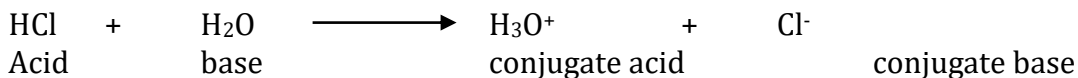


Chapter Summary: Acids and Bases

Arrhenius Theory: Acids donate hydrogen ion (H^+) while bases produce hydroxide ions (OH^-).

The Bronsted-Lowry Theory: Acids are proton (H^+) donors and bases are proton acceptors. However, H^+ cannot exist on its own, so it must attach itself with a small molecule and in presence of H_2O , it gives H_3O^+ , the hydronium ion.



Conjugate Acid: Forms when base accepts a proton.

Conjugate Base: Forms when acid donates a proton.

HCl / Cl^- acid – conjugate base pair and H_2O / H_3O^+ base/conjugate acid pair.

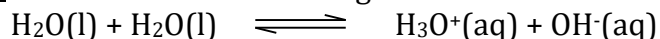
Strength of conjugate acid (CA) and conjugate bases (CB):

Strong base gives weak CA and weak base gives strong CA

Strong acid gives weak CB and weak acid gives strong CB

Amphoteric substance: Is a substance that can behave as either an acid or base e.g. H_2O .

The pH scale: Numerical value of strength of acids and bases. For water



$K_w = [H_3O^+][OH^-]$; For water at $25^\circ C$ $K_w = 1 \times 10^{-14} = (1 \times 10^{-7}) \times (1 \times 10^{-7})$

$$pH = -\log [H_3O^+]$$

$$pOH = -\log [OH^-]$$

$$pK_w = pH + pOH = 14.00$$

Strong vs weak acids: Strong acids dissociate completely to give protons; weak acids are in equilibrium. The more polar the bond of the H the easier it will dissociate.

Strength of acids: Based on the following characteristics.

- 1) **Molecular structure:** a) Size of atom: acid strength increases as you go down the periodic table. b) Acid strength increases as you go across the periodic table; $H_2O > NH_3$.
- 2) **Number of oxygen/Polarity/Electronegativity:** a) More number of oxygen atoms lead to stronger acid e.g. $H_2SO_4 > H_2SO_3$. b) $HOCl > HOBr$ because of electronegativity of halogen.
- 3) **Inductive effect:** In organic acids, $RCOOH$, if R group has electronegative elements (e.g., Cl, F) then the acid will be stronger.

Lewis Acid and Bases:

Lewis acid – electron pair acceptor e.g. BF_3 , $AlCl_3$

Lewis base – electron pair donor e.g. NH_3 , H_2O

Key Words

Arrhenius, Bronsted-Lowry, Lewis acid base	Conjugate acid and base	Amphoteric
Equilibrium constant for water	pH scale	Strength of acids