Ionic Eqlbm :- There are no. of Equilibria that involve ions.

Michael Faraday classified the substances into two categories :-

Electrolytes :- which conduct electricity in their aq. sol^n

Non-Electrolytes :- " donot " " " " .

Electrolytes < Strong → ionize completely in water Eg NaCl
Weak → partially dissociated E.g. CH_3COOH.

In case of weak electrolytes, Eqlbm is established between ions and unionized molecules. This type of Eqlbm involving ions in aq. sol^n is called **ionic eqlbm.**

⇒ Dissociation :- process of seperation of ions in water already existing as such in the solid state of the solute e.g NaCl.

⇒ Ionization :- process in which a neutral molecule splits into charged ions in the solution.

Chemical eqlbm involves dissociation of chemical compounds (solid, gaseous and phase eqlbm)

Ionic eqlbm: dissociation of weak acids and weak bases in aq. media, dissociation of sparingly soluble salts in aq. medium, dissociation of water etc...

Acids and Bases.

I) ARRHENIUS CONCEPT:-

Acid:- which gives hydrogen ion upon dissociation in water

E.g $HCl(g) + Water \rightleftharpoons H^+(aq) + Cl^-(aq)$

$CH_3COOH + water \rightleftharpoons H^+(aq) + CH_3COO^-(aq)$

Base:- which dissociates into hydroxyl ions when dissolved in water

E.g $Ca(OH)_2 + water \rightleftharpoons Ca^{+2}(aq) + 2OH^-(aq)$

⊛ The proton (H^+) is always hydrated as H_3O^+ ∴ we write $H^+(aq)$ as $H_5O_2^+$, $H_7O_3^+$, $H_9O_4^+$ and OH^- as $H_3O_2^-$, $H_5O_3^-$, $H_7O_4^-$

* Drawbacks :- . Only for aq. soln
. No explanat^n for Acidic character of CO_2
. " " . Basic " of NH_3 soln
. Why HCl + NH_3 is acidic
. Why $AlCl_3$, BF_3 acidic
" NH_3, Na_2CO_3 Basic

(*) ⇒ The high dielectric constant of water lowers the force of attraction between the oppositely charged ions and thus causes the dissociation of the electrolyte. (D.E const $\propto \frac{1}{\text{E.Static charge}}$)

⇒ Greater the number of H^+ or OH^- ions given by acid / base in water, greater the strength of the acid / base.

II) LOWRY AND BRÖNSTED

Acid :- Which has a tendency to donate a proton to any other substance

Base :- Which has a tendency to ~~donate~~ accept a proton from any other substance.

∴ Acid proton donor, Base proton acceptor.

$$\text{Acid} \rightleftharpoons H^+ + \text{Base}$$
(proton)

Conjugate Acids and Bases: (C.A and C.B)

$$\underset{\text{Acid}}{CH_3COOH} + \underset{\text{Base}}{H_2O} \rightleftharpoons \underset{\text{Acid}}{H_3O^+} + \underset{\text{Base}}{CH_3COO^-}$$

The pair of substances which can be formed from one

another by the gain or loss of a proton are known as conjugate acid - base pairs.

∴ AcH is conjugate Acid of Ac^-

Ac^- is " Base of AcH.

so $AcH - Ac^-$ is conjugate acid base pair

$NH_4^+ - NH_3$ " " " " "

Important conclusions :-

1) Weaker a base is, stronger the C.A.

Weaker an Acid is " " C.B.

2) Weak Acid acts as a base in presence of a strong Acid as described

$$HCl + HCO_3^- \rightleftharpoons Cl^- + H_2CO_3$$

$$HCO_3^- + OH^- \rightleftharpoons CO_3^{2-} + H_2O$$

Acid Base C.A C.B.

loses proton

adds proton

HCO_3^- can act as both acid and base ∴ Amphiprotic Solvent.

3) Cannot explain the acidic / basic behaviour having no-H atom

Levelling Effect of Solvent / Influence of solvent on Acid strength

Acid strength is a relative term. It also depends on the substance which acts as a base

Solvents can be divided into four categories:-

1. **Protophilic solvent** :- Solvent having property of accepting a proton e.g H_2O, alcohol, NH_3, $-NH_2$ etc

2. **Protogenic solvent**:- Solvent having the property of giving up (protophobic) proton e.g H_2SO_4, formic Acid, Acetic Acid

3. **Amphiprotic solvent**:- Solvent capable of either accepting or giving up proton e.g H_2O, alcohol

4. **Aprotic solvent**:- Any solvent incapable of accepting or giving up a proton is called aprotic solvent.
e.g Benzene, CCl_4, DMSO, DMF etc.

I Dissociation in Acetic Acid: (AcH)

$$HA + CH_3COOH \rightleftharpoons CH_3COOH_2^+ + A^-$$

Acid Base Acid Base

the Eqlbm here cannot lie right much ∵ AcH is a weak base / or small tendency to accept H^+.

∴ even strong acids are only feebly dissociatid in AcH.

$$HClO_4 > HBr > H_2SO_4 > HCl > HNO_3$$

(on the basis of conductance measurements).

II Dissociation in Water:-

Water - Stronger Base than AcH

∴ $HA + H_2O \rightleftharpoons H_3O^+ + A^-$

Acid Base Acid Base

The Eqlbm here lies more on right side.

All the strong Acids behave similarly in H_2O, so their relative acidic strengths cannot be compared. This is called levelling effict.

For weak Acids like formic Acide, Acetic Acid, lactic tartaric, phosphoric acids, it is possible to distinguish their relative strngths.

III in liq. NH_3

Strong basic character

$$\underset{\text{Acid}}{CH_3COOH} + \underset{\text{Base}}{NH_3} \rightleftharpoons \underset{\text{Acid}}{NH_4^+} + \underset{\text{Base}}{CH_3COO^-}$$

∴ all acids like HCl, HNO_3, AcH, propionic Acid appear to be of almost equal strength.

IV In HF:-

Strong Acidic, No Basic

$$\underset{\text{Base}}{HNO_3} + \underset{\text{Acid}}{HF} \rightleftharpoons \underset{\text{Acid}}{H_2NO_3^+} + \underset{\text{Base}}{F^-}$$

So even the strongest acid is incapable of dissociating as an acid in HF.

⇒ Influence of Solvent on Base strength

If Solvent is weak acid like H_2O → can compare base strength

" " " Strong " " AcH → cannot " " "

e.g $C_6H_5NH_2$ (Aniline) Weak Base } in H_2O.
NaOH Strong base

But equal in AcH.