

Lewis structures and valence shell electron pair repulsion (VSEPR) theory

- Used to predict the three-dimensional arrangement of atoms within molecules (molecular geometry)
- The specific arrangements depend on the number of electron pairs present

Single bond: VSEPR electron group containing two electrons

Double bond: VSEPR electron group containing four electrons

Triple bond: VSEPR electron group containing six electrons

Nonbonding electrons are included when determining the number of electron groups
(one pair of nonbonding electrons represents one electron group)

Number of Electron Groups	Electron-Group Geometry	Bond Angles	Bonding Electron Groups	Nonbonding Electron Groups	Molecular Geometry	Hybridization	Example
2	Linear	180°	2	0	Linear	sp (one s and one p mix to form 2 sp orbitals)	CO ₂ HCN
3	Trigonal Planar	120°	3	0	Trigonal planar	sp² (one s and two p mix to form 3 sp ² orbitals)	H ₂ CO BF ₃
			2	1	Bent		SO ₂ NO ₂
4	Tetrahedral	109°	4	0	Tetrahedral	sp³ (one s and three p mix to form 4 sp ³ orbitals)	CH ₄
			3	1	Trigonal pyramidal		NH ₃
			2	2	Bent		H ₂ O
5	Trigonal bipyramidal	120° and 90°	5	0	Trigonal bipyramidal	sp³d (one s, three p and one d mix to form 5 sp ³ d orbitals)	PCl ₅
			4	1	Seesaw		SF ₄
			3	2	T-shaped		ClF ₃
			2	3	linear		XeF ₂
6	Octahedral	90°	6	0	Octahedral	sp³d² (one s, three p and two d mix to form 6 sp ³ d ² orbitals)	SF ₆
			5	1	Square pyramidal		ClF ₅
			4	2	Square planar		XeF ₄

Hybridization (Hybrid Orbitals)

The assumption that atomic orbitals on an atom mix to form new orbitals of different shapes

The process is called hybridization

The number of hybrid orbitals equals the number of atomic orbitals mixed