Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/43**

Paper 4 Extended Theory **October/November 2016**

MARK SCHEME

Maximum Mark: 80

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.

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Question	Answer	Marks
1(a)	proton | +1 | 1 neutron | 0 | 1 electron | –1 | $^{1}/_{1840}$	2
1(b)(i)	(same) number of protons and electrons / 6 protons and six electrons (different) neutron (number) / 6,7 and 8 neutrons	2 1
1(b)(ii)	same <u>number</u> of electrons / electron configuration	1
1(c)	diamond *and* graphite	1
1(d)	two double bonds with no extra electrons on the carbon atoms both oxygen atoms with four non-bonding electrons	1 1

Question	Answer	Marks
2(a)	2,2 / 2.2	**1**
2(b)	BeO	**1**
2(c)(i)	positive ions / cations labelled or named in text electrons labelled or named in text attraction between positive ions and negative electrons	**1** **1** **1**
2(c)(ii)	(conduction due to) moving electrons / mobile electrons	**1**
2(d)(i)	Be^{2+}	**1**
2(d)(ii)	$Be(OH)_2 + 2HCl \rightarrow BeCl_2 + 2H_2O$ formula of $BeCl_2$ all formulae correct and balancing correct	**2**
2(d)(iii)	$2NaOH + Be(OH)_2 \rightarrow Na_2BeO_2 + 2H_2O$ formula of Na_2BeO_2 all formulae correct and balancing correct	**2**

Question	Answer	Marks
3(a)	331	**1**
3(b)(i)	**M1** mol = 6.62 / 331**OR** 0.02 **M2** 0.02 × 223 = 4.46 (g)	**1** **1**
3(b)(ii)	**M1** mol O_2 = 0.02 ÷ 2 **OR** 0.01 **M2** vol = 0.01 × 24 = 0.24 (dm^3)	**1** **1**
3(c)	*test:* glowing splint *result:* relights / rekindles	**1** **1**
3(d)(i)	more than enough to react (with all the acid) **OR** some lead oxide remains after the reaction **OR** (nitric) acid is limiting	**1**
3(d)(ii)	solid stops dissolving	**1**
3(d)(iii)	$PbO + 2HNO_3 \rightarrow Pb(NO_3)_2 + H_2O$ **OR** $PbO + 2H^+ \rightarrow Pb^{2+} + H_2O$	**1**

Question	Answer	Marks
4(a)	*silicon(IV) oxide*: covalent *sodium chloride*: ionic / electrovalent	1 1
4(b)	giant molecular / macromolecular / giant covalent / giant atomic	1
4(c)(i)	**M1** (covalent) bonds are strong **M2** a lot of heat or energy is needed to break / weaken / overcome bonds **OR** there are no <u>weak bonds</u> **OR** there are <u>no intermolecular forces</u> **OR** covalent bonds are the <u>only bonds</u> **OR** strong bonds are the <u>only bonds</u>	2
4(c)(ii)	(it has) no moving ions / no moving electrons / all electrons are used in bonding / no moving charged particles	1
4(d)	(sodium chloride contains) ions / is ionic in the solid ions are not moving / they are in fixed positions ions can move when molten	1 1 1
4(e)(i)	*product at the positive electrode:* chlorine *product at the negative electrode:* hydrogen	1 1
4(e)(ii)	$2H^+ + 2e^{(-)} \rightarrow H_2$ **OR** $2H_3O^+ + 2e^{(-)} \rightarrow H_2 + 2H_2O$	1
4(f)	oxygen	1
4(g)(i)	sodium	1
4(g)(ii)	$Na^+ + e^{(-)} \rightarrow Na$	1

Question	Answer	Marks
4(g)(iii)	*test:* (damp blue) litmus *result:* bleached / removes colour / (turns) white	1 1

Question	Answer	Marks
5(a)(i)	burned / heated in air	1
5(a)(ii)	$S + O_2 \rightarrow SO_2$	1
5(b)(i)	equilibrium / reversible	1
5(b)(ii)	vanadium(V) oxide / vanadium pentoxide	1
5(b)(iii)	increase rate (of reaction) / allow lower temperature to be used / allow lower pressure to be used	1
5(b)(iv)	less SO_3 forward reaction is exothermic / it is exothermic / reverse reaction is endothermic	1 1
5(b)(v)	rate too low / reaction too slow / slower	1
5(b)(vi)	more SO_3 fewer moles or molecules (of gas) on right-hand side / more moles or molecules(of gas) on left-hand side	1 1
5(c)(i)	concentrated sulfuric acid / concentrated H_2SO_4	1
5(c)(ii)	$SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$	1

Question	Answer	Marks
5(d)(i)	water	**1**
5(d)(ii)	$H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$	**1**
5(e)	detergents / car batteries / dyes / paints / synthetic resins / printing inks / metal extraction / cleaning metals /	**1**
5(f)(i)	exists <u>completely</u> as ions (in solution) / <u>completely</u> dissociates (in solution) / <u>completely</u> ionises (in solution)	**1**
5(f)(ii)	Universal Indicator / pH paper / pH indicator / pH meter Universal Indicator or pH paper or pH indicator turns red / pH 0–1	**1** **1**
5(f)(iii)	$Na_2CO_3 + 2C_6H_5SO_3H \rightarrow 2C_6H_5SO_3Na + CO_2 + H_2O$ formula of $C_6H_5SO_3Na$ all formulae correct and balancing correct	**2**

Question	Answer	Marks
6(a)(i)	*condensation:* **M1** (two) molecules / monomers joining **M2** with the removal of a (small) molecule *polymerisation:* **M3** (to form) a large molecule / a long chain	**3**
6(a)(ii)	addition	**1**
6(b)(i)	circled amide link	**1**
6(b)(ii)	all missing atoms and bonds shown on the diacid all missing atoms and bonds shown on the diamine	**1** **1**

Question	Answer	Marks
6(b)(iii)	nylon / Kevlar / Nomex	**1**
6(c)(i)	amino acids	**1**
6(c)(ii)	hydrolysis chromatography (spray with) locating agent / UV determine R_f values / compare with standards	**1** **1** **1** **1**