Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/42**

Paper 4 Extended Theory **October/November 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.

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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.

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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.

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Question	Answer	Marks
1(a)(i)	M1 Melting M2 Condensing M3 Freezing M4 Sublimation	**4**
1(a)(ii)	No new substances are made **or** The change can be reversed (by a physical process)	**1**
1(a)(iii)	Boiling happens at a specific temperature **or** Evaporation happens over a range of temperatures	**1**
1(b)	M1 Separation: Touching M2 Arrangement: Regular M3 Movement: Vibrate	**3**
1(c)	$4X + O_2 \rightarrow 2X_2O$ M1 Species M2 Balance	**2**

Question	Answer	Marks
2(a)	2 : 8 : 8 : 2	**1**
2(b)(i)	M1 Same number of (**or** 2) outer electrons	**2**
2(b)(ii)	M2 (Sr has) outer electrons are in the 5th shell	
2(c)(i)	Hydrogen	**1**

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Question	Answer	Marks
2(c)(ii)	Hydroxide OR OH^-	**1**
2(c)(iii)	7< pH ⩽12	**1**
2(c)(iv)	$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$ M1 $Ca(OH)_2$ M2 Rest of equation	**2**
2(d)(i)	M1 Mg shown with new outer shell with 8 crosses; M2 Both C*l* atoms with a new outer shell with 7 dots and 1 cross; M3 '2+' charge on Mg **and** '–' charge on each C*l*;	**3**
2(d)(ii)	M1 *Physical constants mark* High melting point or high boiling point M2 *Solubility mark* Dissolve in water M3 *Electrical conductivity mark* Conduct (electricity) when molten **or** conduct (electricity) in aqueous solution	**3**
2(e)	$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$ M1 Species M2 States	**2**

Question	Answer	Marks
3(a)	M1 Sulfur dioxide / SO_2 is formed M2 SO_2 reacts with (atmospheric) water (vapour) / rain	**2**
3(b)(i)	$2SO_2 + O_2 \rightleftharpoons 2SO_3$ M1 Balanced equation M2 reversible arrow	**2**
3(b)(ii)	M1 450 °C (units required) M2 1–5 atmospheres (units required) M3 Vanadium (V) oxide **or** vanadium pentoxide **or** V_2O_5	**3**
3(b)(iii)	M1 SO_3 added to (concentrated) H_2SO_4 M2 (Oleum) diluted with / added to water	**2**
3(c)(i)	Measuring cylinder	**1**
3(c)(ii)	M1 No more fizzing; M2 ($ZnCO_3$) stops dissolving or a (white) solid remains / is visible	**2**
3(c)(iii)	To use up all the acid / H^+ ions	**1**
3(c)(iv)	M1 A solution that can hold no more solute M2 at the specified temperature	**2**
3(c)(v)	(aq)	**1**
3(c)(vi)	Zinc oxide **or** zinc hydroxide	**1**
3(c)(vii)	Barium sulfate is insoluble	**1**

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Question	Answer	Marks
3(d)(i)	yellow	**1**
3(d)(ii)	M1 $0.2 \times 25 / 1000 = 5(.00) \times 10^{-3}$ or 0.005(00) (mol) M2 $5(.00) \times 10^{-3} / 2 = 2.5(.0) \times 10^{-3}$ or 0.0025(0) (mol) M3 $2.5(.0) \times 10^{-3} \times 1000 / 20 = 0.125$ (mol / dm^3) M4 $0.125 \times 98 = 12.25$ (g / dm^3)	**4**
3(e)	M1 Mol $FeSO_4 = 15.2 / 152 = 0.1(00)$ M2 Expected mol of $Fe_2O_3 = 0.1 / 2 = 0.05(00)$) **or** Actual mol of $Fe_2O_3 = 4.80 / 160 = 0.03(00)$ M3 Percentage yield = $100 \times 0.03(00) / 0.05(00) = 60\%$	**3**

Question	Answer	Marks
4(a)(i)	Gradient gets less	**1**
4(a)(ii)	Concentration of HC*l* is decreasing	**1**
4(a)(iii)	120 seconds	**1**
4(b)	M1 New line steeper than printed line and starts at origin M2 New line reaches same final volume as printed line	**2**

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Question	Answer	Marks
4(c)	M1 **Time** taken is less M2 (particles) have more energy M3 (particles) move faster M4 More collisions (of particles) occur per second / per unit time M5 More (of the) particles / collisions have energy greater than activation energy **or** More (of the) particles / collisions have sufficient energy to react **or** A greater percentage / proportion / fraction of collisions (of particles) are successful	**5**

Question	Answer	Marks
5(a)	C_4H_6 Propyne	**2**
5(b)	M1 one shared pair between each H and C M2 three shared pairs of electrons between the C atoms and no other unpaired electrons	**2**
5(c)(i)	Any two from: same or similar chemical properties (contain) the same functional group (show) a trend or gradual change in physical properties (consecutive) members differ by CH_2 common methods of preparation	**2**

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Question	Answer	Marks
5(c)(ii)	C_nH_{2n-2}	**1**
5(d)	M1 Bromine water **or** aqueous bromine M2 Changes to colourless **or** decolourises	**2**
5(e)(i)	M1 Acidified; M2 (Potassium) manganate (VII)	**2**
5(e)(ii)	Diagram of ethanoic acid	**1**
5(f)(i)	M1 Methyl propanoate M2 Diagram of methyl propanoate	**2**
5(f)(ii)	Any four carbon ester not named in **5(f)(i)**	
5(g)(i)	Condensation	**1**
5(g)(ii)	Terylene	**1**

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