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Cambridge International General Certificate of Secondary Education

CHEMISTRY

0620/42

Paper 4 Extended Theory

October/November 2016

MARK SCHEME

Maximum Mark: 80

Published

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This document consists of 7 printed pages.

Page 2	Mark Scheme	Syllabus	Paper
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Question	Answer	Mark												
1(a)	fixed volume AND take the shape of the container	1												
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	6
solid	touching	regular	vibrate											
liquid														
gas	not touching	random	random											
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

Page 3	Mark Scheme	Syllabus	Paper
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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

Page 4	Mark Scheme	Syllabus	Paper
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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 AND <u>3</u> 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 HCl needed: $0.04 \times 4 = 0.16$ M4 volume of HCl needed: $(0.16 / 8.0) \times 1000$ AND 20 cm ³	4
5(b)(i)	from colourless to yellow / orange / brown	2
5(b)(ii)	$\text{Cl}_2(\text{g}) + 2\text{Br}^-(\text{aq}) \rightarrow \text{Br}_2(\text{aq}) + 2\text{Cl}^-(\text{aq})$ M1 (aq) as state symbols for the two products given M2 correct products M3 balancing	3

Page 5	Mark Scheme	Syllabus	Paper
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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 ₂ O ₅ M1 76.0 / 127 AND 24.0 / 16.0 M2 0.59 AND 1.5 OR 1 AND 2.5 M3 I ₂ O 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 <i>anode reaction:</i> $2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$ <i>cathode reaction:</i> $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$	5

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

Page 7	Mark Scheme	Syllabus	Paper
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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