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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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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]

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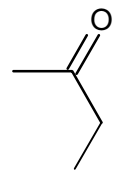
Question	Mark Scheme	Mark	Total
2 (a) (i)	Reactivity increases down the group **OR** reference to observations that indicate trend Outer electrons lost more easily down group Due to increased distance/shielding of outer electrons from nucleus	[1] [1] [1]	[3]
(ii)	$Mg + 2H_2O \rightarrow Mg(OH)_2 + H_2$	[1]	[1]
(iii)	Magnesium hydroxide sparingly soluble/insoluble	[1]	[1]
(iv)	$Mg + H_2O \rightarrow MgO + H_2$	[1]	[1]
(b) (i)	$MgO + 2HNO_3 \rightarrow Mg(NO_3)_2 + H_2O$	[1]	[1]
(ii)	(thermal stability) increases down the group	[1]	[1]
(iii)	$2Mg(NO_3)_2 \rightarrow 2MgO + 4NO_2 + O_2$	[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)	$CaCO_3 \rightarrow CaO + CO_2$ $CaO + H_2O \rightarrow Ca(OH)_2$	[1] [1]	[2]
(ii)	$2H^+ + CO_3^{2-} \rightarrow CO_2 + H_2O$	[1]	[1]
(iii)	$1 \times 10^{-4} \times 8000 = 0.8$ mol H^+ $\frac{0.8}{2} \times 100.1 =$ mass $CaCO_3 = 40$ 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]

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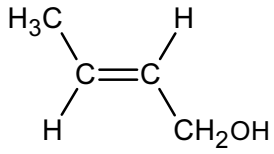
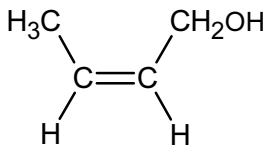
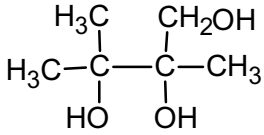
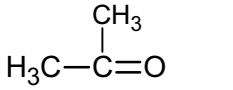
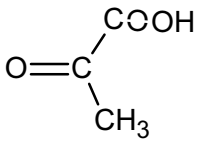
Question	Mark Scheme	Mark	Total
(b) (i)	**D** $CH_2=C(CH_3)CH_2OH$ **E**  trans **OR** *E* **E**  cis **OR** *Z* **F** $H_2C=CHCH_2CH_2OH$	[1] [1+1] [1] [1]	[5]
(ii)	Hydrogen	[1]	[1]
(c) (i)	$C_3H_6O + [O] \rightarrow C_3H_6O_2$	[1]	[1]
(ii)	$C_3H_6O + 2[H] \rightarrow C_3H_8O$	[1]	[1]
			[13]
4 (a) (i)		[1]	[1]
(ii)	 	[1] [1]	[2]

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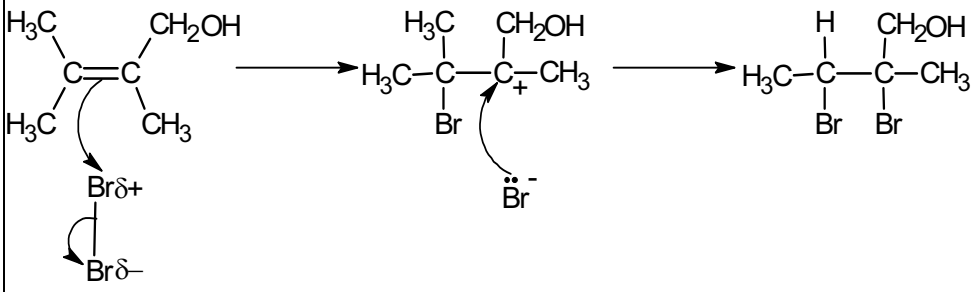
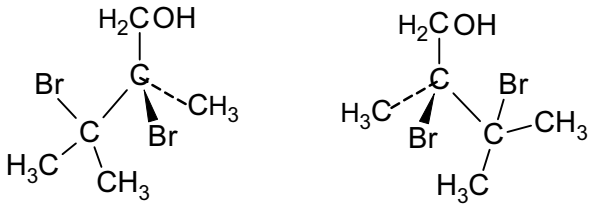
Question	Mark Scheme	Mark	Total
(b) (i)	 M1 = 2 curly arrows M2 = intermediate ion M3 = Br with –ve charge, lone pair and curly arrow to C+	[1] [1] [1]	[3]
(ii)	dipole is <u>induced</u> by proximity to C=C	[1]	[1]
(iii)	Optical	[1]	[1]
(iv)		[1+1]	[2]
			[10]

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