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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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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]

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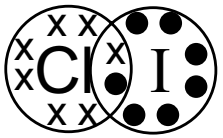
(ii)	 (Yes) as electronegativities are different	1 1	[2]
(d) (i)	**W** = NaC*l*O; **X** = NaC*l*O_3; **Y** = HC*l*; **Z** = AgC*l*	1 1 1 1	[4]
(ii)	$3Cl_2 + 6NaOH \rightarrow 5NaCl + NaClO_3 + 3H_2O$ M1: correct species M2: balanced equation	 1 1	[2]
(iii)	0 to –1 (0 to) +5	1 1	[2]
(iv)	$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$		[1]
			[23]

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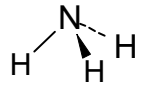
Question	Mark Scheme	Marks	Total
2 (a)	$CH_4 + H_2O \rightarrow CO + 3H_2$	1	[1]
(b)	Label on graph indicating catalysed and uncatalysed Ea OR statement Ea catalysed is lower (than Ea uncatalysed) owtte Reference to catalyst creating alternative mechanism / reaction pathway / route Idea that more molecules have sufficient energy (to react) so greater chance / frequency of successful 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]

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

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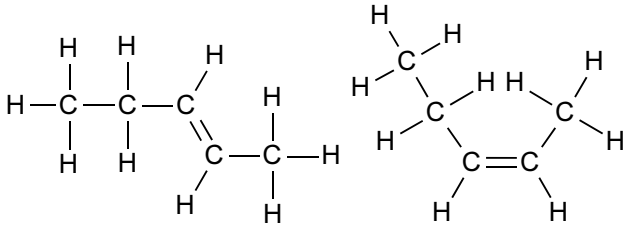
Question	Mark Scheme	Marks	Total
3 (a)	**P**: $CH_3CH_2CH_2CH=CH_2$ **Q**: $CH_3CH_2CH=CHCH_3$ **R**: $CH_3CH_2C(CH_3)=CH_2$ **S**: $CH_3CH=C(CH_3)_2$ **T**: $CH_3CH_2COCH_3$	1 1 1 1 1	[5]
(b) (i)	(Different molecules with the) same (molecular and) structural formula different arrangements of <u>atoms</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]

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Question	Mark Scheme	Marks	Total
4 (a)	reagent = conc H_2SO_4 **or** conc 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** = $CH_3CH_2CH_2OH$ **V** = $CH_3CHBrCH_3$ **V** = $CH_3CH_2CH_2Br$	1 1	[2]
(d)	reagent = KOH / NaOH	1	
	conditions = ethanol / alcohol AND Heat / reflux	1	[2]
			[9]

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