

# Acids, Bases and Buffers

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# Acids, Bases are defined by Four main theories,

- a) Traditional theory / concept
- b) Arrhenius theory
- c) Bronsted and Lowry theory
- d) Lewis theory

# Traditional theory / concept :

**i) Acid:** are the substance

➤ Which converts **blue** litmus paper to **red**

➤ Having the  $P^H < 7$

➤ Sour taste

➤ React with bases to form salts and water

Eg :- Hydrochloric acid (HCl)

**ii) Base:** are the substance

- Which converts **red** litmus paper to **blue**
- Having the  $P^H > 7$
- Bitter taste
- React with Acids to form salts and water

**Eg: Sodium Hydroxide (NaOH)**

# Arrhenius theory:

In 1884 of Svante Arrhenius

Also known as,

a) Arrhenius theory of ionization

b) Electron dissociation theory

This theory defines acids & bases according to their formation of ions when dissolved in water

# Acids

**“An Acid is a substance that can release hydrogen ion (H<sup>+</sup>) when dissolved in water”**

**(OR)**

**“A substance which when dissolved in water gives hydrogen ions (H<sup>+</sup>) is known as acid”**

**Eg: Hydrochloric acid.**



VPC, Kalyan



# Base

**“A Base is a substance that can release a Hydroxyl ion ( $\text{OH}^-$ ) when dissolved in water”**

**(OR)**

**“A substance which when dissolved in water gives Hydroxyl ion ( $\text{OH}^-$ ) is known as acid”**

Eg : Sodium Hydroxide



# Neutralization reaction

**Acid react Base**

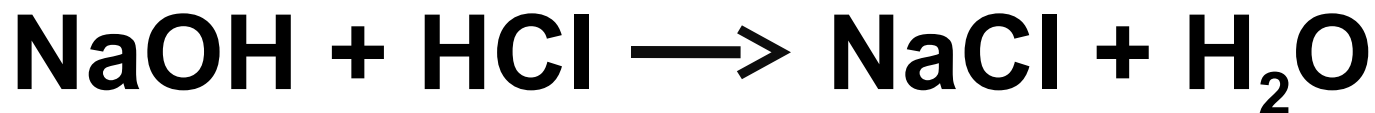


**Salt & Water**

**Eg: Hydrochloric acid react sodium hydroxide**



**Sodium chloride (Salt) & water**



**( base)**

**(Acid)**

**(Salt)**



**According to Arrhenius theory,**

**“Neutralization as the process in which hydrogen ion and hydroxyl ion combine to form unionized molecule or water”**



# Limitations :

- **Water is essential**
- **Not explain acidity or basicity of non aqueous Solvent Eg :benzene**
- **Basisity of Ammonia (No OH<sup>-</sup> ion)**  
  
**is not explained**
- **Acidity of BF<sub>3</sub>,AlCl<sub>3</sub> (No H<sup>+</sup> ion) is not explained**

- **Acidity of oxides of P block element ( $\text{CO}_2$ ) is not explained**
- **Basisity of oxides of S block element ( $\text{Na}_2\text{o}$ ) is not explained**
- **Neutralization with out absence of solvent is not explained**

- **Boric Acid,**
- **Hydrochloric acid,**
- **Strong ammonium hydroxide,**
- **Calcium hydroxide,**
- **Sodium hydroxide.**

# Boric Acid



Syn: Orthoboric Acid, Aecidium boricum

MOP:-

Borax with Sulphuric acid in presence of water



# Properties :-

## a) Physical Properties:

- White crystalline powder
- Odorless
- Soluble in water
- Soluble in Ethanol
- Soluble in glycerin

## **b) Chemical Properties:**

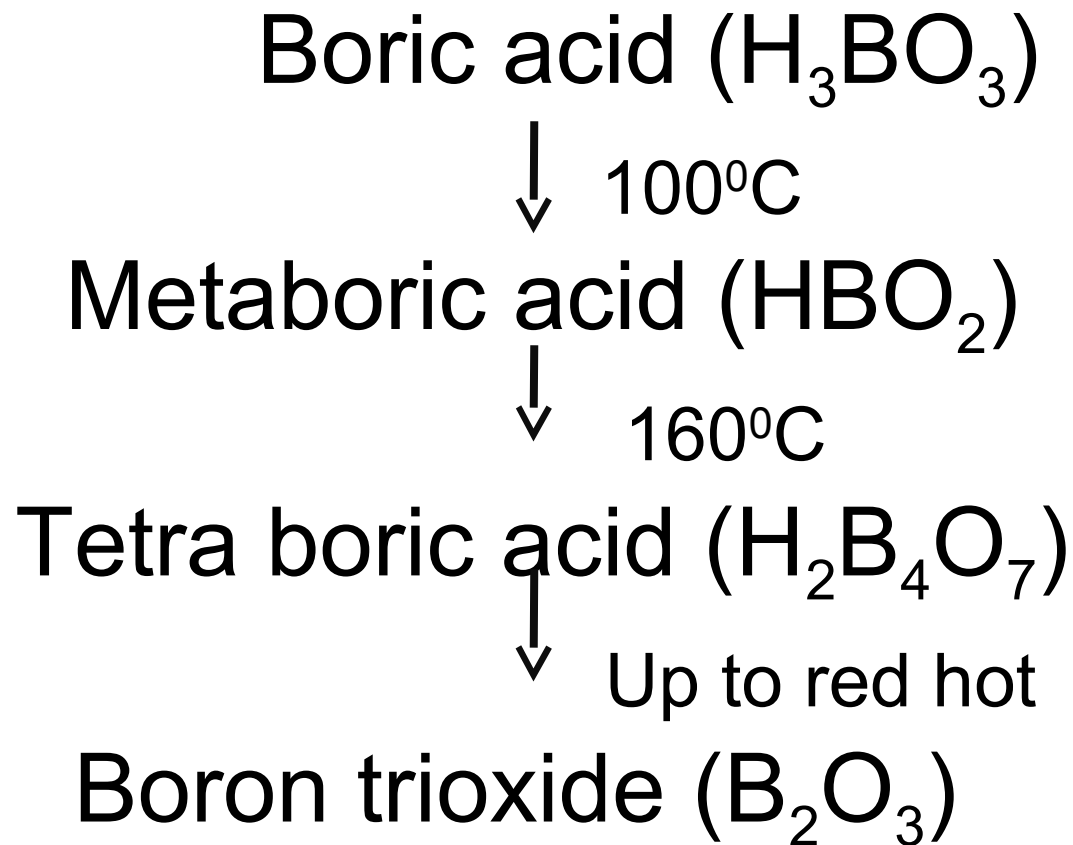
a) Reaction with turmeric paper:  
Boric acid turn into **brown** color

b) Reaction with glycerin:  
Boric acid + glycerin

↓ dissolve

Glyceroboric acid

## c) Action on heating :-





## Uses:

- Local anti-infective
- To maintain acidic  $p^H$  medium in Medicament
- Preparation of buffer solution
- In ophthalmic preparation
- Dusting powder
- Preparation of ointement

# Storage

“ It should be stored in well closed container at a cool Place.”

# Hydrochloric Acid

HCl / 36.46

Syn: spirit of salt, muriatic acid,  
acidium hydrochloricum

MOP:-

Conc.Sulphuric acid react with sodium chloride



# Properties :-

## a) Physical Properties:

- Clear colorless liquid
- Pungent odour
- Miscible with water
- Miscible with alcohol
- fuming liquid

## b) Chemical Properties:-

### i) Reaction with metals :

hydrochloric acid react with sodium gives sodium chloride & evolution of hydrogen gas.



ii) Reaction with alkali :

hydrochloric acid react with sodium hydroxide gives sodium chloride & water



## Uses:

- 1) As a pharmaceutical aid  
( acidifying agent)
- 2) Solvent in industry
- 3) For manufacturing of basic pharmaceuticals
- 4) Reagent in Laboratory

# Storage

“ It should be stored in well closed container of glass at a temperature not exceeding 30<sup>0</sup>C”



# Strong ammonium hydroxide

$\text{NH}_3$  / 17.03

**Syn**: Ammonia solution, ammonium hydroxide, strong ammonium water, liquor ammoniae forties

**MOP**:-

By mixing ammonium chloride with slaked lime



# Properties :-

## a) Physical Properties:

- Clear colorless liquid
- Pungent odour
- Characteristic taste
- Miscible with water
- Aqueous solution is strongly alkaline in nature

## b) Chemical Properties:-

i) Reaction with acid :

React with acid it form salts and water



ii) Reaction with cations :

React with acid it form complex

# Uses:

- Alkalizing agent
- Reflux stimulant (fainted person)
- Vaso constrictor
- Strong base
- Antacid
- Reagent in Laboratory

## Storage

“ It should be stored in well closed amber colored container with a rubber stopper at a cool Place.”

## Incompatibility

- With iodine (Explosive compound)
- heavy metals, silver salts and tannins

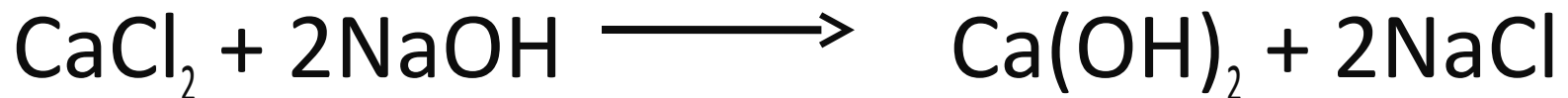
# Calcium hydroxide

$\text{Ca(OH)}_2$  / 74.10

Synonym: slaked lime, lime water

MOP:-

by treating calcium chloride with sodium hydroxide



# Properties :-

## a) Physical Properties:

- White amorphous powder
- Slight bitter taste
- Slightly soluble in water
- Insoluble in alcohol
- Soluble in glycerin

## **b) Chemical Properties:-**

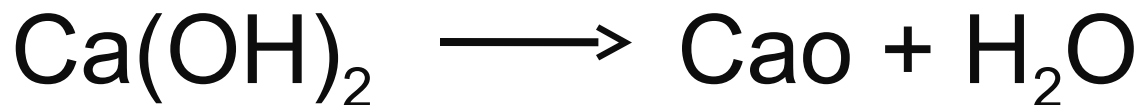
### **i) Reaction with hydrochloric acid :**

On Reaction with hydrochloric acid gives calcium chloride and water



### **ii) Effect of heating :**

On strongly heating it loses water and converted into calcium oxide





# Uses:

- Antacid
- Astringent
- Fluid electrolyte
- Emulsifying agent
- Absorb carbon dioxide
- Making of glass
- White washing of cloth

# Storage

“ It should be stored in air tight container at a cool Place.”

# Sodium hydroxide

## NaOH / 40

Syn: Caustic soda, soda lye

**MOP:**

By treating sodium carbonate  
with lime water



# Properties :-

## a) Physical Properties:

- White amorphous pellets
- Slight bitter taste
- Soluble in water
- Soluble in alcohol
- Soluble in glycerin
- Deliquescent in nature



## **b) Chemical Properties:-**

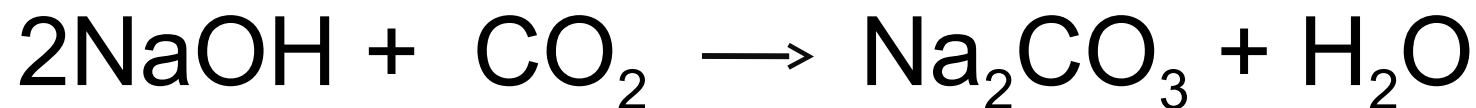
i) Reaction with HCl :

Sodium hydroxide react with Hydrochloric acid gives sodium chloride & water



## ii) Reaction with carbon dioxide:

It absorb carbon dioxide from air to form sodium carbonate



## Uses:

- > Alkalizing agent
- > Disinfectant for animal houses
- > For preparation of soap
- > Absorb  $\text{CO}_2$  gas
- > Common laboratory reagent

## Storage

“ It should be stored in air tight container at a cool Place.”



# Common Properties

$\text{H}_3\text{BO}_3$ ,  $\text{HCl}$ ,  $\text{NH}_3$ ,  $\text{Ca}(\text{OH})_2$  &  $\text{NaOH}$

➤ Colorless or white color

$\text{HCl}$  &  $\text{NH}_3$  : **Liquid**

$\text{H}_3\text{BO}_3$ ,  $\text{Ca}(\text{OH})_2$ ,  $\text{NaOH}$  : **Solid**

➤ characteristic odor

➤ Soluble in water

➤ Soluble in alcohol

(expect calcium hydroxide)

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