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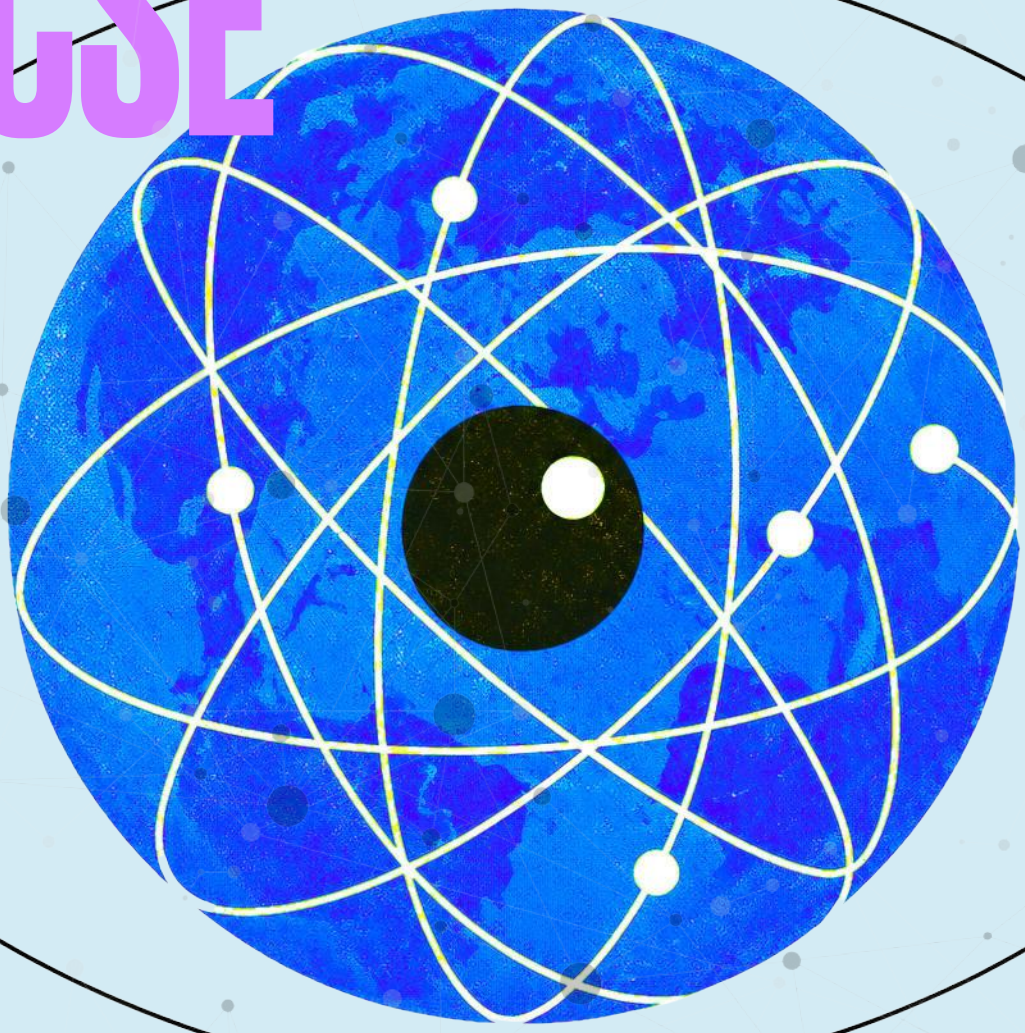
CHEMISTRY

IGCSE



Topical Questions

LATEST SYLLABUS

Paper 2

Edexcel Chemistry IGCSE

Paper 2 • Questions & Answers by Topic

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Edexcel Chemistry IGCSE

Paper 2 • Questions & Answers by Topic

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Edexcel IGCSE - Solved Past Paper

January 2022 · Chemistry Paper 2C (4CH1/2C) · Question 3 · Solubility curves

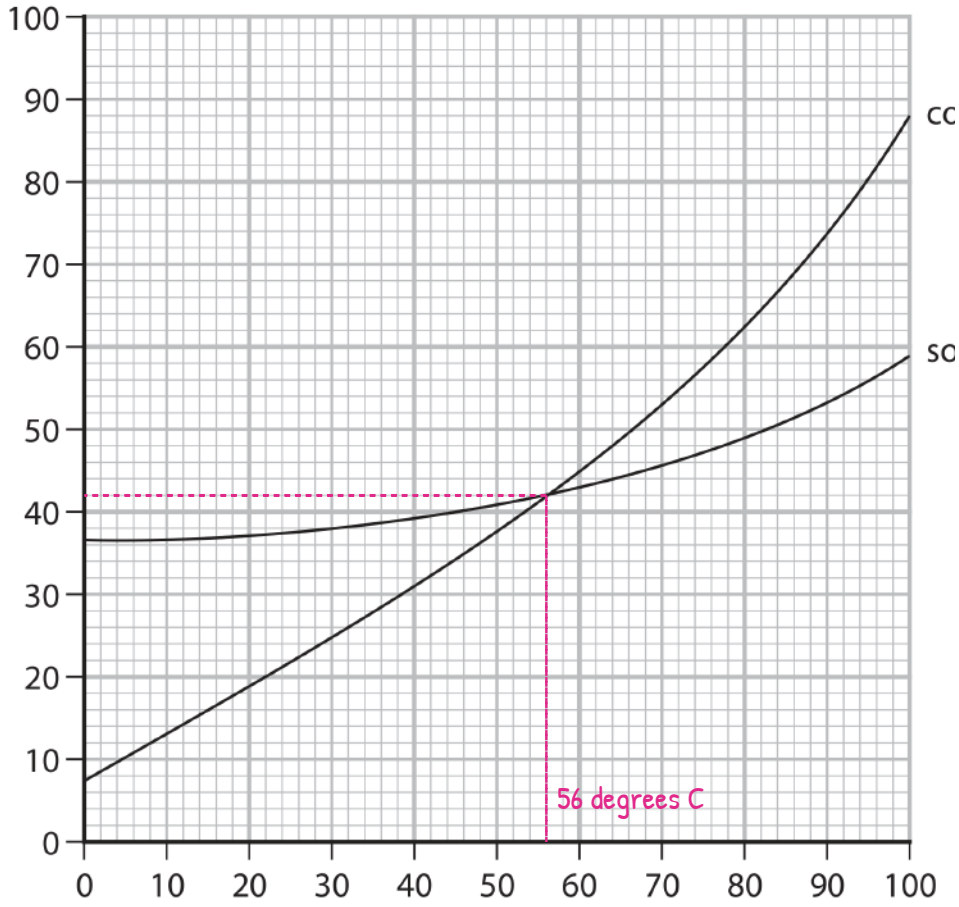
hard medium easy

3 (a)(i)

Determine · [2 marks]

The graph shows the solubilities of copper(II) chloride and sodium chloride at different temperatures. Determine the temperature at which they have the same solubility. Show on the graph how you obtained your answer.

Reading the graph



The two curves cross at about (56 degrees C, 42 g). Drop a vertical line from the crossing point straight down to the temperature axis: that reading is the working the examiner wants to see. The steep upper curve is copper(II) chloride; the flatter one is sodium chloride.

What each of the 2 marks wants

✓ Working shown on the graph: a line is drawn from the point where the two curves cross down to the temperature axis. ✓ The temperature read off the axis = 56 degrees C (allow any value 56–57 degrees C).

Mark scheme 2 marks

- ✓ M1 working shown on the graph (1)
- ✓ M2 56 degrees C (1)

Accept: allow any value between 56 and 57 inclusive

Examiner's insight

The majority placed step G correctly, but the other three steps were less often placed in the right order.

2 (b)(ii)

Calculate · [2 marks]

mass of empty basin = 60.5 g; mass of basin + dry salt = 78.1 g; the solution came from 50.0 cm3 of water (1.00 cm3 of water has a mass of 1.00 g). Calculate the solubility in grams per 100 g of water.

Solubility per 100 g of water

✓ mass of dry salt = 78.1 – 60.5 = 17.6 g

50.0 cm^3 of water has a mass of 50.0 g, so 17.6 g of salt dissolved in 50.0 g of water.

✓ scale up to 100 g of water: solubility = 17.6 x (100 / 50) = 17.6 x 2 = 35.2 g per 100 g of water

solubility = 35.2 g per 100 g of water

Mark scheme 2 marks

- ✓ M1 - mass of dry salt = 78.1 - 60.5 = 17.6 (g) (1)
- ✓ M2 - solubility = 17.6 x 2 = 35.2 (g per 100 g) (1)

Accept: ECF from M1; correct answer with no working scores 2

Where marks are lost

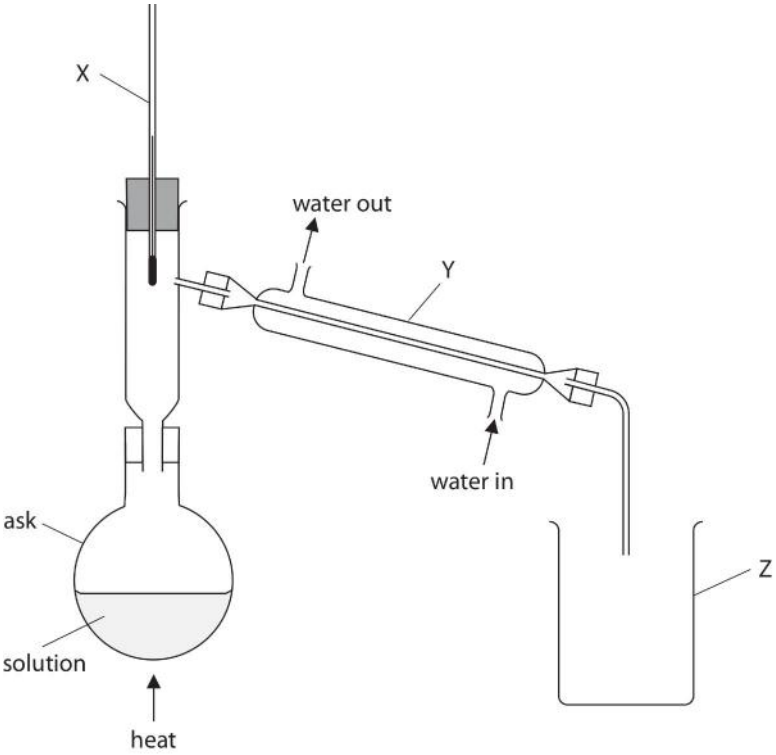
Dividing 17.6 by 100 instead of multiplying by 2 - only 50 g of water was used, so you must DOUBLE the mass to get the value per 100 g.

Examiner's insight

The vast majority scored M1; the common follow-on error was dividing 17.6 by 100 instead of multiplying by 2.

Revise from your notes

- Solubility - Chapter 1 1.5
- Investigating solubility (Paper 2) - Chapter 1 1.6



X points to the tube in the flask neck; Y is the sloping water-jacketed tube; Z is the collecting vessel.

Model answer

✓ X is a thermometer – it reads the temperature of the vapour leaving the flask (should read the boiling point of water). ✓ Y is a (Liebig) condenser – cold water in the outer jacket cools the vapour so it condenses back to liquid. ✓ Z is a beaker – it collects the pure distilled water.

Mark scheme 3 marks - 1 each

- ✓ X = thermometer (1)
- ✓ Y = (Liebig) condenser (1)
- ✓ Z = beaker (1)

Where marks are lost

Naming Y - many candidates could not name the condenser. It is the sloping tube with water flowing through the outer jacket.

Examiner's insight

Most named X and Z easily; the (Liebig) condenser was the one that caught people out.

1 (b)(ii)

State · [1 mark]

State what remains in the flask when the separation is complete.

Model answer

✓ Salt – the water boils off and is collected, leaving the non-volatile salt behind in the flask.

Edexcel IGCSE - Solved Past Paper

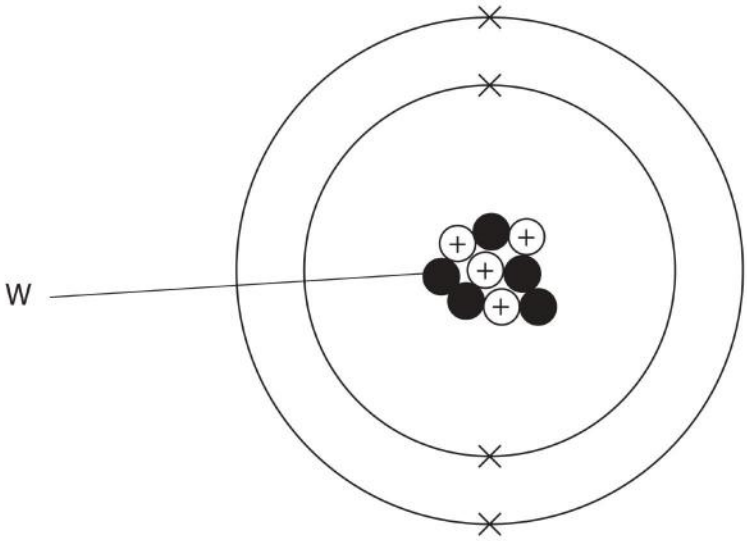
June 2024 · Chemistry Paper 2CR (4CH1/2CR) · Question 2 · Atoms and isotopes

hard medium easy

2 (a)(i)

What · [1 mark]

The diagram represents an atom of an element. What is the name of the particle labelled W?



The nucleus holds 4 positive particles (marked +) and 5 uncharged particles (the solid circles). W points to one of the solid, uncharged particles in the nucleus. Two shells hold the electrons (the crosses).

Answer

- [ ] **A** electron
- [ ] **B** ion
- [x] **C** neutron
- [ ] **D** proton

The logic

✓ W points to a solid (uncharged) particle inside the nucleus. The charged particles in the nucleus are marked '+' (protons), so the uncharged nuclear particle W must be a neutron.

Why the others fail

- **A** electrons are the crosses on the shells OUTSIDE the nucleus, not inside it
- **B** an ion is a whole charged atom, not a single sub-atomic particle
- **D** the protons are the particles marked '+'; W has no charge

Mark scheme 1 mark

✓ C (neutron) (1)

Where marks are lost

Picking proton - the protons are the '+' particles; W is the uncharged one, a neutron.

Edexcel IGCSE - Solved Past Paper

June 2019 · Chemistry Paper 2C (4CH1/2C) · Question 8 · Moles and concentration

hard medium easy

8 (a)

Explain · [2 marks]

NaClO(aq) + 2HCl(aq) ⟶ NaCl(aq) + H2O(l) + Cl2(g). Explain a safety precaution that should be taken when doing this experiment.

Model answer

✓ Work in a fume cupboard, ✓ because the chlorine gas produced is toxic (poisonous).

Equally acceptable route

Or: wear goggles/gloves, because the acid and bleach are corrosive/irritant.

Mark scheme 2 marks - either linked pair

Route 1

✓ use a fume cupboard (1)

Route 1

✓ because chlorine is toxic/poisonous (1)

Route 2

✓ wear goggles/gloves (1)

Route 2

✓ because the acid/bleach is corrosive/irritant (1)

Ignore: ignore 'chlorine is dangerous/harmful' (too vague) and 'wear a lab coat'

Where marks are lost

Giving the precaution but not a proper scientific reason - 'wear gloves so it does not burn you' scores 1; say the bleach is CORROSIVE.

Examiner's insight

Generally well answered, but many scored only 1 by not giving a correct scientific reason for their precaution.

8 (b)(i)

Calculate · [2 marks]

60.0 cm3 of chlorine gas is produced. Calculate the amount, in moles, of chlorine gas. Assume one mole of gas occupies 24 000 cm3.

Moles of gas

✓ moles = volume of gas / molar gas volume = 60.0 / 24000

✓ = 0.0025 mol

amount of chlorine = 0.0025 mol

Mark scheme 2 marks

✓ 60 / 24000 (1)

Edexcel IGCSE - Solved Past Paper

June 2022 · Chemistry Paper 2C (4CH1/2C) · Question 6 · Titanium extraction, alloys

hard medium easy

6 (a)

Calculate · [4 marks]

$TiO_2 + 2Cl_2 + C \longrightarrow TiCl_4 + CO_2$. Calculate the volume, in dm3, of chlorine gas at rtp needed to react completely with 20 tonnes of titanium dioxide. Give your answer in standard form. [1 tonne = 10^6 g; M_r of TiO2 = 80; molar volume = 24 dm3]

Mass -> moles -> gas volume

- ✓ mass of TiO_2 = 20 x 10^6 g; moles of TiO_2 = mass / M_r = 20 x 10^6 / 80 = 2.5 x 10^5 mol
- ✓ from the equation the ratio TiO_2 : Cl_2 is 1 : 2, so moles of Cl_2 = 2.5 x 10^5 x 2 = 5.0 x 10^5 mol
- ✓ volume of Cl_2 = moles x molar volume = 5.0 x 10^5 x 24 = 12 000 000 dm^3
- ✓ in standard form = 1.2 x 10^7 dm^3

volume of chlorine gas = 1.2 x 10^7 dm^3

Mark scheme 4 marks - correct answer with or without working scores 4

- ✓ M1 moles TiO_2 = 20 x 10^6 / 80 OR 2.5 x 10^5 (1)
- ✓ M2 moles Cl_2 = 2.5 x 10^5 x 2 OR 5.0 x 10^5 (1)
- ✓ M3 vol Cl_2 = 5.0 x 10^5 x 24 OR 12 000 000 (1)
- ✓ M4 1.2 x 10^7 (dm3) (1)

Accept: ecf allowed on M2 and M3; correct answer alone scores 4

Accept: 12 000 000 without standard form scores 3; 2.083 x 10^4 (divided instead of multiplied) scores 3

How to reach full marks

Four steps: mass ⟶ moles TiO_2 ⟶ x2 for Cl_2 ⟶ x24 for volume ⟶ write in standard form. The final mark is purely for the standard-form conversion.

Where marks are lost

Not converting to standard form as instructed (loses M4), or dividing by 24 instead of multiplying. Use the 1:2 ratio from the equation.

Examiner's insight

Discriminated well; many scored 3 or 4. A common loss was the fourth mark for not giving the answer in standard form as told.

6 (b)

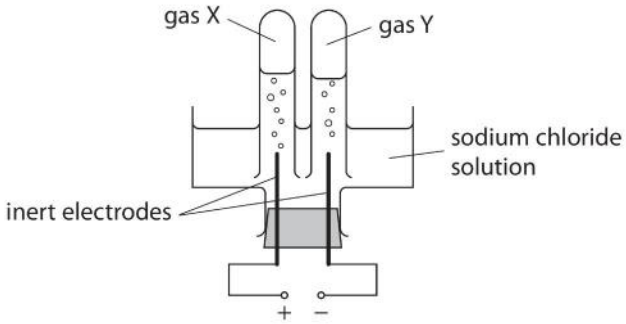
Explain · [2 marks]

In stage 2, $TiCl_4$ vapour is passed through molten magnesium in a container filled with argon: $TiCl_4 + 2Mg \longrightarrow Ti + 2MgCl_2$. Explain why the container is filled with argon rather than air.

4 (e)

Identify · [4 marks]

Concentrated aqueous sodium chloride is electrolysed with inert electrodes. Two gases X and Y form; one gives a squeaky pop with a lighted splint. Use ionic half-equations to identify X and Y.



X is at the positive electrode (anode); Y is at the negative electrode (cathode). The squeaky pop identifies Y as hydrogen.

Identifying the gases

✓ X (positive electrode) is chlorine, Cl_2 – concentrated chloride solution discharges chloride ions at the anode. ✓ Y (negative electrode) is hydrogen, H_2 – it gives the squeaky pop with a lighted splint.

Ionic half-equations

✓ At the anode (X): $2Cl^- \longrightarrow Cl_2 + 2e^-$

chloride ions lose electrons (oxidation)

✓ At the cathode (Y): $2H^+ + 2e^- \longrightarrow H_2$

hydrogen ions gain electrons (reduction)

$X = Cl_2$ · $Y = H_2$

Mark scheme 4 marks

- ✓ X is chlorine / Cl_2 (1)
- ✓ Y is hydrogen / H_2 (1)
- ✓ $2Cl^- \longrightarrow Cl_2 + 2e^-$ (1)
- ✓ $2H^+ + 2e^- \longrightarrow H_2$ (1)

Accept: allow oxygen/O_2 at the anode with $2H_2O \longrightarrow O_2 + 4H^+ + 4e^-$ (or $4OH^- \longrightarrow O_2 + 2H_2O + 4e^-$)

Accept: if both gases given but the wrong way round or unclear, allow 1 mark overall from the identification marks

Where marks are lost

Swapping X and Y, or putting the electrons on the wrong side of a half-equation (electrons are GAINED at the cathode, LOST at the anode).

Examiner's insight

Several clear, concise answers; marks were lost by giving the gases the wrong way round or adding electrons to the wrong side.

Where marks are lost

Just writing 'they are related' without saying HOW - state that volume rises with current (directly proportional).

Examiner's insight

Most gave a correct relationship between current and volume.

3 (d)(i)

Suggest · [1 mark]

$2Cl^- \longrightarrow Cl_2 + 2e^-$ (syringe X) and $2H^+ + 2e^- \longrightarrow H_2$ (syringe Y). Suggest how these show the volume of chlorine should equal the volume of hydrogen.

Model answer

✓ The same number of electrons ($2e^-$) produces one mole of Cl_2 and one mole of H_2. Equal moles of gas occupy equal volumes, so the two volumes should be the same.

Mark scheme 1 mark

✓ same transfer of electrons gives one mole of Cl_2 and one mole of H_2 (equal moles ⟶ equal volumes) (1)

Accept: allow 'same number of moles of Cl2 and H2'; allow molecules for moles

Where marks are lost

Not linking the 2 electrons to EQUAL MOLES of the two gases - that is why equal volumes are expected.

Examiner's insight

Only the best candidates gave the answer in terms of equal moles of the two gases being produced.

3 (d)(ii)

Suggest · [1 mark]

Suggest why the volume of chlorine collected in syringe X is always less than the volume of hydrogen collected in syringe Y.

Model answer

✓ Chlorine is soluble - some of it dissolves in the acid/solution, so less chlorine gas reaches the syringe.

Mark scheme 1 mark

✓ chlorine dissolves / is soluble in the acid/solution (1)

Accept: allow dissolves / soluble in water

Where marks are lost

Blaming a leak (that would affect both gases). The key is that chlorine is far more soluble than hydrogen, so some dissolves.

Examiner's insight

Many were aware that the solubility of chlorine in the solution reduces the volume of chlorine gas.

Ignore: ignore references to electrons - electron transfer is not shown in this equation

Where marks are lost

Talking about gaining electrons - the equation shows no ions, so you must argue from LOSS OF OXYGEN. Saying 'iron loses oxygen' is less precise than 'iron(III) oxide loses oxygen'.

Examiner's insight

References to electrons were ignored as this was not shown; the best answers said iron(III) oxide loses oxygen.

5 (d)(ii)

Draw · [3 marks]

Draw an energy level diagram for the reaction between aluminium and iron(III) oxide (the reaction is exothermic).

An energy LEVEL diagram: two levels, no activation-energy hump needed. The products line is BELOW the reactants line because the reaction is exothermic. Both sides are labelled with the actual formulae from the equation, not just 'reactants' and 'products'.

What each of the 3 marks wants

✓ The right-hand (products) line drawn BELOW the left-hand (reactants) line – it is exothermic. ✓ Both reactants labelled with correct names/formulae: $2Al + Fe_2O_3$. ✓ Both products labelled with correct names/formulae: $Al_2O_3 + 2Fe$.

Mark scheme 3 marks

- ✓ right-hand line below left-hand line (1)
- ✓ correct name / formula of both reactants (1)
- ✓ correct name / formula of both products (1)

Ignore: ignore a horizontal axis drawn, and ignore activation energy / a hump if shown

Accept: using only the words 'reactants' (left) and 'products' (right) scores 1 of M2 and M3; M2 and M3 can still be scored even from an endothermic-looking diagram

How to reach full marks

An energy LEVEL diagram just needs the two levels in the right order (products lower) and both sides named with the real formulae. No activation-energy hump is required.

4 (b)(i)

Give · [1 mark]

Give the formula of the copper ion and the formula of the sulfate ion in copper(II) sulfate.

Model answer

✓ copper ion = Cu^{2+} and sulfate ion = SO_4^{2-} (both charges needed for the one mark).

Mark scheme 1 mark - both correct

✓ Cu^{2+} and SO_4^{2-} (1)

Accept: allow Cu^{+2} and SO_4^{-2}

Where marks are lost

Writing S^{2-} instead of the sulfate ion SO_4^{2-}, or leaving the 2+ off the copper ion - the 'II' tells you the charge is 2+.

Examiner's insight

Many missed the mark, usually from a wrong charge or by writing S^{2-} for the sulfate ion.

4 (b)(ii)

State · [1 mark]

State what would be seen at the positive electrode (oxygen forms there).

Model answer

✓ Bubbles / effervescence / fizzing (of the gas) at the positive electrode.

Mark scheme 1 mark

✓ effervescence / bubbles / fizzing (1)

Where marks are lost

Writing 'gas produced' (a gas cannot be seen) or 'brown/orange copper' - copper forms at the NEGATIVE electrode, not this one. An observation must be something you can actually see.

Examiner's insight

Most scored for bubbles; some wrongly said copper appeared, and 'gas produced' was not accepted as an observation.

4 (b)(iii)

Give · [1 mark]

Give a test for oxygen.

Model answer

✓ A glowing splint relights (is relit) when placed in the gas.

Mark scheme 1 mark

✓ relights a glowing splint (1)

Where marks are lost

Leaving out the key word 'glowing', or giving the hydrogen test (squeaky pop) or the carbon dioxide test (limewater) instead.

✓ All six points plotted correctly, each to within half a small square.

Mark scheme 1 mark

✓ all 6 points plotted +/- half a square (1)

Where marks are lost

Mis-plotting the 20 cm3 point too low - it is the anomaly and reads 9.77 (higher than the trend).

Examiner's insight

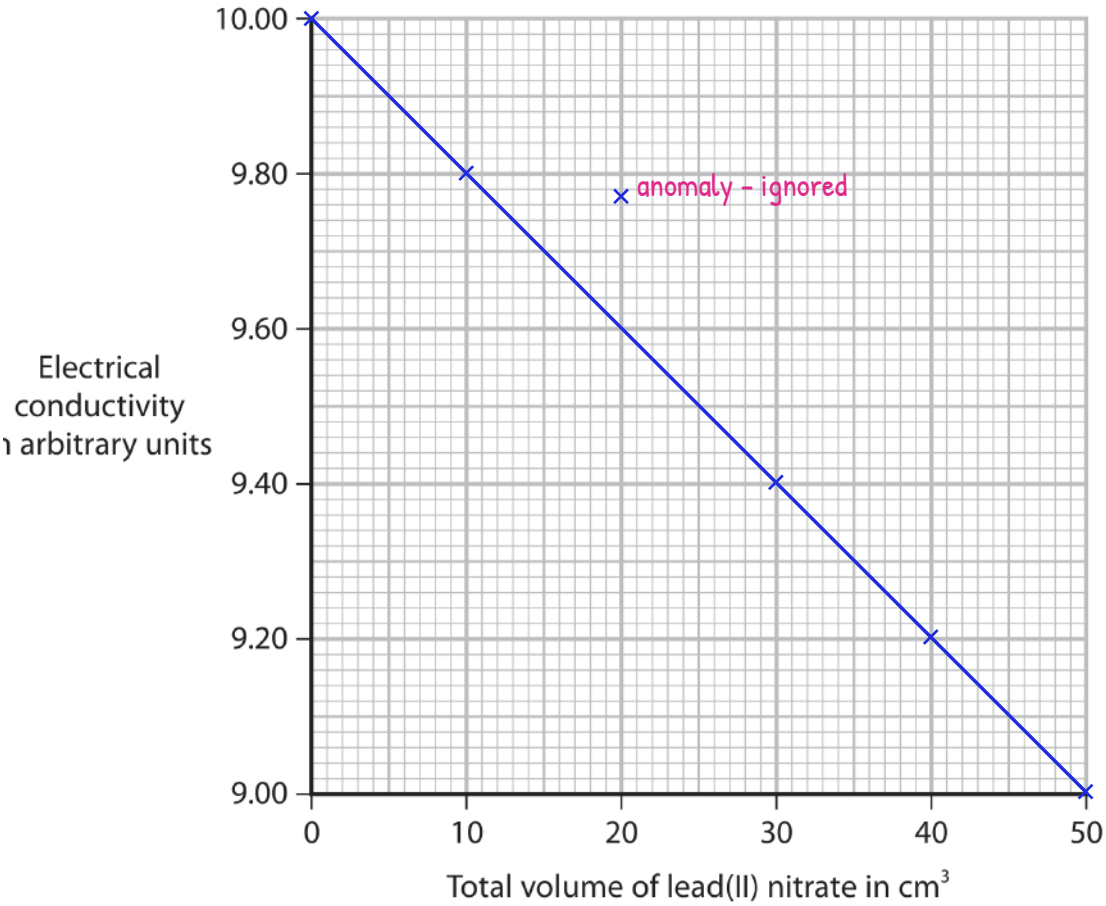
Most scored the plotting mark; the usual slip was plotting the 20 cm3 point too low.

5 (c)(ii)

Draw · [1 mark]

Draw a line of best fit, ignoring the anomalous result.

Line of best fit added



A single straight ruled line of best fit through the trend. The point at 20 cm3 lies above the line and is ignored - do NOT 'join the dots'.

What the 1 mark wants

✓ One straight ruled line of best fit through the trend, ignoring the anomalous point at 20 cm3.

Mark scheme 1 mark

✓ straight line of best fit ignoring the anomaly at 20 cm3 (1)

- ✓ measure time for a set volume of O_2, or volume of O_2 in a set time (1)
- ✓ repeat with the same volume of hydrogen peroxide (1)
- ✓ add a known mass of solid X (then Y, then Z) (1)
- ✓ measure the O_2 the same way with the solid present (1)
- ✓ weigh the solid before and after / check mass is unchanged (1)
- ✓ reduced time / increased volume of gas means the solid is a (possible) catalyst (1)

Accept: allow measure the time until no more oxygen is produced; allow reference to increased rate

How to reach full marks

A good plan has a CONTROL (peroxide only), FAIR TEST (same volume of peroxide, same mass of each solid, same measurement), and a clear conclusion (faster gas AND unchanged mass = catalyst).

Where marks are lost

Jumping straight to the solids with no control run, or giving no way to compare the rates fairly. A catalyst must speed the reaction up AND be left unchanged in mass.

Examiner's insight

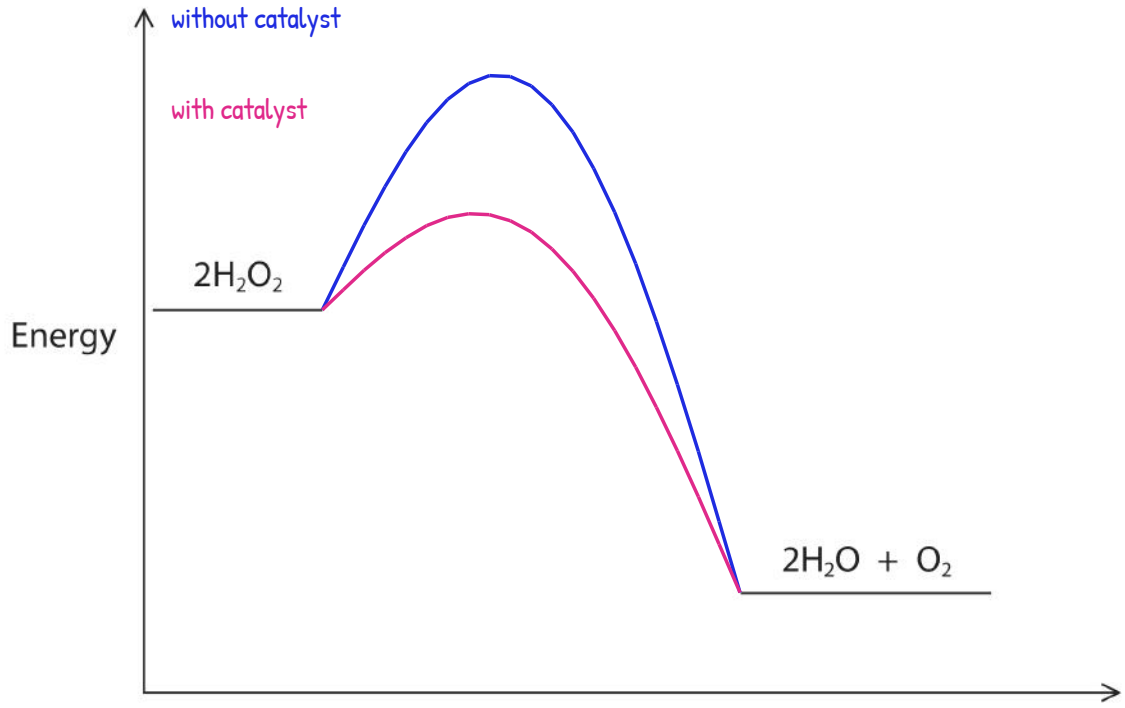
Some excellent, logical descriptions were seen from candidates who had done the investigation; the best included a control run and weighed the solids before and after.

5 (c)

Draw · [2 marks]

The decomposition is exothermic. On the diagram, draw and label the reaction profiles for the reaction WITHOUT a catalyst and WITH a catalyst.

Reaction profiles drawn and labelled



Both curves start from the reactants ($2H_2O_2$) level and finish at the lower products ($2H_2O + O_2$) level - the reaction is exothermic. The catalysed curve (pink) has a LOWER hump: the catalyst lowers the activation energy but does NOT change delta H.

What each of the 2 marks wants

Edexcel IGCSE - Solved Past Paper

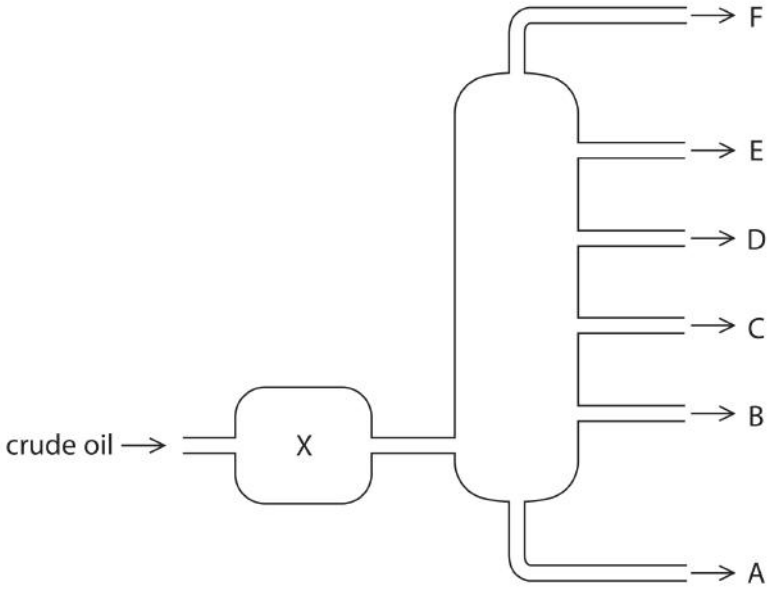
June 2019 · Chemistry Paper 2CR (4CH1/2CR) · Question 3 · Crude oil and fractions

hard medium easy

3 (a)(i)

Name · [1 mark]

Name the process used to separate crude oil into different fractions.



Crude oil enters at X, is vaporised, then rises up the column. Fraction A (bottom) is the heaviest; fraction F (top) is the lightest.

Model answer

✓ Fractional distillation.

Mark scheme 1 mark

✓ fractional distillation (1)

Accept: allow fractionating / fractionation

Where marks are lost

Just writing 'distillation' or 'cracking' - it is FRACTIONAL distillation.

Examiner's insight

Very well known; the majority scored full marks on part (a).

3 (a)(ii)

State · [1 mark]

State what happens to the crude oil at X.

Model answer

✓ It is heated so that it boils and turns to vapour (it is vaporised).

Mark scheme 1 mark

✓ crude oil is heated / vaporised (1)

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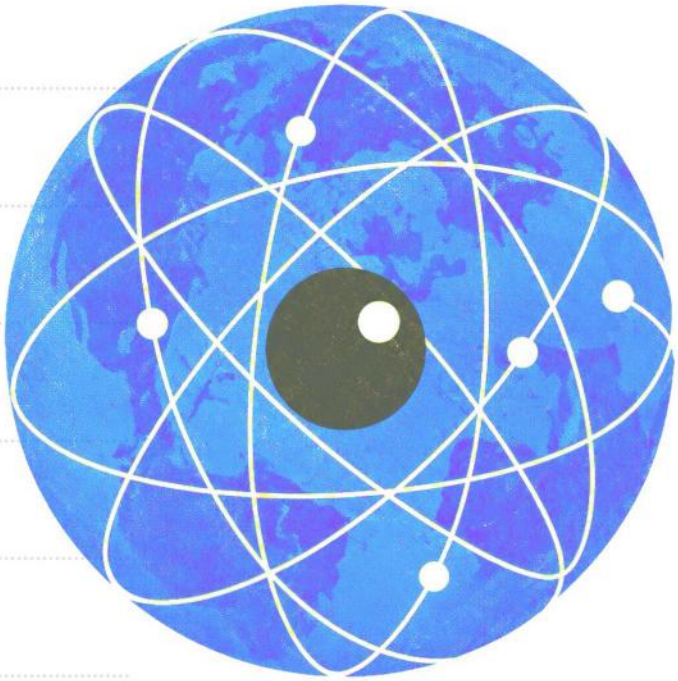

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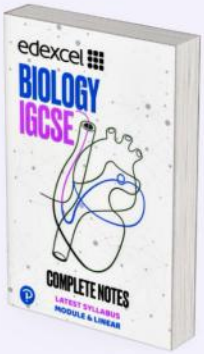

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