1.0 mol of anhydrous sodium thiosulfate in water to form a 1.0 mol dm^{-3} solution.

$$Na_2S_2O_3(s) + aq \rightarrow 2Na^+(aq) + S_2O_3^{2-}(aq)$$

Include a sign and units with your answer.

(2)

1260 / 0.1 = -12600

number of moles dissolved on previous page = 0.1
so energy change per mol = ΔH/number of moles

(b) The experiment is repeated with 0.10 mol of hydrated sodium thiosulfate, $Na_2S_2O_3.5H_2O$, using the same electrical compensation calorimeter.
To allow for the water of crystallisation, slightly less than 100 cm^3 of water should be added.

(i) Calculate the amount of water that should be added.

[Density of water = 1.0 g cm^{-3}]

(3)

0.1 x 5 = 0.5 mol
0.5 x 1 = 0.5 g
0.5 x 18 = 9 g
100 - 9 = 91 cm3 of water should be added to compensate for the water formed from the hydrated salt

Model answer - chain the evidence

✓ The colour change (orange ⟶ green) shows the liquid WAS oxidised; ✓ so the original liquid cannot have been a ketone or tertiary alcohol (those resist oxidation); ✓ a ketone would only be the final product if the liquid were a SECONDARY alcohol — but the liquid could equally be a primary alcohol (or an aldehyde); ✓ refluxed to completion, a primary alcohol gives a CARBOXYLIC ACID — the more likely final product.

Mark scheme 4 marks from 5 points, all independent

- ✓ original liquid was not a ketone (it was oxidised - the colour changed) (1)
- ✓ the liquid has been oxidised (1)
- ✓ ketone final product requires a secondary alcohol (1)
- ✓ original could be a primary alcohol / aldehyde (1)
- ✓ alternative final product: carboxylic acid (1)

Ignore: confirmatory tests and their colours - not asked

Where marks are lost

REFLUX + full oxidation of a primary alcohol goes past the aldehyde to the carboxylic acid - and remember Fehling's already ruled the aldehyde out as the product.

Examiner's insight

Mean mark 1.56 - 'oxidised' and 'carboxylic acid' were the points most often hit; only a few answers chained all the logic together.

3 (c)(ii)

Explain · [2 marks]

Explain how the distillation could help to confirm the identity of the final product.

Model answer

✓ The thermometer gives the product's BOILING TEMPERATURE during distillation; ✓ which can be compared with published (data-book) values to identify it.

Mark scheme 2 marks

- ✓ boiling temperature measured (from the distillation) (1)
- ✓ compared with published/data-book values (1)

Where marks are lost

A banker pair with (a): the thermometer is not decoration - boiling temperature + data book = identification.

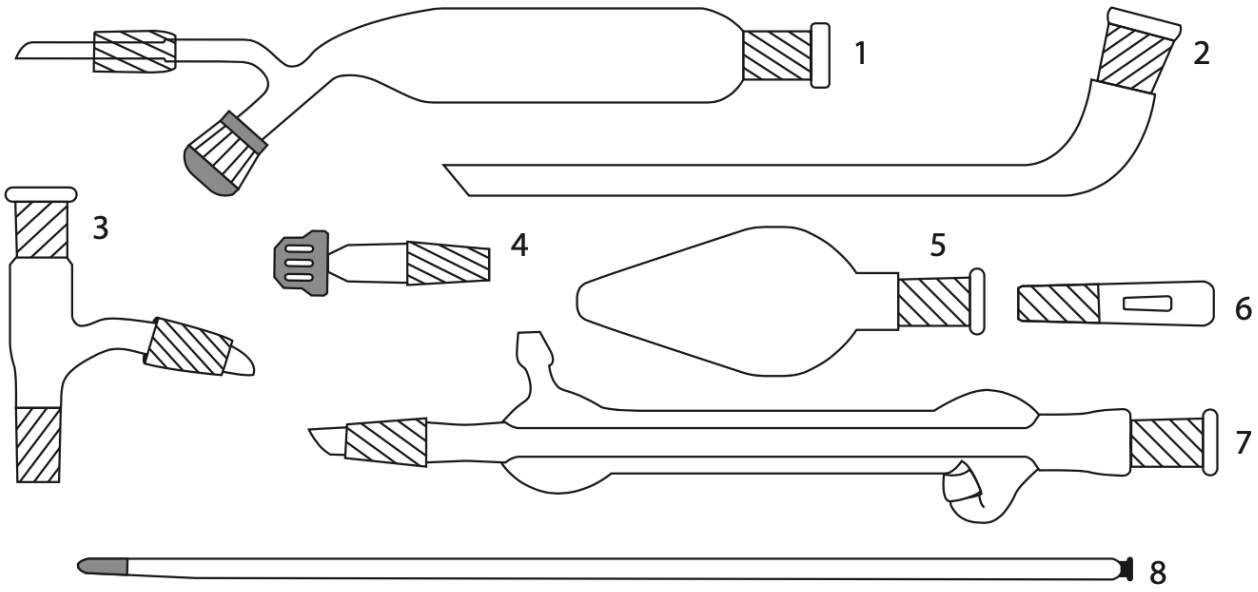
Examiner's insight

Over 85% scored nothing - despite nearly every diagram in (a) including a thermometer, few knew why it was there.

Revise from your notes

- Distillation apparatus U2 §6.2
- Oxidation of alcohols; tests for organics U2 §7.2 U2 §20.3

(iii) Select from the apparatus below, the apparatus you would use for distillation.



You should identify each piece of apparatus by number or name and state how you would connect them together for the preparation of propanal.

You should also name a suitable collecting vessel not shown above.

You should **not** draw a diagram.

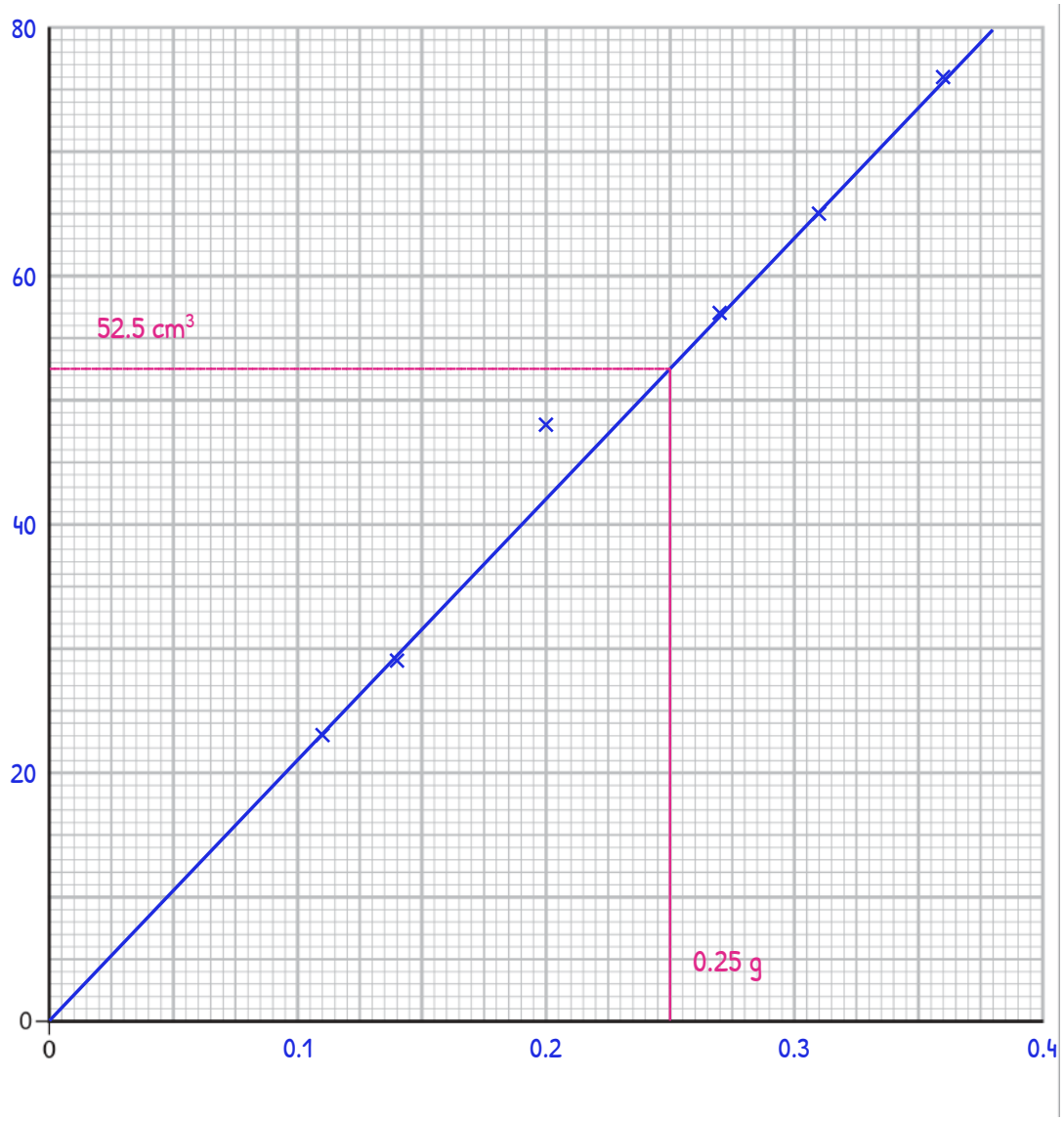
(3)

Rounded flask (5) is connected to condenser (7)

Thermometer (8) is inserted on top of the condenser

Delivery tube (2) is connected to the side arm of condenser

A beaker is placed at the end of the deliver tube to collect the distillate



Best-fit straight line through the origin, EXCLUDING the anomalous point at (0.20, 48); construction lines up from 0.25 g and across to approx. 52.5 cm^3.

Reading

✓ best-fit line through five points and the origin, leaving out (0.20, 48)

✓ at 0.25 g the line gives approx. 52.5 cm^3 (51.5–53.5 accepted)

volume at 0.25 g approx. 52.5 cm^3

Mark scheme 2 marks

- ✓ best-fit line through five points and the origin (1)
- ✓ construction lines and 51.5-53.5 cm^3 (1)

Do not accept: a best-fit line that includes the 0.20 g point

Accept: TE on plotted points

Where marks are lost

The point at (0.20 g, 48 cm^3) is ANOMALOUS - a best-fit line through it loses the mark. Zero mass = zero gas, so the line must pass through the origin. A banker.

Examiner's insight

The anomaly-exclusion plus origin constraint repeated the Jun 2019 pattern.

Do not accept: 'dehydrating agent'; rusting/corrosion
Ignore: absorbing HCl

Where marks are lost

The EXPLAIN command wants both halves: dries the gas AND why that matters here (water destroys the product). Most stopped at 'drying agent'.

Examiner's insight

The purpose was known but few earned the second mark - the significance of the 'explain' command was missed.

4 (a)(ii)

Give · [1 mark]

Give the reason why granules of anhydrous calcium chloride are used rather than powder.

Model answer

✓ Gas can flow freely between granules – a powder would pack tightly and block the tube (pressure would build up).

Mark scheme 1 mark

✓ so the gas can pass through easily / powder would block the tube (1)
Accept: 'prevents build-up of pressure'
Ignore: 'granules stay in position'
Do not accept: surface area / rate arguments

Where marks are lost

Surface-area-and-rate reflexes fail here - the issue is GAS FLOW: powder blocks, granules let the chlorine through. (And no, these aren't anti-bumping granules.)

Examiner's insight

Only a small proportion saw the flow argument; most reached for surface area and rate, and 'granules' distracted some into anti-bumping talk.

4 (b)(i)

Identify · [2 marks]

Step 2 produces chlorine gas. Identify the main hazard related to chlorine gas, giving the best way of minimising the risk.

Model answer

✓ Chlorine is TOXIC (poisonous); ✓ so carry out the whole preparation in a fume cupboard.

Mark scheme 2 marks - marked separately

✓ toxic / poisonous (1)
✓ fume cupboard (1)
Accept: fume box / fume hood
Ignore: irritant / harmful / corrosive; gas mask; smaller amounts; goggles/gloves
Do not accept: flammable

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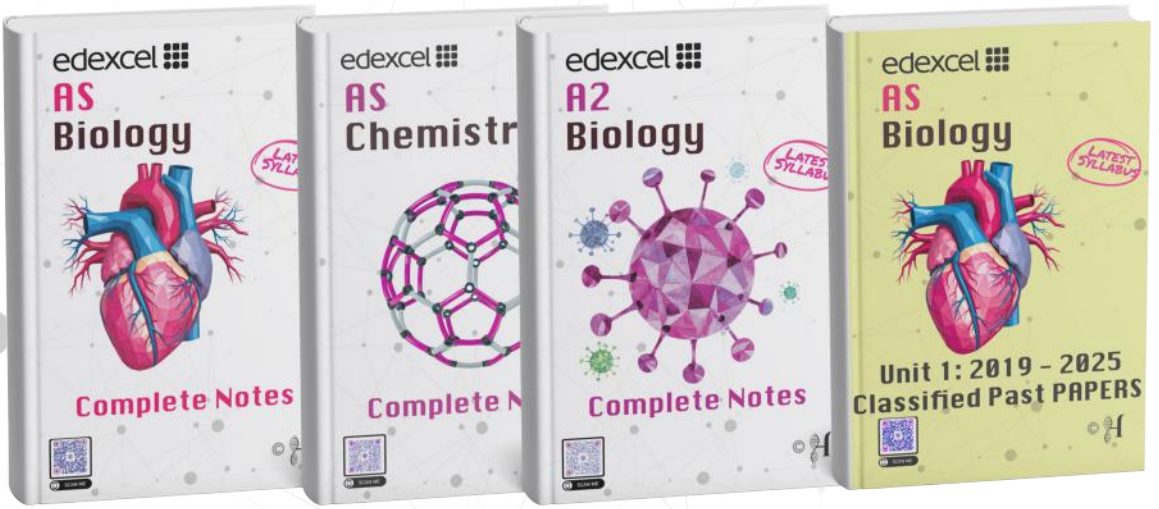

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