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Cambridge International General Certificate of Secondary Education

CHEMISTRY

0620/32

Paper 3 Core 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	Mark
1(a)(i)	K / potassium	1
1(a)(ii)	Cu / copper	1
1(a)(iii)	C / carbon	1
1(a)(iv)	He / helium	1
1(a)(v)	Fe / iron	1
1(b)	<i>number of protons: 47 and 47</i> <i>number of electrons: 47 and 47</i> <i>number of neutrons: 60 and 62</i>	1 1 1

Question	Answer	Mark
2(a)(i)	any 2 from: • more Cl^- in A ORA • more HCO_3^- in A ORA • more Ca^{2+} in A ORA • more Na^+ in B ORA • more K^+ in B ORA • more SiO_3^{2-} in B ORA • more Mg^{2+} in B ORA	2
2(a)(ii)	Ca^{2+}	1

Page 3	Mark Scheme	Syllabus	Paper
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Question	Answer	Mark
2(a)(iii)	$1.5 \text{ mg} = [2]$ $\frac{100}{1000} \times (15) = [1]$ OR $0.1 \times (15) = [1]$	2
2(b)	<i>test:</i> add (nitric acid and) silver nitrate <i>result:</i> white precipitate	1 1
2(c)	the random movement of particles in a suspension	1
2(d)	silicon is a non-metal / silicon is on the right-hand side of the Periodic Table	1
2(e)(i)	decreases (as temperature increases)	1
2(e)(ii)	$11.5 \text{ (mg / dm}^3\text{)}$	1
2(e)(iii)	increases because chemical reaction(s) are faster at higher temperatures / reactions with iron are faster at higher temperatures / reactions with metals are faster at higher temperatures OR decreases because less oxygen is dissolved at higher temperatures	1
2(f)	filtration treatment with chlorine / chlorination	1 1
2(g)(i)	any suitable source, e.g. car (exhausts) / lightning / furnaces /	1
2(g)(ii)	breathing difficulties / irritation to nose (OR lungs OR eyes OR throat or skin)	1

Page 4	Mark Scheme	Syllabus	Paper
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Question	Answer	Mark
3(a)	water (water) is losing oxygen	1 1
3(b)(i)	rock from which metal is extracted / rock containing (high proportion of) a metal (compound)	1
3(b)(ii)	to burn the coke / to form carbon monoxide	1
3(b)(iii)	calcium silicate	1
3(b)(iv)	S on or in 2nd pipe from the bottom on the right / just outside this pipe	1
3(c)	<i>impurities named</i> (max = [1]) - e.g. carbon / sulfur / phosphorous / silicon <i>removal of impurities</i> (max = [1]) - oxygen blown into iron / oxygen blast - calcium oxide added / lime added - sulfur oxidised to sulfur dioxide - sulfur dioxide escapes as gas - carbon oxidised to carbon dioxide - carbon dioxide escapes as a gas - phosphorous oxidised to phosphorous oxide - silicon oxidised to silicon dioxide - slag formed / calcium silicate formed - slag floats on surface of steel <i>relevant word equation</i> (max = [1]) - e.g. sulfur + oxygen → sulfur dioxide - carbon + oxygen → carbon dioxide <i>one other relevant piece of information about impurities / reaction</i> (max = [1])	4

Page 5	Mark Scheme	Syllabus	Paper
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Question	Answer	Mark
4(a)	the sample is impure	1
4(b)	any 3 from: • diffusion • particles move / motion of particles • (movement is) random / in any direction / in all directions • particles spread out / particles mix • particles move from high to low concentration	3
4(c)	red	1
4(d)(i)	(metal) salt water	1 1
4(d)(ii)	filtration / filter	1
4(d)(iii)	E, B, C, A, D	2

Page 6	Mark Scheme	Syllabus	Paper
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Question	Answer	Mark
5(a)(i)	CaO CO ₂	1 1
5(a)(ii)	(thermal) decomposition	1
5(a)(iii)	100 = [2] A _r = 40 (Ca), 12 (C), 16 (O) = [1]	2
5(b)	any 2 from: - compound has a fixed composition / mixture has not got a fixed composition (components of) compound cannot separated (by physical means) / (components of) mixture can be separated (by physical means) - compound has different properties from the elements it has been made from / substances in a mixture have the same properties as those used to make the mixture	2
5(c)	concrete is weaker / steel is stronger	1
5(d)	oxygen / air water	1 1

Page 7	Mark Scheme	Syllabus	Paper
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Question	Answer	Mark
6(a)(i)	<i>hydrocarbon</i>: (compounds which) contain carbon and hydrogen only <i>fraction</i>: • molecules with certain number(s) of carbon atoms / molecules with (limited) range of carbon atoms OR • (limited) range of boiling points OR • molecules of certain sizes / (limited) range of sizes	1 1
6(a)(ii)	<i>naphtha</i>: making chemicals / making alkenes <i>kerosene</i>: fuel for planes / fuel for heating / making alkenes	1 1
6(b)	<i>comment on alkenes</i> (max = [1]) • alkenes have C=C / are unsaturated <i>reference to homologous series</i> (max = [3]) • family of similar carbon compounds / similar organic compounds • (same) functional group • similar chemical properties • trend in physical properties • (same) general formula / C_nH_{2n} • differ by CH_2	4
6(c)(i)	(yes) there is general trend from propene to hexane / (yes) the numbers go up in both columns	1
6(c)(ii)	any value between 35 (°C)–85 (°C) inclusive	1

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Question	Answer	Mark
6(c)(iii)	liquid –60 °C is between the melting and boiling point / the melting point is lower than –60 °C but the boiling point is higher (than –60 °C)	1 1
6(d)	correct structure of ethane showing all of the atoms and all of the bonds	1
6(e)	C ₄ H ₈ C ₈ H ₁₈	1 1

Question	Answer	Mark
7(a)	air would react with sodium / argon is unreactive / argon makes the atmosphere inert / sodium does not react with argon	1
7(b)	D–E	1
7(c)(i)	any 2 from: - gas spreads everywhere / liquid spreads over a surface - gas has no fixed volume / liquid has fixed volume - gas has no surface / liquid has (definite) surface - gas can be compressed / liquid cannot be compressed	2
7(c)(ii)	<i>arrangement</i> : no (fixed) arrangement / random / irregular <i>motion</i> : slow / sliding over each other / slipping over each other	1 1

Page 9	Mark Scheme	Syllabus	Paper
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Question	Answer	Mark
7(d)(i)	any 2 from: • high melting point/high boiling point • high density • catalytic activity • has several oxidation states • forms coloured compounds • hard/strong	2
7(d)(ii)	$\text{Nb}_2\text{Cl}_{10}$	1
7(d)(iii)	any 2 from: • does not conduct electricity/heat • has a low melting point/has a low boiling point • insoluble in water/soluble in organic solvent	2