Chapter 10 Chemical Bonding 2.

Molecular Geometry + Hybridization of Atomic Orbitals.

Molecular Geometry

XPT: X-Ray Diffraction

Simple Model:

VSEPR

Valence Shell Electron Pair Repulsion

Valence Shell: outer

Electron Pair: : pairs

Repulsion: ⊖ ↔ ⊖

↑

LONE-PAIRS + BONDS (single/double/triple)

Two Repulsions

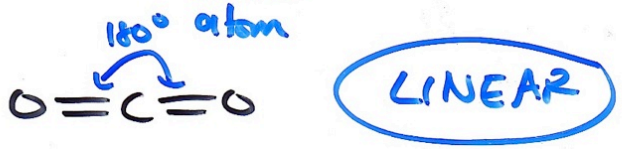
ex: $BeCl_2$ (g)

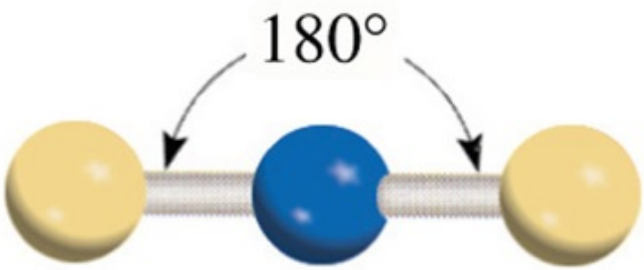
Be: 4 e⁻s.

$BeCl_2$

CO_2

central atom

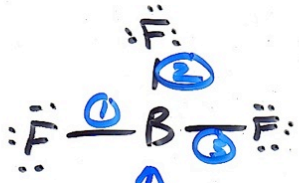




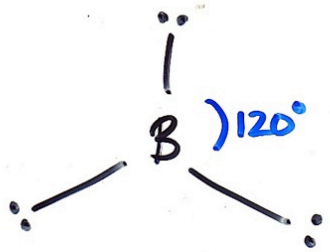
THREE REPULSIONS

B ~ 6 e⁻ !
e⁻ deficient !

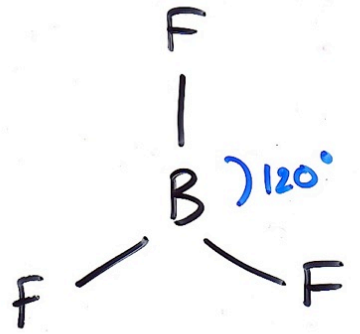
ex: BF_3



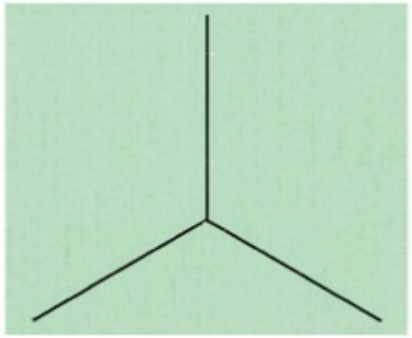
central atom

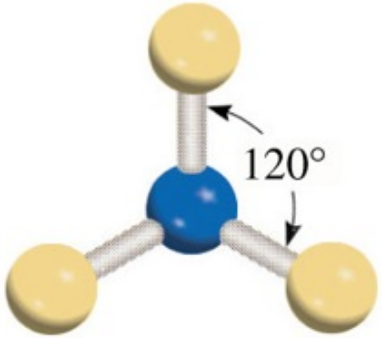


TRIGONAL PLANAR



trigonal planar

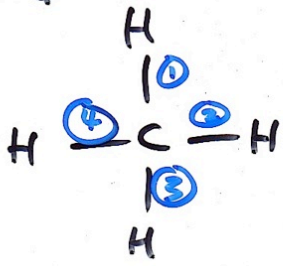


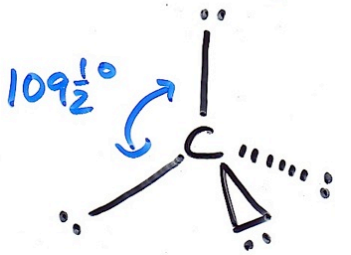


Planar

Four Repulsions

ex: CH_4





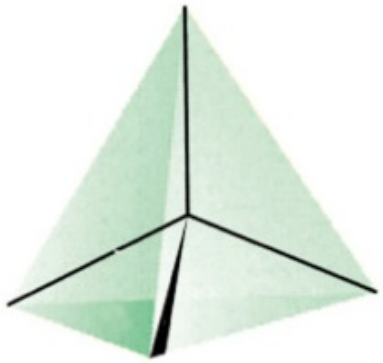
= in plane of page

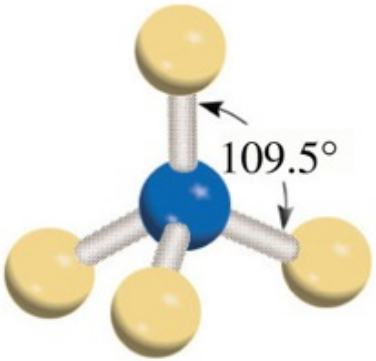
= infront

= behind

TETRAHEDRAL

(?  tetrahedron = 4 sides)

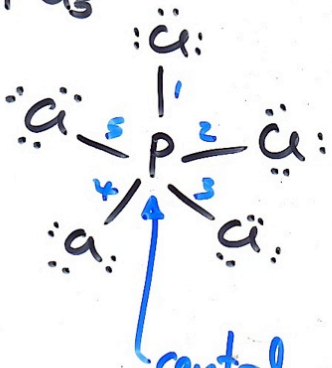


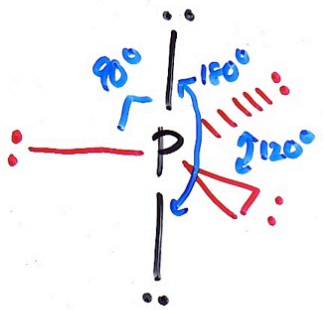


Tetrahedral

Five Repulsions

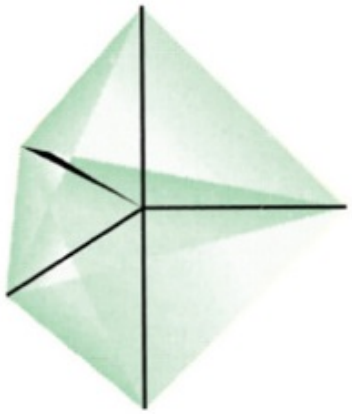
ex: PCl_5



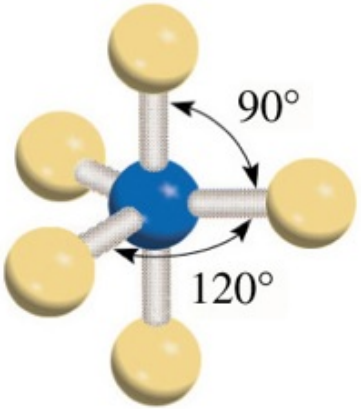


90° ax - eq
120° eq - eq
180° ax - ax

TRIGONAL BIPYRAMIDAL



Trigonal bipyramidal

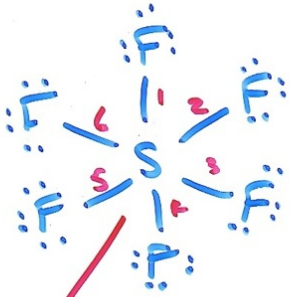


2 x triangular pyramids!

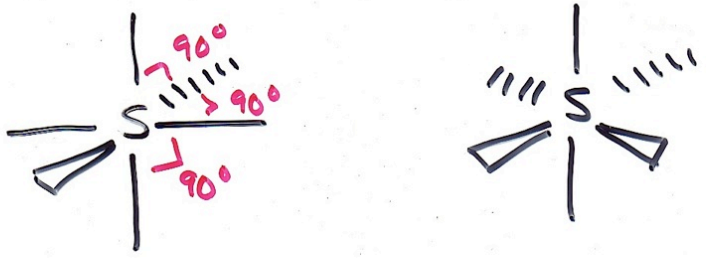
Pyramids in Egypt

Six Repulsions

SF_6



central atom



OCTAHEDRAL

Octahedral

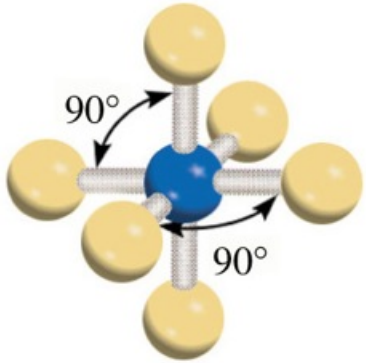
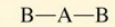
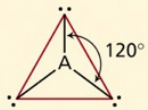
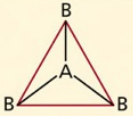
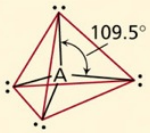
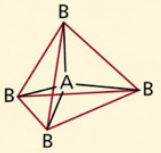
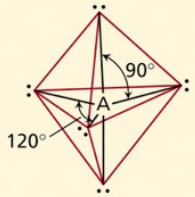
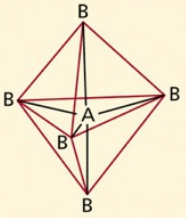
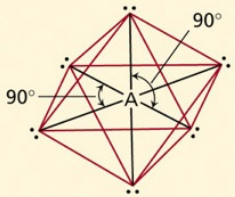
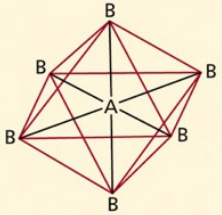


Table 10.1 Arrangement of Electron Pairs About a Central Atom (A) in a Molecule and Geometry of Some Simple Molecules and Ions in Which the Central Atom Has No Lone Pairs

Number of Electron Pairs	Arrangement of Electron Pairs*	Molecular Geometry*	Examples
2	 Linear	 Linear	$BeCl_2$, $HgCl_2$
3	 Trigonal planar	 Trigonal planar	BF_3
4	 Tetrahedral	 Tetrahedral	CH_4, NH_4^+
5	 Trigonal bipyramidal	 Trigonal bipyramidal	PCl_5
6	 Octahedral	 Octahedral	SF_6

*The colored lines are used only to show the overall shapes; they do not represent bonds.