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Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/43**

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

MARK SCHEME

Maximum Mark: 80

Published

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Question	Answer	Marks
1(a)	<table><tr><td>proton</td><td>+1</td><td>1</td></tr><tr><td>neutron</td><td>0</td><td>1</td></tr><tr><td>electron</td><td>–1</td><td>$^{1}/_{1840}$</td></tr></table>	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

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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

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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

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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 weak bonds **OR** there are no intermolecular forces **OR** covalent bonds are the only bonds **OR** strong bonds are the only bonds	**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**

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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

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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

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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

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