

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the May/June 2015 series

9701 CHEMISTRY

9701/22

Paper 2 (Structured Questions AS Core),
maximum raw mark 60

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 May/June 2015 series for most Cambridge IGCSE[®], Cambridge International A and AS Level components and some Cambridge O Level components.

® IGCSE is the registered trademark of Cambridge International Examinations.



CAMBRIDGE
International Examinations

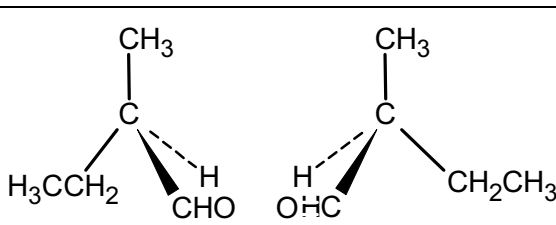
Page 2	Mark Scheme	Syllabus	Paper
	Cambridge International AS/A Level – May/June 2015	9701	22

Question	Mark Scheme	Mark	Total												
1 (a)	<table><tr><td>name of particle</td><td>relative mass</td><td>relative charge</td></tr><tr><td>proton</td><td>1</td><td>+1</td></tr><tr><td>electron</td><td>1/1836</td><td>-1</td></tr><tr><td>neutron</td><td>1</td><td>0</td></tr></table>	name of particle	relative mass	relative charge	proton	1	+1	electron	1/1836	-1	neutron	1	0	[1]	[3]
	name of particle	relative mass	relative charge												
	proton	1	+1												
	electron	1/1836	-1												
neutron	1	0													
		[1]													
		[1]													
(b) (i)	Mass of an atom(s) relative to 1/12 th (the mass) of (an atom of) carbon-12 OR relative to carbon-12 which is (exactly) 12	[1] [1]	[2]												
(ii)	% of third isotope = 10 $\frac{(24 \times 79) + (26 \times 11.0) + 10x}{100} = 24.3$ 10x = 248 x = 24.8 (3s.f.)	[1] [1] [1]	[3]												
(c) (i)	anode $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$ cathode $\text{Mg}^{2+} + 2\text{e}^- \rightarrow \text{Mg}$	[1] [1]	[2]												
(ii)	<table><tr><td>Mg</td><td>O</td><td>H</td><td>Cl</td></tr><tr><td>31.65</td><td>20.84</td><td>1.31</td><td>46.2</td></tr><tr><td>24.3</td><td>16</td><td>1</td><td>35.5</td></tr></table> 1.30 1.30 1.31 1.30 = 1:1:1:1 MgOHCl	Mg	O	H	Cl	31.65	20.84	1.31	46.2	24.3	16	1	35.5	[1] [1]	[2]
Mg	O	H	Cl												
31.65	20.84	1.31	46.2												
24.3	16	1	35.5												
(d) (i)	Na ₂ O basic/alkaline; Al ₂ O ₃ amphoteric/acidic and basic; SO ₃ acidic Na ₂ O (giant) ionic AND SO ₃ (simple/molecular) covalent	[1] [1]	[2]												
(ii)	Na ₂ O + 2HCl → 2NaCl + H ₂ O Al ₂ O ₃ + 6HCl → 2AlCl ₃ + 3H ₂ O Al ₂ O ₃ + 2NaOH + 7H ₂ O → 2NaAl(OH) ₄ (H ₂ O) ₂ OR Al ₂ O ₃ + 2NaOH + 3H ₂ O → 2NaAl(OH) ₄ OR Al ₂ O ₃ + 2NaOH → 2NaAlO ₂ + H ₂ O OR Al ₂ O ₃ + 2OH ⁻ + 7H ₂ O → 2[Al(OH) ₄ (H ₂ O) ₂] ⁻ OR Al ₂ O ₃ + 2OH ⁻ + 3H ₂ O → 2[Al(OH) ₄] ⁻ OR Al ₂ O ₃ + 2OH ⁻ → 2AlO ₂ ⁻ + H ₂ O SO ₃ + NaOH → NaHSO ₄ OR SO ₃ + 2NaOH → Na ₂ SO ₄ + H ₂ O	[1] [1] [1] [1] [1]	[4]												

Page 3	Mark Scheme	Syllabus	Paper
	Cambridge International AS/A Level – May/June 2015	9701	22

Question	Mark Scheme	Mark	Total
			[18]
2 (a) (i)	$2\text{PbS} + 3\text{O}_2 \rightarrow 2\text{PbO} + 2\text{SO}_2$ reagents and formulae balancing	[1] [1]	[2]
(ii)	S (is oxidised) –2 to (+)4 O (is reduced) 0 to –2	[1] [1]	[2]
(b) (i)	T = 400 – 600 °C (chosen as a compromise because) High T increases rate ora High T decreases yield / moves eqm left / makes less SO ₃ as forward reaction exothermic ora	[1] [1] [1]	[3]
(ii)	High pressure increases rate as collision frequency increases ora High pressure moves eqm right / favours forward reaction as more moles on left ora Uneconomic to use high pressures / high yield at low pressure	[1] [1] [1]	[3]
(c) (i)	Reaction (too) exothermic / acid spray produced	[1]	[1]
(ii)	$\text{SO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{H}_2\text{S}_2\text{O}_7$ $\text{H}_2\text{S}_2\text{O}_7 + \text{H}_2\text{O} \rightarrow 2\text{H}_2\text{SO}_4$	[1] [1]	[2]
(d)	Preservative owtte antimicrobial / antioxidant / reducing agent	[1] [1]	[2]
(e) (i)	$12.35 \times 0.01 / 1000 = 1.235 \times 10^{-4}$	[1]	[1]
(ii)	$1.235 \times 10^{-4} \times 1000 / 50 = 2.47 \times 10^{-3}$	[1]	[1]
(iii)	$2.47 \times 10^{-3} \times 64.1 = 0.158327 \text{ g} = 158 \text{ (3 sf only)}$	[1]	[1]
			[18]
3 (a) (i)	Bond breaking = $\text{Cl-Cl} = 242$ $\text{C-H} = 410 = 652 \text{ kJ}$ Bond forming = $\text{C-Cl} = 340$ $\text{H-Cl} = 431 = 771 \text{ kJ}$ Enthalpy change = $652 - 771 = -119$	[1] [1] [1]	[3]
(ii)	UV / High T / sunlight	[1]	[1]

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge International AS/A Level – May/June 2015	9701	22

Question	Mark Scheme	Mark	Total
(iii)	Initiation $\text{Cl}_2 \rightarrow 2\text{Cl}\cdot$ Propagation $\text{C}_2\text{H}_6 + \text{Cl}\cdot \rightarrow \cdot\text{C}_2\text{H}_5 + \text{HCl}$ $\cdot\text{C}_2\text{H}_5 + \text{Cl}_2 \rightarrow \text{C}_2\text{H}_5\text{Cl} + \text{Cl}\cdot$ Termination $\cdot\text{C}_2\text{H}_5 + \cdot\text{C}_2\text{H}_5 \rightarrow \text{C}_4\text{H}_{10}$ All three names correctly assigned	[1] [1] [1] [1] [1]	[5]
(b) (i)	ethene	[1]	[1]
(ii)	KOH/NaOH ethanolic AND heat/reflux	[1] [1]	[2]
(iii)	H_2 AND Pt or Ni (catalyst)	[1]	[1]
			[13]
4 (a) (i)	A = $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CHO}$ B = $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CHO}$ C = $(\text{CH}_3)_2\text{CHCH}_2\text{CHO}$ D = $(\text{CH}_3)_3\text{CCHO}$	[1] [1] [1] [1]	[4]
(ii)		[1+1]	[2]
(b) (i)	Fehling's/Benedict's OR Tollens' OR dichromate OR manganate Warm/heat Fehling's/Benedict's =(Brick)-red ppt Tollens' = silver/mirror OR grey/black precipitate Dichromate = orange to green Manganate = purple to colourless	[1] [1] [1]	[3]
(ii)	(2,4-)DNP(H)/Brady's reagent Orange/yellow/red-orange/yellow-orange ppt	[1] [1]	[2]
			[11]