

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the October/November 2014 series**9701 CHEMISTRY****9701/23**

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

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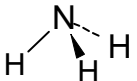
Page 2	Mark Scheme	Syllabus	Paper
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Question	Mark Scheme	Marks	Total
1 (a) (i)	increasing distance of (outer/highest energy) electron(s) from nucleus OR increasing distance of outer/valence shell from nucleus	1	[3]
	increased shielding / screening (from inner shells)	1	
	reduces attraction	1	
(ii)	increasing cation charge / effective nuclear charge OR decreasing number of electrons compared with protons	1	[2]
	increase in attraction	1	
(b)	(boiling point) increases (down the group)	1	[4]
	increasing number of electrons (in molecules) down group	1	
	increasing strength of / more van der Waals' forces (allow correct alternatives to van der Waals' forces)	1	
	so more energy needed to overcome (the forces)	1	
(c) (i)	$\begin{array}{cc} \text{F} & \text{I} \\ \frac{42.8}{19} & \frac{57.2}{127} \\ \hline \frac{2.253}{0.450} & \frac{0.450}{0.450} \end{array}$	1	[3]
	5 1 / IF ₅	1	
	EF = MF or IF ₅ = 222	1	

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(ii)	 <p>(Yes) as electronegativities are different</p>	1	
(d) (i)	<p>W = NaClO; X = NaClO₃; Y = HCl; Z = AgCl</p>	1 1 1 1	[4]
(ii)	<p>$3\text{Cl}_2 + 6\text{NaOH} \rightarrow 5\text{NaCl} + \text{NaClO}_3 + 3\text{H}_2\text{O}$ M1: correct species M2: balanced equation</p>	1 1	[2]
(iii)	<p>0 to –1 (0 to) +5</p>	1 1	[2]
(iv)	<p>$\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s})$</p>		[1]
			[23]

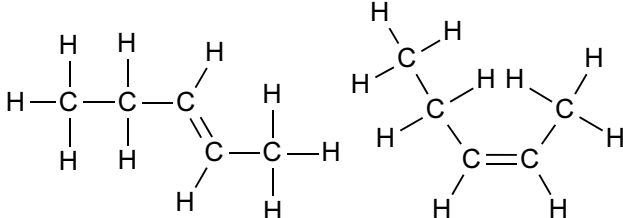
Page 4	Mark Scheme	Syllabus	Paper
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Question	Mark Scheme	Marks	Total
2 (a)	$\text{CH}_4 + \text{H}_2\text{O} \rightarrow \text{CO} + 3\text{H}_2$	1	[1]
(b)	<p>Label on graph indicating catalysed and uncatalysed E_a OR statement E_a catalysed is lower (than E_a uncatalysed) owtte</p> <p>Reference to catalyst creating alternative mechanism / reaction pathway / route</p> <p>Idea that more molecules have sufficient energy (to react)</p> <p>so greater chance / frequency of <u>successful</u> collisions</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	[4]
(c)	 <p>angle = 107° shape = (trigonal) pyramid(al)</p>	<p>1</p> <p>1</p> <p>1</p>	[3]
(d) (i)	<p>Advantage = higher rate Greater Kinetic Energy / speed / collision frequency / proportion of successful collisions</p> <p>Disadvantage – reduced yield / less product / more reactants</p> <p>(Forward reaction) exothermic AND (hence in accordance with Le Chatelier's Principle) equilibrium / reaction shifts left (to counteract increasing temp) ora</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	[4]
(ii)	$K_p = \frac{p\text{NH}_3^4}{p\text{N}_2 \times p\text{H}_2^3}$	1	[1]

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(iii)	$\begin{array}{ccc} \text{N}_2(\text{g}) + & 3\text{H}_2(\text{g}) \rightleftharpoons & 2\text{NH}_3(\text{g}) \\ 2 & 3 & 0 \\ (-0.8) & (-1.6 \times 3/2) & \\ \underline{1.2} & \underline{0.6} & 1.60 \end{array}$	1	
	$\begin{aligned} x\text{NH}_3 &= 1.6/3.4 (= 0.471) \\ x\text{N}_2 &= 1.2/3.4 (= 0.353) \\ x\text{H}_2 &= 0.6/3.4 (= 0.176) \end{aligned}$	1	
	$K_p = \frac{0.471^2 \times (2 \times 10^7)^2}{0.353 \times 2 \times 10^7 \times 0.176^3 \times (2 \times 10^7)^3} = 2.88 \times 10^{-13} \text{ Pa}^{-2}$	1+1	[5]
			[18]

Page 6	Mark Scheme	Syllabus	Paper
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Question	Mark Scheme	Marks	Total
3 (a)	P: $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}=\text{CH}_2$ Q: $\text{CH}_3\text{CH}_2\text{CH}=\text{CHCH}_3$ R: $\text{CH}_3\text{CH}_2\text{C}(\text{CH}_3)=\text{CH}_2$ S: $\text{CH}_3\text{CH}=\text{C}(\text{CH}_3)_2$ T: $\text{CH}_3\text{CH}_2\text{COCH}_3$	1 1 1 1 1	[5]
(b) (i)	(Different molecules with the) same (molecular and) structural formula different arrangements of <u>atoms</u> (in space)	1 1	 [2]
(ii)	 <p>trans-pent-2-ene cis-pent-2-ene</p>	1 1	 [2]
(c)	butan-2-ol	1	[1]
			[10]

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Question	Mark Scheme	Marks	Total
4 (a)	reagent = <u>conc</u> H ₂ SO ₄ or <u>conc</u> H ₃ PO ₄	1	
	conditions = heat	1	
	OR pass vapour over hot Al ₂ O ₃ "reagent" "conditions"		[2]
(b) (i)	C ₃ H ₇ OH + 2[O] → C ₂ H ₅ CO ₂ H + H ₂ O	1	[1]
(ii)	reagent = sodium / potassium dichromate or correct formula	1	[2]
	conditions = H ⁺ / acidified and (heat under) reflux	1	
(c)	U = CH ₃ CH(OH)CH ₃ OR U = CH ₃ CH ₂ CH ₂ OH	1	[2]
	V = CH ₃ CHBrCH ₃ V = CH ₃ CH ₂ CH ₂ Br	1	
(d)	reagent = KOH / NaOH	1	[2]
	conditions = ethanol / alcohol AND Heat / reflux	1	
			[9]