Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/42**

Paper 4 Theory (Extended) **March 2018**

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 International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the March 2018 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.

PUBLISHED

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Question	Answer	Marks
1(a)(i)	**A**	**1**
1(a)(ii)	M1 **C** M2 **D**	**2**
1(a)(iii)	**D**	**1**
1(a)(iv)	**B**	**1**
1(a)(v)	M1 **F** M2 **B**	**2**
1(a)(vi)	M1 **G** M2 **H**	**2**
1(b)(i)	a shared **pair** of electrons (between two atoms) M1 shared electrons M2 pair of / two electrons	**2**
1(b)(ii)	M1 three correct bonding pairs from one N atom to each of three F atoms M2 (3 pairs of) non-bonding electrons on each of three F atoms to complete an octet M3 (1 pair of) non-bonding electrons on N atom to complete an octet	**3**
1(c)(i)	two (or more) substances not chemically combined	**1**
1(c)(ii)	21(%)	**1**
1(c)(iii)	fractional distillation of liquid air M1 air is made into a liquid M2 (allow air to) boil or evaporate M3 condense the vapours / collect the vapours in order (of evaporation) fractional distillation gets M2 and M3	**3**

Question	Answer	Marks
1(c)(iv)	boiling points	**1**

Question	Answer	Marks
2(a)(i)	M1 correct orientation of '+' and '–' on front four ions M2 rest of structure	**2**
2(a)(ii)	18	**1**
2(a)(iii)	Ne or Neon	**1**
2(b)(i)	M1 breakdown of an ionic compound when molten or in aqueous solution M2 (by the passage of) electricity / electric current / electrical energy	**2**
2(b)(ii)	hydrogen chlorine sodium hydroxide	**3**
2(b)(iii)	$2H^+(aq) + 2e^- \rightarrow H_2(g)$ M1 H^+ on left hand side with e^- added M2 fully correct equation	**2**
2(c)(i)	white precipitate	**1**
2(c)(ii)	to ensure all sodium nitrate / $NaNO_3$ was collected	**1**
2(c)(iii)	M1 evaporation M2 crystallisation	**2**

Question	Answer	Marks
2(c)(iv)	M1 (moles of NaCl = 0.20 × 20 ÷ 1000 =) 4(.00) × 10^{-3} or 0.004(00) M2 (M_r of $NaNO_3$ =) 85 M3 (85 × 4(.00) × 10^{-3} =) 0.34 (g) M4 (0.34 × 90 / 100 =) 0.306 (g) OR 0.31 (g)	**4**
2(c)(v)	$2NaNO_3 \rightarrow 2NaNO_2 + O_2$ M1 = $NaNO_2$ M2 = rest of equation	**2**

Question	Answer	Marks
3(a)(i)	M1 calcium oxide M2 CaO	**2**
3(a)(ii)	(step) **3**	**1**
3(a)(iii)	thermal decomposition	**1**
3(a)(iv)	heating	**1**
3(a)(v)	$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$	**1**
3(a)(vi)	M1 CO_2 is acidic M2 $Ca(OH)_2$ is a base / alkali	**2**
3(b)	$MgCO_3 + 2HNO_3 \rightarrow Mg(NO_3)_2 + H_2O + CO_2$ M1 $Mg(NO_3)_2$ M2 rest of equation	**2**

Question	Answer	Marks
3(c)	Mg Si O M1 2.73 / 24 1.58 / 28 3.60 / 16 OR 0.11375 0.0564 0.23(0) M2 0.0.11375 / .0564 0.0564 / .0564 0.230 / .0564 leading to Mg_2SiO_4	**2**

Question	Answer	Marks
4(a)(i)	proton acceptor	**1**
4(a)(ii)	ammonia + named acid → correct ammon**ium** salt M1 ammon**ium** product (from ammonia / ammonium hydroxide + acid) M2 fully correct equation	**2**
4(b)(i)	M1 (moles of NH_3 = 0.68 / 17 =) 0.04(00) M2 (M1 × 3 / 2 =) 0.06(00) M3 (volume of Cl_2 = 0.06(00) × 24000 =) 1440 (cm^3)	**3**
4(b)(ii)	M1 (reactants 2 × 3 × 390 (= 2340) + 3 × 240 (= 720) =) 3060 M2 (products 945 + 6 × 430 (= 2580) =) 3525 M3 M1 – M2	**3**
4(b)(iii)	(**(b)(ii)** is exothermic then) exothermic **and** more energy released than used OR (**(b)(ii)** is endothermic then) endothermic **and** less energy released than used	**1**
4(c)(i)	ammonia / it is oxidised / oxygen is reduced	**1**

Question	Answer	Marks
4(c)(ii)	M1 platinum M2 transition metal / element	**2**

Question	Answer	Marks
5(a)	homologous series	**1**
5(b)	$C_nH_{2n+2}O$ OR $C_nH_{2n+1}OH$	**1**
5(c)(i)	M1 steam M2 catalyst	**2**
5(c)(ii)	$2C_3H_7OH + 9O_2 \rightarrow 6CO_2 + 8H_2O$ M1 species M2 fully correct equation	**2**
5(d)(i)	M1 at least one –O– link between two blocks M2 correct structure including continuation bonds	**2**
5(d)(ii)	hydrolysis	**1**
5(d)(iii)	enzyme OR heat + acid	**1**
5(e)(i)	locating ((re)agent)	**1**
5(e)(ii)	<u>distance travelled by substance</u> distance travelled by solvent	**1**
5(e)(iii)	compare to known data	**1**
5(e)(iv)	similar R_f values	**1**