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CHEMISTRY **0620/42**

Paper 4 Extended Theory **October/November 2016**

MARK SCHEME

Maximum Mark: 80

Published

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Question	Answer	Mark
1(a)	fixed volume **AND** take the shape of the container	**1**
1(b)	<table><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>	**6**
1(c)(i)	melting	**1**
1(c)(ii)	sublimation	**1**

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

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Question	Answer	Mark
2(e)	chlorine must have more than one isotope the masses of these isotopes / (any given) mass numbers are averaged	**2**
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	**3**

Question	Answer	Mark
3(a)	nitrogen (78%) **AND** oxygen (21%) noble gases **OR** argon (1%)	**2**
3(b)	nitrogen **AND** 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)	**3**
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 /	**2**
3(d)	photosynthesis	**1**

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Question	Answer	Mark
4(a)	*copper(II) carbonate* fizzes / bubbles / effervescence dissolves / disappears *copper(II) oxide* dissolves / disappears blue (solution formed)	**2** **2**
4(b)(i)	 $Cu(NO_3)_2$ $\underline{3}Cu$ **AND** $\underline{3}Cu(NO_3)_2$	**2**
4(b)(ii)	hydrogen (gas) is not produced (when copper reacts with nitric acid)	**1**

Question	Answer	Mark
5(a)	$20\,cm^3$ **M1** M_r of MnO_2: 87 **M2** moles of MnO_2 used: 3.48 / 87 = 0.04 **M3** moles of HC*l* needed: 0.04 × 4 = 0.16 **M4** volume of HC*l* needed: (0.16 / 8.0) × 1000 **AND** $20\,cm^3$	**4**
5(b)(i)	 from colourless to yellow / orange / brown	**2**
5(b)(ii)	$Cl_2(g) + 2Br^-(aq) \rightarrow Br_2(aq) + 2Cl^-(aq)$ **M1** (aq) as state symbols for the two products given **M2** correct products **M3** balancing	**3**

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Question	Answer	Mark
5(c)(i)	the (C=C) double bond	1
5(c)(ii)	addition **OR** bromination	1
5(d)(i)	substitution	1
5(d)(ii)	(compounds with the) same molecular formula different structural formulae or structures	2
5(d)(iii)	structure of 1–chloropropane structure of 2–chloropropane	2
5(e)(i)	I_2O_5 **M1** 76.0 / 127 **AND** 24.0 / 16.0 **M2** 0.59 **AND** 1.5 **OR** 1 **AND** 2.5 **M3** I_2O_5	3
5(e)(ii)	(turns) red / pink / orange / yellow iodine is a non-metal	2

Question	Answer	Mark
6(a)	bauxite/Alumina is dissolved in <u>molten</u> cryolite cryolite lowers the melting temperature molten aluminium forms *anode reaction*: $2O^{2-} \rightarrow O_2 + 4e^-$ *cathode reaction:* $Al^{3+} + 3e^- \rightarrow Al$	5

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

Question	Answer	Mark
7(a)	large / big molecule made from (many) monomers (joined together)	**2**
7(b)(i)	hydrolysis	**1**
7(b)(ii)	acid (conditions) / enzyme	**1**
7(c)(i)	$\frac{\text{distance moved by substance}}{\text{distance moved by solvent (front)}}$	**1**
7(c)(ii)	circle around top spot	**1**
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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Question	Answer	Mark
7(d)	fully displayed amide link between any two 'blocks' dipeptide 1: amino acid **A** on left-hand side and amino acid **B** on right-hand side **AND** dipeptide 2: amino acid B on left-hand side and amino acid A on right-hand side correct terminal amine and carboxylic acid group on both correct dipeptides	**3**

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