Stoichiometry in the Lab: Titrations and Gravimetric Analysis!

Titration

- Goal: to determine the unknown concentration!
- A substance in a solution of unknown concentration is reacted with another substance in a solution of known concentration
- Vocab
  - **Titrant** – solution of Known concentration (usually in a buret)
  - **Analyte** – solution of unKnown concentration (usually in flask or beaker)
  - **Equivalence point** – acid and base have completely neutralized each other
    - Moles H^+ = Moles OH^-

    (or: moles of analyte + titrant are stoichiometrically equal)
  - **End point** - indicator changes color

    ↑ if you chose the right indicator, this should be the same as eq. pt!

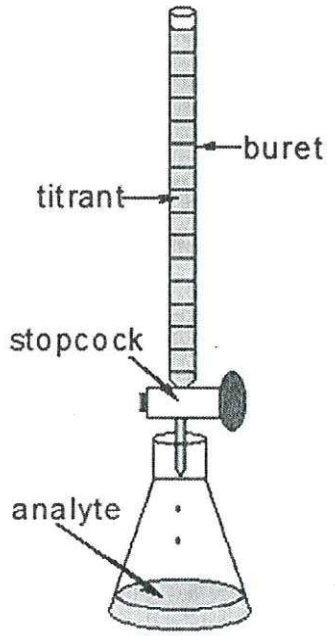

Figure 1: Titration Setup

Example: By titration, 0.13 M aqueous sulfuric acid, H_2SO_4, neutralized 27.4 mL of 0.17 M LiOH solution. What was the volume of the acid solution used in the titration?

$$H_2SO_4\,(aq) + 2\,LiOH\,(aq) \rightarrow 2\,H_2O\,(l) + Li_2SO_4\,(aq)$$

$$27.4\ mL \times 0.17\ M = 4.658\ mmol\ LiOH \times \frac{1\ mol\ H_2SO_4}{2\ mol\ LiOH} = 2.329\ mmol\ H_2SO_4$$

$$M = \frac{mol}{L} = \frac{mmol}{mL} \Rightarrow \#mL = \frac{2.329\ mmol}{0.13\ M} = \boxed{18\ mL\ H_2SO_4}$$

Gravimetric Analysis: a laboratory procedure in which an ion is precipitated out of a mixture in order to find the percent mass of that ion in an impure substance.

Method:

1. Reactant impure material with a known compound, to form a precipitate containing the ion of interest.
2. Filter and dry precipitate, then measure its mass.
3. Use stoichiometry calculations to determine the mass of the ion of interest, using the balanced reaction to work backwards from the mass of the precipitate measured in the lab.