**Two Theories of Acids & Bases**

Acids taste sour and turn blue litmus paper red.

Bases are slippery & turn red litmus paper blue.

1. **The Arrhenius Theory**

* An acid is any substance that produces H+ ions when dissolved in water

HCl(aq) -> H+(aq) + Cl-(aq)

* A base is a substance that produces OH- ions when dissolved in water
* NaOH(s) -> Na+(aq) + OH-(aq)
* Tow problems with this theory:
  + Salts should always be neutral but some aren’t
  + Solvents can affect the reactions of acids and bases

1. **The Bronsted-Lowry Theory**

* An acid is any molecule or ion that can give up a hydrogen ion.
* A base is any molecule or ion that can combine with a hydrogen ion.
* Acids are hydrogen ion (proton) donors
* Bases are hydrogen ion (proton) acceptors

**Bronsted-Lowry Acids**

* Ionization is the process by which ions are created
* Ionization equation is a chemical equation showing a molecular compound separating into ions.

HCl(aq) -> H+(aq) + Cl-(aq)

* BL acids react with water to create a hydronium ion (H3O+)

HCl(g) +  H2O(l) -> H3O+(aq) + Cl-(aq)

* The water acts as a hydrogen accepter and creates the hydronium ion (H3O+)

**Bronsted-Lowry Bases**

* Dissociation is when soluble metal hydroxides dissolve in water
* Dissociation equation shows a molecular compound dissociating in ions

NaOHl(s) ->Na+(aq) + OH-(aq)

* Ammonia is a base that does not fit the Arrhenius definition, but it does fit BL.

NH3(g) +  H2O(l) -> NH4+(aq) + OH-(aq)

1. **Conjugate Acid-Base Pairs**

Every base has a corresponding acid and vice versa, differing by one H+ ion.

**Amphoteric** means that it can be both an acid and a base. Eg. Water.

**Common Conjugate Acid & Base Pairs**

\* amphoteric

Acid Base

H3O+ \*H2O

\*H2O OH-

HCl Cl-

H2SO4 \*HSO4-

\*HSO4- SO4-

H3PO4 \*H2PO4-

\*H2PO4- \*HPO42-

\*HPO42- PO43-

NH4+NH3

Eg.

HCl(g) +  H2O(l) -> H3O+(aq) + Cl-(aq)

acid base conjugate acid conjugate base

NH3(g) +  H2O(l) -> NH4+(aq) + OH-(aq)

base acid conjugate acid conjugate base

1. **Strong and Weak Acids**

* Strong acids ionize completely (strong electrolyte)
  + Hydrochloric acid, sulfuric acid , nitric acid
* Weak acids only partially ionize (weak electrolyte)
  + Acetic acid

1. **Strong and Weak Bases**

* Strong bases completely dissociate
  + Sodium hydroxide
* Weak bases only partially dissociate
  + ammonia