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ACID-BASE BASIC CONCEPTS

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ABSTRACT

Acids and bases are common solutions that exist everywhere. Almost every liquid that we see in our daily life consists of acidic and basic properties, with the exception of water. They differ in their properties and are able to neutralize to form H_2O , which will be discussed later in a subsection. The acids and bases can be classified by three major sections i.e. The Arrhenius definition which states that an acid produces H^+ in solution and a base produces OH^- , Later, Bronsted-Lowry who said that acids have an ability to donate protons whereas the bases to accept the protons and thirdly, the Lewis definitions of acids and bases which describes the acid and base as electron acceptor and donor respectively. This review article is throwing light on some important as well as basic aspects of acids and bases including their physical and chemical properties. In addition to this, the study also investigated about the acid and base for their color tests on the litmus paper as identifications, including their ranges as per pH scale.

Keywords: Acid and bases, acid base theory, Arrhenius theory, Bronsted Lowry theory, Lewis acids and Lewis bases, litmus paper, acid base indicators.

INTRODUCTION

OBJECTIVES: To study the various aspects of acid base concepts including their physical and chemical properties.

INTRODUCTION OF ACID AND BASE

In our daily life we use almost all product especially liquid having acidic and basic characters; Water with an exception. They have property to Neutralize H_2O completely.

Acid

1. It has property having sour taste.
2. They are colorless when placed in phenolphthalein.
3. A pH indicates Red Color on Blue Litmus and $pH > 7$.
4. Produces Hydrogen gas while metals Reacts.
5. When Carbonate reacts to produces Carbon dioxide.
6. Common examples are Lemon, Orange, Vinegar, Sulfuric Acid and Hydrochloric acid.[1]

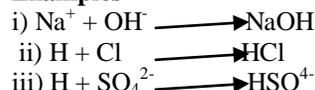
Characteristics of acids

Electronegativity of acids more than Electro positivity of bases reacts and forms dative acid bonds.

1. Due to dilution Strength decreases.

2. Hydrogen gas is formed when metal reacts.
3. Acid has a property which doesn't allow react within itself.
4. Heat is maintained.
5. H^+ concentration of water is increased in it.
6. Blue litmus turned into red.

Examples



Explanation

Solids and gas generally forms Acid by accepting required valence electron. It may be transferring or sharing of electron from one to another. In presence of gases only Acidic Bonds are formed. Such gases like H, N, O, F, Cl plays important role in formation of Acidic bonds.

BASE

1. It has property having Bitter taste.
2. They turned to pink when placed to phenolphthalein.
3. PH indicates Blue on the Red Litmus paper and $pH > 7$.
4. Its Physical stability is slippery in nature.

5. Common examples are Soaps, toothpaste, bleach, Cleansing agents, lime water, Sodium Hydroxide.¹

Characteristics of bases

1. Electro negativity of acids more than Electro positivity of bases reacts and forms ionic base bonds.
2. Due to dilution acids strength decreases.
3. OH⁻ concentration in water increases.
4. It maintains cool
5. Red litmus is turned to Blue.
6. PH > 7.

Examples

NaOH, KOH, Na₂CO₃, N₂O₅ etc.

Explanation

In presence of solids and gases generally Bases are obtained by donating required Valency Electron. It is done by transferring or sharing of electrons from one to another. Gases molecules having valency electrons containing (anions) are involve accepting electrons from solid molecules. In the presence of solids Basic bonds are obtained. And these solids play an important role in formation of base bonds. Such solids like Na²⁺, Mg⁺², Fe⁺², Fe⁺³ etc. without these solids there is no formation of basic bonds [2].

INTRODUCTION OF ACID BASE THEORY

The very famous acid-base theory is an elucidated description about acid and bases. Based on the electrostatic force between atoms or molecules, this theory has been amended from the limitations of the Arrhenius theory, the Bronsted Lowery and the Lewis theory.

In 1887, a Swedish scientist named Svante Arrhenius proposed the Arrhenius theory that was based on the concept of Ionization. He failed to explain some acidic and basic nature which doesn't have H⁺ and OH⁻ ions of molecules such that CO₂, CaO. Based on the theory of proton transfer in atoms, J.N Bronsted and J.M Lowery in 1923 proposed the Bronsted -Lowery theory which failed to explain the He fails to explain the acidic nature of some gases like CO₂, SO₂ etc. and also basic nature of CaO, BaO etc. Lewis theory proposed by Lewis scientist based on transfer of pair electrons in acid and bases. He fails to explain the strength, neutralization, s-p overlap of acid and bases. In chemistry all the fields are covered by this famous theory. It provides the structure of acid and bases in organic compounds and explains the formation of organic and inorganic acid-bases, strengths and salt by the process of neutralization. With the help of structure of acid and bases, it helps us to memorize the distinguished acid and bases [3].

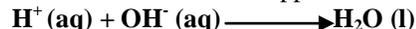
The Arrhenius Theory of Acids and Bases

In the Arrhenius theory acids are defined as substances which dissociate in aqueous solution to give

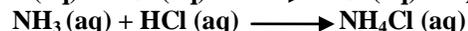
H⁺ (hydrogen ions). Bases are defined as substances which dissociate in aqueous solution to give OH⁻ (hydroxide ions) [4].

Acids are substance that produces Hydrogen ions in ions in solution.

1. Bases are substances that produce hydroxide ion in solution.
2. When hydrogen ions and hydroxide ions react to produce water and neutralization happens.



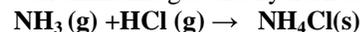
Both Sodium Hydroxide solution and Ammonia solution neutralizes the hydrochloric acid. In both cases we get a colorless solution which we can crystallize to get a white salt which can be either sodium chloride or ammonium chloride.



In the case of sodium hydroxide, the hydrogen ions released by the acid react with the sodium hydroxide ions released from the sodium hydroxide and this justifies the Arrhenius theory. Anyhow, in the case of Ammonia, the hydroxide ions do not appear. This is due to fact that ammonia react with the water in which it was dissolved to produce ammonia as well as hydroxide ions:



The above reaction is reversible in nature and about 99% of ammonia residue as the ammonia molecules itself in a solution of typical dilute ammonia, the hydroxide ions are there and therefore, we can restrain this into theory of Arrhenius. Likewise, the same reaction happens between ammonia gas and hydroxide chloride



In the above equation, since there ions not any solution, therefore, neither the hydrogen ions are there nor the hydroxide ions. Although it is producing the same product as when the two substances were in solution, even then this will not be considered as an acid base reaction by the Arrhenius theory [5].

The Bronsted Lowery Theory

The Bronsted and Lowry developed a general definition of acid and base. They considered the reactions except those present in aqueous solution. According to them Acids were molecules that are having character to donate its Hydrogen ions e.g. HCL and H₂SO₄. Bases was defined those molecules which have character to accept proton. In this reaction, the proton transfer between reactants. Due to this acid involving a transfer of H⁺ ions are called as Proton Acids. So according to Bronsted and Lowry Acids and Bases is defined as, an acid is any molecules or ion that donates a proton to another molecules or ions whereas Bases has tendency to accept or receive that proton. The following statements briefly summarize the Bronsted-Lowry definition.

1. A Bronsted-Lowry acid is a proton donor.
2. A Bronsted-Lowry base is a proton acceptor.

Table 2. Some Examples of Acid-Base Indicators [9]

S. No	Indicator	Color Change	Acid	Base
	Thymol Blue	1.2 – 2.8	Red	Yellow
	Methyl Orange	3.1 – 4.4	Red	Yellow
	Methyl Red	4.4 – 6.2	Red	Yellow
	Chlorophenol Red	5.4 – 6.8	Yellow	Red
	Bromothymol Blue	6.2 – 7.6	Yellow	Blue
	Phenol Red	6.4 – 8.0	Yellow	Red
	Phenolphthalein	8.0 -10.0	Colorless	Red
	Alizarin Yellow	10.0 – 12.0	Yellow	Green

SUMMARY

1. According to Bronsted Lowry theory Acid is a proton donor, Base is a proton acceptor.
2. Lewis acid behaves as electron acceptor, Lewis base behaves as electron donor.
3. Acid turns blue litmus paper red; Base turns red litmus paper to blue.
4. Examples of bases are NaOH, NaHCO₃ etc.
5. Examples of acids are HCl, H₂SO₄ etc.

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CONCLUSION

The study investigated and reviewed for various aspects of acid-base theories including their tests and identifications using litmus papers. There are the discussions of three major theories of acid-base and their chemical and physical aspects in the field of analytical chemistry or pharmaceutical analysis.

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