

Intermolecular and intramolecular forces

London forces, dipole forces, hydrogen bonding, ionic, covalent, metallic bonding

Various forces exist in molecules that bind the atoms together. The forces holding molecules together are generally called intermolecular forces. Three types of force can operate between covalent molecules:

1. Dispersion forces (London dispersion forces)
2. Dipole-Dipole Interaction
3. Hydrogen bonding

The strength of the intermolecular forces are as follows:

dispersion forces < dipole-dipole interactions < hydrogen bonds

Dispersion Forces: These forces arise between molecules due to attraction of electrons to nuclei of other molecules or due to momentary dipoles when molecules approach each other. Dispersion forces increase with increase in number of electrons in a molecule. For example dispersion forces in SiF_4 are higher than CH_4 due to the fact that SiF_4 has more electrons in it compared to CH_4 .

Dispersion forces are observed only in non polar molecules such as BF_3 , CH_4 , CO_2 , C_2H_4 etc.

Dipole-dipole Interactions:

Dipole-dipole interactions are due to interaction between two net dipoles of same molecules. These forces are stronger than dispersion forces. Partial positive charge on one molecule attracts the positive negative charge on the other molecule. Dipole forces are seen in all polar molecules such as CHCl_3 , NO_2 , CO , PH_3 etc.

Hydrogen bonds:

Hydrogen bonding is a type of dipole-dipole interaction that occur only in molecules that contain O-H, N-H or F-H bonds. Oxygen, Nitrogen and fluorine are highly electronegative and have highly localized -ve charge. Hydrogen has only one proton and have highly localized +ve charge. The electrostatic attraction is higher when compared to other polar molecules. Hence, hydrogen bonding is stronger than dipole-Dipole attractions. Some of the molecules that have hydrogen bonding are NH_3 , H_2O , HF , CH_3OH , CH_3COOH

Intramolecular forces:

An intramolecular force is the force that holds the atoms or ions together in a compound. These forces are stronger than intermolecular forces. Intramolecular forces are categorized into three types.

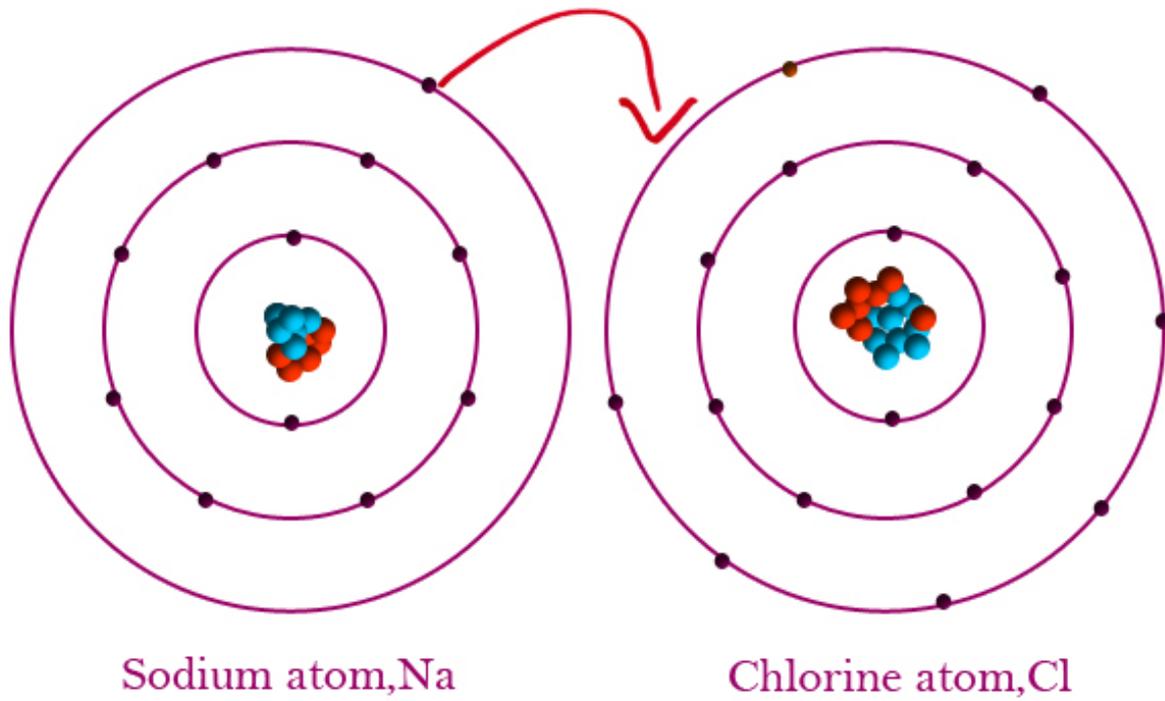
1. Metallic bonding
2. Ionic bonding
3. Covalent bonding

Metallic bonding:

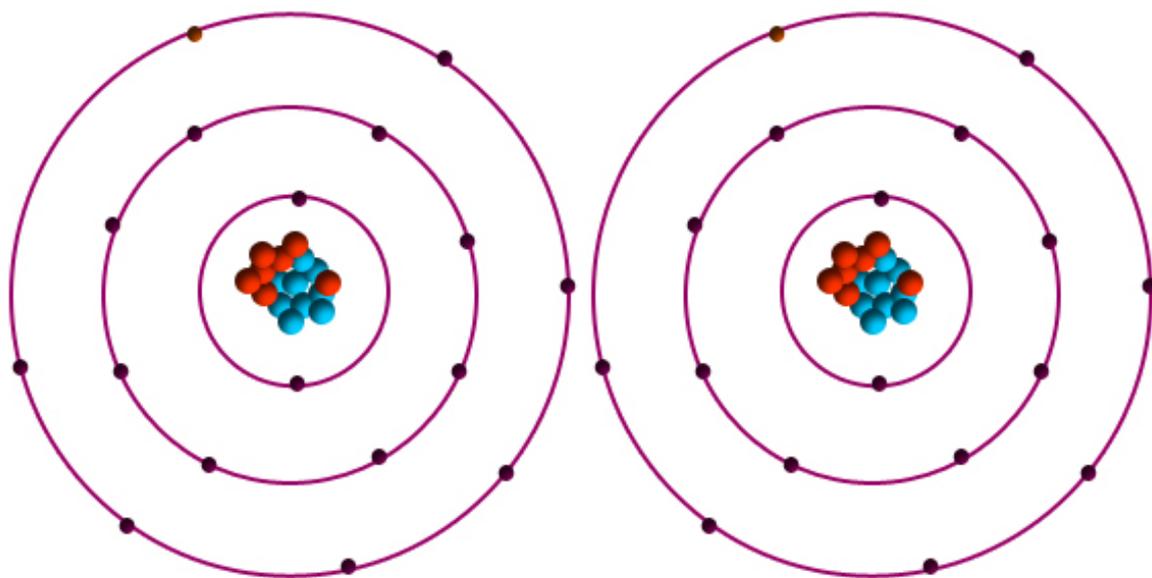
This type of bonding is formed when metal atoms share delocalized electrons.

Ionic bonding:

This type of bonding is formed when metal atom donate one or more electrons to non metal atoms. An electrostatic attraction builds between the two ions, which is known as ionic bonding.

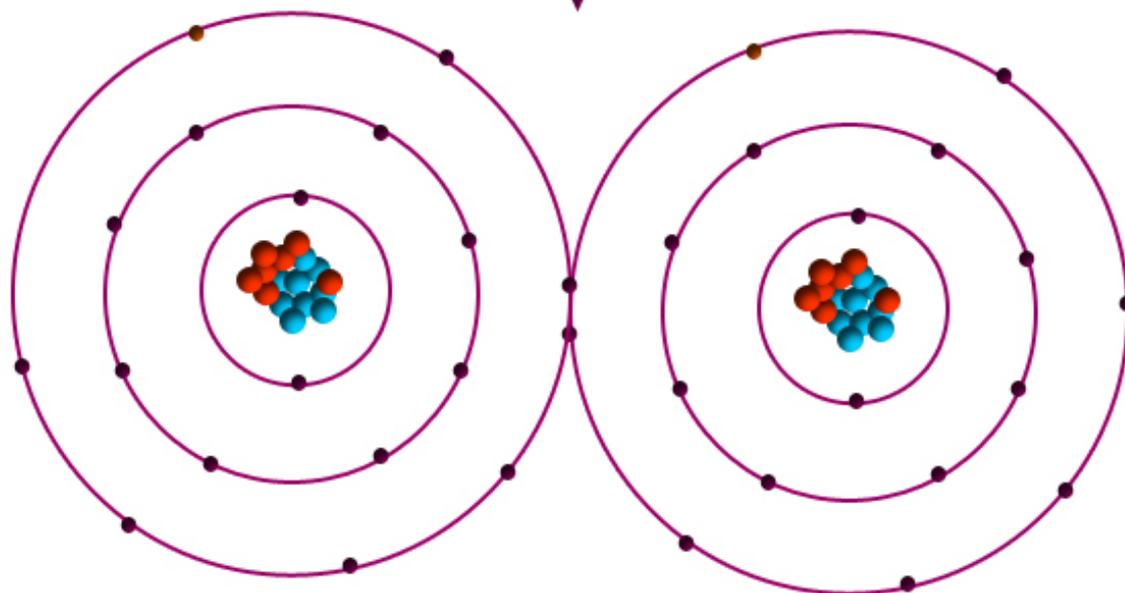


Covalent bonding: Covalent bonding involves sharing a pair of electrons. By sharing a pair of electrons both atoms gain a stable electron configuration state.



Chlorine atom, Cl

Chlorine atom, Cl



Chlorine Molecule(stable)