

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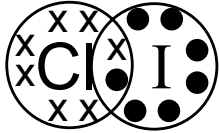
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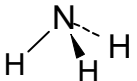
<b>Page 2</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>Cambridge International AS/A Level – October/November 2014</b>	<b>9701</b>	<b>23</b>

Question	Mark Scheme	Marks	Total				
<b>1 (a) (i)</b>	increasing <b>distance</b> of (outer/highest energy) electron(s) from nucleus OR increasing distance of outer/valence shell from nucleus	1	[3]				
	increased <b>shielding</b> / screening (from inner shells)	1					
	reduces <b>attraction</b>	1					
<b>(ii)</b>	increasing cation charge / effective nuclear charge OR decreasing number of electrons compared with protons	1	[2]				
	increase in attraction	1					
<b>(b)</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					
<b>(c) (i)</b>	<table style="margin-left: 20px;"> <tr> <td style="padding-right: 20px;">F</td> <td>I</td> </tr> <tr> <td style="padding-right: 20px;"><math>\frac{42.8}{19}</math></td> <td><math>\frac{57.2}{127}</math></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;"><math>\frac{2.253}{0.450}</math></td> <td><math>\frac{0.450}{0.450}</math></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 <sub>5</sub>							
EF = MF or IF <sub>5</sub> = 222							

Page 3	Mark Scheme	Syllabus	Paper
	Cambridge International AS/A Level – October/November 2014	9701	23

(ii)	 <p>(Yes) as electronegativities are different</p>	1	
		1	[2]
(d) (i)	<b>W</b> = NaClO; <b>X</b> = NaClO <sub>3</sub> ; <b>Y</b> = HCl; <b>Z</b> = 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]

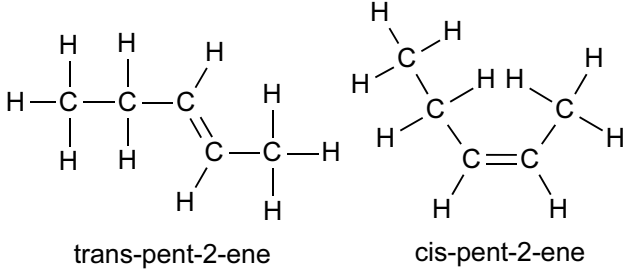
<b>Page 4</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>Cambridge International AS/A Level – October/November 2014</b>	<b>9701</b>	<b>23</b>

Question	Mark Scheme	Marks	Total
<b>2 (a)</b>	$\text{CH}_4 + \text{H}_2\text{O} \rightarrow \text{CO} + 3\text{H}_2$	1	[1]
<b>(b)</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]
<b>(c)</b>	 angle = $107^\circ$ shape = (trigonal) pyramid(al)	1  1 1	[3]
<b>(d) (i)</b>	Advantage = higher rate Greater Kinetic Energy / speed / collision frequency / proportion of successful collisions  Disadvantage – reduced yield / less product / more reactants  (Forward reaction) <b>exothermic AND</b> (hence in accordance with Le Chatelier's Principle) equilibrium / reaction <b>shifts left</b> (to counteract increasing temp) ora	1 1  1  1	[4]
<b>(ii)</b>	$K_p = \frac{p\text{NH}_3^4}{p\text{N}_2 \times p\text{H}_2^3}$	1	[1]

<b>Page 5</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>Cambridge International AS/A Level – October/November 2014</b>	<b>9701</b>	<b>23</b>

<b>(iii)</b>	$\begin{array}{ccc} \text{N}_2(\text{g}) + & 3\text{H}_2(\text{g}) \rightleftharpoons & 2\text{NH}_3(\text{g}) \\ 2 & 3 & 0 \\ (-0.8) & (-1.6 \times 3/2) & \\ \underline{1.2} & \underline{0.6} & 1.60 \end{array}$	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]
			<b>[18]</b>

<b>Page 6</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>Cambridge International AS/A Level – October/November 2014</b>	<b>9701</b>	<b>23</b>

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

