AL-Mustaqbal University College

Radiology Techniques Department

First Class

General Chemistry

Third lecture

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Acid and Base

Acid: is any hydrogen-containing substance that is capable of donating a proton (hydrogen ion) to another substance.

Base: is a molecule or ion able to accept a hydrogen ion from an acid.

Theories of Acids and Bases

Three different theories have been put forth in order to define acids and bases. These theories include the Arrhenius theory, the Bronsted-Lowry theory, and the Lewis theory of acids and bases. A brief description of each of these theories . Acids and bases can be defined via three different theories.

- He Arrhenius theory of acids and bases states that "an acid generates H^+ ions in a solution whereas a base produces an OH^- ion in its solution".
- The Bronsted-Lowry theory defines "an acid as a proton donor and a base as a proton acceptor".
- Finally, the Lewis definition of acids and bases describes "acids as electron-pair acceptors and bases as electron-pair donors".

Properties of Acids and Bases

1. Properties of Acids

- Acids are corrosive in nature.
- They are good conductors of electricity.
- Their pH values are always less than 7.
- When reacted with metals, these substances produce hydrogen gas.
- Acids are sour-tasting substances.
- Examples: Sulfuric acid H_2SO_4

2. Properties of Bases

- They are found to have a soapy texture when touched.
- These substances release hydroxide ions (OH^- ions) when dissolved in water.
- In their aqueous solutions, bases act as good conductors of electricity.
- The pH values corresponding to bases are always greater than 7.
- Bases are bitter-tasting substances which have the ability to turn red litmus paper blue.
- Examples: Sodium hydroxide NaOH.

Buffer Solution

A buffer is a solution that can resist pH change upon the addition of an acidic or basic components. It is able to neutralize small amounts of added acid or base, thus maintaining the pH of the solution relatively stable

Uses of Buffer Solutions

There exists a few alternate names that are used to refer buffer solutions, such as pH buffers or hydrogen ion buffers.

An example of the use of buffers in pH regulation is the use of bicarbonate and carbonic acid buffer system in order to regulate the pH of animal blood.

Buffer solutions are also used to maintain an optimum pH for enzyme activity in many organisms.

The absence of these buffers may lead to the slowing of the enzyme action, loss in enzyme properties, or even denature of the enzymes.

Types of Buffers

There are two types of buffers, acid buffer and basic buffer.

1- Acid buffer

A buffer solution containing large amounts of a weak acid, and its salt with a strong base, is termed as an acid buffer. Such buffer solutions have pH on the acidic side i.e., pH is less than 7 at 298 K. The pH of an acid buffer is given by the equation. CH_3COOH and CH_3COONa

2-Basic buffer

A buffer solution containing relatively large amounts of a weak base and its salt with a strong acid is termed as a basic buffer. Such buffers have pH on the alkaline side i.e., pH is higher than 7 at 298 K. e.g.: NH_4OH and NH_4Cl

Importance of Buffers .

Many chemical reactions are affected by the acidity of the solution in which they occur. In order for a particular reaction to occur or to occur at an appropriate rate, the

pH of the reaction medium must be controlled. Such control is provided by buffer solutions, which are solutions that maintain a particular pH. Biochemical reactions are especially sensitive to pH. Most biological molecules contain groups of atoms that may be charged or neutral depending on pH, and whether these groups are charged or neutral has a significant effect on the biological activity of the molecule.

In all multi cellular organisms, the fluid within the cell and the fluids surrounding the cells have a characteristic and nearly constant pH. This pH is maintained in a number of ways, and one of the most important is through buffer systems.

Volumetric analysis

Volumetric analysis is a general term for a method in quantitative chemical analysis in which the amount of a substance is determined by the measurement of the volume that the substance occupies. It is commonly used to determine the unknown concentration of a known reactant. Volumetric analysis is often referred to as titration.

The volumetric analysis can be classified into three types:

1-Simple titration

2-Back titration

3-Double titrations