

ANALYTICAL CHEMISTRY

Read the details of the information given below from Skoog and West's "Fundamentals of Analytical Chemistry" book, which is recommended as a reference.

This content has been prepared for educational purposes only and the responsibility for copying and sharing belongs to third parties.

Titration in Analytical Chemistry

Some Terms Used in Volumetric Titrations

Standard Solutions

Volumetric Calculations

Gravimetric Titrations

Titration Curves

Titration methods are based on determining the quantity of a reagent of known concentration that is required to react completely with the analyte.

- **Volumetric titrations:** the volume of a standard reagent.
- **Gravimetric titrations:** the mass of the reagent
- **Coulometric titrations:** the quantity of charge required to complete a reaction.

13A Some terms used in volumetric titrations

A **standard solution** is a reagent of known concentration and used in titrations and in many other chemical analyses.

Back-titration is a process in which the excess of a standard solution used to consume an analyte is determined by titration with a second standard solution.

- the rate of reaction between the analyte and reagent is slow
- the standard solution lacks stability.

13A-1 Equivalence points and end points

The **equivalence point** is the point in a titration when the amount of added standard reagent is equivalent to the amount of analyte.

The **end point** is the point in a titration when a physical change occurs that is associated with the condition of chemical equivalence.

The **titration error**, $E_t = V_{ep} - V_{eq}$

Indicators are often added to the analyte solution to produce an observable physical change at or near the equivalence point.

The **titration** is performed by slowly adding a standard solution from a buret or other liquid-dispensing device to a solution of the analyte until the reaction between the two is judged complete.

$$V_{\text{titrant}} = \text{Final reading of buret} - \text{Initial reading of buret}$$

Analyte → erlenmeyer flask

Standard reagent → buret

13A-2 Primary standards

A **primary standard** is an ultrapure compound that serves as the reference material for a titration.

1. High purity
2. Atmospheric stability
3. Absence of hydrate water
4. Modest cost
5. Reasonable solubility in the titration medium
6. Reasonably large molar mass

A **secondary standard** is a compound whose purity has been determined by chemical analysis. The secondary standard serves as the working standard material for titrations and for many other analyses.

13B Standard solutions

1. be sufficiently stable so that it is necessary to determine its concentration only once;
2. react rapidly with the analyte so that the time required between additions of reagent is minimized;
3. react more or less completely with the analyte so that satisfactory end points are realized;
4. undergo a selective reaction with the analyte that can be described by a balanced equation.

13C Volumetric calculations

Some useful relationships

Calculating the molar concentration of standard solutions

Working with titration data

Working with titration data

1. Compute concentrations of solutions that have been standardized against either a primary standard or another standard solution.
2. Calculate the amount of analyte in a sample from titration data.