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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Qι	uestion	Mark Scheme	Mark	Total
1	(a)	(1s ²)2s ² 2p ⁶	[1]	[1]
	(b) (i	The amount of energy required/energy change when one electron is removed	[1]	
		from each atom in one mol of gaseous atoms	[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)	$20.2 = \frac{(20 \times 90.48) + (21 \times 0.27) + (9.25y)}{100}$	[1]	
		$\frac{2020 - 1815.27}{9.25} = 22.133$		
		y = 22	[1]	[2]
	(d) (i)	$pV = \frac{mRT}{M_r}$		
		$M_r = \frac{mRT}{pV} = \frac{0.275 \times 8.31 \times 298}{100 \times 10^3 \times 200 \times 10^{-6}}$	[1]	
		$M_r = 34.05/34.1$	[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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Ques	stion	Mark Scheme	Mark	Total
2 ((a) (i)	Reactivity increases down the group OR reference to observations that indicate trend	[1]	
		Outer electrons lost more easily down group Due to increased distance/shielding of outer electrons from nucleus	[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)	$2H^{+} + CO_{3}^{2-} \rightarrow CO_{2} + H_{2}O$	[1]	[1]
	(iii)	$1 \times 10^{-4} \times 8000 = 0.8 \text{mol}\text{H}^{+}$	[1]	
		$\frac{0.8}{2}$ × 100.1 = mass CaCO ₃ = 40 g	[1]	[2]
				[19]
3 ((a) (i)	A/B =	[1]	
			[1]	
		C =O	[4]	
			[1]	[3]
	(ii)	Chain	[1]	[1]
	(iii)	Silver mirror/ppt/solid (black/grey)	[1]	[1]

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Questic	on	Ма	rk Scheme	Mark	Total
(b)	(i)	D CH ₂ =C(CH ₃)CH ₂ OH		[1]	
		E	E		
		H₃C H	H₃C CH₂OH	[1+1]	
		С=С Н СН ₂ ОН	н н н	[1]	
		trans OR <i>E</i>	cis OR Z	[1]	
		F			
		H ₂ C=CHCH ₂ CH ₂ OH			[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)	${ m H_3C} { m CH_2OH} { m H_3C-C-C-CH_3} { m HO} { m OH}$		[1]	[1]
	(ii)	CH ₃ H ₃ C—C=O		[1]	
		н ₃ с—с=0 соон о=с сн ₃		[1]	[2]

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Question	Mark Scheme	Mark	Total
(b) (i)	H ₃ C CH ₂ OH H ₃ C CH ₂ OH H CH ₂ OH H ₃ C CH ₃ Br Br Br 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 induced by proximity to C=C	[1]	[1]
(iii)	Optical	[1]	[1]
(iv)	H ₂ COH H ₂ COH H ₂ COH C Br C C Br H ₃ C C H ₃ C H ₃ C H ₃ C	[1+1]	[2]
			[10]