



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

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**CHEMISTRY**

**0620/32**

Paper 3 Core Theory

**October/November 2016**

MARK SCHEME

Maximum Mark: 80

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**Published**

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<b>Question</b>	<b>Answer</b>	<b>Mark</b>
1(a)(i)	K/potassium	<b>1</b>
1(a)(ii)	Cu/copper	<b>1</b>
1(a)(iii)	C/carbon	<b>1</b>
1(a)(iv)	He/helium	<b>1</b>
1(a)(v)	Fe/iron	<b>1</b>
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>	<b>1</b> <b>1</b> <b>1</b>

<b>Question</b>	<b>Answer</b>	<b>Mark</b>
2(a)(i)	any 2 from: <ul style="list-style-type: none"> <li>• more <math>Cl^-</math> in <b>A ORA</b></li> <li>• more <math>HCO_3^-</math> in <b>A ORA</b></li> <li>• more <math>Ca^{2+}</math> in <b>A ORA</b></li> <li>• more <math>Na^+</math> in <b>B ORA</b></li> <li>• more <math>K^+</math> in <b>B ORA</b></li> <li>• more <math>SiO_3^{2-}</math> in <b>B ORA</b></li> <li>• more <math>Mg^{2+}</math> in <b>B ORA</b></li> </ul>	<b>2</b>
2(a)(ii)	$Ca^{2+}$	<b>1</b>

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

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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)	<b>S</b> 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"> <li>e.g. carbon / sulfur / phosphorus / silicon</li> </ul> <p><i>removal of impurities</i> (max = [1])</p> <ul style="list-style-type: none"> <li>oxygen blown into iron / oxygen blast</li> <li>calcium oxide added / lime added</li> <li>sulfur oxidised to sulfur dioxide</li> <li>sulfur dioxide escapes as gas</li> <li>carbon oxidised to carbon dioxide</li> <li>carbon dioxide escapes as a gas</li> <li>phosphorus oxidised to phosphorus oxide</li> <li>silicon oxidised to silicon dioxide</li> <li>slag formed / calcium silicate formed</li> <li>slag floats on surface of steel</li> </ul> <p><i>relevant word equation</i> (max = [1])</p> <ul style="list-style-type: none"> <li>e.g. sulfur + oxygen → sulfur dioxide</li> <li>carbon + oxygen → carbon dioxide</li> </ul> <p><i>one other relevant piece of information about impurities / reaction</i> (max = [1])</p>	4

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<b>Question</b>	<b>Answer</b>	<b>Mark</b>
4(a)	the sample is impure	<b>1</b>
4(b)	any 3 from: <ul style="list-style-type: none"> <li>• diffusion</li> <li>• particles move / motion of particles</li> <li>• (movement is) random / in any direction / in all directions</li> <li>• particles spread out / particles mix</li> <li>• particles move from high to low concentration</li> </ul>	<b>3</b>
4(c)	red	<b>1</b>
4(d)(i)	(metal) salt water	<b>1</b> <b>1</b>
4(d)(ii)	filtration / filter	<b>1</b>
4(d)(iii)	<b>E, B, C, A, D</b>	<b>2</b>

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<b>Question</b>	<b>Answer</b>	<b>Mark</b>
5(a)(i)	CaO CO <sub>2</sub>	<b>1</b> <b>1</b>
5(a)(ii)	(thermal) decomposition	<b>1</b>
5(a)(iii)	100 = [2] A <sub>r</sub> = 40 (Ca), 12 (C), 16 (O) = [1]	<b>2</b>
5(b)	any 2 from: <ul style="list-style-type: none"> <li>• compound has a fixed composition / mixture has not got a fixed composition</li> <li>• (components of) compound cannot separated (by physical means) / (components of) mixture can be separated (by physical means)</li> <li>• 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</li> </ul>	<b>2</b>
5(c)	concrete is weaker / steel is stronger	<b>1</b>
5(d)	oxygen / air water	<b>1</b> <b>1</b>

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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"> <li>• molecules with certain number(s) of carbon atoms / molecules with (limited) range of carbon atoms <b>OR</b></li> <li>• (limited) range of boiling points <b>OR</b></li> <li>• molecules of certain sizes / (limited) range of sizes</li> </ul>	1 1
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>	1 1
6(b)	<p><i>comment on alkenes</i> (max = [1])</p> <ul style="list-style-type: none"> <li>• alkenes have C=C / are unsaturated</li> </ul> <p><i>reference to homologous series</i> (max = [3])</p> <ul style="list-style-type: none"> <li>• family of similar carbon compounds / similar organic compounds</li> <li>• (same) functional group</li> <li>• similar chemical properties</li> <li>• trend in physical properties</li> <li>• (same) general formula / <math>C_nH_{2n}</math></li> <li>• differ by <math>CH_2</math></li> </ul>	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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<b>Question</b>	<b>Answer</b>	<b>Mark</b>
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)	<b>1</b> <b>1</b>
6(d)	correct structure of ethane showing all of the atoms and all of the bonds	<b>1</b>
6(e)	C <sub>4</sub> H <sub>8</sub> C <sub>8</sub> H <sub>18</sub>	<b>1</b> <b>1</b>

<b>Question</b>	<b>Answer</b>	<b>Mark</b>
7(a)	air would react with sodium / argon is unreactive / argon makes the atmosphere inert / sodium does not react with argon	<b>1</b>
7(b)	<b>D–E</b>	<b>1</b>
7(c)(i)	any 2 from: <ul style="list-style-type: none"> <li>• gas spreads everywhere / liquid spreads over a surface</li> <li>• gas has no fixed volume / liquid has fixed volume</li> <li>• gas has no surface / liquid has (definite) surface</li> <li>• gas can be compressed / liquid cannot be compressed</li> </ul>	<b>2</b>
7(c)(ii)	<i>arrangement:</i> no (fixed) arrangement / random / irregular <i>motion:</i> slow / sliding over each other / slipping over each other	<b>1</b> <b>1</b>



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<b>Question</b>	<b>Answer</b>	<b>Mark</b>
7(d)(i)	any 2 from: <ul style="list-style-type: none"> <li>• high melting point/high boiling point</li> <li>• high density</li> <li>• catalytic activity</li> <li>• has several oxidation states</li> <li>• forms coloured compounds</li> <li>• hard/strong</li> </ul>	<b>2</b>
7(d)(ii)	$\text{Nb}_2\text{C}_{10}$	<b>1</b>
7(d)(iii)	any 2 from: <ul style="list-style-type: none"> <li>• does not conduct electricity/heat</li> <li>• has a low melting point/has a low boiling point</li> <li>• insoluble in water/soluble in organic solvent</li> </ul>	<b>2</b>