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

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2017 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

Cambridge Assessment International Education

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)	see table below	**4**

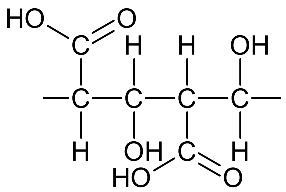
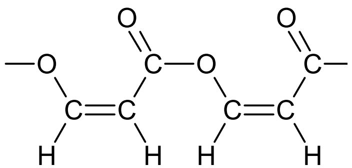
	number of electrons	number of neutrons
^{33}S	16 (1)	17 (1)
$^{25}Mg^{2+}$	10 (1)	13 (1)

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)	$\mathbf{4}OH^- \rightarrow O_2 + \mathbf{2}H_2O + \mathbf{4e^-}$ (1)	**1**
A2(c)(iii)	hydroxide (ions) low**er** 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**

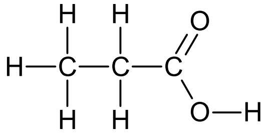
Question	Answer	Marks
A3(a)(i)	**Any two of:** reference to layers (1) (layers) slide (1)	**2**
A3(a)(ii)	mobile electrons / electrons can move (1)	**1**
A3(b)	silver < iron < titanium < calcium (1)	**1**
A3(c)(i)	mol $Fe_2O_3 = \frac{14.4}{160}$ **OR** 0.090 (1) mol Fe = 2 $\times$ 0.090 **OR** 0.180 (1) mass = (0.180 $\times$ 56) = 10.1 (1)	**3**
A3(c)(ii)	mol $CO_2 = \frac{3}{2} \times 0.18$ **OR** 0.27 (1) volume = 0.27 $\times$ 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**