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

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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

Cambridge will not enter into discussions about these mark schemes.

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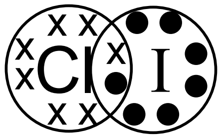
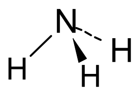
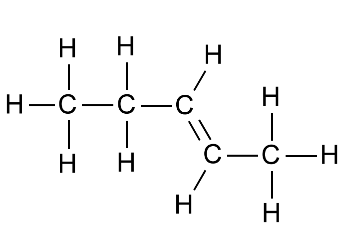
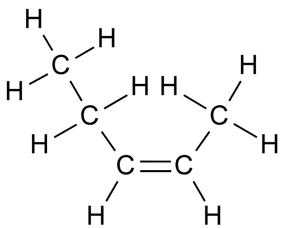
CAMBRIDGE
International Examinations

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	
	increased **shielding** / screening (from inner shells)	1	
	reduces **attraction**	1	[3]
(ii)	increasing cation charge / effective nuclear charge OR decreasing number of electrons compared with protons	1	
	increase in attraction	1	[2]
(b)	(boiling point) increases (down the group)	1	
	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	[4]
(c) (i)	F I $\frac{42.8}{19}$ $\frac{57.2}{127}$	1	
	$\frac{2.253}{0.450}$ $\frac{0.450}{0.450}$		
	5 1 / IF_5	1	
	EF = MF or IF_5= 222	1	[3]

(ii)	 (Yes) as electronegativities are different	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]

Question	Mark Scheme	Marks	Total
2 (a)	$CH_4 + H_2O \rightarrow CO + 3H_2$	1	[1]
(b)	Label on graph indicating catalysed and uncatalysed Ea OR statement Ea catalysed is lower (than Ea 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)	$K_p = \frac{pNH_3^{2}}{pN_2 \times pH_2^{3}}$	1	[1]

(iii)	$N_2(g)$ + $3H_2(g)$ ⇌ $2NH_3(g)$ 2 3 0 (–0.8) (–1.6×3/2) <u>1.2</u> <u>0.6</u> 1.60	1	
	xNH_3 = 1.6/3.4 (= 0.471) xN_2 = 1.2/3.4 (= 0.353) xH_2 = 0.6/3.4 (= 0.176)	1	
	$K_p = \dfrac{0.471^2 \times (2 \times 10^7)^2}{0.353 \times 2 \times 10^7 \times 0.176^3 \times (2 \times 10^7)^3} = 2.88 \times 10^{-13}\ Pa^{-2}$	1+1	[5]
			[18]

Question	Mark Scheme	Marks	Total
3 (a)	**P**: $CH_3CH_2CH_2CH{=}CH_2$ **Q**: $CH_3CH_2CH{=}CHCH_3$ **R**: $CH_3CH_2C(CH_3){=}CH_2$ **S**: $CH_3CH{=}C(CH_3)_2$ **T**: $CH_3CH_2COCH_3$	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)	 trans-pent-2-ene  cis-pent-2-ene	1 1	[2]
(c)	butan-2-ol	1	[1]
			[10]

Question	Mark Scheme	Marks	Total
4 (a)	reagent = <u>conc</u> H_2SO_4 **or** <u>conc</u> H_3PO_4	1	
	conditions = heat	1	
	OR pass **vapour** over hot Al_2O_3 "reagent" "conditions"		[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	1	
	conditions = H^+ / acidified and (heat under) reflux	1	[2]
(c)	**U** = $CH_3CH(OH)CH_3$ OR **U** = $CH_3CH_2CH_2OH$	1	
	V = $CH_3CHBrCH_3$ **V** = $CH_3CH_2CH_2Br$	1	[2]
(d)	reagent = KOH / NaOH	1	
	conditions = ethanol / alcohol AND Heat / reflux	1	[2]
			[9]