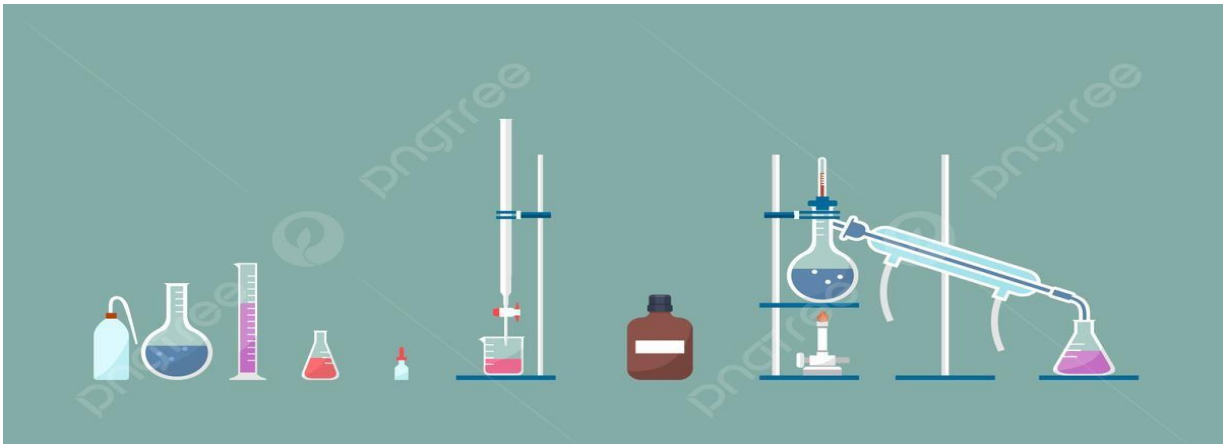
Al Mamoun University College
Laser and Optoelectronics Engineering Department
Chemistry

Analytical Chemistry



Chapter Three

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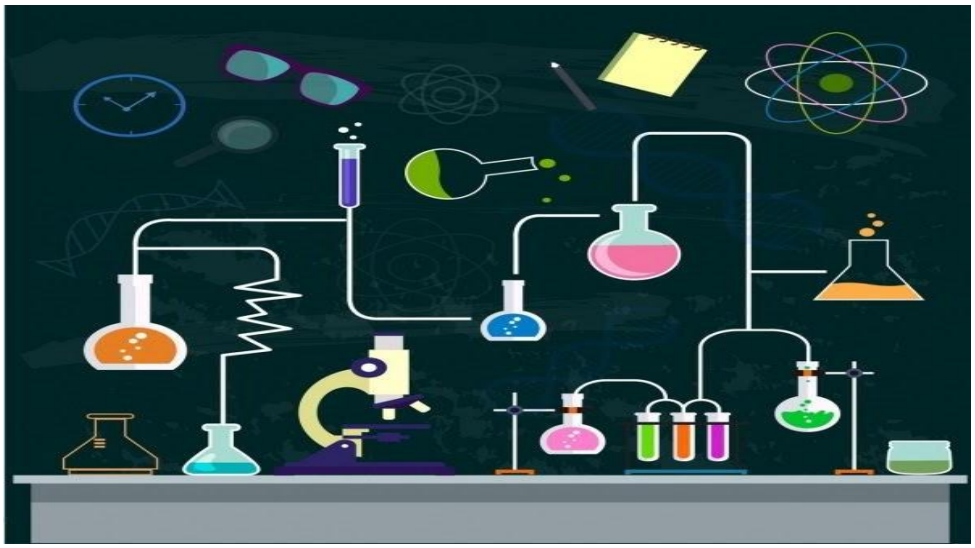
Stoichiometric Calculations

- ***Stoichiometry and Chemical Equations***
- ***Conservation of Mass***
- ***Conservation of Charge***
- ***Conservation of Protons***
- ***Conservation of Electron Pairs***
- ***Conservation of Electron***



❖ ***Stoichiometry and Chemical Equations***

The calculation of the quantities of reactants and products involved in chemical reaction. A balanced chemical reaction indicates the quantitative relationships between the moles of reactants and products. These stoichiometric relationships provide the basis for many analytical calculations.

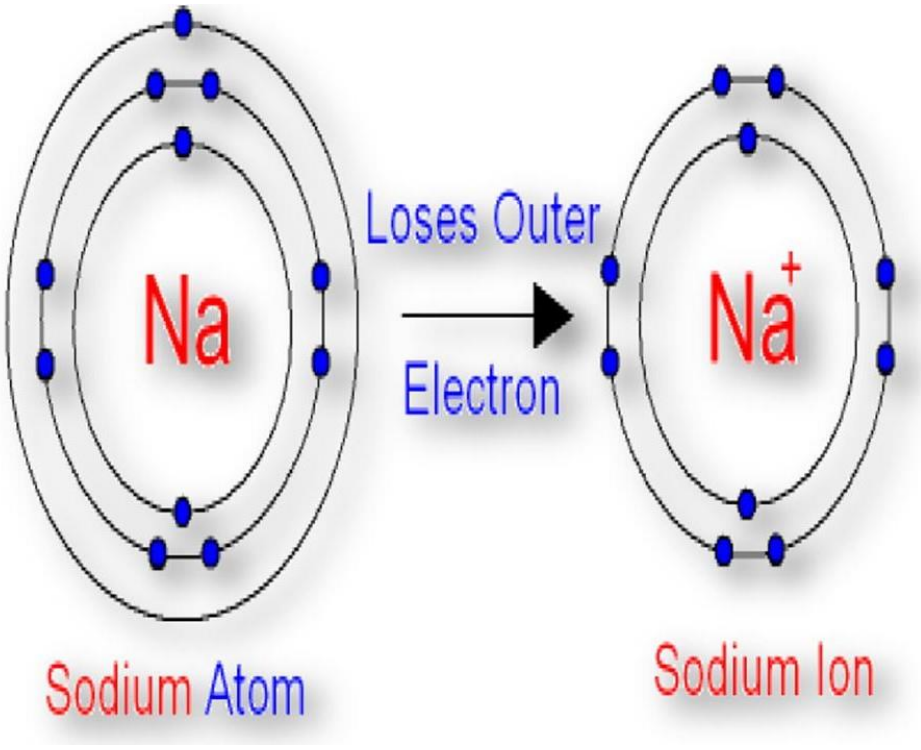
❖ *Conservation of Mass*

The easiest principle to appreciate is conservation of mass. Except for nuclear reactions, an element's total mass at the end of a reaction must be the same as that present at the beginning of the reaction; thus, an element serves as the most fundamental reaction unit.

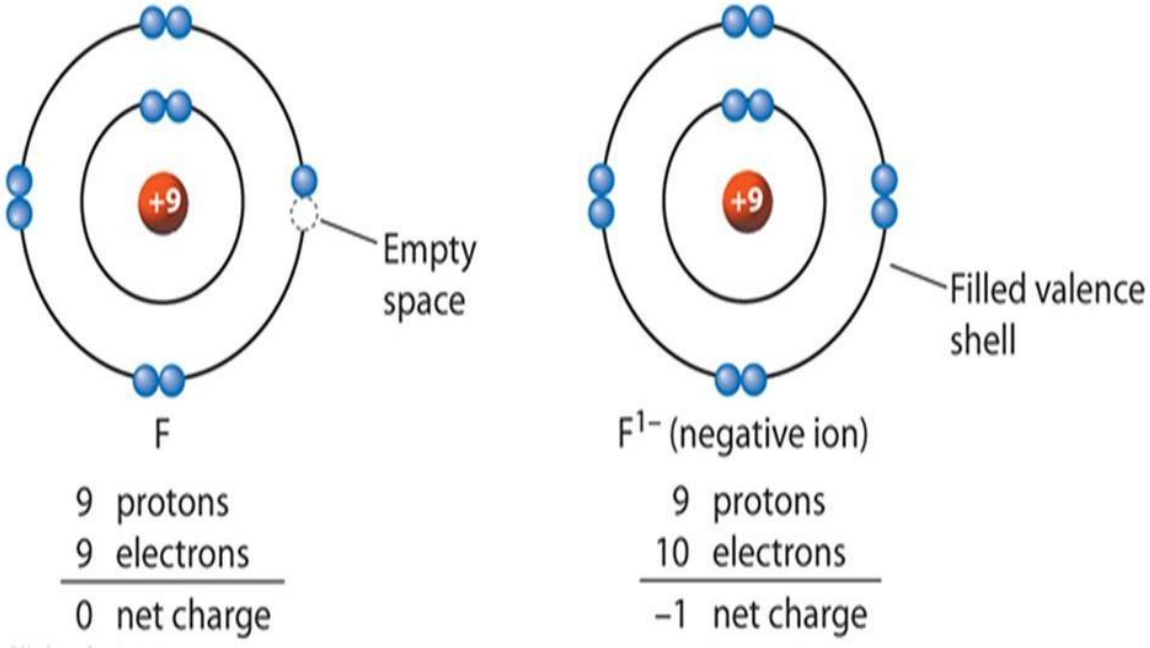
❖ *Conservation of Charge*

The stoichiometry between two reactants in a precipitation reaction is governed by a conservation of charge, requiring that the total cation charge and the total anion charge in the precipitate be equal.

Positive ions formed by ***losing*** electrons are called ***Cation***, For example, a sodium atom loses an electron to become a sodium cation Na^+.



Negative ions formed by electron gain are called ***Anion,*** for example, chlorine atom ***gains*** an electron to become a chloride anion Cl^-.



Some atoms become more stable by gaining or losing an entire electron (or several electrons). When they do so, atoms form ions, or charged particles. Electron gain or loss can give an atom a filled outermost electron shell and make it energetically more stable, this is done by creating chemical bonds.

❖ *Conservation of Protons*

In an acid–base reaction, the reaction unit is the proton. For an acid, the number of reaction units is given by the number of protons that can be donated to the base; and for a base, the number of reaction units is the number of protons that the base can accept from the acid.

❖ *Conservation of Electron Pairs*

In a complexation reaction, the reaction unit is an electron pair. For the metal, the number of reaction units is the number of coordination sites available for binding. The number of reaction units is equivalent to the number of electron pairs that can be donated to the metal.

❖ *Conservation of Electron*

In a redox reaction, the reaction unit is an electron transferred from a reducing agent to an oxidizing agent.

Oxidation – Reduction Reactions "Redox" Reactions

In Oxidation – Reduction Reactions, electrons move between atoms.

Oxidation: **Process involves loss of electrons.**

$Na \longrightarrow Na^{+} + e^{-}$ **Oxidation**

$Fe \longrightarrow Fe^{+} + e^{-}$ **Oxidation**

Reduction: **Process involves gain of electrons.**

$Cl + e^-$ Cl^- Reduction

$S + 2e^-$ S^{2-} Reduction

Oxidation Agents: **Substance which gains the electrons is called oxidation agents.**

Reduction Agents: **Substance which loses the electrons is called reduction agents.**


The End