Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/42**

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

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2016 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

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**

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**

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**

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**

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)	

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**