

Chemical Bonding

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Constituents (atoms, molecules or ions) of different elements except noble gases, do not have complete octet so they combine with other constituent atoms by chemical bonds to achieve complete (stable) octet. The process of their combination is called chemical bonding. Chemical bonding depends upon the valency of atoms.

Types of Chemical Bond

They are divided in the following types depending upon the mode electron transferred or shared electrons or forces of attraction

- Electrovalent or ionic bond
- Coordinate or dative covalent bond
- Van der Waal's forces
- Covalent bond
- Hydrogen bond

Electrovalent Bond

The bond formed by the transfer of electrons from one atom to another is called electrovalent bond and the compound is called **electrovalent compound** or **ionic compound**. These bonds are formed between metals and non-metals.

These conduct electricity when dissolved in water and also soluble in water. These are insoluble in organic solvents like alcohol etc.

Some Electrovalent Compounds (Ionic Compounds)

Name	Formula	Ions present
Aluminium oxide (Alumina)	Al_2O_3	Al^{3+} and O^{2-}
Ammonium chloride	NH_4Cl	NH_4^+ and Cl^-
Calcium chloride	CaCl_2	Ca^{2+} and Cl^-

Covalent Bond

The bond is formed by the sharing of electrons between two atoms of same (or different) elements, is called covalent bond.

Covalent bond may be single, double or triple depends upon the number of sharing pairs of electrons.

Covalent compounds are usually liquids or gases having low melting point and boiling point. These do not conduct electricity and are insoluble in water but dissolve in organic solvent.

Some Covalent Compounds

Name	Formula	Element's part
Alcohol (Ethanol)	$\text{C}_2\text{H}_5\text{OH}$	C, H and O
Ammonia	NH_3	N and H
Acetylene (Ethyne)	C_2H_2	C and H

Coordinate or Dative Bond

The bond is formed by one sided sharing of one pair of electrons between two atoms. The necessary condition for the formation of coordinate bond is that octet of one atom should be complete, having atleast one lone pair of electrons and other atom should have a deficiency of atleast one pair of electrons.

The atom having complete octet which provides the electron pair for sharing, is known as **donor**. The other atom which accept the electron pair, is called the **acceptor**.

Bonding between A and B is predominantly

- Ionic if there is large difference in electronegativity.
- Covalent if both A and B have approximately same value of electronegativity.
- Coordinate if lone pair on A (or B) is donated to electron deficient B (or A).

Compounds Containing Ionic and Covalent Bonds

Name	Formula
Potassium cyanide	KCN
Sodium hydroxide	NaOH
Calcium carbonate	CaCO ₃

Compounds Containing Covalent and Coordinate Bonds

Name	Formula
Carbon monoxide	CO
Ozone	O ₃
Dinitrogen oxide	N ₂ O
Dinitrogen trioxide	N ₂ O ₃
Nitric acid	HNO ₃

Compounds Containing Electrovalent, Covalent and Coordinate Bonds

Name	Formula
Ammonium chloride	NH ₄ Cl
Ammonium bromide	NH ₄ Br

Hydrogen Bond

The electrostatic force of attraction between hydrogen atom (which is covalently bonded to a highly electronegative atom) and any other electronegative atom which is present in the same or different molecules, is known as hydrogen bond.

It is maximum in the solid state and minimum in the gaseous state.

Intermolecular H-bonding (e.g. HF, water (H₂O) molecule) It occurs between different molecules of a compound and results in increasing solubility in water and high boiling point.

Intramolecular H-bonding (e.g. o-nitrophenol) It occurs within different parts of a same molecule and results in decreasing solubility in water and low boiling point.

Van der Waals' Forces

The ability of geckos (lizard) which can hang on a glass surface using only one toe to climb on sheer surfaces had been attributed to the Van der Waals' forces between these surfaces and their foot-pads.