CAMBRIDGE
INTERNATIONAL EXAMINATIONS

NOVEMBER 2001

ADVANCED SUBSIDIARY LEVEL

MARK SCHEME

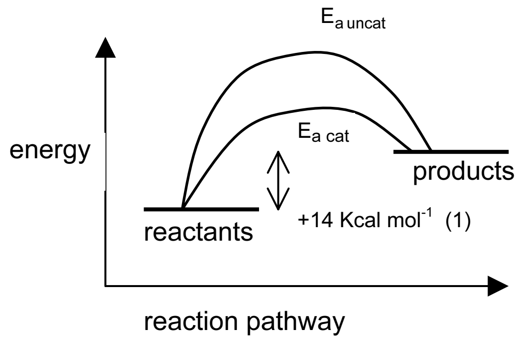
MAXIMUM MARK : 60

SYLLABUS/COMPONENT : 8701/2

CHEMISTRY
(Structured Questions)

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

Question Number	Mark Scheme Details	Part Mark
1 (a)	Mg $1s^2$ $2s^2$ $2p^6$ $3s^2$ Mg^{2+} $1s^2$ $2s^2$ $2p^6$ } (1)	
	O $1s^2$ $2s^2$ $2p^4$ O^{2-} $1s^2$ $2s^2$ $2p^6$ } (1)	[2]
(b) (i)	● ○ ● ○ ○ ● ○ ● ● ○ ● ○ ● is Mg^{2+} ○ is O^{2-} regular (1) cations surrounded by anions etc. (1)	[2]
(ii)	Two physical properties insulator ions unable to move high m.p./b.p. forces between doubly charged ions are strong insoluble in water conducts when molten (1) for each	[2]
(iii)	Furnace linings, electrical insulators, spark plugs, ceramics any two	[1]
(c) (i)	CO (1) and water vapour (1) [or from equations]	
(ii)	$CaO + H_2O \rightarrow Ca(OH)_2$ (1) $Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$ <u>OR</u> $CaO + CO_2 \rightarrow CaCO_3$ (1) max 3	[3]
	[Total:	**10]**

Question Number	Mark Scheme Details	Part Mark
2 (a) (i)	Rate of forward reaction is equal to rate of backward or equivalent. (1)	
(ii)	 activation energy mentioned (1) two E_a peaks (1) (1)	[5]
(b) (i)	$K_c = \dfrac{[ester][water]}{[acid][alcohol]}$ (1)	
(ii)	Since same number of terms in expression, top & bottom or equivalent (1)	[2]
(c) (i)	ethanol = ethanoic acid = 0.43 (1) ethyl ethanoate = 0.57 (1) water = 1.57 (1)	
(ii)	$K_c = \dfrac{0.57 \times 1.57}{0.43 \times 0.43} = 4.84$ (1) [marked consequentially from **(i)**]	[4]
	[Total:	**11]**

3 (a) red / brown liquid / vapour (1) **[1]**

(b) Stronger van der Waals' forces between molecules (1)
since bromine is a <u>bigger</u> molecule / more electrons than chlorine (1)
and has more induced dipoles on its surface (1) Max (2) **[2]**

(c) (i) $2P + 5Cl_2 \rightarrow 2PCl_5$ (1)

(ii) $PCl_5 + 4H_2O \rightarrow H_3PO_4 + 5HCl$ (1)

(iii) $NaCl + AgNO_3 \rightarrow AgCl\downarrow + NaNO_3$
<u>OR</u> $Cl^-_{(aq)} + Ag^+_{(aq)} \rightarrow AgCl_{(s)}$ (1)

(iv) $AgCl + 2NH_3 \rightarrow Ag(NH_3)_2{}^+{}_{(aq)} + Cl^-$ <u>OR</u> to $Ag(NH_3)_2Cl$ (1) **[4]**

(d) (i) $CH_2{=}CH_2 + Br_2 \rightarrow CH_2BrCH_2Br$ (1)

(ii) Electrophilic addition (1)

(iii) Electron-rich double bond attracts Br_2 which is then polarised

$CH_2{=}CH_2$ (1) $\longrightarrow Br^{\delta+}\!-\!Br^{\delta-}$ (1) intermediate $CH_2CH_2Br^+$ (1)

Final addition of Br^- **[5]**

[Total: 12]

4 (a)

N_2	zero	(1)	NO_2^-	+ 3	(1)
NH_4^+	- 3		NO_3^-	+ 5	

[2]

(b) (i) The triple bond (high energy) needs to be broken (1)

(ii) gives NH_4^+ directly / gives soluble N to soil (1) **[2]**

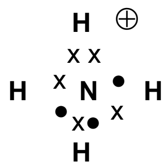
(c) (i) 6.3×10^{-9} mol dm^{-3} (1)

(ii) Since H^+ is a product, and this is removed (1)

(iii) lime / a base / ammonia (1) **[3]**

(d) Waterlogged soils will contain very little oxygen / will discourage nitrifying bacteria (1) **[1]**

(e) (i)



charge (1) To include dative bond

(ii) tetrahedral, 109 or $109\frac{1}{2}{}^{o}$ (1) **[2]**

[Total: max 10]

5 (a) (i) $CH_3(CH_2)_9CHBrCH_2Br$ (1)

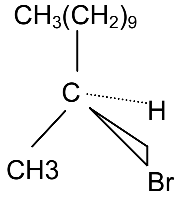
(ii) $CH_3(CH_2)_9CHBrCH_3$ (1)

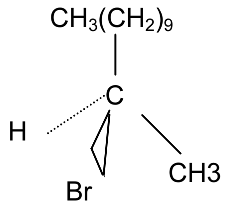
(iii) $CH_3(CH_2)_9CO_2H$ (1)

(iv) $CH_3(CH_2)_9CH(OH)CH_3$ (1) **[4]**

(b) (i) optical isomerism (1)

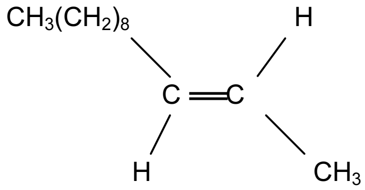
(ii)



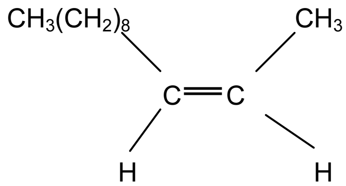


(1) each **[3]**

(c)



trans



cis

(1) each **[2]**

[Total: 9]

6 *A* Only alcohol — sodium (1) – bubbles of gas / H_2 (1)
<u>OR</u> PCl_5 (1) misty fumes (1)
<u>OR</u> carboxylic acid + catalyst (1) smell of ester (1) **[2]**

<u>Not</u> $H^+/Cr_2O_7^{2-}$ or H^+/MnO_4^-

B Only ketone — DNP reagent gives red precipitate (1)
does not give Tollens or Fehlings
<u>OR</u> $H^+/Cr_2O_7^{2-}$ tests (1) **[2]**

C alkene and aldehyde — decolourises Br_2 (water) (1)
red/brown ppt with Benedicts or Fehlings
<u>OR</u> Ag mirror – Tollens (1)
DNP test (1) if not used elsewhere **[2]**

D aldehyde only — DNP gives red ppt (1)
Benedicts/Tollens/Fehlings positive (1) **[2]**
(as *C*)

[Total: 8]