**Unit 10 Miscellaneous Acid/Base and Titration Curves**

**For strong acids:** #Oxygens - # Hydrogens is 2 or greater. 
H₂SO₄ strong, H₂SO₃ weak, HIO₃ strong etc.

**Acid strength increases with the number of oxygens.** (The more oxygens, the better the negative charge can be supported and be made stable when the H⁺ leaves.)

**Molarity = mol / L = mmol / ml**

**For buffer solutions the weak acid must have a pKa within one pH unit of the desired buffer pH.**

**In titrations:**

At the [halfway point to equivalency](##) HA will equal A⁻, so \( \text{pH} = \text{pK}_a \).

\[ \begin{align*}
\text{HA} + \text{OH}^- & \rightleftharpoons \text{H}_2\text{O} + \text{A}^- \\
1.0\text{M} & \quad 0.5\text{M} \\
-0.5 & \quad -0.5 \\
0.5 & \quad 0.5
\end{align*} \]

\[ \text{pH} = \text{pK}_a + \log \left( \frac{[\text{A}^-]}{[\text{HA}]} \right) \]

\[ \text{pH} = \text{pK}_a \]

**At the equivalence point:**

**for strong acids:** the titration curve is steep and the equivalence point equals \( \text{pH} = 7 \). (strong acids and strong bases completely neutralize one another to make a neutral pH of 7.)

**but for weak acids/weak bases:** the titration curve has less of a steepness (it is flatter) and the equivalence point is determined by stoichiometry and the dissociation of the weak acid/weak base, not by pH. It will not be neutral!

{The pH at the equivalence point of a weak acid with a strong base is always greater than 7, because the anion of the acid (that is left in solution) is a base. *The weaker the acid, the higher the pH at the equivalence point.*}

The pH at the equivalence point of a weak base with a strong acid will be less than 7, since the hydrated base is acidic. *The weaker the base, the lower the pH at the equivalence point.*}
Titration Curves

**Strong Acid with Strong Base Added**

pH starts acidic, then base is added to equivalency. Equivalence point is at pH = 7. The graph is tall.

**Strong Base with Strong Acid Added**

pH starts basic, then acid is added to equivalency. Equivalence point is at pH = 7. The graph is tall.

**Weak Acid with Strong Base Added**

pH starts acidic, but not as acidic as a strong acid, then base is added to equivalency. **Equivalence point is basic,** since weak acids fall apart to make conjugate bases, having basic pH’s. The graph is not as tall, since it starts at a higher pH (weak acid).

**Weak Base with Strong Acid Added**

pH starts basic, then acid is added to equivalency. The weak base starts at a lower pH than a strong base. **The equivalency point is acidic,** since the weak base falls apart to make its conjugate acid. The graph is shorter than strong base/strong acid, since it starts at a lower pH (weak base).

**Weak acids start at higher pH’s than strong acids. The smaller the K_a, the weaker the acid, so the higher the pH, when it starts.**

**Weak bases start at lower pH’s than strong bases. The smaller the K_b, the weaker the base, so the lower the pH, when it starts.**

*End of Notes*