Send# 32
B.Sc. II
Group-B



# Hydrolysis Constant ($K_h$)

General equation

$$BA + H_2O \rightleftharpoons BOH + HA$$

Applying Law of chemical equilibrium

$$\frac{[HA][BOH]}{[BA][H_2O]} = K \quad \text{(equilibrium Constant)}$$

Water present in large excess in solution so consider it as a Constant.

then,

$$\frac{[HA][BOH]}{[BA]} = K[H_2O] = K_h$$

$K_h$ is hydrolysis Constant

Step I : $K_h$ of salts of weak acid and strong base.

$$BA + H_2O \rightleftharpoons BOH + HA$$

(Salt) (Water) (strong base) (Weak acid)

or,

$$B^+ + A^- + H_2O \rightleftharpoons B^+ + OH^- + HA$$

or, $$A^- + H_2O \rightleftharpoons OH^- + HA$$

Means Anion hydrolysis

∴ hydrolysis constant ($K_h$)

$$K_h = \frac{[OH^-][HA]}{[A^-]} \quad \text{---- (i)}$$

For the weak acid (HA), the dissociation equilibrium is

$$HA \rightleftharpoons H^+ + A^-$$

∴ Dissociation constant ($K_a$) is

$$K_a = \frac{[H^+][A^-]}{[HA]} \quad \text{---- (ii)}$$

We Know,

Ionic product of water ($K_w$) is

$$K_w = [H^+][OH^-] \quad \text{---------} \quad (iii)$$

Multiplying eq$^n$. (i) with eq$^n$. (ii) and dividing by eq$^n$. (iii)

then.

$$\boxed{K_h = \frac{K_w}{K_a}} \quad \text{---------} \quad (iv)$$

Step II : $K_h$ of Salts of strong acid and weak base

$$BA + H_2O \rightleftharpoons BOH + HA$$

(Salt) (Water) (Weak base) (strong acid)

Means Cation hydrolysis

Hydrolysis Constant ($K_h$)

$$K_h = \frac{[BOH][H^+]}{[B^+]} \quad \text{---} \quad (i)$$

BOH weak base, the dissociation equilibrium is

$$BOH \rightleftharpoons B^+ + OH^-$$

∴ dissociation Constant ($K_b$) is

$$K_b = \frac{[B^+]\,[OH^-]}{[BOH]} \quad \text{---(ii)}$$

Ionic Product of Water

$$K_w = [H^+].[OH^-] \quad \text{---(iii)}$$

Multiplying eqn. (i) with eqn (ii) and dividing by eqn. (iii)

then,

$$\boxed{K_h = \frac{K_w}{K_b}} \quad \text{---(iv)}$$

Step III : $K_h$ of Salts of weak acid and weak base

$$\therefore \boxed{K_h = \frac{K_w}{K_a \cdot K_b}}$$