SUBJECT - CHEMISTRY
CLASS - BSc (Sub/NIEN) PART-I
GROUP - B
TOPIC - Hybridisation
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We know that S, Px, Py etc are atomic orbitals. The process of mixing two or more different outer atomic orbitals such as S, Px, Py, Pz etc of an atom to form an equal number of equivalent orbitals is called hybridisation and such equivalent orbitals are called as hybrid orbitals. Firstly hybrid orbitals are formed from atomic orbitals and then the filling of electrons is done obeying Pauli Rule, Hund Rule and Aufbau order. The number of hybrid orbitals formed is always equal to the number of atomic orbitals mixed. An atom mobilises only as many hybrid orbital as it has atoms or groups to form strong σ bonds. Hence all outer orbitals donot participate in hybridisation or we can say that some of these orbitals remain unhybridised i.e unused. Hybridisation is a mathematical device in calculation and not a physical reality. Hybridisation occurs so that the other atoms thus bonded and the electron pairs constituting the bonds are as far apart from each other as possible i.e so that the internal energy of the compound so formed is at a minimum.

Hybrid orbitals differ from pure atomic orbitals. They are directional and hence have definite geometrical shapes.

The notation of hybrid orbitals is obtained from combining orbitals so when s and Px - two atomic orbitals are mixed two equivalent sp hybrid orbitals are formed.

$S + P_x \xrightarrow{sp\ hybridisation} 2sp$

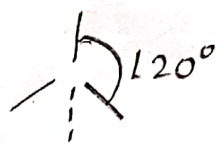
This process is called sp hybridisation. These two sp hybrid orbitals orient at an angle of 180° to give linear shape -

Linear

When S, P_x and P_y - three atomic orbitals mix, three equivalent sp^2 hybrid orbitals are formed -

$S + P_x + P_y \xrightarrow{sp^2\ hybridisation} 3sp^2$

This process is called sp^2 hybridisation. These three sp^2 orbitals orient at an angle of 120° to give triangular planar shape -

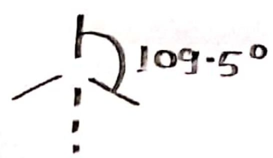


Triangular plane

When S, P_x, P_y and P_z - four atomic orbitals are mixed, four equivalent sp^3 hybrid orbitals are formed.

$S + P_x + P_y + P_z \xrightarrow{sp^3\ hybridisation} 4sp^3$

This process is called sp^3 hybridisation. These four sp^3 hybrid orbitals orient at an angle of 109.5° to give tetrahedral shape -



Tetrahedral

Similarly dsp^2, sp^3d, sp^2d^2, sp^3d^2, sp^3d^3 etc hybrid orbitals are formed. The number of atomic orbitals mixed, hybridisation and structure are interrelated -

No. of atomic orbitals mixed	Hybridisation	Structure
2	sp	Linear
3	sp^2	Triangular plane
4	sp^3	Tetrahedral
	dsp^2	Square planar
5	sp^3d	Trigonal bipyramid
	sp^2d^2	Square pyramid
6	sp^3d^2	Octahedral
7	sp^3d^3	Pentagonal bipyramid