

## Chemical Bonding

When two atoms have combined or a bond is formed then the bond is called a **chemical bond**. Thus a chemical bond may be visualised as an effect that leads to the **decrease in the energy**. The combination of atoms leads to the formation of a molecule that has distinct properties different from that of the constituent atoms.

The stable electronic configuration of the noble gases can be achieved in a number of ways; by losing, gaining or sharing of electrons. Accordingly, there are different types of chemical bonds, like,

Ionic or electrovalent bond

Covalent bond

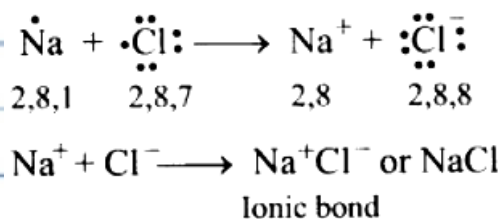
Co-ordinate covalent bond

In addition to these we have a special kind of bond called hydrogen bond.

### I. Ionic or Electrovalent Bond

In the process of formation of ionic bond the atoms acquire the noble gas electronic configuration by the gain or loss of electrons.

eg. Formation of NaCl



The positively charged sodium ion and the negatively charged chloride ion are held together by electrostatic attractions. The bond so formed is called an electrovalent or an ionic bond. Thus the ionic bond can be visualised as the electrostatic force of attraction that holds the cation and anion together. The compounds so formed are termed as ionic or electrovalent compounds.

### *Characteristic Properties of Ionic Compounds*

*Crystalline solids*

*Hard and brittle in nature*

*High melting and boiling points due to strong electrostatic interactions between the ions*

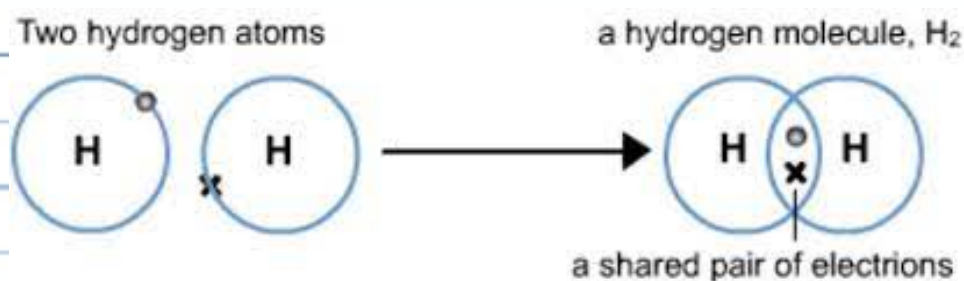
*Soluble in water and less soluble in non-polar solvents like ether, alcohol, etc*

*Conduct electricity when in molten state or in aqueous solutions.*

### **2. Covalent Bond**

*“sharing of a pair of electrons” between the two atoms. Both the atoms contribute an electron each to this pair.*

*For example, two hydrogen atoms form a molecule by sharing a pair of electrons.*



*These representations are called Lewis electron-dot structures or simply Lewis structures*

*In a Lewis representation the electrons shown to be involved in the bond formation are called **bonding electrons**; the pair of electrons is called ‘**bond pair**’ and the pairs of electrons not involved in the bonding process are called ‘**lone pairs**’.*

*This shared pair of electrons contributes towards the stability of both the atoms and is said to be responsible for ‘bonding’ between the two atoms. Such a bond is called covalent bond and the compounds so obtained are called covalent compounds.*

You may have noticed that in the process of bond formation, the elements of second period acquire eight electrons in their valence shell. This is called 'Octet rule'.

### Characteristic Properties of Covalent Compounds

Have low melting and boiling points due to weak forces of interaction between the molecules.

Generally insoluble in water and dissolve in nonpolar solvents like benzene, carbon tetrachloride etc.

Poor conductors of electricity as these lack ionic species.

### 3. Coordinate Covalent Bond

When both the electrons of the shared pair are contributed by only one species (atom, molecule or ion). For example is the formation of a bond between boron trifluoride ( $\text{BF}_3$ ) and ammonia ( $\text{NH}_3$ ).  $\text{BF}_3$  is an electron deficient molecule and can accept a pair of electrons. The molecule of ammonia on the other hand is electron rich. It has a lone pair of electron on the nitrogen atom and that can be donated. Electron rich ammonia donates a pair of electron to electron deficient  $\text{BF}_3$ . Such electron donor-acceptor bonds are called **coordinate covalent** or **dative bonds**.

