

Some important compounds of Sodium

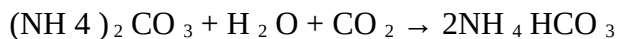
1. Sodium Carbonate decahydrate [Na₂CO₃.10H₂O] (Washing Soda)

Preparation: Solvay Process (Ammonia-Soda Process)

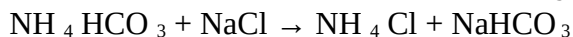
• In this process, CO₂ is passed through a concentrated solution of NaCl saturated with ammonia. Ammonium carbonate first formed



• Then converted to ammonium bicarbonate



• Reacts with NaCl to form NaHCO₃.



• Sodium bicarbonate precipitated are filtered and heated to get sodium carbonate.



➤ In this process, NH₃ is recovered when the solution containing NH₄Cl is treated with Ca(OH)₂.

Note: Solvay process cannot be used for the preparation of K₂CO₃ because potassium bicarbonate (KHCO₃) is so much soluble in water that it does not get precipitated

Properties:

Action of Heat: On heating, the decahydrate loses its water of crystallisation to form a monohydrate.

Above 373K the monohydrate becomes completely anhydrous and changes to a white powder this anhydrous Na₂CO₃ called "soda ash".

Uses

1. It is used in water softening, laundering and cleaning.
2. It is used in the manufacture of soap, glass, borax and caustic soda.

2. Sodium Hydroxide (Caustic Soda) [NaOH]

Preparation:

It is prepared commercially by the electrolysis of NaCl in **Castner-Kellner cell**.

Cathode reaction (Reduction): $\text{Na}^+ + \text{e}^- \rightarrow \text{Na}/\text{Hg}$ (Sodium amalgam)

Anode reaction (Oxidation): $2\text{Cl}^- \rightarrow \text{Cl}_2 + \text{e}^-$

Final Reaction: $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$

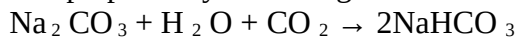
• Crystals of NaOH are Amorphous. i.e. they absorb moisture from the atmosphere and dissolve in it.

Uses:

1. in the manufacture of soap,
2. in petroleum refining.
3. in the leaching of bauxite.

3. Sodium bicarbonate, NaHCO₃ (Baking Soda)

It is prepared by saturating a solution of Sodium carbonate with CO₂.



Uses:

- i) It is a mild antiseptic for skin infection
- ii) It is used as a fire extinguisher & for baking

Some Important Compounds of Calcium

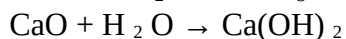
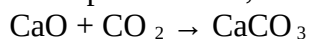
1. Calcium Oxide, CaO [Quick lime]

It is prepared commercially by heating lime stone (CaCO₃) around 1270K.



Properties:

On exposure to air, it absorbs moisture and CO₂.



- **The addition of limited amount of water breaks the big pieces of lime. This process is called slaking of lime. The product obtained is called slaked lime.**

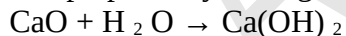
Uses:

1. It is an important primary material for the manufacture of cement and is the cheapest form of alkali.
2. it is used as a flux in metallurgy.

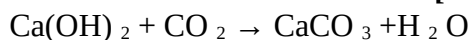
2. Calcium Hydroxide, Ca(OH)₂ [Slaked lime]

Preparation:

It is prepared by adding water to quick lime.



- **An aqueous solution of slaked lime is known as “lime water”**
- **A suspension of slaked lime in water is known as “milk of lime”**
- **When CO₂ is passed through lime water, it turns milky due to the formation of CaCO₃ (Insoluble). On passing CO₂ continuously, the solution becomes clear due to the formation of calcium bicarbonate [Ca(HCO₃)₂] (Soluble)**



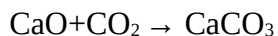
Uses:

1. It is used in the preparation of mortar, a building material.
2. It is used in white washing

3. It is used for the preparation of bleaching powder (When dry chlorine gas is passed through dry slaked lime, we get bleaching powder (a mixture of CaCl_2 & calcium hypochlorite))

3. Calcium Carbonate, CaCO_3 [Lime stone]

It can be prepared by passing carbon dioxide through CaO



- It is thermally stable

Uses:

1. It is used as a building material in the form of marble and in the manufacture of quick lime.
2. It is also used as an antacid, mild abrasive in tooth paste, a constituent of chewing gum, and filler in cosmetic

4. Calcium Sulphate hemi hydrate (Plaster of Paris), $\text{CaSO}_4 \cdot \frac{1}{2} \text{H}_2\text{O}$

- It is obtained when gypsum [$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$] is heated to 393 K.



- Above 393 K, no water of crystallisation is left and **anhydrous calcium sulphate** (CaSO_4) is formed. This is known as '**dead burnt plaster**'.
- It has a remarkable **property of setting** with water. On mixing with an adequate quantity of water it forms a plastic mass that gets into a hard solid in 5 to 15 minutes. During this process its volume increases.

Uses:

1. The largest use of Plaster of Paris is in the building industry as well as plasters.
2. It is used for covering bone fracture or sprain & used for the preparation of statues.
3. It is also employed in dentistry, in ornamental work and for making casts of statues and busts.

5. Cement [man made silica]

Components

CaO – 50-60%

SiO_2 – 20-25%

Al_2O_3 – 5-10%

MgO – 2-3%

Fe_2O_3 , SO_3 – 1-2%

Gypsum – 2-3%

Setting of Cement: When mixed with water, the setting of cement takes place to give a hard mass. During this process the hydration of the silicates and aluminates occurs and a large amount of heat is evolved

- **Setting rate is controlled by Gypsum**