Cambridge International Examinations
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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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)	*number of protons:* 47 and 47 *number of electrons:* 47 and 47 *number of neutrons:* 60 and 62	**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**

Question	Answer	Mark
2(a)(iii)	1.5 mg = [2] $\frac{100}{1000} \times (15)$ = [1] **OR** 0.1 × (15) = [1]	**2**
2(b)	*test:* add (nitric acid and) silver nitrate *result:* 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**

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)	*impurities named* (max = [1]) • e.g. carbon / sulfur / phosphorous / silicon *removal of impurities* (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 *relevant word equation* (max = [1]) • e.g. sulfur + oxygen → sulfur dioxide • carbon + oxygen → carbon dioxide *one other relevant piece of information about impurities / reaction* (max = [1])	**4**

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**

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**

Question	Answer	Mark
6(a)(i)	*hydrocarbon*: (compounds which) contain carbon and hydrogen only *fraction*: • 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)	*naphtha:* making chemicals / making alkenes *kerosene:* fuel for planes / fuel for heating / making alkenes	**1** **1**
6(b)	*comment on alkenes* (max = [1]) • alkenes have C=C / are unsaturated *reference to homologous series* (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**

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_4H_8 C_8H_{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)	*arrangement:* no (fixed) arrangement / random / irregular *motion:* slow / sliding over each other / slipping over each other	**1** **1**

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)	Nb_2Cl_{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**