

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the May/June 2015 series

9701 CHEMISTRY

9701/23

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

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

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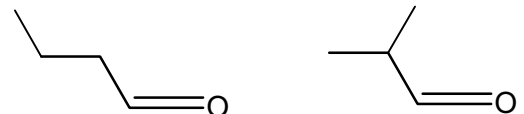
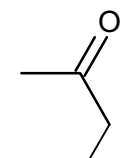
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Page 2	Mark Scheme	Syllabus	Paper
	Cambridge International AS/A Level – May/June 2015	9701	23

Question	Mark Scheme	Mark	Total
1 (a)	$(1s^2)2s^22p^6$	[1]	[1]
(b) (i)	The amount of energy required/energy change when one electron is removed from each atom in one mol of gaseous atoms	[1] [1] [1]	[3]
(ii)	Greater nuclear charge/number of protons Same shielding/number of shells/energy level	[1] [1]	[2]
(c) (i)	mean/average mass of the isotopes/an atom(s) relative to 1/12 of the mass of an atom of ^{12}C /on a scale where an atom of ^{12}C is (exactly) 12	[1] [1]	[2]
(ii)	$20.2 = \frac{(20 \times 90.48) + (21 \times 0.27) + (9.25y)}{100}$ $\frac{2020 - 1815.27}{9.25} = 22.133$ $y = 22$	[1] [1]	[2]
(d) (i)	$pV = \frac{mRT}{M_r}$ $M_r = \frac{mRT}{pV} = \frac{0.275 \times 8.31 \times 298}{100 \times 10^3 \times 200 \times 10^{-6}}$ $M_r = 34.05/34.1$	[1] [1]	[2]
(ii)	(Let % Ne = x so % Ar = 100-x) $\frac{20.2x + 39.9(100 - x)}{100} = 34.05$ % Ne = 29.7	[1]	[1]
1 (e) (i)	Van der Waal's/London/dispersion Uneven electron distribution/temporary dipole Induced dipole-dipole attraction	[1] [1] [1]	[3]
(ii)	more electrons more polarisable/greater attraction/stronger IMFs	[1] [1]	[2]
			[18]

Page 3	Mark Scheme	Syllabus	Paper
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Question	Mark Scheme	Mark	Total
2	(a) (i) Reactivity increases down the group OR reference to observations that indicate trend Outer electrons lost more easily down group Due to increased distance/shielding of outer electrons from nucleus	[1] [1] [1]	[3]
	(ii) $\text{Mg} + 2\text{H}_2\text{O} \rightarrow \text{Mg}(\text{OH})_2 + \text{H}_2$	[1]	[1]
	(iii) Magnesium hydroxide sparingly soluble/insoluble	[1]	[1]
	(iv) $\text{Mg} + \text{H}_2\text{O} \rightarrow \text{MgO} + \text{H}_2$	[1]	[1]
	(b) (i) $\text{MgO} + 2\text{HNO}_3 \rightarrow \text{Mg}(\text{NO}_3)_2 + \text{H}_2\text{O}$	[1]	[1]
	(ii) (thermal stability) increases down the group	[1]	[1]
	(iii) $2\text{Mg}(\text{NO}_3)_2 \rightarrow 2\text{MgO} + 4\text{NO}_2 + \text{O}_2$	[1]	[1]
	(iv) N from (+)5 to (+)3 O from -2 to 0 N is reduced and O is oxidised	[1] [1] [1]	[3]
	(c) (Very) strong electrostatic attraction/ionic bond High charge (density) of cation and anion/ Mg^{2+} and O^{2-}	[1] [1]	[2]
	(d) (i) $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2$	[1] [1]	[2]
	(ii) $2\text{H}^+ + \text{CO}_3^{2-} \rightarrow \text{CO}_2 + \text{H}_2\text{O}$	[1]	[1]
	(iii) $1 \times 10^{-4} \times 8000 = 0.8 \text{ mol H}^+$ $\frac{0.8}{2} \times 100.1 = \text{mass CaCO}_3 = 40 \text{ g}$	[1] [1]	[2]
			[19]
3	(a) (i) A/B =  C = 	[1] [1] [1]	[3]
	(ii) Chain	[1]	[1]
	(iii) Silver mirror/ppt/solid (black/grey)	[1]	[1]

Page 4	Mark Scheme	Syllabus	Paper
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Question	Mark Scheme	Mark	Total
(b) (i)	D $\text{CH}_2=\text{C}(\text{CH}_3)\text{CH}_2\text{OH}$	[1]	
	E $\begin{array}{c} \text{H}_3\text{C} \quad \text{H} \\ \diagdown \quad \diagup \\ \text{C}=\text{C} \\ \diagup \quad \diagdown \\ \text{H} \quad \text{CH}_2\text{OH} \end{array}$ trans OR <i>E</i>	[1+1]	
	E $\begin{array}{c} \text{H}_3\text{C} \quad \text{CH}_2\text{OH} \\ \diagdown \quad \diagup \\ \text{C}=\text{C} \\ \diagup \quad \diagdown \\ \text{H} \quad \text{H} \end{array}$ cis OR <i>Z</i>	[1]	
	F $\text{H}_2\text{C}=\text{CHCH}_2\text{CH}_2\text{OH}$	[1]	
(ii)	Hydrogen	[1]	[5]
(c) (i)	$\text{C}_3\text{H}_6\text{O} + [\text{O}] \rightarrow \text{C}_3\text{H}_6\text{O}_2$	[1]	[1]
(ii)	$\text{C}_3\text{H}_6\text{O} + 2[\text{H}] \rightarrow \text{C}_3\text{H}_8\text{O}$	[1]	[1]
			[13]
4 (a) (i)	$\begin{array}{c} \text{H}_3\text{C} \quad \text{CH}_2\text{OH} \\ \quad \\ \text{H}_3\text{C}-\text{C}-\text{C}-\text{CH}_3 \\ \quad \\ \text{HO} \quad \text{OH} \end{array}$	[1]	[1]
(ii)	$\begin{array}{c} \text{CH}_3 \\ \\ \text{H}_3\text{C}-\text{C}=\text{O} \end{array}$	[1]	
	$\begin{array}{c} \text{COOH} \\ \\ \text{O}=\text{C} \\ \\ \text{CH}_3 \end{array}$	[1]	

Page 5	Mark Scheme	Syllabus	Paper
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Question	Mark Scheme	Mark	Total
(b) (i)	M1 = 2 curly arrows M2 = intermediate ion M3 = Br with -ve charge, lone pair and curly arrow to C+	[1] [1] [1]	[3]
(ii)	dipole is <u>induced</u> by proximity to C=C	[1]	[1]
(iii)	Optical	[1]	[1]
(iv)		[1+1]	[2]
			[10]