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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

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Page 2	Mark Scheme	Syllabus	Paper
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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>$\frac{1}{1840}$</td></tr> </table>	proton	+1	1	neutron	0	1	electron	−1	$\frac{1}{1840}$	2
proton	+1	1									
neutron	0	1									
electron	−1	$\frac{1}{1840}$									
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 <i>and</i> 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)	<u>positive ions / cations</u> labelled or named in text <u>electrons</u> labelled or named in text <u>attraction</u> 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 → BeCl ₂ + 2H ₂ O formula of BeCl ₂ all formulae correct and balancing correct	2
2(d)(iii)	2NaOH + Be(OH) ₂ → Na ₂ BeO ₂ + 2H ₂ O formula of Na ₂ BeO 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 $0.02 \times 223 = 4.46$ (g)	1 1
3(b)(ii)	M1 mol O ₂ = $0.02 \div 2$ OR 0.01 M2 vol = $0.01 \times 24 = 0.24$ (dm ³)	1 1
3(c)	<i>test:</i> glowing splint <i>result:</i> 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)	$\text{PbO} + 2\text{HNO}_3 \rightarrow \text{Pb}(\text{NO}_3)_2 + \text{H}_2\text{O}$ OR $\text{PbO} + 2\text{H}^+ \rightarrow \text{Pb}^{2+} + \text{H}_2\text{O}$	1

Page 5	Mark Scheme	Syllabus	Paper
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Question	Answer	Marks
4(a)	<i>silicon(IV) oxide</i> : covalent <i>sodium chloride</i> : 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 no <u>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)	<i>product at the positive electrode</i> : chlorine <i>product at the negative electrode</i> : hydrogen	1 1
4(e)(ii)	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$ OR $2\text{H}_3\text{O}^+ + 2\text{e}^- \rightarrow \text{H}_2 + 2\text{H}_2\text{O}$	1
4(f)	oxygen	1
4(g)(i)	sodium	1
4(g)(ii)	$\text{Na}^+ + \text{e}^- \rightarrow \text{Na}$	1

Page 6	Mark Scheme	Syllabus	Paper
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Question	Answer	Marks
4(g)(iii)	<i>test:</i> (damp blue) litmus <i>result:</i> 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)	$\text{H}_2\text{S}_2\text{O}_7 + \text{H}_2\text{O} \rightarrow 2\text{H}_2\text{SO}_4$	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)	$\text{Na}_2\text{CO}_3 + 2\text{C}_6\text{H}_5\text{SO}_3\text{H} \rightarrow 2\text{C}_6\text{H}_5\text{SO}_3\text{Na} + \text{CO}_2 + \text{H}_2\text{O}$ formula of $\text{C}_6\text{H}_5\text{SO}_3\text{Na}$ all formulae correct and balancing correct	2

Question	Answer	Marks
6(a)(i)	<i>condensation:</i> M1 (two) molecules / monomers joining M2 with the removal of a (small) molecule <i>polymerisation:</i> 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