YR 11 Acid & Base Revision

1) MnO_4^- is a pink/purple species. At 273K the solution is only slightly pink meaning there is only a low concentration of MnO_4^- however as the temperature increases the colour intensifies signifying an increase in $[MnO_4^-]$ ∴ favouring the reverse reaction. This indicates that the reaction is exothermic as adding heat favours the reverse reaction.

$$\therefore \quad MnO_4^-(aq) + H_2O_2(aq) + 6H^+(aq) \rightleftharpoons 4H_2O(l) + Mn^{2+}(aq) + O_2(g) + \text{Heat}$$

2.) $\underset{\text{Base}}{NH_3} + H^+ \rightleftharpoons \underset{\text{acid}}{NH_4^+}$

$$pOH = pK_b + \log\left(\frac{\text{acid}}{\text{base}}\right)$$

$$pK_b = -\log(1.8 \times 10^{-5})$$

$$= 4.74$$

$$[NH_3] = 0.01M \qquad [NH_4^+] = 0.05$$

$$\therefore \quad pOH = 4.74 + \log\left(\frac{0.05}{0.01}\right)$$

$$= 5.44$$

$$pH = 14 - pOH$$

$$\therefore \quad pH = 14 - 5.44$$

$$pH = \underline{8.56}$$

3) A Bronsted/Lowry acid is a proton donator. (1 mk)

4) $\underset{\text{Acid}}{HSO_4^-} / \underset{\text{conjugate base}}{SO_4^{2-}}$

H_3O^+ / H_2O.

5) $pH = -\log(3.2 \times 10^{-4})$

$= 3.9$

6) $pOH = -\log(5.6 \times 10^{-3})$

$= 2.25$.

$pH = 14 - pOH$.

$= 14 - 2.25$

$= 11.75$.

7.) Molarity = moles/Litres.

moles $H^+ = 3.2 \times 10^{-4}$.

Vol = 0.1 L.

$\therefore M = \frac{3.2 \times 10^{-4}}{0.1}$

$= 3.2 \times 10^{-3} M$.

$pH = -\log[H^+]$

$= -\log(3.2 \times 10^{-3} M)$

$= 2.5$.

8) $[OH^-] = \frac{1.0 \times 10^{-9}}{0.5}$

$= 2.0 \times 10^{-9}$

$pOH = -\log(2.0 \times 10^{-9})$

$= 8.7$.

3) cont. $pH = 14 - pOH$.

$\therefore pH = 14 - 8.7$

$= \underline{\underline{5.3}}$

4)

$$PCl_{3(g)} \rightleftharpoons Cl_{2(g)} \rightleftharpoons PCl_{5(g)}$$

	PCl_3	Cl_2	PCl_5
INITIAL	2.0M	2.0M	0M
FINAL	$\frac{2.0M - 0.5M}{1.5M}$	$\frac{2.0M - 0.5M}{1.5M}$	0.5M

$$K_{eq} = \frac{[PCl_5]}{[PCl_3][Cl_2]}$$

$$= \frac{0.5}{(1.5)(1.5)}$$

$$= 2.22 \times 10^{-1}$$

b) The reverse reaction will be favoured as according to Le Chateliers Principle when a stress is applied to a dynamic equilibrium the position of equilibrium shifts to counteract the change and reestablish equilibrium. If volume is increased, pressure will be reduced so the side which would increase pressure will be favoured ie. the side with more gas molecules.

c) Keq will ~~remain~~ change as concentration on one side of reaction will increase and the other will decrease.

d) The reverse reaction will be favoured as this will counteract the change caused by adding PCl_5. ie. Some of the added PCl_5 will decompose to form PCl_3 and Cl_2 and reestablish equilibrium.

e) K_{eq} will remain unchanged as, though PCl_5 is added ~~some~~ will decompose and more PCl_3 and Cl_2 will form and ∴ K_{eq} will remain unchanged.

f) This is an endothermic reaction ($\Delta H = +ve$) ∴ the forward reaction would be favoured & more PCl_5 would be produced.

10) a) approx 10 min

b) $F_{2(g)}$ was added. This caused the COF_2 to be produced as the extra F_2 reacted with the remaining $CO_{(g)}$. This caused the $[CO_{(g)}]$ ~~to~~ to drop.

c) Since the product was favoured when temp was decreased this reaction is seen to be exothermic as the ~~reaction~~ position of equilibrium moves to favour an increase in temp.