Name of the Student:_____
Max. Marks : 25 Marks **Time : 25 Minutes**

Mark Schemes

Q1.

(a) Amount of Nitrogen monoxide = 1.15 mol

Answers to min 2sf

1

Amount of Chlorine = 0.825 mol

1

(b)

$$K_c = \frac{[NOCl]^2}{[NO]^2[Cl_2]}$$

1

(c)

$$1.32 \times 10^{-2} = \frac{[NOCl]^2}{\left[\frac{0.85}{0.800}\right]^2 \left[\frac{0.458}{0.800}\right]}$$

M1 = divides mole quantities by 0.800

1

$[NOCl]^2 = 8.53 \times 10^{-3}$ mol^2dm^{-6}

M2 = evaluates $[NOCl]^2$

1

$[NOCl] = 0.0924$ mol dm^{-3}

M3 = $\sqrt{M2}$

1

n(NOCl) = 0.0924 x 0.800 = 0.0739 mol

M4 = M3 x 0.800 (allow ecf on an incorrect volume used in M1)

(answer to 2sf or more)

1

If no division in M1 then max 3
M2 = 4.37 x 10^{-3}
M3 = 0.0661 mol dm^{-3}
M4 = 0.0529 mol

If Kc upside down then can still score 4
M1 = divides mole quantities by 0.800
M2 = 48.96

Downloaded from www.merit-minds.com

M3 = 7.00 mol dm^{-3}
M4 = 0.600 mol

Incorrect rearrangement loses M2

[7]

Downloaded from www.merit-minds.com

Q2.

(a) **M1** EQM amount A = 0.25 – 0.015 = 0.235 mol

Allow 0.24 mol for M1

1

M2 EQM amount B = 0.25 – (2 x 0.015) = 0.22 mol

1

(b) **M1** $K_c = \frac{[C]}{[A][B]^2}$

1

M2 $\frac{\frac{0.02}{0.35}}{\frac{0.30}{0.35} \times \left(\frac{0.25}{0.35}\right)^2}$

Correct insertion of numbers and use of volume

Allow ecf from their K_c

Scores M1 here (even if volume not used)

1

M3 = 0.13

Kc = 1.067 if vol not used Max 3

Kc = 7.63 if expression upside down Max 3

1

M4 Units $mol^{-2}\ dm^6$

Allow answers using cm^3 and then the corresponding units i.e. 1.31 x $10^5\ mol^{-2}\ cm^6$

Allow conseq units to wrong K_c

1

(c) $[H_2O]$ / conc of water is (effectively) constant (because it it so much larger than the other concentrations)

1

(d) **M1** Initial amount $ClCH_2CHO = {}^{4.71}/_{78.5} = 0.06$ mol

Calculates initial mol

1

M2 EQM amount $ClCH_2CHO = (0.06 – x)$ mol

EQM amount $ClCH_2CH(OH)_2 = x$ mol

Sets up algebraic expressions for EQM mol of both

If no M2 can only score M3 and M5 conseq leads to 44.4 mol dm^{-3} via

$[ClCH_2CHO] = \frac{0.06}{0.05}$

1

M3 $37 = \frac{\frac{x}{V}}{\frac{(0.06-x)}{V}}$

Inserts into K

Does not need to show V as it cancels but allow expressions that do show V and subsequent calculations

1

Downloaded from www.merit-minds.com

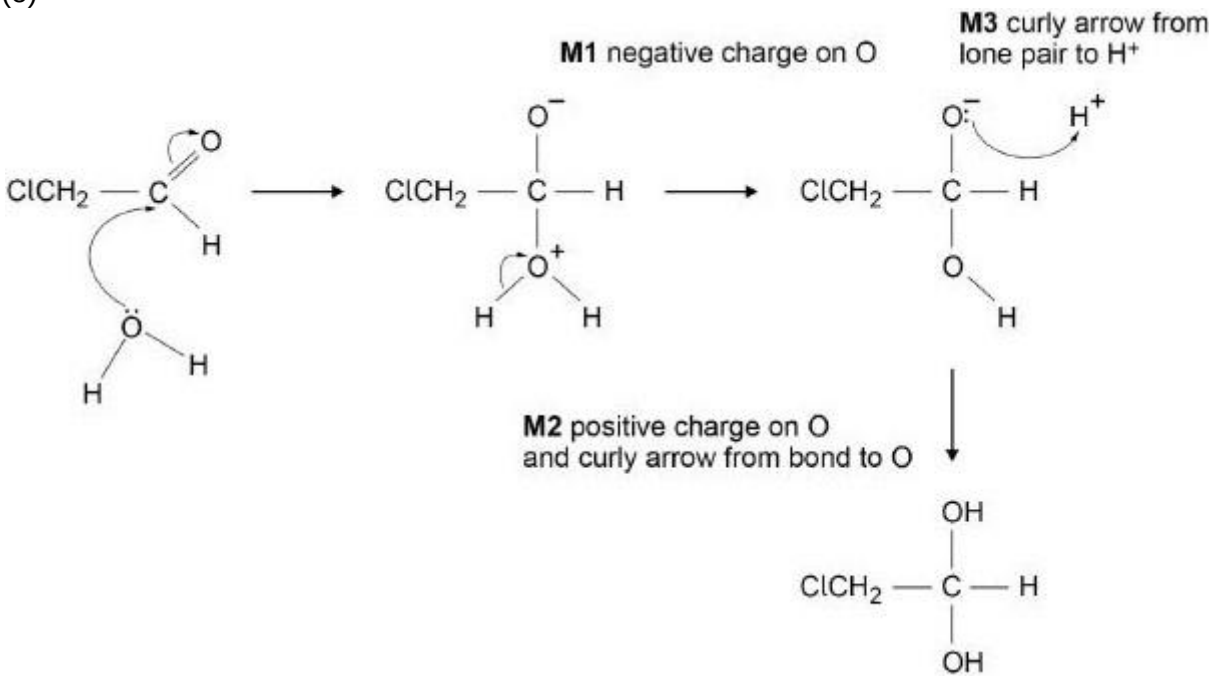
M4 $37(0.06 - x) = x$
$2.22 = 38x$
$x = 0.058421$
Solve for x

1

M5 $[ClCH_2CH(OH)_2] = \frac{0.058421}{0.05} = 1.17$ mol dm^{-3}
Calculate concentration

1

(e)



3

(f) **M1** C in C=O is less δ+ / less electron deficient
Allow converse
Ignore discussion in terms of C-Cl bond polarity

1

M2 Because CH_3 attached is electron donating Or

CH_3 has a (positive) inductive effect

1

M3 So higher E_a
*Allow for **M3** water less attracted to δ+C / electron deficient C / C in C=O*
(so lower collision frequency/ fewer collisions with correct orientation)

1

[18]

Downloaded from www.merit-minds.com