Titrations

Stoichiometry & Solutions

Titrations: General Principles

- In a titration, a solution of known concentration is used to determine the number of moles in an unknown sample. The solute in the titrating solution reacts with the unknown.
- **Equivalence point:** The point at which all of the unknown sample has completely reacted with the titrating solution.
- **Endpoint:** The point at which an **indicator** for the reaction changes color. A good indicator has an endpoint near the equivalence point.

Titrations (continued)

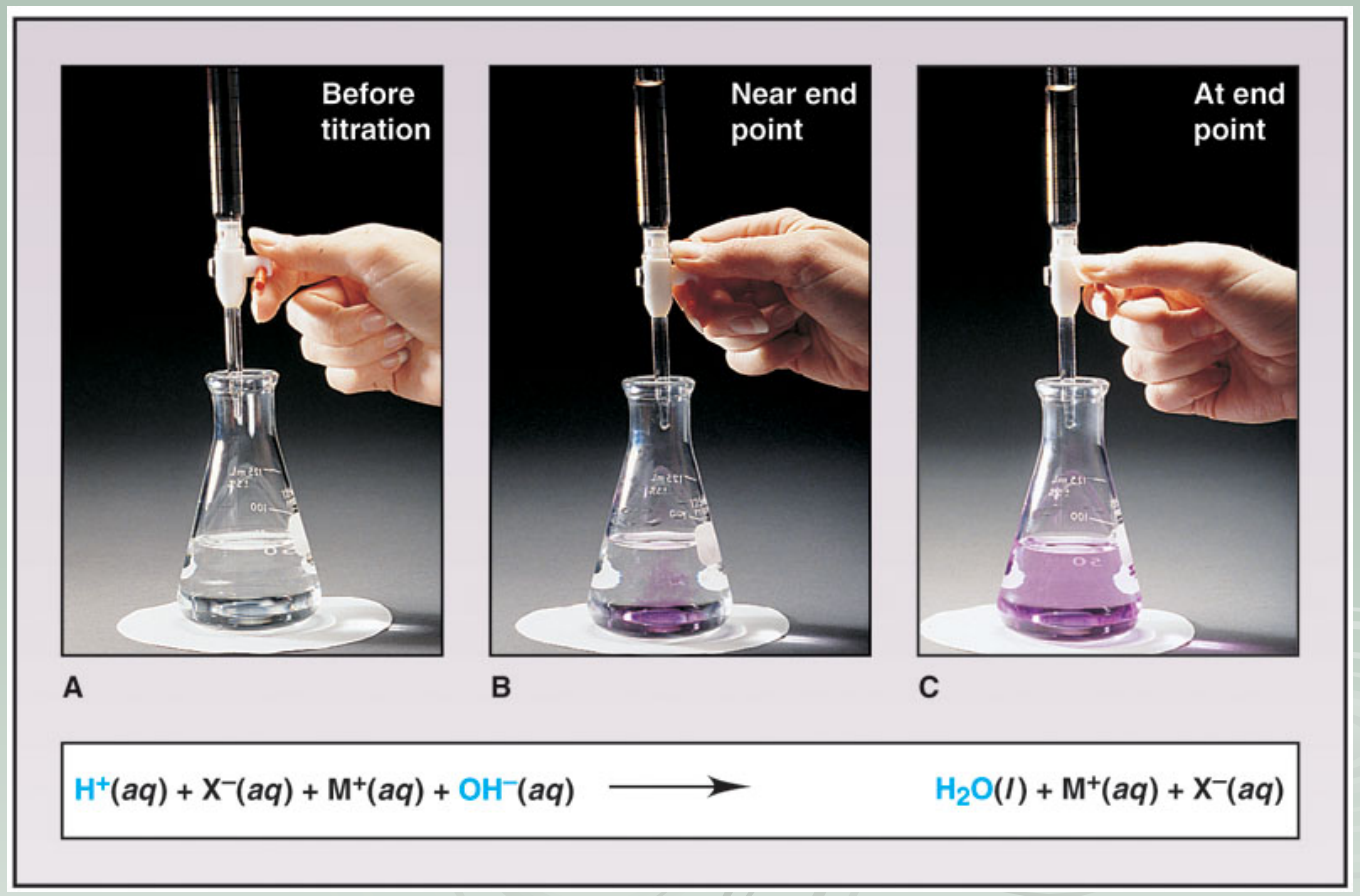
- **Stoichiometry** is used to analyze the results of a titration.
- Once moles are calculated, concentration or molar mass may be determined.
- In an **acid-base titration**, we determine the number of moles in an unknown solution by evaluating an acid-base reaction.

Titration Example:

Consider the titration of 20.0 mL of a sulfuric acid solution with a 0.127 *M* solution of NaOH. If 32.66 mL of NaOH is required to reach the endpoint, what is the concentration of the H_2SO_4 solution?

Phenolphthalein as an indicator

- Phenolphthalein is a good indicator when titrating an acid with a strong base.
- It is clear in acidic and neutral solutions, but is pink when there is a slight excess of base.



Titrations (continued)

Example:

What is the molar mass of an acid if a 0.363-g sample of the triprotic acid requires 23.44 mL of a 0.135 *M* NaOH solution?

Titrations (continued)

- The concentration of a solution used for titrating must be known for it to be useful. Therefore, the solutions must be ***standardized***.

- In a standardization titration, a highly pure solid is massed, dissolved in water, and then titrated with the solution that you wish to determine the concentration of.

Titrations (continued)

Example:

A solution of HCl was standardized using solid sodium carbonate as a primary standard.

A 0.5271-g sample of sodium carbonate was massed out, dissolved in ~ 25 mL of water and titrated with the HCl solution. The endpoint was reached with the addition of 34.73 mL of the solution.

What is [HCl] ?