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.

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Applications of Neutralization Titrations

Reagents for Neutralization Titrations

Typical Applications of Neutralization Titrations

16B Typical applications of neutralization titrations

- Inorganic
- Organic
- Biological species

} that possess acidic or basic properties

16B-1 Elemental analysis

- The elements susceptible to this type of analysis are nonmetals such as **carbon, nitrogen, chlorine, bromine, fluorine**, as well as a few other less common species.

- Pretreatment converts the element to an inorganic acid or base that is then titrated.

Nitrogen

- Amino acids, proteins, synthetic drugs, fertilizers, explosives, soils, potable water supplies, and dye.

- The most common method for determining organic nitrogen is the **Kjeldahl method**, which is based on a neutralization titration

Sulfur

- Sulfur in organic and biological materials is conveniently determined by burning the sample in a stream of oxygen.

- The sulfur dioxide formed during the oxidation is collected by distillation into a dilute solution of hydrogen peroxide:

$$SO_2(g) + H_2O_2 \rightarrow H_2SO_4$$

16B-2 The determination of inorganic substances

- Ammonium salts
- Nitrates and nitrites
- Carbonate and carbonate mixtures
- Carboxylic and sulfonic acid groups
- Amine groups

Nitrates and nitrites

- These ions are first reduced to ammonium ion by reaction with an alloy of 50% Cu, 45% Al, and 5% Zn(Devarda's alloy).
- Granules of the alloy are introduced into a strongly alkaline solution of the sample in a Kjeldahl flask.
- The ammonia is distilled after reaction is complete.
- An alloy of 60% Cu and 40% Mg (Arnd's alloy) has also been used as the reducing agent.

Carbonate and carbonate mixtures

Volume Relationships in the Analysis of Mixures Containing Hydroxide, Carbonate, and Hydrogen Carbonate Ions

Constituents in Sample	Relationship between V_{phth} and V_{bcg} in the Titration of an Equal Volume of Sample*
NaOH	$V_{phth} = V_{bcg}$
Na_2CO_3	$V_{phth} = \frac{1}{2} V_{bcg}$
$NaHCO_3$	$V_{phth} = 0;\ V_{bcg} > 0$
NaOH, Na_2CO_3	$V_{phth} > \frac{1}{2} V_{bcg}$
Na_2CO_3, $NaHCO_3$	$V_{phth} < \frac{1}{2} V_{bcg}$

*V_{phth} = volume of acid needed for a phenolphthalein end point; V_{bcg} = volume of acid needed for a bromocresol green end point

16B-3 The determination of organic functional groups

Direct or indirect determination of several organic functional groups

- *Carboxylic and sulfonic acid groups*
- *Amine groups*
- *Ester groups*
- *Hydroxyl groups*
- *Carbonyl groups*

16B-4 The determination of salts

- The salt is converted to an equivalent amount of an acid or base by passing a solution containing the salt through a column packed with an ion-exchange resin.