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**CHEMISTRY**

**0620/42**

Paper 4 Extended 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)	fixed volume <b>AND</b> take the shape of the container	<b>1</b>												
1(b)	<table border="1"> <tr> <td>solid</td> <td>touching</td> <td>regular</td> <td>vibrate</td> </tr> <tr> <td>liquid</td> <td></td> <td></td> <td></td> </tr> <tr> <td>gas</td> <td>not touching</td> <td>random</td> <td>random</td> </tr> </table>	solid	touching	regular	vibrate	liquid				gas	not touching	random	random	<b>6</b>
solid	touching	regular	vibrate											
liquid														
gas	not touching	random	random											
1(c)(i)	melting	<b>1</b>												
1(c)(ii)	sublimation	<b>1</b>												

<b>Question</b>	<b>Answer</b>	<b>Mark</b>
2(a)	(total) number of protons and neutrons in a nucleus (of an atom)	<b>2</b>
2(b)	Na    2 : 8 : 1 P <sup>3-</sup> 2 : 8 : 8	<b>2</b>
2(c)	radiotherapy <b>OR</b> treatment of cancer	<b>1</b>
2(d)	<u>average</u> mass of (naturally occurring) <u>atom(s)</u> (of an element) (compared to an atom of <sup>12</sup> C)	<b>2</b>

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<b>Question</b>	<b>Answer</b>	<b>Mark</b>
2(e)	chlorine must have more than one isotope the masses of these isotopes / (any given) mass numbers are averaged	<b>2</b>
2(f)	lattice of labelled $Al^{3+}$ ions electrons seen on the diagram between the ions attraction between (positive) ions and (sea of / delocalised) electrons	<b>3</b>

<b>Question</b>	<b>Answer</b>	<b>Mark</b>
3(a)	nitrogen (78%) <b>AND</b> oxygen (21%) noble gases <b>OR</b> argon (1%)	<b>2</b>
3(b)	nitrogen <b>AND</b> oxygen (from the air) react (in the) high temperatures of a car engine $NO_x$ / oxides of nitrogen react with or dissolve in water (to form an acid)	<b>3</b>
3(c)	any 2 from: (named) ruminant animal / cattle / (anaerobic) digestion / flatulence (in animals) / animal waste / (animal) dung decomposing vegetation / animals / organisms / decaying (organic) matter / (fractional distillation / cracking of) petroleum / crude oil / hydrocarbons / natural gas / coal /	<b>2</b>
3(d)	photosynthesis	<b>1</b>

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Question	Answer	Mark
4(a)	<i>copper(II) carbonate</i> fizzes / bubbles / effervescence dissolves / disappears  <i>copper(II) oxide</i> dissolves / disappears blue (solution formed)	2  2
4(b)(i)	$\text{Cu}(\text{NO}_3)_2$ <u>3</u> Cu <b>AND</b> <u>3</u> Cu(NO <sub>3</sub> ) <sub>2</sub>	2
4(b)(ii)	hydrogen (gas) is not produced (when copper reacts with nitric acid)	1

Question	Answer	Mark
5(a)	20 cm <sup>3</sup> <b>M1</b> $M_r$ of MnO <sub>2</sub> : 87 <b>M2</b> moles of MnO <sub>2</sub> used: $3.48 / 87 = 0.04$ <b>M3</b> moles of HCl needed: $0.04 \times 4 = 0.16$ <b>M4</b> volume of HCl needed: $(0.16 / 8.0) \times 1000$ <b>AND</b> 20 cm <sup>3</sup>	4
5(b)(i)	from colourless to yellow / orange / brown	2
5(b)(ii)	$\text{Cl}_2(\text{g}) + 2\text{Br}^-(\text{aq}) \rightarrow \text{Br}_2(\text{aq}) + 2\text{Cl}^-(\text{aq})$  <b>M1</b> (aq) as state symbols for the two products given <b>M2</b> correct products <b>M3</b> balancing	3

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<b>Question</b>	<b>Answer</b>	<b>Mark</b>
5(c)(i)	the (C=C) double bond	<b>1</b>
5(c)(ii)	addition <b>OR</b> bromination	<b>1</b>
5(d)(i)	substitution	<b>1</b>
5(d)(ii)	(compounds with the) same molecular formula different structural formulae or structures	<b>2</b>
5(d)(iii)	structure of 1–chloropropane structure of 2–chloropropane	<b>2</b>
5(e)(i)	I <sub>2</sub> O <sub>5</sub> <b>M1</b> 76.0 / 127 <b>AND</b> 24.0 / 16.0 <b>M2</b> 0.59 <b>AND</b> 1.5 <b>OR</b> 1 <b>AND</b> 2.5 <b>M3</b> I <sub>2</sub> O <sub>5</sub>	<b>3</b>
5(e)(ii)	(turns) red / pink / orange / yellow iodine is a non-metal	<b>2</b>

<b>Question</b>	<b>Answer</b>	<b>Mark</b>
6(a)	bauxite/Alumina is dissolved in <u>molten</u> cryolite cryolite lowers the melting temperature molten aluminium forms <i>anode reaction:</i> $2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$ <i>cathode reaction:</i> $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$	<b>5</b>

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<b>Question</b>	<b>Answer</b>	<b>Mark</b>
6(b)	carbon or graphite electrode reacts with oxygen / burns (in oxygen) / combusts	<b>2</b>
6(c)	<i>use 1</i> : manufacture of aircraft <i>reason 1</i> : low density <i>use 2</i> : food containers <b>OR</b> cooking foil <i>reason 2</i> : Al resistant to corrosion	<b>4</b>

<b>Question</b>	<b>Answer</b>	<b>Mark</b>
7(a)	large / big molecule made from (many) monomers (joined together)	<b>2</b>
7(b)(i)	hydrolysis	<b>1</b>
7(b)(ii)	acid (conditions) / enzyme	<b>1</b>
7(c)(i)	$\frac{\text{distance moved by substance}}{\text{distance moved by solvent (front)}}$	<b>1</b>
7(c)(ii)	circle around top spot	<b>1</b>
7(c)(iii)	mixture of amino acids is placed as a spot onto a (pencil) baseline placed into a (suitable) solvent / water a locating agent is added to the (finished) chromatogram (to reveal spots)	

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<b>Question</b>	<b>Answer</b>	<b>Mark</b>
7(d)	<p>fully displayed amide link between any two 'blocks'</p> <p>dipeptide 1: amino acid <b>A</b> on left-hand side and amino acid <b>B</b> on right-hand side</p> <p><b>AND</b></p> <p>dipeptide 2: amino acid <b>B</b> on left-hand side and amino acid <b>A</b> on right-hand side</p> <p>correct terminal amine and carboxylic acid group on both correct dipeptides</p>	<b>3</b>