AQUEOUS ACID-BASE SUMMARY

PURE WATER

IONIZATION REACTION:

$H_2O + H_2O \longrightarrow H_3O^+ + OH^-$ simplified: $H_2O \longrightarrow H^+ + OH^-$

H^+ loves OH^-

Only 1 in 500,000 molecules ionized

$[H^+] = [OH^-] = 1 \times 10^{-7}$ and $[H^+] \times [OH^-] = 1 \times 10^{-14}$

AQUEOUS SOLUTIONS OF ACIDS $[H^+] > [OH^-]$

Acids are MOLECULAR COMPOUNDS that react with water to produce ions.

IONIZATION REACTION OF ACIDS:

$HA_{(aq)} + H_2O \longrightarrow H_3O^+ + A^-$ simplified: $HA \longrightarrow H^+ + A^-$

STRONG ACIDS (HCl, HBr, HI, HNO_3, $HClO_4$, H_2SO_4)

Every molecule in solution reacts with water to produce ions. Solution is acidic because of H_3O^+ (H^+).

$HCl_{(aq)} + H_2O \longrightarrow H_3O^+ + Cl^-$ simplified: $HCl \longrightarrow H^+ + Cl^-$

In solution, H^+ hates Cl^-

M SA $\longrightarrow$ theoretical $[H^+]$

WEAK ACIDS (all other acids)

FEW molecules in solution react with water to produce ions. Solution has very few H_3O^+ (H^+).

$HC_2H_3O_{2(aq)} + H_2O \longrightarrow H_3O^+ + C_2H_3O_2^-$ simplified: $HC_2H_3O_2 \longrightarrow H^+ + C_2H_3O_2^-$

In solution, H^+ likes $C_2H_3O_2^-$

M WA $\not\longrightarrow$ theoretical $[H^+]$

AQUEOUS SOLUTIONS OF BASES $[OH^-] > [H^+]$

STRONG BASES – SOLUBLE METAL HYDROXIDES (Group IA hydroxides & $Ca(OH)_2$, $Sr(OH)_2$, $Ba(OH)_2$)

Strong bases are IONIC COMPOUNDS that dissociate into ions upon dissolving in water. Solution is basic because of OH^-.

$NaOH \longrightarrow Na^+ + OH^-$

In solution, Na^+ hates OH^-

M SB $\longrightarrow$ theoretical $[OH^-]$

WEAK BASES (NH_3)

Weak bases are MOLECULAR COMPOUNDS that react with water to produce ions.

IONIZATION REACTION OF NH_3:

$NH_{3(aq)} + H_2O \longrightarrow NH_4^+ + OH^-$ simplified: $NH_4OH \longrightarrow NH_4^+ + OH^-$

FEW molecules in solution react with water to produce ions. Solution has very few OH^-.

In solution, NH_4^+ likes OH^-

M WB $\not\longrightarrow$ theoretical $[OH^-]$