Cambridge O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

CHEMISTRY **5070/21**

Paper 2 Theory **October/November 2017**

MARK SCHEME

Maximum Mark: 75

Published

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>A1(a)(i)</td><td>krypton / Kr (1)</td><td>1</td></tr>
<tr><td>A1(a)(ii)</td><td>nitrogen / N_2(1)</td><td>1</td></tr>
<tr><td>A1(a)(iii)</td><td>calcium / Ca (1)</td><td>1</td></tr>
<tr><td>A1(a)(iv)</td><td>copper / Cu (1)</td><td>1</td></tr>
<tr><td>A1(a)(v)</td><td>chlorine / Cl_2 (1)</td><td>1</td></tr>
<tr><td>A1(b)</td><td><table><tr><td></td><td>number of electrons</td><td>number of neutrons</td></tr><tr><td>^{33}S</td><td>16 (1)</td><td>17 (1)</td></tr><tr><td>$^{25}Mg^{2+}$</td><td>10 (1)</td><td>13 (1)</td></tr></table></td><td>4</td></tr>
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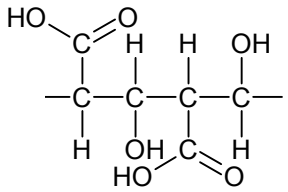
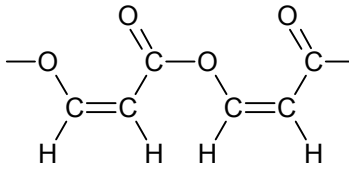
<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>A2(a)</td><td>arrangement: ordered / lattice / regular / layers / uniformly arranged / repeated pattern (1)
type of force: electrostatic (1)</td><td>2</td></tr>
<tr><td>A2(b)</td><td>solid: ions cannot move (1)
aqueous: ions can move (1)</td><td>2</td></tr>
<tr><td>A2(c)(i)</td><td>(ionisation of) water (1)</td><td>1</td></tr>
<tr><td>A2(c)(ii)</td><td>4OH^- → O_2 + 2H_2O + 4e$^-$ (1)</td><td>1</td></tr>
<tr><td>A2(c)(iii)</td><td>hydroxide (ions) lower in reactivity (than sulfate (ions)) / sulfate (ions) less easily oxidised (than hydroxide (ions)) (1)</td><td>1</td></tr>
<tr><td>A2(d)(i)</td><td>H^+, OH^-, SO_4^{2-}, Cu^{2+} (1)</td><td>1</td></tr>
</table>

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**

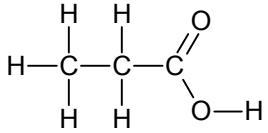
Question	Answer	Marks
A3(a)(i)	**Any two of:** reference to layers (1) (layers) slide (1)	**2**
A3(a)(ii)	mobile electrons / electrons can move (1)	**1**
A3(b)	silver < iron < titanium < calcium (1)	**1**
A3(c)(i)	mol $Fe_2O_3 = \frac{14.4}{160}$ **OR** 0.090 (1) mol Fe = 2 × 0.090 **OR** 0.180 (1) mass = (0.180 × 56) = 10.1 (1)	**3**
A3(c)(ii)	mol $CO_2 = \frac{3}{2} \times 0.18$ **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)	for addition polymer:  two (or more) repeat units with single bonds between carbon atoms (1) continuation bonds dependent on correct structure (1) **OR** for condensation polymer:  two (or more) repeat units with ester link and continuation bonds (2) if 2 marks not awarded, 1 mark for ester link drawn correctly	**2**

Question	Answer	Marks
A5(a)	$2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$ 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) mol Ge = $\frac{21.9}{73}$ and 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 $H_2SO_4 = 0.150 \times \frac{10.5}{1000}$ **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**