Acid-Base Titration Introduction:

Water dissociates (self-ionizes) into H^+ (hydrogen ion) and OH^- (hydroxide ion) ions naturally to a very small extent:

$$H_2O \rightarrow H^+ + OH^-$$

In a neutral solution the concentration of $[H^+]$ and $[OH^-]$ are equal at 1.0×10^{-7} M. An acidic solution is one in which the concentration of $[H^+] > [OH^-]$, and in an basic solution the $[H^+] < [OH^-]$. pH is a measure of the concentration of $[H^+]$ and is defined as :

$$pH = -\log[H^+]$$

In a neutral solution pH = 7. A pH < 7 indicates an acidic solution and pH > 7 signifies a basic solution.

An acid-base reaction is one in which H^+ ion are transferred from an acid to a base:

$$HA + B \rightarrow A^- + BH^+,$$ where HA is an acid and B is an base

In this experiment we will explore the use of titration, adding small quantities of a base to an acid and recording the rise of pH. We can plot the pH against the amount of base added producing a titration curve. The steepest point on the curve occurs at the equivalence point, when the acid is exactly neutralized. Because the titration curve is so steep near equivalence only a small amount of base can result in a large change in pH.

This point is the end point of our reaction and can be signified by the color change of an indicator. An indicator, in an acid base reaction, is a substance whose color changes over a particular pH range. Phenolphthalein is an example of an indictor which changes from colorless to pink as pH goes from 8 to 10.

In this lab we will be using a strong acid and a strong base to perform our acid base titration. Strong acids and bases can be assumed to dissociate in water completely. We will be adding NaOH, a strong base, to HCl, a strong acid. The NaOH will neutralize the HCl in a reaction that produces sodium chloride (salt) and water:

$$HCl + NaOH \rightarrow NaCl + H_2O$$

Since the stoichiometric ratio of hydrogen ions to hydroxide ion is 1:1 in this reaction, the number of moles of NaOH added to HCl will be equal at the end point or:

(Molarity acid)x(Volume of acid) = (Molarity of base)x(Volume of base added)