

## Covalent bond:

It was proposed by Lewis. The bond formed by sharing of electron pair is called covalent bond. In covalent bonding, both atoms will contribute & both will share.

Covalent bond can be formed between same atoms or different atoms.

- Maximum number of bonds (covalent) formed between 2 atoms is 3. But, an atom can form bonds upto 8.
- Pure or 100% covalent bond is the bond formed between same atoms.
- With decrease in electronegativity, difference, the tendency to form covalent bonds increase.

Favourable conditions for formation of covalent bond: [Fazan's rule]

- Cation should be smaller & anion should be larger in size.
- Cation with more positive charge & anion with more negative charge will favour covalent bonding.
- The electronegativity difference should be less than 1.7 in between combining atoms to form covalent bonds

The purpose of forming covalent bonds in between the atom is to attain stability by attaining noble gas configuration.

Covalent bond is denoted by "—"

Eg.: Homonuclear diatomic molecule.

## Covalency:

It is the number of electrons contributed by an atom or the number of covalent bonds formed by an atom

Covalency:

|                  |                          |   |  |
|------------------|--------------------------|---|--|
| H <sub>2</sub>   | covalency of hydrogen is | 1 |  |
| O <sub>2</sub>   | covalency of oxygen is   | 2 |  |
| N <sub>2</sub>   | covalency of nitrogen is | 3 |  |
| H <sub>2</sub> O | covalency of oxygen is   | 2 |  |
| H <sub>2</sub> O | covalency of hydrogen is | 1 |  |
| NH <sub>3</sub>  | covalency of nitrogen is | 3 |  |
| CO <sub>2</sub>  | covalency of carbon is   | 4 | PCl <sub>5</sub> covalency of phosphorous is 5 |
| SF <sub>6</sub>  | covalency of sulphur is  | 6 |  |

## Properties of covalent compounds:

- They exist as either gases or liquids due to weak Vanderwaal's forces.
- MP<sub>s</sub> & BP<sub>s</sub> are very low due to weak Vanderwaals forces in between the molecules.
- Electrical conductance :
- They are bad conductors as they donot contain ions.
- Due to directional nature of covalent bond, covalent compounds exhibit Isomerism

- The reactions in between covalent compounds are slow because they involve breaking & making of bonds.

#### Solubility:

They are soluble in non-polar solvents like  $\text{CCl}_4$ , chloroform,  $\text{C}_6\text{H}_6$  & insoluble in polar solvents like water.

#### Exceptions to the above properties:

Certain covalent compounds like sugar, urea, glucose, etc will exist as crystalline solids due to strong inter-molecular forces i.e. may be H bonds.

- Some covalent compounds like HCl, HF, HI, etc. are good conductors because they are polar & ionise in water.
- Some covalent compounds like sugar, urea, glucose, alcohol, HF are soluble in polar solvents like water due to H  $\delta$  bonding.

Best solvent for Ionic & covalent substances is liquid ammonia.

Best solvent for Ionic & polar solvents is water.

#### Exceptions to Octet rule (or) Failures of Lewis theory:-

- There are many molecules which do not obey the octet rule i.e., having less than 8 or more than 8  $e^-$ s in the valence shell of central atom.  
Ex:  $\text{BeCl}_2$  (4  $e^-$ s);  $\text{BCl}_3$  (6  $e^-$ s);  $\text{PCl}_5$  (10  $e^-$ s)  $\text{SF}_6$  (12  $e^-$ s)
- It fails to explain single electron or odd electron bond.
- Eg :  $\text{H}_2^+$  single  $e^-$  bond. Odd  $e^-$  bond:  $\text{O}_2^-$ , NO,  $\text{NO}_2$ ,  $\text{ClO}_2$
- It could not explain the shapes & bond angles of various molecules.
- Transition elements generally disobey the octet rule.