Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CHEMISTRY **5070/21**

Paper 2 Theory **October/November 2016**

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.

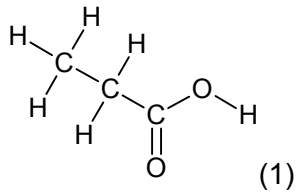
Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2016 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

Question	Answer	Mark
A1(a)	NO / nitrogen oxide / nitric oxide (1)	1
A1(b)	CH_4 / methane (1)	1
A1(c)	$Ba(NO_3)_2$ / barium nitrate (1)	1
A1(d)	V_2O_5 / vanadium pentoxide / vanadium(V) oxide (1)	1
A1(e)	CaO / calcium oxide (1)	1
	Total:	**5**

Question	Answer	Mark
A2(a)(i)	acid that is completely ionised / acid that is completely dissociated / acid that releases all ionisable hydrogen (1)	1
A2(a)(ii)	add Universal Indicator AND compare colour with pH (colour) chart (1)	1
A2(b)	add calcium oxide / add lime / add calcium hydroxide / add calcium carbonate (1) base (reacts with the acid) / neutralising (the acid) (1)	2
A2(c)	rate increases as pH increases (then remains constant) (1)	1
	Total:	**5**

Question	Answer	Mark
A3(a)	$C_8H_{18}O$ (1)	**1**
A3(b)(i)	increases with increased number of carbon atoms (1)	**1**
A3(b)(ii)	values between 0.806 and 0.813 (inclusive) (1)	**1**
A3(b)(iii)	liquid because melting point is below room temperature and boiling point is above room temperature (1)	**1**
A3(c)	(viscosity) increases as number of C atoms increases / increases down the alcohols (1) any correct answer related to length / size / mass of molecule e.g. size of molecule increases / length of carbon chain increases / chains get more tangled / van der Waals' forces increase / intermolecular forces increase (1)	**2**
A3(d)	$C_3H_7OH + 4½O_2 \rightarrow 3CO_2 + 4H_2O$ correct formulae for reactants and products (1) correct balancing, dependent on correct formulae (1)	**2**
A3(e)(i)	(acidified) potassium manganate(VII) / potassium permanganate (1) heat / reflux (1)	**2**
A3(e)(ii)	 (1)	**1**
	Total:	**11**

Question	Answer	Mark
A4(a)	peroxodisulfate: increases rate / doubling concentration doubles the rate (1) iodide: increases rate / doubling concentration doubles the rate (1)	**2**
A4(b)	lower the activation energy (1)	**1**
A4(c)(i)	oxidation number of iron decreases / they gain electrons / iron(III) gets reduced (1)	**1**
A4(c)(ii)	yellow → brown (1)	**1**
A4(c)(iii)	add (aqueous) sodium hydroxide / add (aqueous) ammonia (1) red-brown precipitate (1)	**2**
A4(d)	$2Fe^{2+} + S_2O_8^{2-} \rightarrow 2Fe^{3+} + 2SO_4^{2-}$ (1)	**1**
	Total:	**8**

Question	Answer	Mark
A5(a)	39% (2) If 2 marks not scored, molar mass of $KClO_3 = 122.5$ scores 1 mark	**2**
A5(b)	$KClO_3 = \frac{12.25}{122.5}$ OR 0.10 (mol) (1) moles $O_2 = 1.5 \times 0.01 = 0.15$ moles / idea of multiplying moles by 1.5 (1) volume of $O_2 = 3.6\,dm^3$ / 3600 cm^3, correct unit must be included (1)	**3**

Question	Answer	Mark
A5(c)(i)	potassium (atom(s)) loses electron(s) (1) chlorine (atom(s)) gains electron(s) (1) so there are 8 electrons in outer shells of both ions (1)	**3**
A5(c)(ii)	One mark each for any **two** of : • high melting point / high boiling point • dissolves in water • does not conduct electricity when solid / conducts electricity when molten	**2**
	Total:	**10**

Question	Answer	Mark
A6(a)	nitrogen 78% AND oxygen 21% (1)	**1**
A6(b)(i)	correct 'dot-and-cross' diagram with two pairs of bonding electrons and four non-bonding electrons on each of the two oxygen atoms (1)	**1**
A6(b)(ii)	Ar (1)	**1**
A6(c)	argon is unreactive / argon is inert / argon does not react (1) air would react with sodium / air would react with titanium / air would react with the reaction mixture / argon prevents sodium reacting with air / argon stops titanium reacting with air / to exclude air (1)	**2**
A6(d)	any suitable e.g. lamps / bulbs / lasers (1)	**1**
	Total:	**6**

Question	Answer	Mark
B7(a)	reactants labelled on left and products labelled on right AND product level below reactant level (1) enthalpy change labelled and shown by downward arrow (1) activation energy as upward arrow from left hand energy level to energy 'hump' above the highest energy level of both products and reactant (1)	**3**
B7(b)	bromine water / aqueous bromine / bromine (1) turns colourless (1)	**2**
B7(c)	$Cu + \mathbf{4}HNO_3 \rightarrow Cu(NO_3)_2 + \mathbf{2}H_2O + \mathbf{2}NO_2$ (1)	**1**
B7(d)	$OCOCH_3$ | $CH{-}CH_2$ (1) extension bonds shown (1)	**2**
B7(e)	One mark each for any **two** suitable points e.g. : • fills landfill sites • litter • when burnt greenhouse gases given off / burning produces poisonous gases • get caught in birds / fish gullets (causing choking / death)	**2**
	Total:	**10**

Question	Answer	Mark
B8(a)	One mark each for any **two** of : • catalyst / phosphoric acid • high temperature / heat • high pressure	**2**
B8(b)(i)	% yield decreases as temperature increases (1) reaction is exothermic / reaction releases energy (1) (equilibrium) moves to the left (1)	**3**
B8(b)(ii)	at 200 ºC rate of reaction will be low / slow reaction at 200 ºC / 300 ºC rate of reaction will be high / fast reaction at 300 ºC (1) idea of compromise temperature / idea of balance between lower yield and faster rate (1)	**2**
B8(c)	position of equilibrium shifts to the right / equilibrium moves towards the product side (1) more molecules on left than right / more moles of on left than on right (1)	**2**
B8(d)	$HCO_2H + C_2H_5OH \rightarrow HCO_2C_2H_5 + H_2O$ (1)	**1**
	Total:	**10**

Question	Answer	Mark
B9(a)	One mark each for any **two** suitable properties e.g.: • shiny • conducts heat / conducts electricity • malleable • ductile	**2**
B9(b)	2 electrodes dipping into liquid and connected to a power supply (1) electrolyte labelled as aqueous silver ions, soluble silver compound or named soluble silver compound / silver nitrate solution (1) silver anode / silver positive electrode AND tin cathode / tin negative electrode (1)	**3**
B9(c)	mol Sn = $\frac{5.95}{119}$ mol Cl = $\frac{3.55}{35.5}$ dividing masses by correct atomic masses (1) (mol Sn = 0.05 and mol Cl = 0.1) formula is SnCl_2 (1)	**2**
B9(d)	mol tin(II) oxide = $\frac{13.5}{135}$ OR 0.10 mol (1) mass tin(IV) oxide expected = $0.10 \times 151 = 15.1$ g (1) % yield = $\frac{12.7}{15.1} \times 100$ = 84% (1)	**3**
	Total:	**10**

Question	Answer	Mark
B10(a)	add acid to alkali in flask with indicator and record volume of acid needed (to neutralise alkali) (1) repeat without indicator adding the recorded volume of acid (1) evaporate solution to point of crystallisation / leave to crystallise (1) filter off crystals and dry with filter paper / leave in a drying oven (1)	**4**
B10(b)	mol LiOH = $0.500 \times \frac{20}{1000}$ OR 0.01 mol molar mass of hydrated lithium nitrate = 123 (1) mass = $123 \times 0.01 = 1.23$ g (1)	**3**
B10(c)	brown fumes / colourless liquid condensing at mouth of tube / white solid forming (1)	**1**
B10(d)	ions (are free to) move (1)	**1**
B10(e)	anode: oxygen / O_2 AND cathode lithium / Li (1)	**1**
	Total:	**10**