

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

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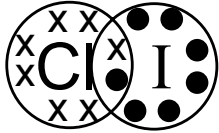
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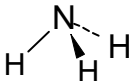
Page 2	Mark Scheme	Syllabus	Paper
	Cambridge International AS/A Level – October/November 2014	9701	23

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)	<table style="margin-left: 20px;"> <tr> <td style="padding-right: 20px;">F</td> <td>I</td> </tr> <tr> <td style="padding-right: 20px;">$\frac{42.8}{19}$</td> <td>$\frac{57.2}{127}$</td> </tr> </table>	F	I	$\frac{42.8}{19}$	$\frac{57.2}{127}$	1	[3]
	F	I					
	$\frac{42.8}{19}$	$\frac{57.2}{127}$					
	<table style="margin-left: 20px;"> <tr> <td style="padding-right: 20px;">$\frac{2.253}{0.450}$</td> <td>$\frac{0.450}{0.450}$</td> </tr> </table>	$\frac{2.253}{0.450}$	$\frac{0.450}{0.450}$				
$\frac{2.253}{0.450}$	$\frac{0.450}{0.450}$						
5 1 / IF ₅							
EF = MF or IF ₅ = 222							

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(ii)	 <p>(Yes) as electronegativities are different</p>	1	
		1	[2]
(d) (i)	W = NaClO; X = NaClO ₃ ; Y = HCl; Z = AgCl	1 1 1 1	[4]
(ii)	$3Cl_2 + 6NaOH \rightarrow 5NaCl + NaClO_3 + 3H_2O$ M1: correct species M2: balanced equation	1 1	[2]
(iii)	0 to -1 (0 to) +5	1 1	[2]
(iv)	$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$		[1]
			[23]

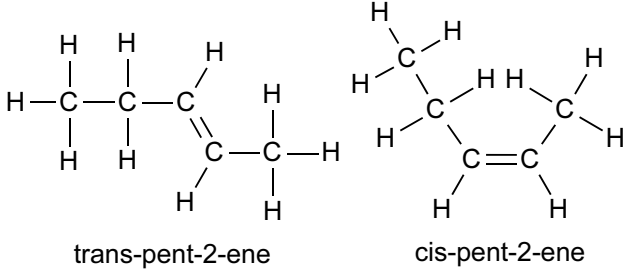
Page 4	Mark Scheme	Syllabus	Paper
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Question	Mark Scheme	Marks	Total
2 (a)	$\text{CH}_4 + \text{H}_2\text{O} \rightarrow \text{CO} + 3\text{H}_2$	1	[1]
(b)	Label on graph indicating catalysed and uncatalysed E_a OR statement E_a catalysed is lower (than E_a uncatalysed) owtte Reference to catalyst creating alternative mechanism / reaction pathway / route Idea that more molecules have sufficient energy (to react) so greater chance / frequency of <u>successful</u> collisions	1 1 1 1	[4]
(c)	 angle = 107° shape = (trigonal) pyramid(al)	1 1 1	[3]
(d) (i)	Advantage = higher rate Greater Kinetic Energy / speed / collision frequency / proportion of successful collisions Disadvantage – reduced yield / less product / more reactants (Forward reaction) exothermic AND (hence in accordance with Le Chatelier's Principle) equilibrium / reaction shifts left (to counteract increasing temp) ora	1 1 1 1	[4]
(ii)	$K_p = \frac{p\text{NH}_3^2}{p\text{N}_2 \times p\text{H}_2^3}$	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	
	$\begin{array}{l} x\text{NH}_3 = 1.6/3.4 (= 0.471) \\ x\text{N}_2 = 1.2/3.4 (= 0.353) \\ x\text{H}_2 = 0.6/3.4 (= 0.176) \end{array}$	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]

Page 7	Mark Scheme	Syllabus	Paper
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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 conditions = heat OR pass vapour over hot Al ₂ O ₃ “reagent” “conditions”	1 1	[2]
(b) (i)	$C_3H_7OH + 2[O] \rightarrow C_2H_5CO_2H + H_2O$	1	[1]
(ii)	reagent = sodium / potassium dichromate or correct formula conditions = H ⁺ / acidified and (heat under) reflux	1 1	[2]
(c)	U = CH ₃ CH(OH)CH ₃ OR U = CH ₃ CH ₂ CH ₂ OH V = CH ₃ CHBrCH ₃ V = CH ₃ CH ₂ CH ₂ Br	1 1	[2]
(d)	reagent = KOH / NaOH conditions = ethanol / alcohol AND Heat / reflux	1 1	[2]
			[9]