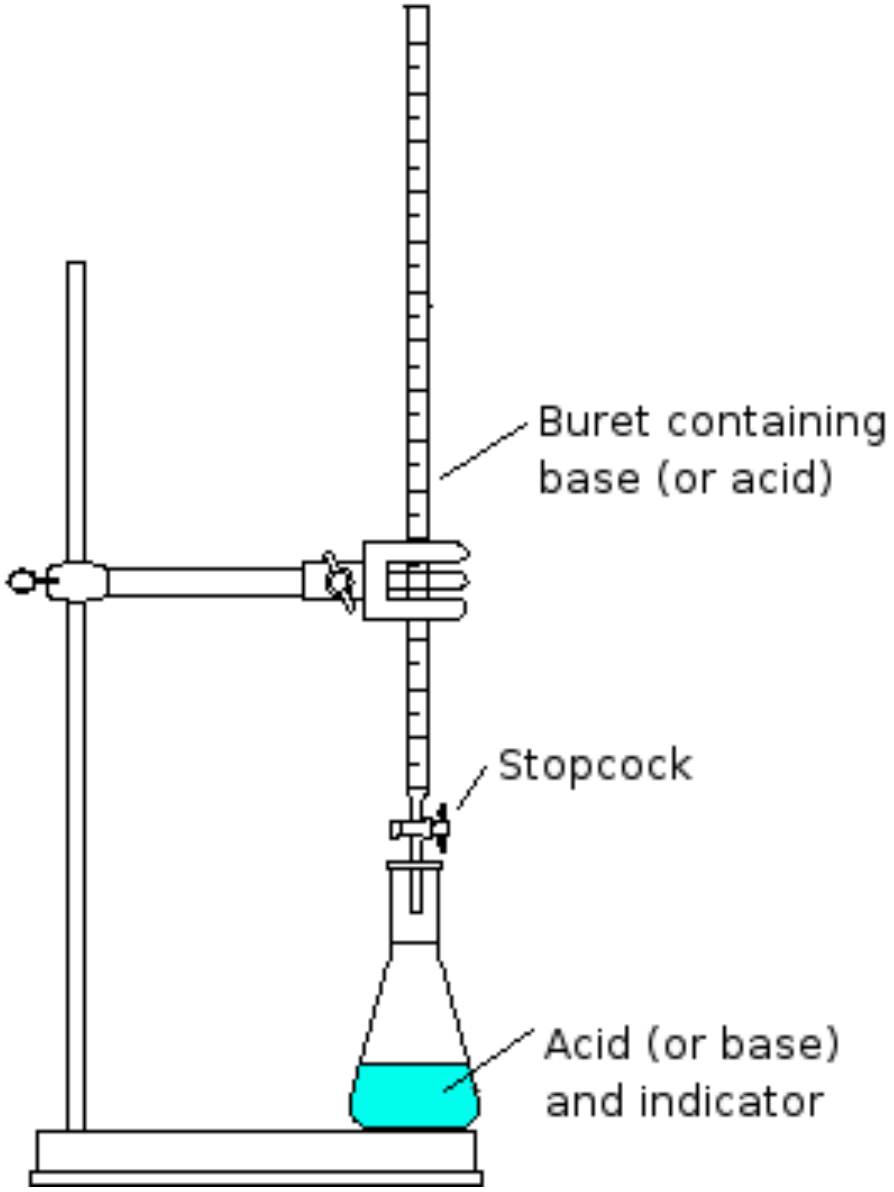
Titrations

Volumetric Analysis

titration- process in which a solution of known concentration (standard solution) is added to analyze another solution (analyte). The analyte is of unknown concentration



Titrations are most often used for acids and bases, but can be used for other types of reactions, also.

titrant- solution of known concentration (usually in buret)

equivalence point or stoichiometric point-
point where just enough titrant has been added to react with the substance being analyzed

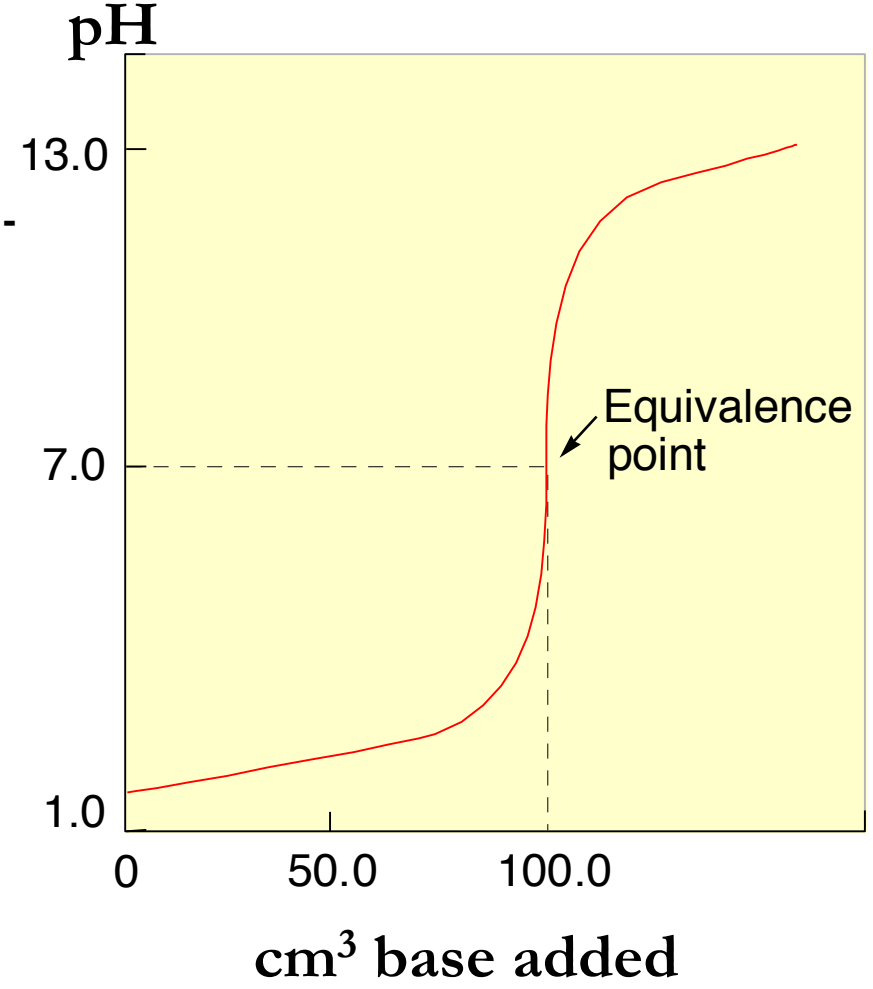
Indicator - chemical which changes color at or near the equivalence point

Titration Curve

- **Titration curve: a graph showing pH vs volume of acid or base added**
  - **The pH shows a sudden change near the equivalence point**
  - **The Equivalence point (a.k.a. stoichiometric point) is the point at which the moles of OH- are equal to the moles of H_3O^+.** It is halfway through inflection on the curve.

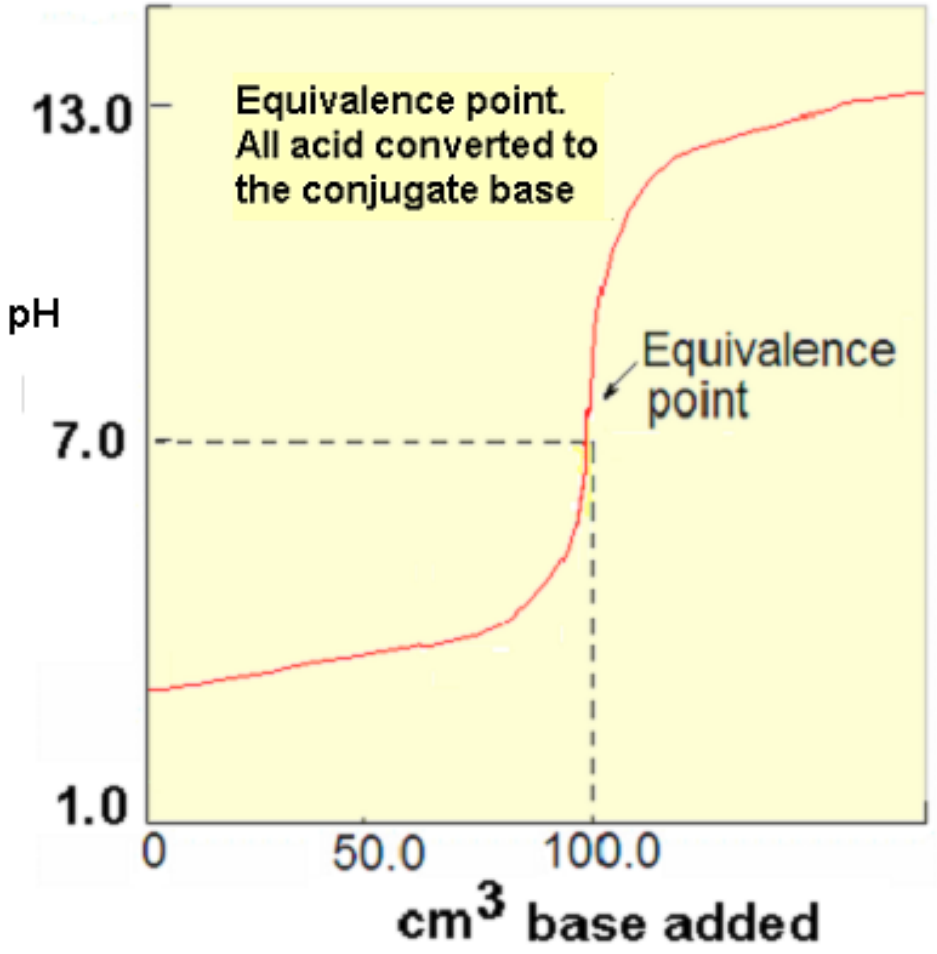
Strong acid-strong base Titration Curve

- **At equivalence point, V_{eq}:**
  Moles of H_3O^+ = Moles of OH^-
- **There is a sharp rise in the pH as one approaches the equivalence point**
- **With a strong acid and a strong base, the equivalence point is at pH =7**



Weak acid-strong base Titration Curve

- The increase in pH is more gradual as one approaches the equivalence point
- With a weak acid and a strong base, the equivalence point is higher than pH = 7



- A 50 mL sample of HCl was titrated with 2M NaOH. The equivalence point was reached after 25 mL of base was added. What is the molarity of the HCl?

Ex. 54.6 mL of 0.100 M $HClO_4$ solution is required to neutralize 25.0 mL of an NaOH solution of unknown molarity. What is the concentration of the NaOH solution?

$HClO_4 + NaOH \rightarrow H_2O + NaClO_4$

$$0.0546\ L\ HClO_4 \left| \frac{0.100\ mol\ HClO_4}{1\ L\ HClO_4} \right| \frac{1\ mol\ NaOH}{1\ mol\ HClO_4} =$$

$0.00546\ mol\ NaOH$

$$\frac{0.00546\ mol\ NaOH}{0.025L} = 0.218\ M\ NaOH$$

On your own…..

- P. 625 question 65