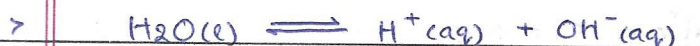


20 - Ionic EquilibriaQ-1)  $K_w$  - ionic product of water

$$K_w = [H^+][OH^-]$$

$$K_w = 1.00 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6} \text{ at } 298 \text{ K.}$$

In water,  $[H^+] = [OH^-]$ 

$$\therefore K_w = [H^+]^2$$

$$\therefore [H^+] = 1.00 \times 10^{-7} \text{ mol dm}^{-3}$$

Q-2) What is pH?

> pH is the negative logarithm to the base 10 of the hydrogen ion concentration.

$$pH = -\log_{10} [H^+]$$

$$\therefore [H^+] = 10^{-pH}$$

Q-3) Calculating pH of strong acids and strong bases.

**Strong acid:**

$[H^+]$  is same as [acid] since they are completely ionised.

$$pH = -\log_{10} [H^+]$$

**strong base:**

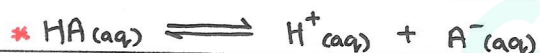
$[OH^-]$  is same as [alkali]

① use  $[H^+] = \frac{K_w}{[OH^-]}$  to find  $[H^+]$

② then use  $-\log_{10} [H^+]$

Q-4)  $K_a$  - acid dissociation constant.

>  $K_a$  is the equilibrium constant for the dissociation of weak acids.



$$K_a = \frac{[H^+][A^-]}{[HA]}$$

\* In the equation, the  $H^+$  arising from the ionisation of water (aq) are ignored.  $\therefore [H^+] = [A^-]$

\* We assume that ionisation of weak acid is v. small that  $[HA]$  at equilibrium is same as  $[HA]$  at start.

$$\therefore K_a = \frac{[H^+]^2}{[HA]}$$

$pK_a$  values can be used to compare strengths of weak acids

$$pK_a = -\log_{10} K_a$$

High value of  $K_a$  = STRONG ACID

Low value of  $pK_a$  = STRONG ACID.

\* Equilibrium constant  $K_c$

$$K_c = \frac{[C]^c [D]^d}{[A]^a [B]^b} \quad \text{if} \quad aA + bB \rightleftharpoons cC + dD$$





## 20 - Ionic Equilibria continued...

Q-5) Acid-base titrations.

\* Strong acid - strong base.

end point : 10.5 - 3.5.

\* Strong acid - weak base

end point : 7.5 - 3.5.

\* Weak acid - strong base

end point : 11 - 7.5

\* Weak acid - weak base

no indicator.

Q-6) What are buffer solutions?

> A buffer solution is a solution in which the pH does not change significantly when small amounts of acids or alkalis are added.



• equilibrium shift and large reserve of ions means the pH doesn't change significantly.

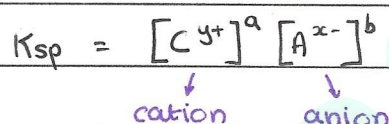
$$[\text{H}^+] = K_a \frac{[\text{acid}]}{[\text{salt}]}$$

OR

$$\text{pH} = \text{p}K_a + \log_{10} \frac{[\text{salt}]}{[\text{acid}]}$$

Q-7) What is solubility product?

- > Solubility product is the product of the concentrations of each ion in a saturated solution of a sparingly soluble salt at 298K, raised to the power of their relative concentrations.



Q-8) What is the common ion effect?

- > The common ion effect is the reduction in the solubility of a dissolved salt achieved by adding a solution of a compound which has an ion in common with the dissolved salt.

Q-9) What is partition co-efficient?

- > Partition co-efficient is the distribution of a solute in two immiscible solvents.

$$K_{pc} = \frac{[\text{organic top layer}]}{[\text{inorganic bottom layer}]}$$

\* see notebook for example.