PREDICTION OF STATE OF HYBRIDISATION

Multiple techniques exist for determining the state of hybridization in a molecule, but one of the most suitable methods is the electron-pair (EP) method, elucidated as follows:
Calculate the electron pairs (EP) by adding the number of bonded pairs (BP) to the number of lone pairs (LP):

$$EP = BP(\text{Bonded pair}) + LP(\text{Lone pair})$$

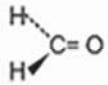
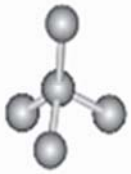
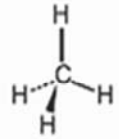
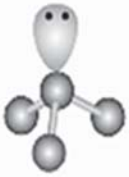
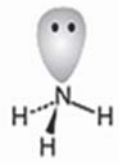
This method involves counting both the bonded pairs contributing to the formation of chemical bonds and the lone pairs residing on the central atom. The resulting sum of bonded and lone pairs provides a comprehensive measure of the electron pairs influencing the hybridization state of the atom.

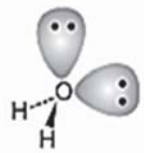
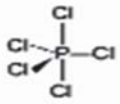
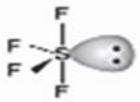
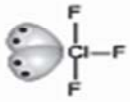
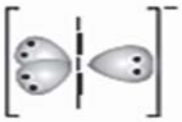
Valence Shell Electron Pair Repulsion Theory

1. In accordance with this theory, the geometry of a compound is determined by the quantity and nature of electron pairs surrounding the central atom in the compound.
   (a) Bond pair: A pair of electrons influenced by two atoms.
   (b) Lone pair: A pair of electrons localized on a single atom.

2. Electron pairs within a compound experience mutual repulsion and strive to position themselves as far apart as possible.
   The hierarchy of repulsion follows the sequence:
   Lone pair-lone pair > Lone pair-bond pair > Bond pair-bond pair
3. A double bond induces more repulsion compared to a single bond.

Hybridisation and Shapes of Molecules

Number of σ-Bonds	Number of Lone Pairs	Hybridisation	Molecular Geometry	Shape	Examples
2	0	sp		Linear	O = C= O
3	0	sp^2		Trigonal planar	
2	1			Bent	
4	0			Tetrahedral	
3	1	sp^3		Trigonal pyramidal	

2	2		Bent	
5	0	sp^3d	Trigonal bipyramidal	
4	1		See-saw [Distorted tetrahedron or folded square]	
3	2		T-shaped	
2	3		Linear	
6	0	sp^3d^2	Octahedral	
5	1		Square pyramidal	
4	2		Square planar