A SEMINAR ON ACID, BASE, BUFFER AND DIFFERENCE BETWEEN ACIDS AND BASES

SUBMITTED BY-

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ACID , BASE, BUFFER AND DIFFERENCE BETWEEN ACIDS AND BASES

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ACID, BASES, BUFFER AND DIFFERENCE BETWEEN ACIDS AND BASES

INTRODUCTION

- **Acids are those substances which can react with bases.**
- **Bases are those substances which can react with acids.**
- **Buffers is an aqoueos solution consisting of a mixture of weak acids and it's conjugate base or a weak base and it's conjugate acids.**
- **Acids,bases and buffers plays important role in maintaining the biological system of body**

ACID, BASE , BUFFER AND DIFFERENCE BETWEEN ACIDS AND BASES

DEFINATIONS OF ACID

1) ARRHENIUS CONCEPT-

- **It was given by ARRHENIUS IN 1884.According to this concept-**

"An acid is a substance that increases the concentration of hydronium ions when dissolved in water."

$$H_20(l) + H_20(l) \longrightarrow H_30^+ + OH^-$$

2) BRONSTED-LOWRY CONCEPT-

- **It was given by BRONSTED-LOWRY in 1923.According to this concept-**

" An acid is a substance which can give proton.In other words acids are proton donor."

$$HCl \rightleftharpoons H^+ + Cl^-$$

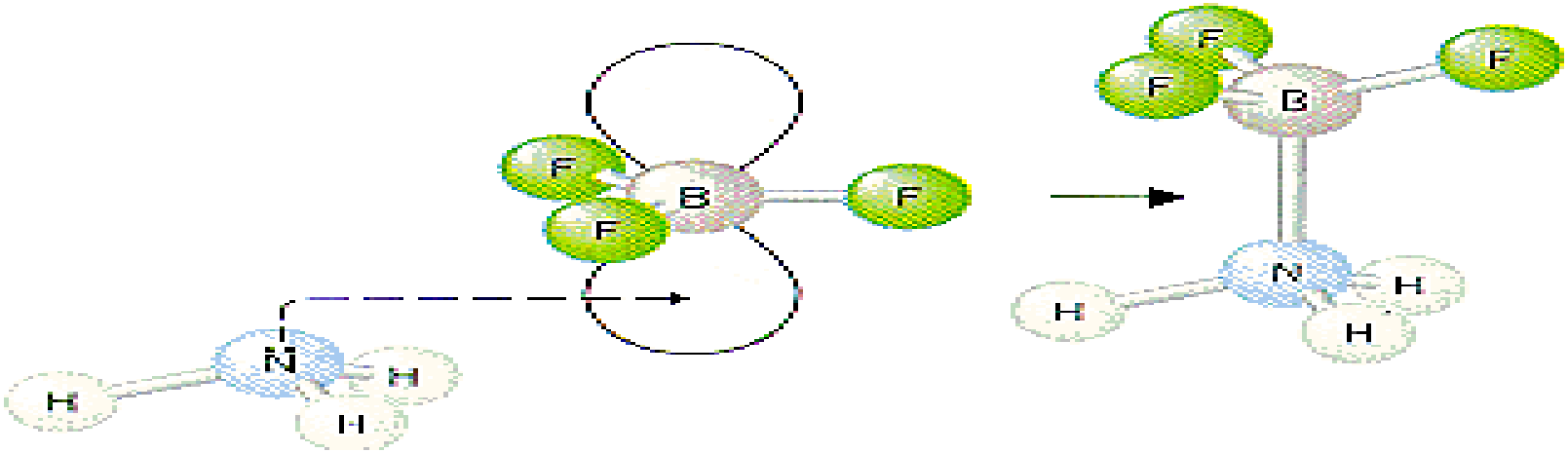
$$HCO_3 \rightleftharpoons H^+ + CO_3^{2-}$$

DFINATION OF ACIDS

3) LEWIS CONCEPT-

In 1923,LEWIS proposed a concept. According to this concept-

"**Acids are those substance,ions or molecules which can accept loan pair of electrons.In other words acids are loan pair acceptor.**



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PROPERTIES OF ACID

1) PHYSICAL PROPERTIES OF ACID

- **Change blue litmus to red.**
- **Acids have pH less than 7.**
- **Acids generally have sour taste.**
- **They produce hydrogen ions.**
- **They are electron pair acceptor.**
- **Ex- CH_3COOH, HNO_3, H_2SO_4, HCL**

2) CHEMICAL PROPERTIES OF ACID

❑ **IONISATION:-** On the basis of ionisation acids are classified as-

1) **MONOPROTIC ACIDS-** Monoprotic acids are those acids that are able to donate one proton per molecule during the process of dissociation. For ex-

$$HCl \longrightarrow H^+ + Cl^-$$

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PROPERTIES OF ACID

2) POLYPROTIC ACIDS- Polyprotic acids are those acids which are able to donate more than one proton per acid molecule

$$H_2SO_4 \longrightarrow H^+ + HSO_4$$
$$HSO_4 \longrightarrow H^+ + SO_4^-$$

- **NEUTRALISATION-**

  Acids react with bases to give salt and water.For ex-

$$\underset{\text{(acid)}}{HCl} + \underset{\text{(base)}}{NaOH} \longrightarrow \underset{\text{(salt)}}{NaCl} + \underset{\text{(water)}}{H_2O}$$

- **ACID STRENGTH OR pKa VALUE-**

  pKa or acid-dissociation constant is the quantitative measure of strength of acid in the solution.

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PROPERTIES OF ACID

- pKa is the negative base 10 logarithm of acid dissociation constant of solution.

$$pk_a = -\log_{10} k_a$$

- Lower the pKa value , stronger is the acid.

CLASSIFICATION OF ACID ON THE BASIS OF STRENGTH-

1) **STRONG ACIDS-** strong acids are those acids which gets completely dissociate in water. For ex- HCl.

2) **WEAK ACIDS-** weak acids are those acids which does not gets completely dissociate in water. For ex- CH_3COOH

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APPLICATIONS OF ACID

1) Acids are used as electrolyte in wet cell battery such as sulphuric acid in car battery.

2) In chemical industry nitric acid react with ammonia to produce ammonium nitrate ,a fertilizer

3) Ascorbic acid(vitamin c) is an essential vitamin which is required in our body and is present in foods such as amla,lemon.

4) Acids also plays an important role in human body.Hydrocholoric acid which is present in stomach helps in digestion.

5) Amino acids are required for synthesis of proteins which are required for growth and repair of body tissues.

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DEFINATIONS OF BASE

1) ARRHENIUS CONCEPT-

- It was given by **ARRHENIUS in 1884**.According to this concept- **BASE is a substance that increases the concentration of hydroxyl ion when dissolved in water.For ex-**

$$NaOH \longrightarrow Na^+ + OH^-$$
$$NH_4OH \longrightarrow NH_4^+ + OH^-$$

2) BRONSTED-LOWRY CONCEPT-

- In **1923,Bronsted and lowry** proposed this concept. According to this concept **Bases are those substances which can accept a proton. In other words bases are proton acceptor.For ex-**

$$C_2H_5N + H^+ \longrightarrow [C_2H_5NH]^+$$
$$HCO_3^- + H^+ \longrightarrow H_2CO_3$$

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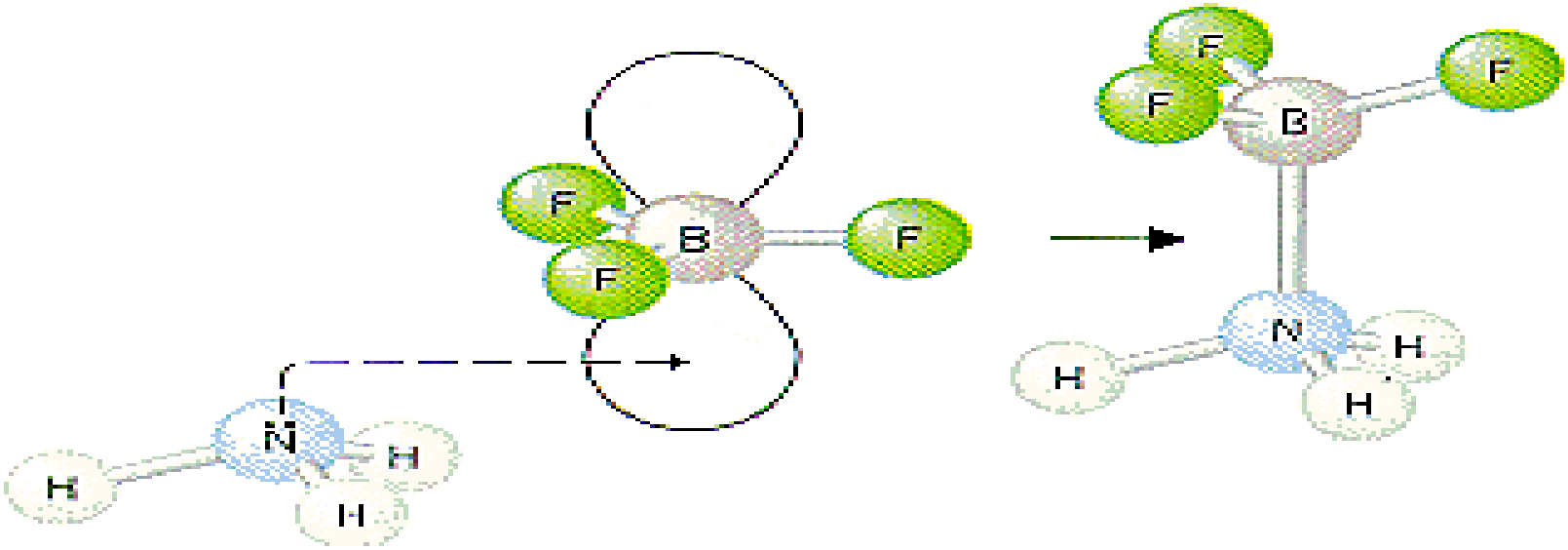
DEFINATIONS OF BASE

LEWIS CONCEPT-

In 1923, Lewis proposed a concept. According to this concept. Base are those substances, ions or molecules which can donate loan pair of electrons.In other words bases are loan pair donor.



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PROPERTIES OF BASE

1) PHYSICAL PROPERTIES OF BASES-

- Bases are generally bitter in taste.
- Bases are soapy in touch.
- They change red litmus blue.
- They are generally electron pair donor.
- Their pH is more than 7.
- It's aqoues solution conducts electricity.
- Ex-NaOH,KOH,NH_3

2) CHEMICAL PROPERTIES OF BASES-

❑ **NEUTRALISATION-**Acids react with bases to give salt and water.

$$\underset{\text{(acid)}}{HCl} + \underset{\text{(base)}}{NaOH} \longrightarrow \underset{\text{(salt)}}{NaCl} + \underset{\text{(water)}}{H_2O}$$

PROPERTIES OF BASES

❑ Pk_b VALUE-

- Base dissociation constant for a chemical reaction is the quantitative measure of strength of base in the solution
- pk_b is the negative base 10 logarithm of base dissociation constant of a solution.

$$pk_b = - \log_{10} k_b$$

- lower the pkb value,stronger is the base.

CLASSIFICATION OF BASES ON THE BASIS OF STRENGTH-

- **STRONG BASES-** Strong bases are those bases which completely dissociates in water.Ex-NaOH.
- **WEAK BASES-** Weak bases are those bases which does not completely dissociates in water.

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APPLICATIONS OF BASE

- **Sodium hydroxide is used in manufacturing of soaps,in petroleum-refining,in making rayons.**
- **Potassium hydroxide are used in alkaline batteries.**
- **Ammonium hydroxide is used to remove ink spots from clothes and to remove grease from windows.**
- **Calcium hydroxide which is also known as SLAKED LIME used to neutralise acid in water supplies and in manufacture of bleaching powder.**

ACIDS, BASES, BUFFER AND DIFFERENCE BETWEEN ACIDS AND BASES

DIFFERENCE

ACIDS	BASES
1)They are electron pair acceptor.	1) They are electron pair donor.
2)Their Ph is less than 7.	2) Their Ph is more than 7.
3)They are generally sour in taste.	3) They are generally bitter in taste.
4)Acids change blue litmus in to red.	4) They change red litmus in to blue.
5) Phenopthalein in acidic condition remains colourless.	5) On adding base,phenoptahlein becomes pink.
6)They produce H + ions when dissolved in water.	6) They produce OH – ions when dissolved in water.

TABLE NO 1- DIFFERENCE BETWEEN ACIDS AND BASES

ACID, BASE, BUFFER AND DIFFERENCE BETWEEN ACIDS AND BASES

BUFFERS

DEFINATION

- **Buffer is an aqoues solution consisting of weak acid and it's conjugate base or weak base and it's conjugate acid.**
- **Buffer solution is the one which possess the capability to resist the a greater or lesser changes in pH when some acid or base is added to it.**

CHARACTERISTICS OF BUFFER SOLUTIONS-

- **pH of buffer solution remains unchanged on keeping it for long time.**
- **It has a definite,constant pH value.**
- **pH value of buffer solution changes slightly by addition of strong acids or strong bases**

MECHANISM OF BUFFER ACTION

- **Consider a buffer solution of weak acid(acetic acid) and it's salt sodium acetate .Acetic acid is a weak acid and hence it is feebly ionised.Therefore there are very few H^+ ions present in the solution.**

Consider a following reaction-

$$CH_3COOH \longrightarrow CH_3COO^- + H^+$$

$$CH_3COONa \longrightarrow CH_3COO^- + Na^+$$

$$H+$$

$$CH_3COOH$$

PRINCIPLE OF BUFFERING

- **If hydogen ions are added in the form of some acid,the equliribrium gets disturbed.To remove excess hydrogen H^+ will combine with anions and hence equliribrium will not disturbed.**

- **If strong alkali is added to buffer solution,equilibrium will again disturbed due to excess hydroxide ions.Now CH_3COOH will ionise and H^+ ion will now reacts with OH^- ion to re-establish the equlibrium.**

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HANDERSON-HAZELBATCH REACTION

The Henderson–Hasselbalch equation is derived from the acid dissociation constant equation by the following steps:

Consider a following reaction-

Applying law of mass action-

$$K_a = \frac{[H^+][A^-]}{[HA]}$$

$$\log_{10} K_a = \log_{10}\left(\frac{[H^+][A^-]}{[HA]}\right)$$

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HANDERSON-HAZELBATCH REACTION

$$\log_{10} K_a = \log_{10}[H^+] + \log_{10}\left(\frac{[A^-]}{[HA]}\right)$$

$$pH = pK_a + \log_{10}\left(\frac{[A^-]}{[HA]}\right)$$

This equation is known as Henderson-hazel reaction.With the help of this equation a buffer solution of desired pH is prepared by mixing known quantities of a weak acid and it's salt.

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APPLICATIONS

- **To keep the correct pH for enzymes in many organisms to work**.
- **In our body,buffer of carbonic acid and bicarbonate is present in blood plasma to maintain Ph between 7.3-7.4.**
- Used in fermentation process.
- **In dyes and in colouring fabrics to setting correct conditions**
- **In chemical analysis and calibration of pH meters**.

ACID,BASE,BUFFER AND DIFFERENCE BETWEEN ACIDS AND BASES

SUMMARY

Acids are electron pair acceptor which are generally sour in taste and changes blue litmus in to red

Bases are electron pair donor which are generally bitter in taste and changes red litmus in to blue

Smaller the value of pKa and pK_b,stronger are the acids and bases

Buffers are solutions which resists a greater or lesser degree changes in pH when some acid or baes is added to it.

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CONCLUSION

- **Buffers play important role in maintaining the ph of any substance.**

- **Enzymes are pH specific and hence acids ,bases and buffers also play important role in our body.**

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