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<u>Question Number</u>	<u>Suggested Answer</u>	<u>Mark Allocation</u>
1.1	C	2
1.2	B	2
1.3	D	2
1.4	B	2
1.5	D	2
1.6	A	2
1.7	B	2
1.8	D	2
1.9	C	2
1.10	A	2
2.1.1	Zn	1
2.1.2	Graphite	1
2.1.3	F ₂ or graphite	1
2.1.4	C ₆ H ₁₈	1
2.1.5	Ar	1
2.1.6	NaF or MgSO ₄	1
2.1.7	NH ₃	1
2.1.8	MgSO ₄	1
2.2.1	Homogenous mixture of solute and solvent (Definition 0/2)	2
2.2.2	Hydrogen bond IMF	2
2.2.3	Water has 2 lone pairs and hence 2 hydrogen bond IMF ✓ per oxygen molecule while NH ₃ only has 1 lone pair and hence 1 hydrogen bond per nitrogen molecule	2
2.3.1	Intramolecular ✓	1
2.3.2	Stronger ✓ Bond length is shorter within layer ✓ than between layers ✓ (1,42 Angstrom vs 3,40 Angstrom)	3
		[18]

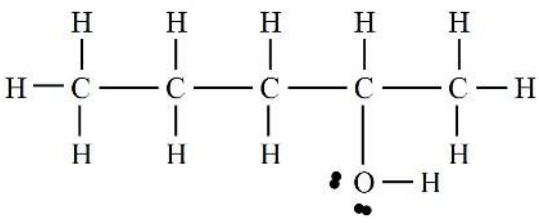
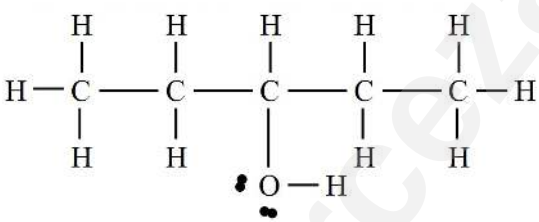
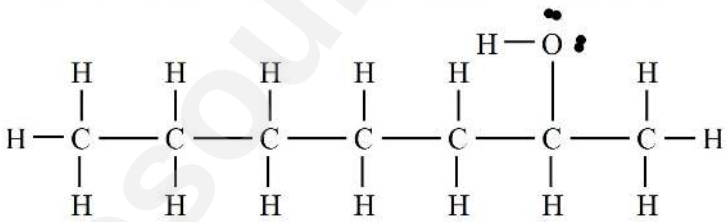
3.1.1	The change in concentration per unit time ✓ for either products or reactants. ✓	2
3.1.2	The minimum energy needed to form the activated complex ✓✓ OR the minimum energy to start a chemical reaction. ✓✓	2
3.2.1	Provides an alternative pathway (orients the molecule) ✓ Higher proportion of successful collisions (Lower energy activated complex) ✓	2
3.2.2	greater proportion of collisions ✓ have sufficient energy to react ✓ more successful collisions per second ✓ [Lower E_A means more molecules/greater % have sufficient energy to form the activated complex, thus greater percentage of the collisions are successful, thus faster rate.]	3
3.3	Sketch higher peak ✓ peak left ✓ width narrower ✓	3
3.4	E_a (at peak) ✓ arrow for E_a (up) ✓ label E_a ✓	5

	QUESTION 4																													
4.1.1	A closed system is one in which mass is conserved inside the system ✓ but energy can enter or leave the system freely. ✓	2																												
4.1.2	YES ✓	1																												
4.1.3	Increase ✓ more particles per unit volume ✓ more collisions per unit time ✓ faster reaction ✓	4																												
4.1.4	Darker ✓ Forward favoured ✓	2																												
4.1.5	$K_c = \frac{[NO]^2}{[NO]^2[O_2]}$ numerator ✓ denominator ✓	2																												
4.1.6	<table border="1"><thead><tr><th></th><th>2NO</th><th>O₂</th><th>2NO₂</th></tr></thead><tbody><tr><td>R</td><td>2</td><td>1</td><td>2</td></tr><tr><td>I</td><td>0,7</td><td>0,9</td><td>0</td></tr><tr><td>C</td><td>0,4 ✓</td><td>0,2</td><td>0,4</td></tr><tr><td>E</td><td>0,3 ✓</td><td>0,7 ✓</td><td>0,4 ✓</td></tr><tr><td>C</td><td>0,6</td><td>1,4</td><td>0,8 ✓</td></tr><tr><td></td><td></td><td></td><td></td></tr></tbody></table> K _c = 1,27 ✓		2NO	O ₂	2NO ₂	R	2	1	2	I	0,7	0,9	0	C	0,4 ✓	0,2	0,4	E	0,3 ✓	0,7 ✓	0,4 ✓	C	0,6	1,4	0,8 ✓					6
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E	0,3 ✓	0,7 ✓	0,4 ✓																											
C	0,6	1,4	0,8 ✓																											
4.2.1	No effect ✓	1																												
4.2.2	Increase ✓✓	2																												
4.2.3	Increase ✓✓	2																												
4.2.4	Increase ✓✓	2																												
4.2.5	Decrease ✓	1																												

	QUESTION 5	
5.1.1	Base – Proton acceptor ✓✓	2
5.1.2	Strong base – dissociates (almost) completely in aqueous solution ✓✓	2
5.2.1	$X(OH)_2(s) \checkmark \rightarrow X^{2+}(aq) \checkmark + 2 OH^{-1} \checkmark(aq)$	3
5.2.2	$0,4 \text{ mol/dm}^3 \checkmark$	1
5.2.3	$n(OH)_2 = cv \checkmark$ $= 0,2 \times 0,5 \checkmark$ $= 0,1 \text{ mol} \checkmark$ $n = m/M = 0,2 / 0,1 \checkmark = 62 \text{ g.mol}^{-1} \checkmark$	5
5.3.1	the point where an acid and base have reacted where neither is in excess ✓✓	2
5.3.2	ethanoic acid ✓	1
5.3.3	$n_b = cV = (0,2)(0,025) \checkmark = 0,005 \checkmark \checkmark$ $n_a = 0,01 \checkmark$ (ratio) $c_a = 0,01/0,032 \checkmark = 0,309 \text{ mol.dm}^{-3} \checkmark$	6
5.4.1	acid ✓	1
5.4.2	Weak ✓ (in equilibrium, used as indicator) ✓	2
5.4.3	Molecule/ion that has one extra H^+	2
5.4.4	$HIn/In^{-1} \checkmark$ $H_2O / H_3O^+ \checkmark$	2
5.4.5	When a stress is placed on a system in dynamic chemical equilibrium, the equilibrium point will shift to counteract the stress.	2
5.4.6	Blue	1
5.4.7	The base removes the $H_3O^+ \checkmark$ so forward reaction favoured ✓ to replace it increasing $[In^-] \checkmark$ which is blue ✓	4

	QUESTION 6	
6.1.1	No ✓ Reacts with the solution ✓	2
6.1.2	$E^0 = E^0_{\text{cat}} - E^0_{\text{anode}} \checkmark$ $= 0,15 - (-1,66) \checkmark$ $= 1,81 \text{ V} \checkmark$	3
6.2.1	Electrode at which oxidation occurs (0 or 2) ✓✓	2
6.2.2	$\text{Al} \rightarrow \text{Al}^{3+} + 3\text{e}^- \checkmark\checkmark$	2
6.2.3	$\text{Sn}^{4+} + 2\text{e}^- \rightarrow \text{Sn}^{2+} \checkmark\checkmark$	2
6.2.4	$2\text{Al} + 3\text{Sn}^{4+} \rightarrow 2\text{Al}^{3+} + 3\text{Sn}^{2+}$ LHS ✓ RHS ✓	2
6.2.5	$\text{Al}/\text{Al}^{3+} \checkmark // \text{Sn}^{4+}, \text{Sn}^{2+}_{(\text{ions})}/\text{Pt} \checkmark$ std conditions 1 mol/dm ³ conc ✓ 25 ^o C ✓	5
6.3.1	Yes ✓ – forward reaction is favoured ✓	2
6.3.2	No change ✓ ions change oxidation state – remain in solution ✓	2
6.3.3	Yes ✓ – forward reaction is exothermic (releases potential energy) ✓ so reverse favoured (a reaction is favoured) ✓	3
6.4.1	To keep the half cells electrically neutral by allowing the flow of charge ✓ To complete the circuit ✓	2
6.4.2	KNO_3 (any soluble salt that doesn't react directly) ✓	1
6.4.3	The [positive charge] would decrease in cathode as reduction occurs. ✓ So +ve ions flow into half cell/-ve ions flow out of half cell to maintain electrically neutral. ✓ In the same way, anions flow into anode/cations flow out of cathode as $[\text{Al}^{3+}]$ increases. ✓	3

	QUESTION 7	
7.1	P ✓ .	1
7.2	A substance that can conduct electricity by forming free ions when molten or dissolved in solution ✓✓	2
7.3.1	No ✓ The Ag is a poor reducing agent and the Cu will be preferentially oxidized ✓	2
7.3.2	No ✓ The Zn^{2+} is a poor oxidising agent and the Cu^{2+} will be preferentially reduced ✓	3
7.3.3	$Q = It \checkmark =$ $500.600 \times 60 \checkmark$ $= 18\,000\,000\text{C} \checkmark$ $n_e = \frac{Q}{F} = \frac{18\,000\,000}{96500} \checkmark$ $= 186,5 \text{ mol}$ $n_{\text{cu}} = 93,25 \text{ mol (method dividing } n_e \text{ by 2)} \checkmark$ $m_{\text{Cu}} = nM = 63,5(93,25) = 5921 \text{ g or } 5,9 \text{ kg} \checkmark$	6

	QUESTION 8	
8.1.1	D ✓	1
8.1.2	B ✓	1
8.1.3	A,D,E (any 2) ✓✓	2
8.1.4	C ✓ F ✓	2
8.2.1	methylbutane ✓✓	2
8.2.2	ethyl ✓ butan ✓ oate ✓	3
8.2.3	pent ✓ -2 ✓ -ene ✓	3
8.3.1	 OR 	2
8.3.2	Addition ✓	1
8.4.1		3
8.4.2	Substitution ✓✓	2
9.1	C_6H_{14} ✓✓	2
9.2	C_nH_{2n} ✓✓	2
9.3.1	Isomer same general formula ✓ different structural formula ✓	2
9.3.2	No ✓ Have different molecular formula ✓ (and structural formula)	2
9.4	$2 C_6H_{14} + 19 O_2 \rightarrow 12 CO_2 + 14 H_2O$ LHS ✓ 12 ✓ CO_2 and 14 ✓ H_2O H_2O and CO_2 ✓	4
9.5	butene ✓ either 1 or 2 ✓	2
9.6.1	Add bromine ✓ No light ✓ Alkene goes from brown to colourless ✓	3
9.6.2	Addition fast Substitution slow ✓✓	2

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