

Unofficial MS for AQA A level Chem Paper 1 2025

JOIN <https://discord.gg/alevels> for exam discussions/ pdfs of the paper after the exam, future unofficial mark schemes and **many more resources!**
Total marks for P1 is 105

****TIP: appropriate significant figure is 2, if no significant figure is stated, always check the significant figure they use in questions.**

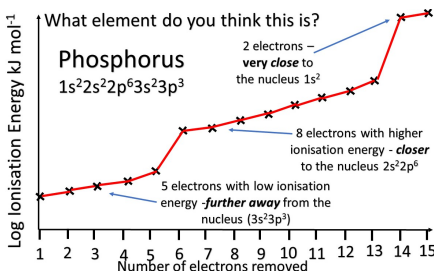
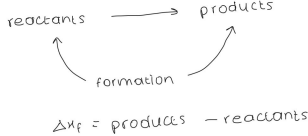
E.g: X has concentration of 3.45 mol dm^{-3}

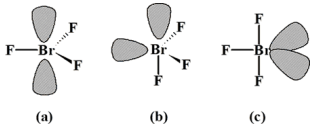
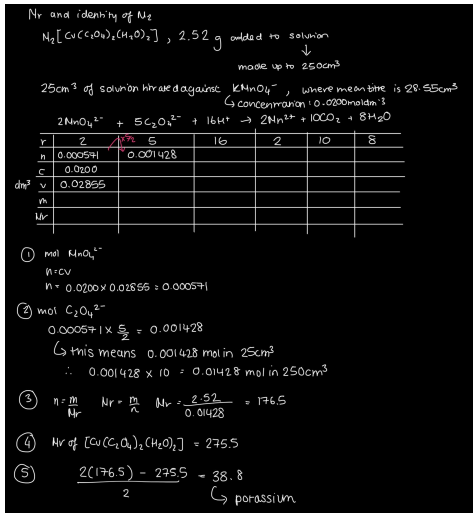
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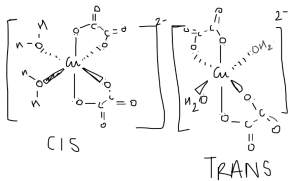
<https://ig.me/j/AbbN4-oy3TWsko7G/> ← **Link for the IG (Instagram) Group**

Really easy	Easy	Middle	A bit hard	Hard
✓✓✓✓✓✓✓✓✓✓	✓✓✓✓✓✓✓✓	✓✓✓✓✓✓✓✓✓✓ ✓✓	✓✓✓✓✓✓	✓✓✓✓✓✓✓✓✓✓✓✓✓✓

Question	Marks	Answer	Additional Comments
1.1) equation and role of Mg in titanium chloride extraction	2	$\text{TiCl}_4 + 2\text{Mg} \rightarrow \text{Ti} + 2\text{MgCl}_2$ reducing agent	
1.2) Calcium uses for neutralising soil pH and removing sulfur	2	Ca(OH)_2 CaO/CaCO_3	
Why is magnesium hydroxide used not sodium hydroxide	1	Mg(OH)_2 Less soluble	
Identify the group 2 metal in X and write the ionic equation	2	$\text{Mg}^{2+} + 2\text{OH}^- \rightarrow \text{Mg(OH)}_2$	
Identify the anion and explain why the AgNO_3 needed to be acidified	3	Anion = Br^- Explain- react with any other ions that could give false positive	I wrote remove other anions
Explain why V can be shaped into a long wire	1	It has rows of cations which can slide Ductile, strong, high bp mp?	Does malleable count?
1.4) What property of BaSO_4 makes it useful in hospitals?	1	insoluble	
Deduce the period 3 element from this	3	P The increase in	

ionisation graph and explain your deduction		ionisation energy at 6th ionisation energy suggests that the electron removed was from a higher energy level - the element has 5 electrons in the outer shell, and so it is Phosphorus	 What element do you think this is? Phosphorus $1s^2 2s^2 2p^6 3s^2 3p^3$
Find the third ionisation energy	1	$10^{3 \times 45}$ 2820 kJ mol ⁻¹	3 significant figures
Write the equation for the second ionisation energy of Beryllium ?	1	$\text{Be(g)} \rightarrow \text{Be}^+(\text{g}) + \text{e}^-$	
Why does Beryllium have the greatest first ionisation energy in grp 2?	2	Least electron shells so least shielding and smallest atomic radius so greatest electrostatic attraction between nucleus and outermost electron so most energy required to overcome	I said electrons removed from n=2 shell, atomic radius decreases (1), stronger attractive forces/electrostatic forces between outer electrons and protons in the atomic nuclei (1)
Which element in period 3 has the SMALLEST second ionisation energy?	1	Magnesium	
What standard conditions does the $\ominus$ mean	1	298k and 100kPa	or 1atm for the pressure
Delta g one	5	575	Assume $\Delta G = 0$ $\Delta G = \Delta H^\ominus - T\Delta S$ $T = \Delta H^\ominus / \Delta S$ Your final answer should be in kelvin right? I got somewhere like 776K
bond Enthalpy of N-O	3	463 Bond enthalpy $\Delta H^\ominus = \sum(\Delta \text{reactants}) - \sum(\Delta \text{products})$	 REACTANTS: 8128 PRODUCTS: 8 × (N-O) + 5556 and then equation would be $-1132 = 8128 - 8(\text{N-O}) + 5556$ and solve for (N-O) ?yes Enthalpy = bonds broken - bonds formed Enthalpy = -1132 Bonds broken = 8128 Bonds formed = 5556 + 8x (x being N-O)

			$-1132 = 8128 - (5556 + 8x)$ $-3704 = -8x$ $463 = x$ ✓
Why when the temperature of the reaction between Oxygen and Ammonia is increased does the mole fraction of NO ₂ decrease?	3	Exothermic forward reaction (1) Equilibrium shifts to left (1) and favours endo reaction making more reactants (1)	Use Le Chatelier's principle
Oxidation state of B and F in BF ₃	1	B +3 F -1	
BrF ₃ structure	2		Bp bp > lp lp To be as far apart as possible
Mean titre	1	28.55cm ³	Use concordant results, +/- 0.10cm ³
Mr and identity of M	7	M is K, Total Mr= 353	M₂[Cu(C₂O₄)₂(H₂O)₂] 2M - 275.5  Dissolved in HCl, made up to 250cm³ 2.51g in 25cm³? 25cm³ titrated against KMnO₄ M₂[Cu(C₂O₄)₂(H₂O)₂] $\text{MnO}_4^- : \text{C}_2\text{O}_4^{2-}$ $2 : 5$ $\text{mol MnO}_4^- : 0.02 \times 10^{-3} \times 28.55 = 5.71 \times 10^{-4}$ $\text{mol C}_2\text{O}_4^{2-} \text{ in } 25.0 \text{ cm}^3 : 5.71 \times 10^{-4} \times \frac{5}{2} = 1.4275 \times 10^{-3}$ $\text{in } 250 \text{ cm}^3 : 1.4275 \times 10^{-2}$ $\therefore \text{mol M}_2[\text{Cu}(\text{C}_2\text{O}_4)_2(\text{H}_2\text{O})_2] = \frac{1}{2} \times 1.4275 \times 10^{-2} = 7.1375 \times 10^{-3}$ $M_r = \frac{\text{mass}}{\text{mol}} = \frac{2.51}{7.1375 \times 10^{-3}} = 351.6637478$ $M_r [\text{Cu}(\text{C}_2\text{O}_4)_2(\text{H}_2\text{O})_2] = 275.5$ $M_r M_2 = 351.66 - 275.5 = 76.16$ $M = 38$ I think I used incorrect mass before but I just found metal w closest Mr.
How does water act as a ligand	1 or 2	Donates lone pair of electrons on water	

		forming dative covalent bond to central metal ion	
[Cu(H₂O)₆]²⁺ and [CuCl₄]⁻ 1. Explain the shape of each complex ion 2. Explain why colour arises 3. Explain why [Cu(H₂O)₆]²⁺ is blue and [CuCl₄]⁻ is yellow	6	[Cu(H₂O)₆]²⁺ : Octahedral 90 degrees 6 monodentate ligands surrounding it [CuCl₄]⁻ : Tetrahedral (might actually be wrong) Only 4 monodentate ligands Tetrahedral is correct Explain the shapes: [CuCl₄]²⁻ is tetrahedral because Cl⁻ ions are bigger than H₂O, therefore co-ordination number is 4.	Absorbs some wavelengths of visible light This excites e- in d. The remaining wavelengths of visible light are transmitted. Colour is different because: [Cu(H₂O)₆]²⁺ : absorbs other frequencies of visible light, but transmits blue. [CuCl₄]⁻ : Absorbs other frequencies of visible light but transmits yellow. Factors influencing colours in metal ion complexes: - Co-ordination number ← - Ligands ← - Variable oxidation states (does not apply to this question)
Drawing the complex ion stereoisomers	2	 CIS TRANS	
equation between MnO₄⁻ and C₂O₄²⁻	1	$16 \text{ H}^+ + 5 \text{ C}_2\text{O}_4^{2-} + 2 \text{ MnO}_4^- \rightarrow 2 \text{ Mn}^{2+} + 10 \text{ CO}_2 + 8 \text{ H}_2\text{O}$	
Vanadium (III) Sulfate reaction with water	3	$2[\text{V}(\text{H}_2\text{O})_6]^{3+} + 3 \text{ SO}_4^{2-} \rightarrow \text{V}_2(\text{SO}_4)_3 + 6 \text{ H}_2\text{O}$ V³⁺ is small and high charge density so polarised and weakens OH bonds	
equation for contact process of V₂O₅ and SO₂	2	$\text{V}_2\text{O}_5 + \text{SO}_3 \rightarrow \text{V}_2\text{O}_4 + \text{SO}_2$ $\text{V}_2\text{O}_4 + \text{O}_2 \rightarrow \frac{1}{2} \text{ V}_2\text{O}_5$	Multiples allowed but try to avoid them
Equations for alkaline hydrogen oxygen cell	2	$2 \text{ H}_2 + 4 \text{ OH}^- \rightarrow 4 \text{ H}_2\text{O} + 4 \text{ e}^-$ negative $\text{O}_2 + 2 \text{ H}_2\text{O} + 4 \text{ e}^- \rightarrow 4 \text{ OH}^-$ positive	
Explain why melting point of Vanadium sulfate is high	2	Need some guidance for the answer on this It is a giant ionic lattice (1) and so has a strong electrostatic force of attraction between V(III) and SO₄²⁻ ions (1) I think	Structure + bonding

Why is current produced?	2	Talk about the electrons produced and how it forms a current through the KNO ₃ filter paper	To power the motor
How many unpaired electrons in Cu ²⁺ ion	1	1 unpaired electron	[Ar] 3d ⁹
I dont remember 1 but Cu ²⁺ ions w iodide ions		$2\text{Cu}^{2+}(\text{aq}) + 4\text{I}^{-}(\text{aq}) \rightarrow 2\text{CuI}(\text{s}) + \text{I}_2(\text{aq})$.	
Graph of conc to the log 10 against time i think	1 mark	3rd one	Is this one the straight line graph, directly proportional? I cannot find the image to fit it in.
Ecell equation	1	$2\text{VO}_2^{+}(\text{aq}) + \text{Sn}(\text{s}) + 4\text{H}^{+}(\text{aq}) \rightarrow 2\text{V}^{3+}(\text{aq}) + 2\text{H}_2\text{O}(\text{l}) + \text{Sn}^{2+}(\text{aq})$	
Why does the acid hydrogen-oxygen cell have the same emf as the alkaline cell?	1 mark	Same overall reaction	They have the same electrode potential or something?
Why does the KOH electrolyte thing not be replaced? Smth like that		Talk about regen and replenishing of the constituency of the ions	Can be recharged? Or reaction is reversible.
Q8. Acids Bases Question When NaBr is titrated with conc. H ₂ SO ₄ Write equations and state observations	4	Acid-Base $\text{H}^{+} + \text{Br}^{-} \rightarrow \text{HBr}$ (1) Observation Misty white fumes or choking gas (as per PMT MS format) (from HBr) (1) Redox $2\text{Br}^{-} + \text{H}_2\text{SO}_4 + \text{H}^{+} \rightarrow \text{Br}_2 + \text{SO}_2 + 2\text{H}_2\text{O}$ (1) Observation Orange fumes (from Br ₂) Or Choking fumes (from SO ₂) (1)	Half-equations in acid-base I wrote this: $\text{H}^{+} + \text{Br}^{-} \rightarrow \text{HBr}$ (I don't know what they are asking for) Half equations in redox $\text{H}_2\text{SO}_4 + 2\text{H}^{+} + 2\text{e}^{-} \rightarrow \text{SO}_2 + 2\text{H}_2\text{O}$ $2\text{Br}^{-} \rightarrow \text{Br}_2 + 2\text{e}^{-}$
Graph - weak/strong acid with weak/strong base tickbox	1	Strong base added to weak acid	Initially the curve had a slight increase (buffer action -> weak acid) then pH ended really high (strong base) after end point
pH of 0.150 moldm ⁻³ nitric acid	2	0.82	<u>2 d.p</u>
Which indicators were suitable?	1	Middle 3, bottom one was second from bottom, not top 2	

Buffer solution B is made up of 0.656g Sodium Ethanoate (Mr=82) and 50cm³ of 0.120mol dm⁻³ ethanoic acid. Calculate pH change when 1.5cm³ of 0.200mol dm⁻³ HCl is added. K_a = 1.78x10⁻⁵	7 DONT STRESS LOTS OF METHOD MARKS CARRIED ON Correct method, wrong final answer gains you 5-6/7 marks 6 if you use the wrong sig fig, 5 if you get [H⁺] wrong	0.03 - 0.04 seen in a range of answers Use this equation to form acid dissociation constant: CH₃COOH ⇌ CH₃COO⁻ + H⁺	$\text{mol A}^- : \frac{0.656}{82} = 8 \times 10^{-3}$ $\text{mol HA} : 0.12 \times 50 \times 10^{-3} = 6 \times 10^{-3}$ $\text{mol H}^+ \text{ added} : 1.5 \times 10^{-3} \times 0.2 = 3 \times 10^{-4}$ $\text{H}^+ + \text{A}^- \rightarrow \text{HA}$ $\text{mol HA after} : 6 \times 10^{-3} + 3 \times 10^{-4} = 6.3 \times 10^{-3}$ $\text{mol A}^- \text{ after} : 8 \times 10^{-3} - 3 \times 10^{-4} = 7.7 \times 10^{-3}$ $K_a = \frac{[\text{H}^+][\text{A}^-]}{[\text{HA}]}$ $[\text{H}^+] = K_a \times \frac{\text{mol HA}}{\text{mol A}^-} = 1.78 \times 10^{-5} \times \frac{6.3 \times 10^{-3}}{7.7 \times 10^{-3}}$ $= 1.456 \times 10^{-5}$ $\text{pH} = -\log [\text{H}^+] = -\log (1.456 \times 10^{-5})$ $= 4.84 \text{ (2dp)}$ $\text{pH change} = 4.84 - 4.87 = -0.03$ $\text{calculated original pH is } 4.874518734$ $4.874518734 - 4.836730173 = -0.03778856$ $= -0.04 \text{ (2dp)}$ 1. Work out moles of acid added 2. Work out initial moles of HA and A⁻ 3. Initial moles HA + H⁺ added 4. Initial moles of A⁻ - H⁺ added 5. Rearrange acid dissociation constant to find [H⁺] 6. Use [H⁺] to find pH 7. Original pH - new pH you calculated Concentrations don't NEED to be worked out because the volumes cancel out. It would still work if they were calculated, for anybody wondering.
percentage abundance	2	98.5%	$\text{mass no. 49 and 51}$ $\text{relative atomic mass: } 50.97$ $\% \text{ abundance of } 51$ $50.97 = 51x + 49(1-x)$ $50.97 = 51x + 49 - 49x$ $1.97 = 2x$ $x = 0.985$ 98.5%
Electrospray ionisation formula and m/z	2	Q(g) + H ⁺ → QH ⁺ (g) 602	You lose marks if you don't have state symbols on these MS equations.
Conc ethanoic acid pH=2.89 K _a =1.35x10 ⁻⁵	3	0.123	$\text{pH} = 2.89 \quad K_a = 1.35 \times 10^{-5}$ find conc of acid $[\text{H}^+] = 10^{-2.89}$ $K_a = \frac{[\text{H}^+][\text{A}^-]}{[\text{HA}]}$ $K_a = \frac{[\text{H}^+]^2}{[\text{HA}]}$ $[\text{HA}] = \frac{[\text{H}^+]^2}{K_a} = \frac{(10^{-2.89})^2}{1.35 \times 10^{-5}}$ $= 0.1229323635$ $= 0.123$

BP Question [explain why] does Br₂ have a higher boiling point than Cl₂?	2	Br bigger so stronger VDWs So BP greater than Cl Option 1: Br ₂ has larger Mr value, so more electrons VdW forces are stronger so more energy required to overcome forces Option 2: Cl ₂ has a smaller Mr value se less electrons VdW forces are weaker than in Br ₂ so less energy required to overcome	VdW strength + structure
Excess water, concentrated NH₃ solution to [CuCl₄]²⁻ What was the colour of the product formed? Write the equation for the reaction.	2	CuCO ₃ - blue-green $[\text{CuCl}_4]^{2-} + 6\text{NH}_3 \rightarrow [\text{Cu}(\text{NH}_3)_6]^{2+} + 4\text{Cl}^-$ Swear this is wrong it goes to form Cu(NH ₃) ₄ (H ₂ O) ₂	
Why does solution b or whatever resist pH change? What even was this question again Why does the mole fraction of [one of the products] decrease when you add more NaOH to the mixture??	2	Acid from ch ₃ cooh reacts with salt ch ₃ cooh-na ⁺ partially neutralising it - edit if im wron Equilibrium HA - A ⁻ + H ⁺ , added OH ⁻ reacts with H ⁺ to remove it, eq shifts to oppose change in H conc thus restoring it	I think it reacts then some more ethanoic acid is produced to re-establish equilibrium. G It asked to explain it qualitatively so talk about what you can see and how the reaction does occur I said equilibrium shifts left to oppose increase in pH, removing excess A ⁻ , by creating more of the original solution to react with H ⁺ or OH ⁺ I must've made an error
MCQ Pt/Rb catalyst used, where all the reactants and products are gaseous	1	heterogeneous	The catalyst is solid whereas all reactants and products are gaseous, so they are in different phases. This means that they are heterogeneous catalysts.