ACIDS, BASES AND SALTS

- **1. Acids**: Acids are sour in taste, turn blue litmus red and give H₃O+ ion (hydronium ions in solution. e.g. HCl, H₂SO₄, HNO₃ etc
- **2.** *Bases:* Bases are bitter in taste, have soapy touch, turns red litmus blue and give hydroxide ions (OH-) in solution. Example NaOH, KOH etc
- **3.** Salts: A salt is a compound which is formed by neutralization reaction between an acid and base. For example, sodium chloride is formed by reaction between hydrochloric acid and sodium hydroxide.

Acid + base → Salt + water HCl+NaOH→NaCl+H2O

4. Indicators - Indicators are substances which indicate the acidic or basic nature of the solution by their colour change. The colour of some acid-base indicators in acidic and basic medium are given below

INDICATORS	COLOUR IN ACIDIC	COLOUR IN BASIC
	MEDIUM	MEDIUM
1. Litmus Solution	Red	Blue
2. Methyl Orange	Pink	Orange
3. Phenolphthalein	Colourless	Pink

5 Chemical properties of acids

4. Methyl Red

(i) Acids react with active metals to give hydrogen gas.

Yellow

 $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

(ii) Acids react with metal carbonate and metals hydrogen carbonate to give carbon dioxide.

Red

 $NaHCO_3+HCl \rightarrow NaCl + H_2O+CO_2$

(iii) Acids react with bases to give salt and water. This reaction is called neutralization reaction.

 $NaOH + HCl \rightarrow NaCl + H2O + CO_2$

(iv) Acids react with metals oxides to give salt and water.

$$CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$$

6 Chemical properties of Bases-

1. Reaction with Metals – Certain metals such as Zinc, Aluminum, Tin

react with Alkali solutions on heating and hydrogen gas is evolved

$$2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2$$

2. Reaction with acids – Bases react with acids to form salt and water.

$$KOH + HCl \rightarrow KCl + H_2O$$

3. Reaction with Non – metallic oxides –

Non - metallic oxides are generally acidic in nature. They react with bases to form salt and water.

$$2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$$

7. Strong and Weak Acids

An acid which completely dissociates into ions in aqueous solution is called strong acid such as HCl, H_2SO_4 , and HNO_3 etc. Weak acids are those which are weakly dissociated in its aqueous solution such as CH_3COOH , H_2CO_3 , and HCN etc.]

8. Strong and Weak Bases

A base such as NaOH or KOH which is completely dissociated in aqueous solution is called a strong base. On the other hand a base which is weakly dissociated such as NH₄ OH in its aqueous solution is called a weak base.

9. pH Scale

The concentration of hydrogen ions in solution is expressed in terms of pH. The pH of a solution is defined as the negative logarithm of hydrogen ion concentration in moles per litre.

$$pH = -log [H_+]$$

$$pH = -log [H3O+]$$

where [H₊] or [H₃O₊] represents concentrations of hydrogen ions in solution.

For water or neutral solutions, pH =7

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For acidic solutions, pH< 7

For basic solutions, pH > 7

10. pH of Salts

- (a) pH of salts of strong acid strong base such as NaCl=7
- (b) pH of salts of strong acid weak base such as CuSO4 is <7
- (c) pH of salts of weak acid and strong base such as CH₃COONa >7

11. Some Important Chemical Compounds

(a) Common Salt (NaCl)

Sodium chloride is known as common salt .Its main source is sea water. It also exists in the form of rocks and sodium chloride obtained from rocks is called rock salt. Common salt is an important component of our food. It is also used for preparing sodium hydroxide, baking soda, washing soda etc.

(b) Sodium Hydroxide or Caustic Soda (NaOH)

Sodium hydroxide is prepared by passing electricity through an aqueous solution of sodium chloride (also known as brine).

$$2NaCl(aq) + 2H_2O(l) 2NaOH(aq) + Cl_2(g) + H_2(g)$$

This process is known as chlor -alkali process due to the formation of chlorine and sodium hydroxide (an alkali) as the products.

Properties -

- 1. It is a white translucent solid.
- 2. It is readily soluble in water to give a strongly alkaline solution.
- 3. Crystals of sodium hydroxide are deliquescent.

(c) Bleaching Powder (CaOCl₂)

Its chemical name is calcium oxychloride .It is prepared by passing chlorine gas through dry slaked lime.

Ca (OH) 2 + Cl2 CaOCl2 + H2O Slaked lime Bleaching powder

Uses-

- 1. For bleaching cotton and linen in textile industry.
- 2. For bleaching wood pulp in paper industry.
- 3. For disinfecting drinking water.
- (d) Baking soda (NaHCO3)

Its chemical name is sodium hydrogen carbonate .It is prepared by passing CO₂ gas through brine solution saturated with ammonia.

⊦ NaHCO₃

Ammonium chloride

Sodium Hydrogen carbonate

The precipitated sodium hydrogen carbonate is filtered off.

Properties –

- 1. It is a white crystalline solid, sparingly soluble in water at room temperature.
- 2. Its aqueous solution is weakly alkaline due to hydrolysis.
- 3. On heating, it decomposes to give sodium carbonate and carbon dioxide.

2NaHCO3 Na2 CO3 + H2O + CO2 4.

It reacts with acids to give CO2 gas.

NaHCO3+HCl NaCl+H2O+CO2

Uses-

- 1. It is used as a component of baking powder. In addition to sodium hydrogen carbonate baking soda contains tartaric acid.
- 2. It is used in soda- acid fire extinguisher.

3. It acts as mild antiseptic and antacid.

(e) Washing soda (Na₂ CO₃.10 H₂O)

Its chemical name is sodium carbonate decahydrate. It is obtained by heating baking soda in turn is obtained by passing CO₂ gas through sodium chloride solution saturated with ammonia.

$$NaCl + H_2O + CO_2 + NH_3 \longrightarrow NH_4Cl + NaHCO_3$$

Sodium hydrogen carbonate Sodium Carbonate

Recrystallisation of sodium carbonates gives washing soda.

Na₂ CO₃ + 10 H₂O Na₂ CO₃ .10 H₂O

Uses-

1. It is used in glass, soap and paper industries. 2. It is used for removing permanent hardness of water. 3. It can be used as a cleaning agent for domestic purposes.

(f)Plaster of Paris (CaSO4..1/2 H2O)

Its chemical name is calcium sulphate hemihydrate. It is obtained by heating Gypsum upto 373 K.

$$CaSO_{4}.2H_{2}O ------ \Delta ------ \rightarrow CaSO_{4}..1/2H_{2}O + 11/2H_{2}O$$

Gypsum Plaster of Paris

On treatment with water it is again converted into gypsum and sets as a hard mass.

Plaster of Paris Gypsum

Uses -

- 1. It is used by Doctors for setting fractured bones.
- 2. It is used for making statues, models and other decorative materials.