

PHARMACEUTICAL ANALYSIS – BP102T**UNIT : II ACID-BASE TITRATIONS AND NON-AQUEOUS TITRATIONS****CLASS:12****TOPIC: ACID-BASE THEORIES****CONCEPT OF ACID-BASE:**

The concept can be understood by three major theories proposed by

- 1. Arrhenius acid-base theory**
- 2. Bronsted lowry proton theory**
- 3. Lewis electron theory**

1. Arrhenius acid-base concept:

Arrhenius suggested his theory in 1884. According to Arrhenius,

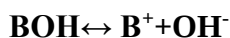
Acid- It is a substance which gives hydrogen ions when dissolved in aqueous solution.

These hydrogen ions form hydronium ions in association with solvent.



Example: $\text{HCl} \leftrightarrow \text{H}^+ + \text{Cl}^-$

Base- A substance which ionizes to give hydroxyl ions when dissolved in aqueous solution.

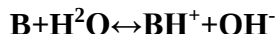


Example: $\text{NaOH} \leftrightarrow \text{Na}^+ + \text{OH}^-$

There are some substances which do not contain hydroxyl ions themselves but increase OH⁻ ions concentration of the solution.

Example: Amines

It is explained on the basis of hydrolysis or reaction with water and those substances are called Pseudo bases.

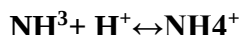


Limitations of Arrhenius Theory:

Explains acidic and basic solutions and fails to explain in non-aqueous solutions.

Many acids which do not contain H^+ / OH^- ions but they are acidic or basic nature NH^3 , SO^2 , BF^3

Example: $HCl \leftrightarrow H^+ + Cl^-$



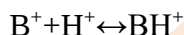
According to Arrhenius acid base concept the substance ready to donate H^+ ion is called as anacid, and the substance ready to donate OH^- is a base.

Bronsted-Lowry theory:

This theory was put forward by Bronsted in 1923 and similar theory was proposed by Lowry independently.

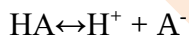
According to Bronsted-Lowry Theory:

Acid- A substance which donate protons to any other substance.



BH^+ acts as acid as it donates proton.

Base- A substance that accepts proton from other substance.



A^- Acts as base as it accepts proton.

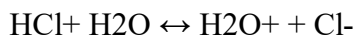
Conjugated Acid-Base Pair:

In these equation, acid-base pairs are called as conjugate acid-base pair.

Acid -conjugate acid of the base

Base- Conjugate base of the acid.

Acid + Base $\rightarrow$ Conjugate acid + Conjugate base



In this reaction, HCl donates a proton to H_2O and is therefore an acid. On the other hand, water accepts a proton from HCl and is therefore a base.

In this reverse reaction which at equilibrium proceeds at the same rate as the forward reaction,

the H_2O^+ ion donates a proton to Cl^- ion and hence H_2O^+ is a base.

The acid-base pairs, in which they can be formed mutually by the gain or loss of proton are called conjugate acid-base pairs.

LIMITATIONS:-

- 1.The Bronsted-Lowry concept could not explain the acid-base behaviour in aprotic solvents like benzene etc.
- 2.Since there is no proton transfer reaction between acid oxides, for example, sulphur dioxide and carbon dioxide and basic oxides for example calcium oxide (CaO) and Magnesium oxide (MgO) respectively. It failed to explain this type of reaction.
- 3.It failed to exhibit the acidic nature of substances like Aluminium chloride (AlCl_3) and Boron trifluoride (BF_3) with no proton.
- 4.Water is acting as Bronsted lowry acid and Ammonium is acting as Bronsted lowry's base.
- 5.For acid-base reaction to take place necessary to have two conjugative acid-base systems involve proton transfer from one system to the other.
- 6.Bronsted theory able to explain acid-base behavior in non-aqueous solvents.
7. H_2O acts as both acid and base i.e amphoteric in nature.

LEWIS ACID-BASE CONCEPT:

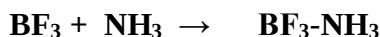
Lewis suggested this theory in 1923.

An acid can accept an electron pair to form coordinate bond

A base can donate an electron pair to form coordinate bond.

BF_3 an acid as they form acid-base complex / co-ordination complex.

NH_3 a base as they form acid-base complex / co-ordination complex.



Acid Base Coordinate complex

Lewis theory explain indicator colour change in non-protonic system shows acid-base reaction.

2MARKS QUESTION:

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