# ACIDS, BASES AND SALTS

**Properties of Acids**

**Properties of Base**

**Acid's Reaction With Metal**

**Reaction of Acid and Base**

**Strength of Acid or Base Solutions**

**Salts**

**Properties of Acids:**

(i) Are generally sour in taste. (For example, the sour taste of lemon juice is due to citric acid)
(ii) Strong or concentrated acids or their fumes often produce a stinging feeling on mucous membranes
(iii) Change the color of pH indicators as follows: turn blue litmus and methyl orange red, turn phenolphthalein colorless
(iv) React with metals to produce a metal salt and hydrogen
(v) React with metal carbonates to produce water, CO2 and a salt
(vi) React with metal hydroxides and metal oxides to produce water and a salt
(vii) Conduct electricity, depending on the degree of dissociation in aqueous solution
(viii) Produce solvonium ions, such as oxonium (H3O+) ions in water

**Properties of Base:**

(II) Slimy or soapy feel on fingers, due to saponification of the lipids in human skin
(III) Concentrated or strong bases are caustic (corrosive) on organic matter and react violently with acidic substances
(IV) Aqueous solutions or molten bases dissociate in ions and conduct electricity.
(V) Reactions with indicators: bases turn red litmus paper blue and phenolphthalein pink

**Acid's Reaction With Metal:**

Metal displaces hydrogen from the acids. This is seen as hydrogen gas. The metal combines with the remaining part of the acid and forms a compound called a salt. Thus,
the reaction of a metal with an acid can be summarised as –
Acid + Metal $\longrightarrow$ Salt + Hydrogen gas

Example:
$2NaOH + Zn = \underset{\text{Sodium Zincoate}}{Na_2ZnO_2} + H_2$

**Reaction of Metal Carbonates with Acid**:
$Na_2CO_3 + 2HCl = 2NaCl + H_2O + CO_2$

**Reaction of Metal Hydrogen carbonates with Acid:**
$NaHCO_3 + HCl = NaCl + H_2O + CO_2$

In these reactions the metal forms salt and water and carbon dioxide is released.

**Reaction of Acid and Base**: Both neuitralise each other and salt and water is formed:
Base + Acid = Salt + Water

$NaOH + HCl = NaCl + H_2O$

**Reaction of Metal Oxides with Acids:** Metal forms salt and hydrogen and oxygen form water>
Metal Oxide + Acid = Salt + Water

**Effect of Dissolution in water on Acid and Base**: When Acid is dissolved in water it makes Hydrogen ions. When base is dissolved in water it produces Hydroxide ions.
Acid Solution in water conducts electricity.

## STRENGTH OF ACID OR BASE SOLUTIONS

A scale for measuring hydrogen ion concentration in a solution, called pH scale has been developed. The p in pH stands for 'potenz' in German, meaning power.

| | |
|---|---|
| pH 7 | Neutral Solution |
| pH < 7 | Acidic Solution |
| pH > 7 | Basic Solution |

Range of pH is from 0 to 14

### pH Sensitivity of Plants & Animals:

Human body works in a narrow range of pH 7 to 7.8. Acidity can be lethal for plants and animals. Most of the orgnaism can survive in a narrow range of pH.

### pH of Digestive System:

Stomach secretes HCl to kill bacteria in the food. The inner lining of stomach protects vital cells from this acidic pH.

### pH and tooth decay:

Lower pH because of sour food and sweet food can cause tooth decay. The pH of mouth should always be more than 5.5.

### pH as self defense mechanism in plants & animals:

Certain animals like bee and plants like nettle secrete highly acidic substance for self defence.

## SALTS

Salts are formed after neutralization reaction between acids and bases.

### Common Salt

Common salt is formed by the combination of hydrochloric acid and sodium hydroxide solution and is called sodium chloride.

Common salt — A raw material for chemicals

## Sodium hydroxide

When electricity is passed through an aqueous solution of sodium chloride (called brine), it decomposes to form sodium hydroxide. The process is called the chlor-alkali process because of the products formed– chlor for chlorine and alkali for sodium hydroxide.

$2NaCl + 2H_2O \rightarrow 2NaOH + Cl_2 + H_2$

Chlorine gas is given off at the anode, and hydrogen gas at the cathode. Sodium hydroxide solution is formed near the cathode. The three products produced in this process are all useful. .

## Bleaching powder

Chlorine is produced during the electrolysis of aqueous sodium chloride (brine). This chlorine gas is used for the manufacture of bleaching powder. Bleaching powder is produced by the action of chlorine on dry slaked lime [Ca(OH)2]. Bleaching powder is represented as CaOCl2, though the actual composition is quite complex.

$Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2 + H_2O$

Use of Bleaching Powder:
(i) for bleaching cotton and linen in the textile industry, for bleaching wood pulp in paper factories and for bleaching washed clothes in laundry;
(ii) as an oxidising agent in many chemical industries; and
(iii)for disinfecting drinking water to make it free of germs.

## Baking soda

The chemical name of the compound is sodium hydrogencarbonate (NaHCO3). It is produced using sodium chloride as one of the raw materials.

$NaCl + H_2O + CO_2 + NH_3 = NH_4Cl + NaHCO_3$

**Sodium Hydrogencarbonate**

Uses of sodium hydrogencarbonate (NaHCO3)
(i) For making baking powder, which is a mixture of baking soda (sodium hydrogencarbonate) and a mild edible acid such as tartaric acid. When baking powder is heated or mixed in water, the following reaction takes place –

$NaHCO_3$ + Hydrogen Ion $= CO_2 + H_2O$ + Sodium salt of acid

Carbon dioxide produced during the reaction causes bread or cake to rise making them soft and spongy.
(ii) Sodium hydrogencarbonate is also an ingredient in antacids. Being alkaline, it neutralises excess acid in the stomach and provides relief.
(iii)It is also used in soda-acid fire extinguishers.

## Washing soda

Recrystallization of sodium carbonate gives washing soda. It is also a basic salt.

$Na_2CO_3 + 10H_2O = Na_2CO_3.10H_2O$

**Uses of washing soda**

(i) Sodium carbonate (washing soda) is used in glass, soap and paper industries.
(ii) It is used in the manufacture of sodium compounds such as borax.
(iii) Sodium carbonate can be used as a cleaning agent for domestic purposes.
(iv) It is used for removing permanent hardness of water.