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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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This document consists of **9** printed pages.

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: <ul style="list-style-type: none"> • 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

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Question	Answer	Mark
2(a)(iii)	1.5 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 (mg / dm ³)	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)	<p><i>impurities named</i> (max = [1])</p> <ul style="list-style-type: none"> e.g. carbon / sulfur / phosphorous / silicon <p><i>removal of impurities</i> (max = [1])</p> <ul style="list-style-type: none"> 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 <p><i>relevant word equation</i> (max = [1])</p> <ul style="list-style-type: none"> e.g. sulfur + oxygen → sulfur dioxide carbon + oxygen → carbon dioxide <p><i>one other relevant piece of information about impurities / reaction</i> (max = [1])</p>	4

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Question	Answer	Mark
4(a)	the sample is impure	1
4(b)	any 3 from: <ul style="list-style-type: none"> • 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

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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: <ul style="list-style-type: none"> • 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)	<p><i>hydrocarbon</i>: (compounds which) contain carbon and hydrogen only</p> <p><i>fraction</i>:</p> <ul style="list-style-type: none"> 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 	<p>1</p> <p>1</p>
6(a)(ii)	<p><i>naphtha</i>: making chemicals / making alkenes</p> <p><i>kerosene</i>: fuel for planes / fuel for heating / making alkenes</p>	<p>1</p> <p>1</p>
6(b)	<p><i>comment on alkenes</i> (max = [1])</p> <ul style="list-style-type: none"> alkenes have C=C / are unsaturated <p><i>reference to homologous series</i> (max = [3])</p> <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> • 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

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Question	Answer	Mark
7(d)(i)	any 2 from: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • does not conduct electricity / heat • has a low melting point / has a low boiling point • insoluble in water / soluble in organic solvent 	2