

Learn the key concepts of Science topic - Main group elements

Hi guys, hope you all are studying well. Many of you have doubts related to Main group elements. So today's blog will clear all your doubts related to this topic. Let's explore deep then.

Main group elements have been grouped into 8 vertical columns, called groups. These groups are IA (1), IIA (2), IIIA (13), IVA (14), VA (15), VIA (16), VIIA (17), and zero (18). These elements are placed at the extreme left and extreme right of the periodic table.

## s-block elements

In the s-block elements, the last electron enters the s-orbital. As the s-orbital can accommodate only two electrons, two groups (1 and 2) belong to the s-block. The general electronic configuration of s-block elements is  $ns^{1 \text{ or } 2}$ .

### Group-1 (Alkali Metals):

Group-I elements have one electron in their valence shell. They do not occur in the native or free state. These elements are collectively known as alkali metals because their oxides and hydroxides form strong alkalies like NaOH, KOH, etc. Lithium is known as a **Bridge element**.

Important compounds of alkali metals:

**1. Sodium Chloride or Table Salt (NaCl):** Sea water contains 2.7 to 2.9% by mass of the salt. Sodium chloride is obtained by evaporation of sea water but due to the presence of impurities like  $\text{CaCl}_2$  and  $\text{MgCl}_2$ , it has a delicate nature. It is purified by passing HCl gas through the impure saturated solution of NaCl and due to common ion effect, pure NaCl gets precipitated. The 28% NaCl solution is called brine.

#### Uses:

- As an enhance of flavour and as a preservative for food.
- To clear the ice on high-ways, which blocks the roads during winter.
- As physiological solution (0.9% NaCl in water), as it is iso-osmotic with blood-plasma.

### 2. Sodium Hydroxide or Caustic Soda [NaOH]:

**Method of Preparation:** Electrolytic process involves Nelson cell and Castner-Kellner cell. A brine solution is electrolyzed using a mercury cathode and a carbon anode. Sodium metal discharged at the cathode combines with Hg to form Amalgam. Chlorine gas is evolved at the anode. The amalgam is treated with water to give sodium hydroxide and hydrogen gas.  $2\text{Na-Hg} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + 2\text{Hg} + \text{H}_2$

#### Uses:

- It is used as a reagent in the laboratory.
- It is used in the manufacture of soap, paper, dyes, fat, and oils, etc.

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### 3. Sodium Bicarbonate or Baking Soda ( $\text{NaHCO}_3$ ):

**Method of Preparation:** It is obtained as an intermediate product in the Solvay process.

**Uses:**

- It is used as a constituent of baking powder which is a mixture of sodium bicarbonate, starch and potassium bitartrate or cream of tartar and in medicine to remove acidity of the stomach (as antacid).
- $\text{NaHCO}_3$  is a mild antiseptic for skin infections
- It is used as a fire extinguisher.

### Group-II (Alkali earth metals):

Group-II elements are Be, Mg, Ca, Sr, Ba and Ra, which have two electrons in their valence shell. These are commonly called alkaline earth metals because their oxides are alkaline in nature and are found in earth's crust.

**Uses of Alkaline Earth Metals:**

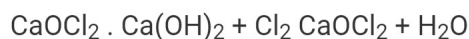
- Beryllium (Be) is used in corrosion resistant alloys.
- Alloy of Mg with aluminium is used as structural material because of its high strength, low density and ease in machining.
- Strontium carbonate is used for the manufacture of glass for colour TV picture tubes.
- Magnesium is present in chlorophyll, a green pigment in plants, essential for photosynthesis.
- Anhydrous  $\text{CaCl}_2$  because of its hygroscopic nature is a good drying agent but it cannot be used to dry alcohols/ ammonia/ amines.

**Important compounds of alkali earth metals:**

**Calcium Oxide or Quicklime or Lime ( $\text{CaO}$ ):** It is a basic oxide. Its aqueous suspension is known as slaked lime. On heating with ammonium salts, it gives ammonia. It reacts with carbon to form calcium carbide.



**Calcium Hydroxide or Slaked Lime or Limewater ( $\text{Ca(OH)}_2$ ):** Its suspension in water is known as milk of lime. It gives  $\text{CaCO}_3$  (milky) and then  $\text{Ca(HCO}_3)_2$  with  $\text{CO}_2$ . It reacts with  $\text{Cl}_2$  to give bleaching powder,



**Calcium Carbonate or Limestone or Marble or Chalk [ $\text{CaCO}_3$ ]:** It is insoluble in  $\text{H}_2\text{O}$  but dissolves in the presence of  $\text{CO}_2$ , due to the formation of calcium bicarbonate.

**Gypsum, Calcium Sulphate Dihydrate ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ):** It is also known as alabaster. On heating at 390 K, it gives the plaster of Paris. It is added to cement to slow down its rate of setting



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**Plaster of Paris or Calcium Sulphate Hemihydrate ( $\text{CaSO}_4 \cdot \frac{1}{2} \text{H}_2\text{O}$ ):** When it is mixed with water, it first forms a plastic mass which sets into a solid mass with slight expansion due to dehydration and its reconversion into gypsum. It is obtained when gypsum is heated at 393 K.



Above 393 K, no water of crystallization is left and anhydrous calcium sulphate is obtained. It is known as **dead burnt plaster**.

**Bleaching Powder ( $\text{CaOCl}_2$ ):** Its aqueous solution gives  $\text{Ca}^{2+}$ ,  $\text{Cl}^-$  and  $\text{OCl}^-$  ions. With limited quantity of dil.  $\text{H}_2\text{SO}_4$ , it gives nascent oxygen which is responsible for its oxidising and bleaching action. With excess of dil  $\text{H}_2\text{SO}_4$  (or  $\text{CO}_2$ ), it forms  $\text{Cl}_2$ , which is known as available chlorine.  $\text{Ca(OH)}_2 + \text{Cl}_2 \rightarrow \text{CaOCl}_2 + \text{H}_2\text{O}$

**Cement:** Cement is an important building material. It is a product obtained by combining materials such as limestone (lime and clay provides alumina and silica,  $\text{SiO}_2$  along with the oxides of iron and magnesium).

## p-block elements

In p-block elements, the last electron enters in the outermost p-orbital. There are six groups of p-block elements in the Periodic Table, numbering from 13 to 18. Their valence shell electronic configuration is  $ns^{1-2}np^{1-6}$  (except for He). In this part of main group elements, we will only study variations and characteristics properties of Group-15 and Group-17 elements.

**Group-15:** The 15 group of the periodic table consists of nitrogen, phosphorus, arsenic, antimony and bismuth. These elements are known as pnictogens and their compounds as pnictides.

**Group-17:** The 17 group of Periodic Table contains five elements fluorine (F), chlorine (Cl), bromine (Br), iodine (I) and astatine (As) collectively known as halogens (salt forming elements). Astatine is an artificially prepared radioactive element

In this blog, we understood and learned about recent trends and properties of the main group element in detail. Stay connected for more.