Unit 10 Miscellaneous Acid/Base and Titration Curves

** For strong acids: #Oxygens - # Hydrogens is 2 or greater.
H_2SO_4 strong, H_2SO_3 weak, HIO_3 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 **$pH = pK_a$**.

$HA + OH^- \leftrightarrow H_2O + A^-$

1.0M	0.5M		
-0.5	-0.5		+0.5
0.5			0.5

$pH = pK_a + \log \{[A^-] / [HA]\}$
$pH = pK_a$

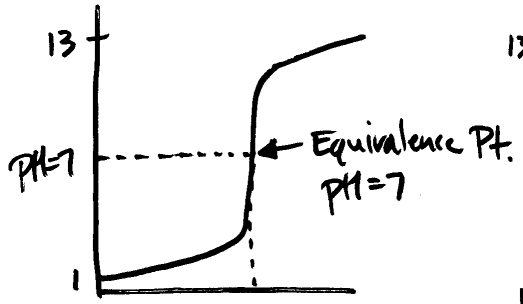
At the equivalence point:
for strong acids: the titration curve is steep and the equivalence point equals pH = 7.
(strong acids and strong bases completely neutralize one another to make a neutral pH of 7.)

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!

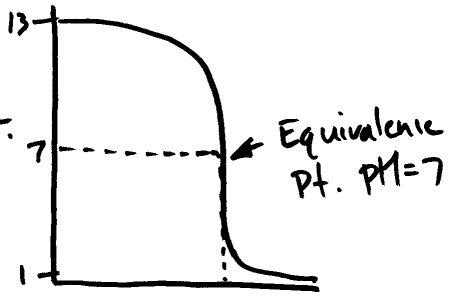
{The pH at the equivalence point of a **weak acid with a strong base** is always greater than 7, because the anion of the acid (that is left in solution) is a base. *The weaker the acid, the higher the pH at the equivalence point.*

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.*}

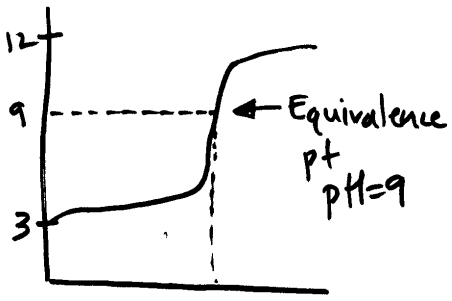
Titration Curves



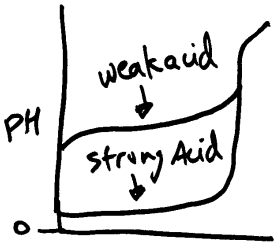
Strong Acid with Strong Base Added
pH starts acidic, then base is added to equivalency. Equivalence point is at pH = 7. The graph is tall.



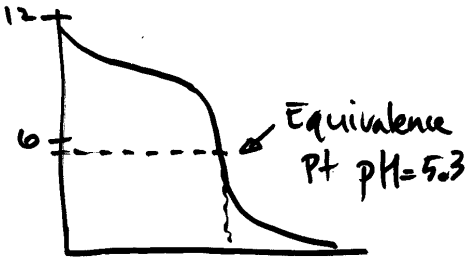
Strong Base with Strong Acid Added
pH starts basic, then acid is added to equivalency. Equivalence point is at pH = 7. The graph is tall.



Weak Acid with Strong Base Added
pH starts acidic, but not as acidic as a strong acid, then base is added to equivalency. **Equivalency 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 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 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 it's conjugate acid. The graph is shorter than strong base/strong acid, since it starts at a lower pH (weak base).

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