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CHEMISTRY

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Paper 2 Theory

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MARK SCHEME

Maximum Mark: 75

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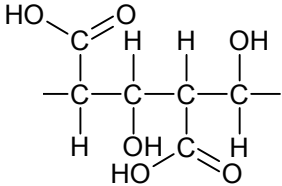
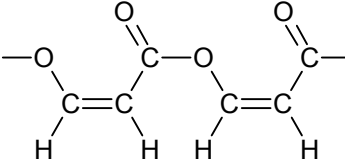
Question	Answer	Marks									
A1(a)(i)	krypton / Kr (1)	1									
A1(a)(ii)	nitrogen / N ₂ (1)	1									
A1(a)(iii)	calcium / Ca (1)	1									
A1(a)(iv)	copper / Cu (1)	1									
A1(a)(v)	chlorine / Cl ₂ (1)	1									
A1(b)	<table border="1"> <thead> <tr> <th></th> <th>number of electrons</th> <th>number of neutrons</th> </tr> </thead> <tbody> <tr> <td>³³S</td> <td>16 (1)</td> <td>17 (1)</td> </tr> <tr> <td>²⁵Mg²⁺</td> <td>10 (1)</td> <td>13 (1)</td> </tr> </tbody> </table>		number of electrons	number of neutrons	³³ S	16 (1)	17 (1)	²⁵ Mg ²⁺	10 (1)	13 (1)	4
	number of electrons	number of neutrons									
³³ S	16 (1)	17 (1)									
²⁵ Mg ²⁺	10 (1)	13 (1)									

Question	Answer	Marks
A2(a)	arrangement: ordered / lattice / regular / layers / uniformly arranged / repeated pattern (1) type of force: electrostatic (1)	2
A2(b)	solid: ions cannot move (1) aqueous: ions can move (1)	2
A2(c)(i)	(ionisation of) water (1)	1
A2(c)(ii)	$4\text{OH}^- \rightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^-$ (1)	1
A2(c)(iii)	hydroxide (ions) lower in reactivity (than sulfate (ions)) / sulfate (ions) less easily oxidised (than hydroxide (ions)) (1)	1
A2(d)(i)	H ⁺ , OH ⁻ , SO ₄ ²⁻ , Cu ²⁺ (1)	1

Question	Answer	Marks
A2(d)(ii)	hydroxide removed (1) idea of H ⁺ remaining (causing acidity) (1)	2
A2(d)(iii)	Cu ²⁺ ions removed (at negative electrode) (1)	1
A2(e)	two pairs of bonding electrons (1) rest of structure correct (1)	2

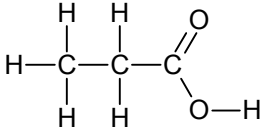
Question	Answer	Marks
A3(a)(i)	Any two of: reference to layers (1) (layers) slide (1)	2
A3(a)(ii)	mobile electrons / electrons can move (1)	1
A3(b)	silver < iron < titanium < calcium (1)	1
A3(c)(i)	mol Fe ₂ O ₃ = $\frac{14.4}{160}$ OR 0.090 (1) mol Fe = 2 × 0.090 OR 0.180 (1) mass = (0.180 × 56) = 10.1 (1)	3
A3(c)(ii)	mol CO ₂ = $\frac{3}{2}$ × 0.18 OR 0.27 (1) volume = 0.27 × 24 = 6.48 (dm ³) (1)	2

Question	Answer	Marks
A4(a)	alcohol (1)	1
A4(b)	propanol (1) reflux / heat (with sulfuric / strong acid / conc acid) (1)	2
A4(c)	bromine decolourised by fumaric acid / colour of bromine goes (brown to) colourless with fumaric acid (1) no colour change with malic acid / bromine remains brown with malic acid / bromine remains the same colour with malic acid (1)	2
A4(d)(i)	addition (1) condensation (1)	2

Question	Answer	Marks
A4(d)(ii)	<p>for addition polymer:</p>  <p>two (or more) repeat units with single bonds between carbon atoms (1)</p> <p>continuation bonds dependent on correct structure (1)</p> <p>OR</p> <p>for condensation polymer:</p>  <p>two (or more) repeat units with ester link and continuation bonds (2)</p> <p>if 2 marks not awarded, 1 mark for ester link drawn correctly</p>	2

Question	Answer	Marks
A5(a)	$2\text{C}_4\text{H}_{10} + 13\text{O}_2 \rightarrow 8\text{CO}_2 + 10\text{H}_2\text{O}$ correct reactants and products (1) balancing dependent on correct formulae (1)	2
A5(b)	bond breaking is endothermic and bond making is exothermic (1) more energy released (in bond making) than absorbed (in bond breaking) (1)	2
A5(c)	jet fuel, heating oil (1)	1

Question	Answer	Marks
B6(a)	acid which doesn't dissociate completely to give H^+ / doesn't ionise completely to give H^+ (1)	1
B6(b)(i)	equilibrium shifts to the right (1) to reduce the amount of ethanol added (1)	2
B6(b)(ii)	equilibrium moves to the left (1) the (forward) reaction is exothermic / backward reaction is endothermic / moves in the direction of the endothermic reaction (1)	2
B6(c)(i)	increases (with increasing number of carbon atoms) (1)	1
B6(c)(ii)	any value between 0.97 and 1.04 (1)	1
B6(c)(iii)	solid because 15°C is below its melting point / solid because the melting point is above 15°C (1)	1
B6(c)(iv)	there is no clear trend / the values go up and down (and up) (1)	1

Question	Answer	Marks
B6(c)(v)	correct structure of propanoic acid showing all atoms and all bonds (1) 	1

Question	Answer	Marks
B7(a)(i)	giant (molecular) structure / many covalent bonds (1) takes a lot of energy to break the bonds / needs a high temperature to break the bonds (1)	2
B7(a)(ii)	Diamond has a giant covalent structure whereas tin has a metallic structure (1) because diamond or carbon has a much higher melting point OR diamond does not conduct electricity but tin does (1)	2
B7(a)(iii)	(oxide which) reacts with acids or bases (1)	1
B7(b)(i)	mass of germanium = 21.9 (g) (1) $\text{mol Ge} = \frac{21.9}{73}$ and $\text{mol Cl} = \frac{42.6}{35.5}$ OR mol ratio Ge : Cl is 0.3 to 1.2 (1) GeCl ₄ (1)	3
B7(b)(ii)	(simple) molecular (1) covalent bonding (1)	2
B8(a)	$\frac{3 \times 14}{149} \times 100 = 28.2\%$ (2 marks) If 2 marks not scored correct $M_r = 149$ (1)	2

Question	Answer	Marks
B8(b)	to increase plant growth / to help make more protein / to add nitrogen to soil depleted by previous year's growth (1)	1
B8(c)	(damp) red litmus paper (1) turns blue (1)	2
B8(d)	ammonia is formed (1) idea of ammonia escaping from the soil as a gas (1)	2
B8(e)	mol H ₂ SO ₄ = $0.150 \times \frac{10.5}{1000}$ OR 1.575×10^{-3} (1) mol NH ₃ (aq) = $2 \times 1.575 \times 10^{-3}$ OR 3.15×10^{-3} (1) concentration of NH ₃ (aq) = 0.158 (mol dm ⁻³) (1)	3

Question	Answer	Marks
B9(a)	they have the same molecular formula but the atoms are arranged differently (1)	1
B9(b)	rate decreases (1) the gradient of the graph decreases / slope of the graph decreases (1)	2
B9(c)	increases rate (no marks) particles closer together / more particles in a given volume / more crowded particles (1) greater collision frequency / more collisions per second / rate of collisions increases (1)	2

Question	Answer	Marks
B9(d)	decreases rate (no marks) particles move more slowly / particles have less kinetic energy (1) number of particles with energy equal to or greater than the activation energy is decreased / fewer successful collisions / fewer effective collisions (1)	2
B9(e)	left hand box: propanol (1) C_3H_7OH (1) right hand conditions: catalyst / Ni AND heat / high temperature / high pressure (1)	3