Chemistry Study Materials for Class 11 (NCERT Based Notes of Chapter- 04)

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CHEMICAL BONDING AND MOLECULAR STRUCTURE

Orbital overlap concept

Orbital overlapping is the process of partial interpenetration of atomic orbitals.

The important characteristics of orbital overlapping are:

1. A covalent bond is formed by the overlapping of half filled atomic orbitals present in the valence shell of atoms.
2. The overlapping orbitals should contain electron with opposite spin.
3. As a result of overlapping, the electrons get paired and a stable covalent bond is formed.
4. The strength of a covalent bond depends on the extent of overlapping. The greater the extent of overlapping, the stronger will be the covalent bond formed.

Types of overlapping

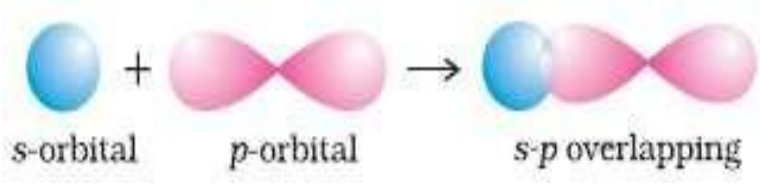
There are two types of orbital overlapping.

1. Axial overlapping:

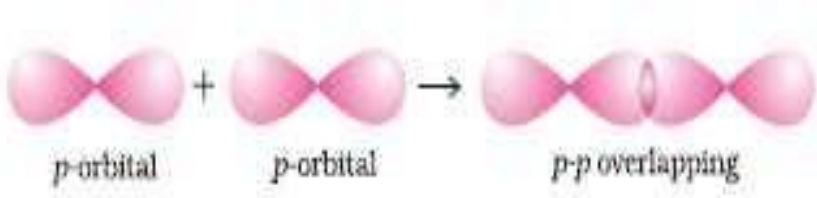
If the overlapping of atomic orbitals take place *along inter nuclear axis*, it is called axial overlapping or end to end overlapping. A bond formed by axial overlapping is called **sigma (σ) bond**. The electrons present in sigma bond are called sigma electrons. All single bonds are sigma bonds. A sigma bond can be formed by the following ways:

i) **s-s overlapping:** Here the overlapping of two half filled s-orbitals take place along the inter nuclear axis.

ii) s-p overlapping: It occurs with the overlapping of one half filled s-orbital and one half filled p-orbital.



iii) p-p overlapping: Here two half filled p- orbitals of two atoms overlap.

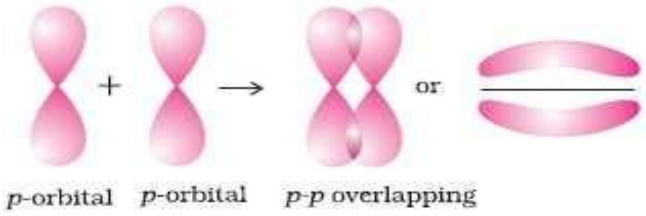


2. Lateral overlapping:

Here the overlapping take place perpendicular to inter nuclear axis.

The bond formed as a result of lateral overlapping is called pi (π) bond.

The electrons in pi bond are called π electrons.



A π bond is always present along with σ bonds. A double bond contains one σ bond and one π bond. A triple bond contains one sigma bond and two pi bonds.

A sigma bond is stronger than a pi bond. This is because the extent of overlapping is greater in a sigma bond.

Hybridisation

It is the process of inter mixing atomic orbitals having slightly different energies to form new orbitals having equivalent energy and identical shape. The new orbitals formed are called hybrid orbitals.

Characteristics of hybridisation

1. The number of hybrid orbitals formed is equal to the number of atomic orbitals undergo hybridization.
2. The hybrid orbitals are always equivalent in energy and in identical shape.
3. The hybrid orbitals are more effective in forming stable bonds than the pure atomic orbitals.
4. The hybrid orbitals are directed to some fixed positions in space. So the type of hybridization gives the shape of the molecule.

Important conditions of hybridisation

a) The orbitals present in the valence shell of the atom are hybridized.

b) The orbitals undergoing hybridization should have almost equal energy.

c) Promotion of electrons is not an essential condition before hybridisation.

d) Completely filled orbitals of valence shell can also take part in hybridisation.

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