

## Success 24/7 Chemistry: Titration Calculations

**Titration** - the process of adding a substance of known concentration (titrant or standard solution) to a substance of unknown concentration until the substance of unknown concentration is completely reacted.

- Indicators are often used to determine the **equivalence point**.
  - At the equivalence point, there is a change in color
  - This signals the end of the reaction
  - You should be able to identify indicators such as bromothymol blue and phenolphthalein.
- The point at which the indicator changes color is called the **end point**.
- **Burette** - instrument used in a titration.

Explain the difference between an endpoint and equivalence point.

During an acid/base titration, the acid contributes a hydrogen ion that reacts with a hydroxide from the base.

- Equivalent - mass of acid or base that can furnish or accept one mole of  $H^+$
- Sulfuric acid ( $H_2SO_4$ ) is diprotic, so it has two equivalents per mole. This means that it would take two hydroxide ions to neutralize one formula unit of sulfuric acid.

We can use a balanced neutralization equation to find concentrations of acids and bases that are titrated.

There are many ways to solve these problems. We will use stoichiometry or the following equation:

$$\frac{M_a V_a}{\text{mol a}} = \frac{M_b V_b}{\text{mol b}}$$

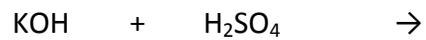
1. If it takes 54 mL of 0.10 M NaOH to neutralize 125 mL of an HCl solution, what is the concentration of the HCl?



2. If it takes 25 mL of 0.050 M HCl to neutralize 345 mL of NaOH solution, what is the concentration of the NaOH solution?



3. If it takes 50.0 mL of 0.50 M KOH solution to completely neutralize 125 mL of sulfuric acid solution ( $\text{H}_2\text{SO}_4$ ), what is the concentration of the  $\text{H}_2\text{SO}_4$  solution?



4. 35.0 mL of 4.0 M HCl is titrated with 2.5 M  $\text{Ca}(\text{OH})_2$ . What volume of  $\text{Ca}(\text{OH})_2$  is required to reach the equivalence point?

