Summary of Titration Lab Calculations

At end point, moles from buret = moles (via per expression) in the Erlenmeyer flask

First Titration: Molarity NaOH

Molarity of HCL (from instructor)

↓

$$\text{HCl (mL)} \times \frac{\text{HCl Moles}}{1000\ \text{mL}} \times \frac{1\ \text{mole NaOH}}{1\ \text{mole HCl}} \times \frac{1}{\text{NaOH added from buret (L)}} = \text{Molarity NaOH}$$

Second Titration: Molarity HOAc

Molarity NaOH (fromTitration 1)

↓

$$\text{NaOH added (mL)} \times \frac{\text{NaOH Moles}}{1000\ \text{mL}} \times \frac{1\ \text{mole HOAc}}{1\ \text{mole NaOH}} \times \frac{1}{\text{HOAc in Erlenmeyer (L)}} = \text{Molarity HOAc}$$

What is Happening During the Titration

At the start of the titration, the reaction flask contains only the acid. So, the pH is very low.

As base (OH^-) is added, the hydroxide ion rapidly reacts with any hydrogen ions encountered.

$H^+ + OH^- \rightarrow HOH$ (neutralization reaction forming water)

Initially, there is an overwhelming amount of acid present. So, the base added has little impact on the pH of the solution. (With low pH, there is little, if any, observable indicator color).

As acid is consumed by the neutralization reaction of the added base, the pH slowly rises.

When a significant amount of acid has been consumed, the added base forms a high local concentration (at the point where the drop of the base hits the reaction solution.) of base. At this time, the local pH causes the indicator pink color to appear. However, as the solution is swirled, the base finds some acid, is neutralized, the local pH drops, and the lingering pink color disappears.

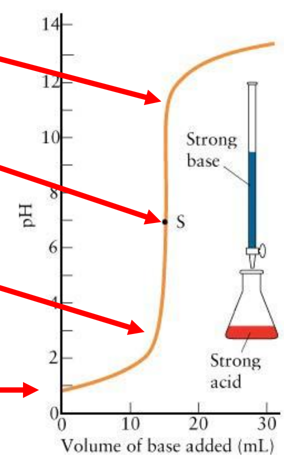
The pH slowly increases (takes longer for the lingering pink color to disappear) with added base. As soon as all the acid is consumed (end point), the pH rapidly increases since the pH is now determined by the excess hydroxide ion. Below is a plot of pH versus the amount of base added during the titration:

Acid consumed, pH very high (bright pink color)

End or Equivalence Point (very faint pink color)

Pink color starts to linger

Low pH, solution colorless



The steep nature of this S-shaped curve in the vicinity of end-point is why we need to slow down addition of base when we see the pink color start to linger.

Copyright Larry P. Taylor, Ph.D. All Rights Received