

# CHEMISTRY STUDY MATERIALS FOR CLASS 11

## (NCERT BASED NOTES OF CHAPTER 10)

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## The s – Block Elements

### GROUP II ELEMENTS

### [ALKALINE EARTH METALS]

#### Some Important Compounds of Calcium

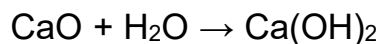
#### 1. Calcium Oxide, CaO [Quick lime]

It is prepared commercially by heating lime stone ( $\text{CaCO}_3$ ) in a rotary kiln (furnace) at 1070 – 1270K.  $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$

The  $\text{CO}_2$  is removed as soon as it is formed to enable the reaction to proceed completion.

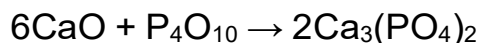
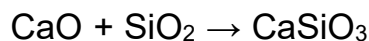
#### Properties:

On exposure to air, it absorbs moisture and  $\text{CO}_2$ .



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. Quick lime slaked with soda ( $\text{NaOH}$ ) gives solid soda lime ( $\text{NaOH} + \text{CaO}$ ).

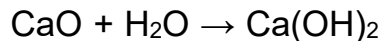
Because of the basic nature of  $\text{CaO}$ , it combines with acidic oxides at high temperature to form salts. So it is used as a flux in metallurgy.



- Uses:**
1. It is an important primary material for the manufacture of cement and is the cheapest form of alkali.
  2. It is used in the manufacture of  $\text{Na}_2\text{CO}_3$  from caustic soda.
  3. It is used in the purification of sugar and in the manufacture of dye stuffs.

## 2. Calcium Hydroxide, Ca(OH)<sub>2</sub> [Slaked lime]

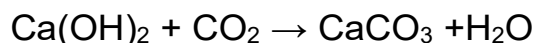
**Preparation:** It is prepared by adding water to quick lime.



An aqueous solution of slaked lime is known as lime water and a suspension of slaked lime in water is known as milk of lime.

### **Properties:**

When CO<sub>2</sub> is passed through lime water, it turns milky due to the formation of CaCO<sub>3</sub>. On passing CO<sub>2</sub> continuously, the solution becomes clear due to the formation of soluble calcium bicarbonate [Ca(HCO<sub>3</sub>)<sub>2</sub>]



When dry chlorine gas is passed through dry slaked lime, we get bleaching powder (a mixture of CaCl<sub>2</sub> & calcium hypochlorite)

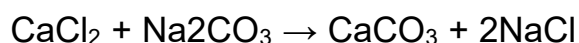
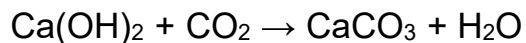


### **Uses:**

1. It is used in the preparation of mortar, a building material.
2. It is used in white washing due to its disinfectant nature.
3. It is used in glass making, in tanning, for the preparation of bleaching powder and for purification of sugar.

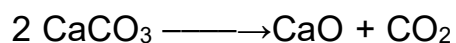
## 3. Calcium Carbonate, CaCO<sub>3</sub> [Lime stone]

Calcium carbonate occurs in nature in several forms like limestone, chalk, marble etc. It can be prepared by passing carbon dioxide through slaked lime or by the addition of sodium carbonate to calcium chloride.



### **Properties**

When heated to 1200 K, it decomposes to evolve carbon dioxide.



It reacts with dilute acid to liberate carbon dioxide.



- Uses:** 1. It is used as a building material in the form of marble and in the manufacture of quick lime.
2. Calcium carbonate along with magnesium carbonate is used as a flux in the extraction of metals such as iron.
3. Specially precipitated  $\text{CaCO}_3$  is extensively used in the manufacture of high quality paper.
4. It is also used as an antacid, mild abrasive in tooth paste, a constituent of chewing gum, and filler in cosmetics.

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

It is a hemihydrate of calcium sulphate. 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 ( $\text{CaSO}_4$ ) 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. So it is used for the preparation of statues.

- Uses:** 1. The largest use of Plaster of Paris is in the building industry as well as plasters.
2. It is used for immobilizing the affected part of organ where there is a bone fracture or sprain.
3. It is also employed in dentistry, in ornamental work and for making casts of statues and busts.

#### **Cement**

Cement was first introduced by Joseph Aspidine. It is a product obtained by combining lime ( $\text{CaO}$ ) with clay which contains silica,  $\text{SiO}_2$  along with the oxides of aluminium, iron and magnesium.

The raw materials for the manufacture of cement are limestone and clay. When clay and lime are strongly heated together they fuse and react to form 'cement clinker'. This clinker is mixed with 2-3% by weight of gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) to form cement. The purpose of adding gypsum is to slow down the process of setting of the cement so that it gets sufficiently hardened.

**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.

### **Biological Importance of Magnesium and Calcium**

Mg is present in Chlorophyll, the green colouring pigment in plants. All enzymes that use ATP in phosphate transfer require Mg as cofactor.

Ca is present in bones and teeth in the form of calcium phosphate. It also plays important roles in neuromuscular function, interneuronal transmission, cell membrane integrity and blood coagulation.

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