CHAPTER - 3

METALS AND NON-METALS

CLASS – X

SUBJECT - SCIENCE

MODULE -4/6

REACTION OF METAL WITH NON-METAL

Metals :- **lose electrons and become positive ions. So they are called electropositive elements.**

Eg :- The atomic number of sodium is 11, its electronic configuration is 2,8,1, it has 1 valence electron. It loses 1 electron and forms a sodium ion Na^+

$$Na \rightarrow Na^+ + e^-$$

Non metals :- **gain electrons and become negative ions. So they are called electro negative elements.**

Eg:- The atomic number of chlorine is 17, its electronic configuration is 2,8,7, it has 7 valence. It gains 1 electron and forms a chloride ion Cl^-

$$Cl + e^- \rightarrow Cl^-$$

Many metals form ionic bonds when they react with non-metals. Compounds so formed are known as ionic compounds.

Ionic bond

- The bond which is formed by loss and gain of electrons between the atoms is called ionic or electrovalent bond.
- Ionic bonding is observed because metals have few electrons in their outer-most orbital. By losing those electrons, these metals can achieve noble gas configuration and satisfy the octet rule.
- Similarly, non-metals that have close to 8 electrons in their valence shells tend to readily accept electrons to achieve noble gas configuration.
- In ionic bonding, more than 1 electron can be donated or received to satisfy the octet rule. The charges on the anion and cation correspond to the number of electrons donated or received. In ionic bonds, the net charge of the compound must be zero.

FORMATION OF SODIUM CHLORIDE

The atomic number of Na is 11, its electronic configuration is 2,8,1, it has 1 valence electron, it loses 1 electron to form Na^+ ion. The atomic number of Cl is 17, its electronic configuration is 2,8,7, it has 7 valence electrons, it gains 1 electron to form Cl^- ion. Then the attraction between the Na^+ ion and Cl^- ion results in the formation of sodium chloride molecule – NaCl.

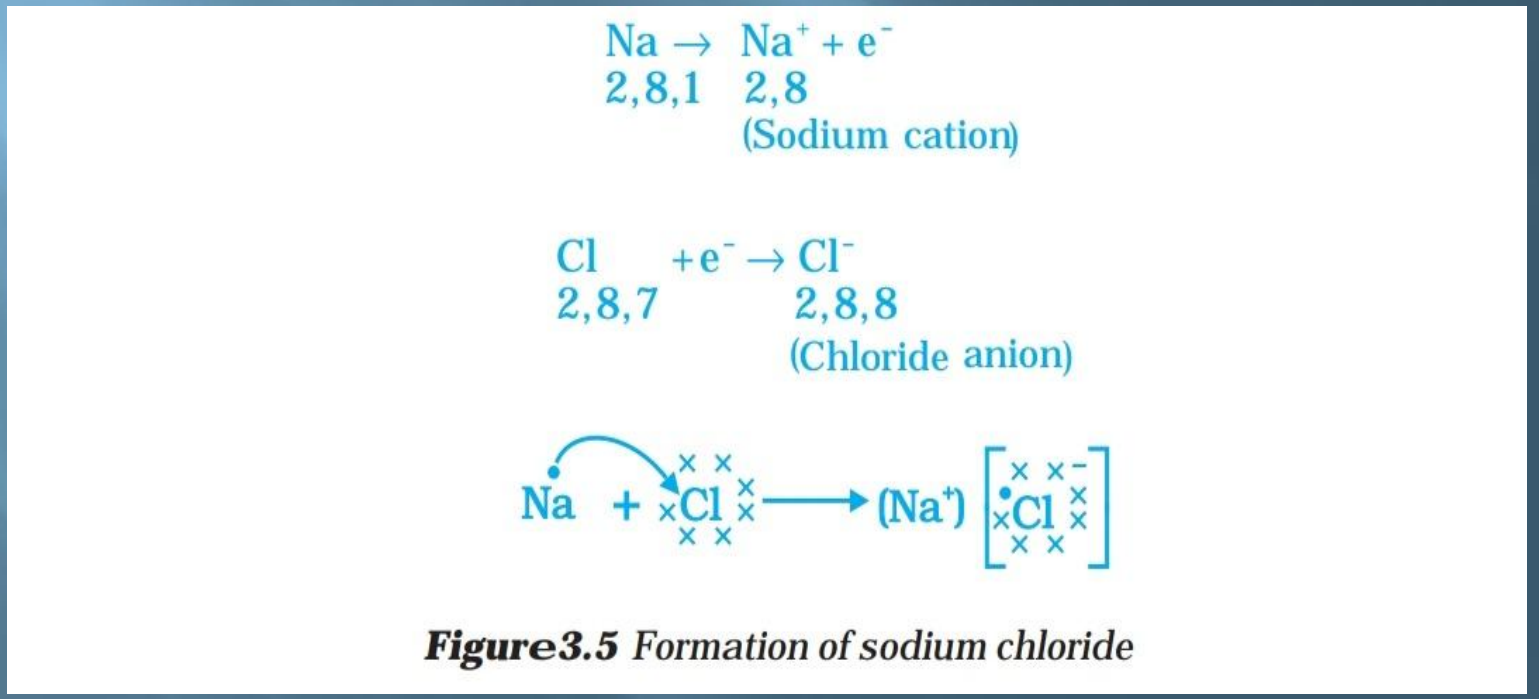

Figure3.5 *Formation of sodium chloride*

Formation of Magnesium chloride

- The A.N. of Mg is 12, its EC is 2,8,2, it has 2 valence electrons, it loses 2 electrons to form Mg^{2+}. The AN of Cl is 17, its EC is 2,8,7, it has 7 valence electrons, it gains 1 electron to form Cl^-. Then the attraction between Mg^{2+} ion and 2 Cl^- ions results in the formation of Magnesium chloride molecule – $MgCl_2$.

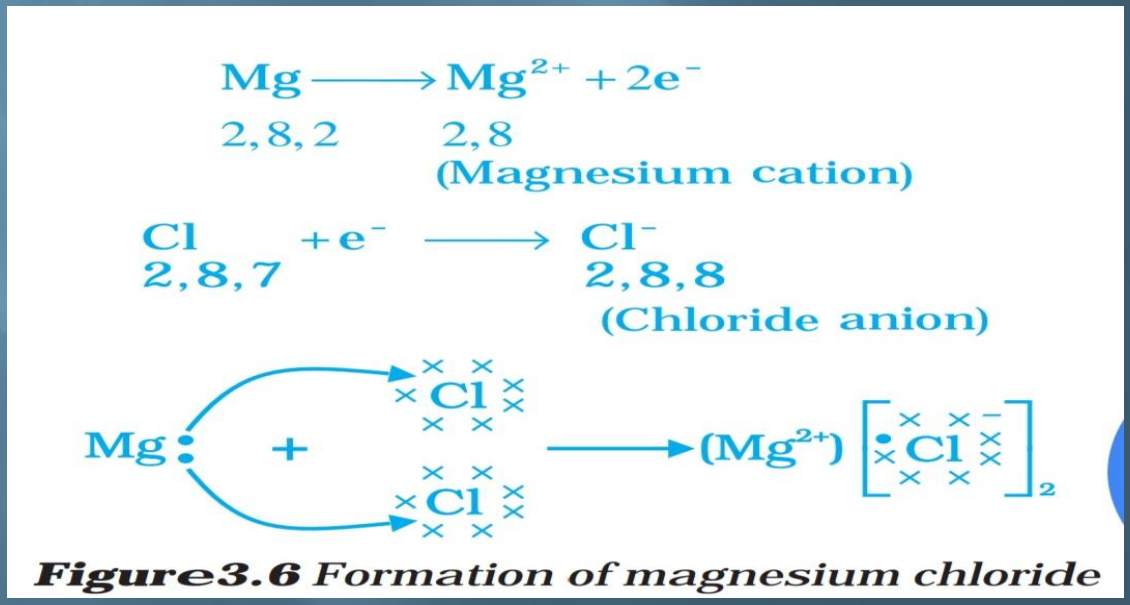

***Figure3.6** Formation of magnesium chloride*

Ionic compounds

Ionic compounds are compounds formed by the transfer of electrons from a metal to a non metal.

Properties of ionic compounds :-

- 1) ***Physical nature*:** Ionic compounds are solids and are somewhat hard because of the strong force of attraction between the positive and negative ions. These compounds are generally brittle and break into pieces when pressure is applied.

- 2) ***Melting and Boiling points*:** Ionic compounds have high melting and boiling points. This is because a considerable amount of energy is required to break the strong inter-ionic attraction.

- 3) ***Solubility*:** Electrovalent compounds are generally soluble in water and insoluble insolvents such as kerosene, petrol, etc.

4) Conduction of Electricity: The conduction of electricity through a solution involves the movement of charged particles. A solution of an ionic compound in water contains ions, which move to the opposite electrodes when electricity is passed through the solution. Ionic compounds in the solid state do not conduct electricity because movement of ions in the solid is not possible due to their rigid structure. But ionic compounds conduct electricity in the molten state. This is possible in the molten state since the electrostatic forces of attraction between the oppositely charged ions are overcome due to the heat. Thus, the ions move freely and conduct electricity.

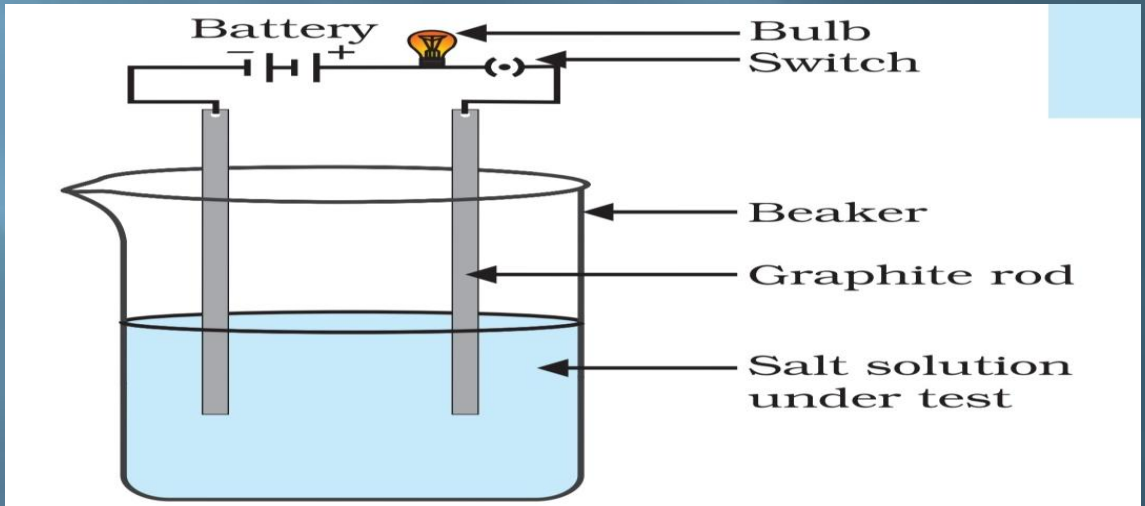

Figure 3.8
Testing the conductivity of a salt solution

FLAME TEST

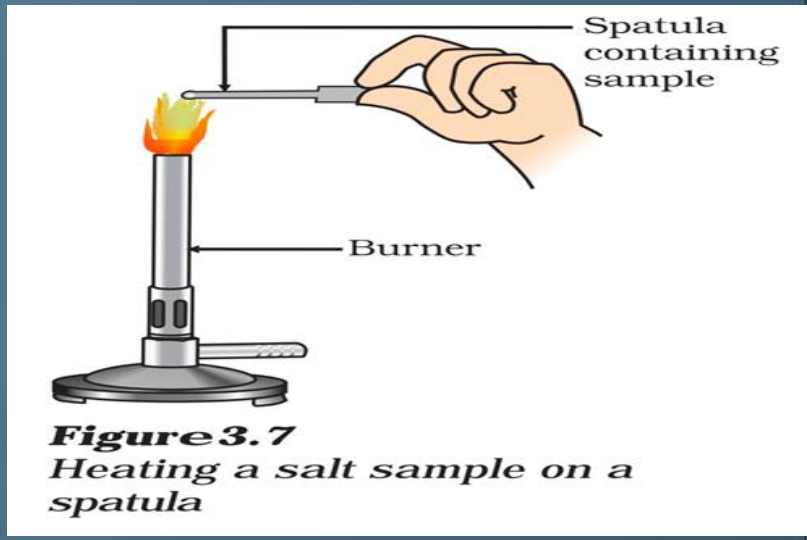

Figure 3.7
Heating a salt sample on a spatula

ACTIVITY-

Take samples of sodium chloride, potassium iodide, barium chloride or any other salt from the science laboratory.

Take a small amount of a sample on a metal spatula and heat directly on the flame.

Repeat with other samples.

What did you observe?

Did the samples impart any colour to the flame?

Questions

1) Write electronic configuration of Na (atomic no,11) and chlorine (atomic no 17)
2) Which colour produce when sodium chloride directly heated on flame?
3) Show the formation of MgO by the transfer of electrons.
4) Why do ionic compounds have high melting points?
5) What type of force of attraction shown by ionic compounds?
6) Ionic compounds do not conduct electricity in solid state. Give reason.