THE BASICS OF ACIDS & BASES

Acids:

The two main definitions of acids are:

- Bronsted-Lowry Acid – Molecules that can donate a hydrogen ion (proton donors)
- Lewis Acid – Molecules that can accept an electron pairs (electron acceptors)

Bases:

- Bronsted-Lowry Base – Molecules that can accept hydrogen ions (proton acceptors)
- Lewis Base – Molecules that can donate electron pairs (electron donors)

pH, pOH, pKw:

- pH is a measure of the concentration of hydronium ions

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

$$[H_3O^+] = 10^{-pH}$$

- pOH is a measure of the concentration of hydroxide ions

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

$$[OH^-] = 10^{-pOH}$$

- The p in front of the H and OH indicates a -log. This stands to reason that pKw is:

$$pKw = -\log(Kw)$$

- The relationship between Kw, hydronium concentration, and hydroxide concentration is:

$$Kw = 1X10^{-14} = [H_3O^+][OH^-]$$

- If we take the -log of everything we can develop the full relationship

$$-\log(Kw) = -\log(1X10^{-14}) = -\log([H_3O^+][OH^-])$$

$$pKw = 14 = -\log([H_3O^+]) + (-\log([OH^-]) = pH + pOH$$

- Example
  - Calculate the [H 3 O +], [OH -], pH, and pOH for .1M HNO 3
    - Since HNO 3 is a strong acid, so all the hydrogen ions will be dissociated in water to form H 3 O +

$$[H_3O^+] = .1M$$

$$pH = -\log([H_3O^+]) = -\log(.1) = 1$$

$$pOH = pKa - pH = 14 - 1 = 13$$

$$[OH^-] = 10^{-pOH} = 10^{-13}$$

  - Calculate the [H 3 O +], [OH -], pH, and pOH for .05M NaOH
    - This works the same way, but NaOH is a strong base so we can find the concentration of OH - first and work backward to find the concentration of H 3 O +

$$[OH^-] = [NaOH] = .05M$$

$$pOH = -\log([OH^-]) = -\log(.05) = 1.30$$

$$pH = 14 - pOH = 14 - 1.3 = 12.70$$

$$[H_3O^+] = 10^{-12.7} = 2X10^{-13}$$