Polarity

Andy Schweitzer

What does it mean to be polar?

- A molecule is polar if it contains + and – somewhere in the molecule.

- Remember: Protons can not move. So for a molecule to get a +/- it must somehow have its electrons dragged from one atom to another!

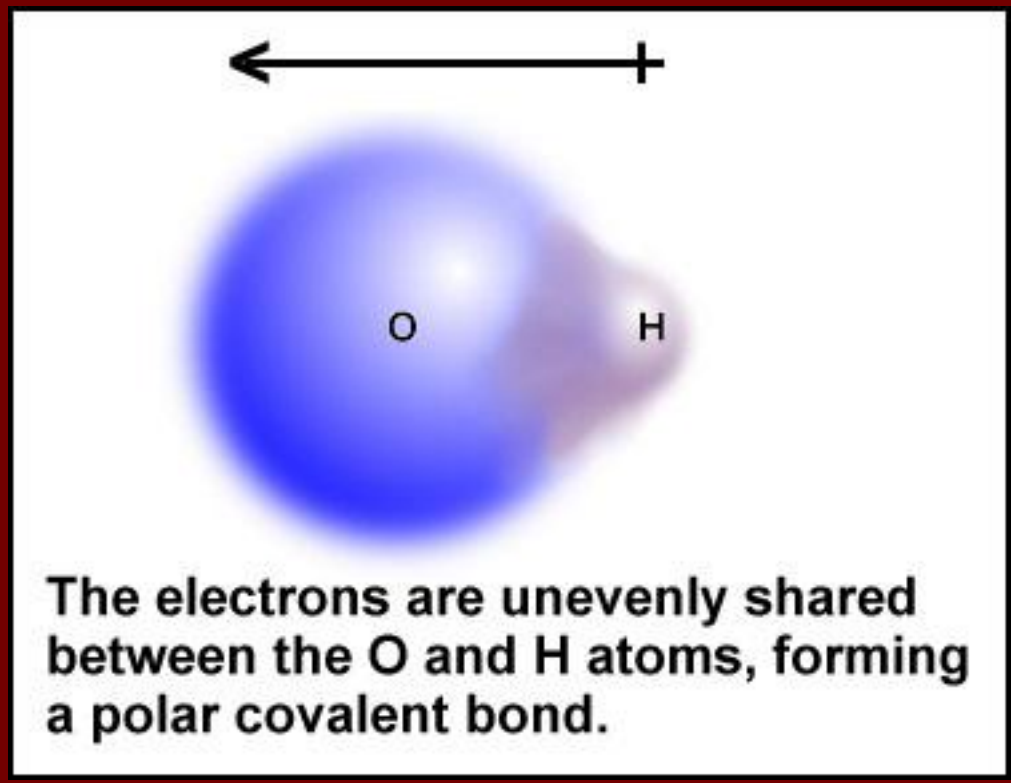
How does polarity affect a molecules properties?

- Solute dissolving in a solvent?
  - "Likes dissolve likes"
    - Non-polar solutes dissolve in non-polar solvents
    - Polar solutes dissolve in polar solvents.
  - Biologically
    - Drugs are absorbed into the brain (past the blood brain barrier) based upon their polarity.
    - Morphine and Heroine are very similar
    - Your body converts heroine to morphine after it enters the brain.
    - Heroin is 90% more polar there for it absorbs a lot faster.

How does a molecule become polar.

- Must have at least one polar bond.
- What is a polar bond?
  - A covalent bond where the electrons are not being shared equally.

Electrons are being dragged from one atom to another



The electrons are unevenly shared between the O and H atoms, forming a polar covalent bond.

Why are or why aren't the electrons being shared equally

- Electronegativity: An atoms attraction for electrons in a bond.
  - Some atoms, when bonded suck the electrons toward them.

- Electronegativity Difference: When you get two atoms bonded where one is highly electronegative and the other is not there will be unequal sharing.

Electronegativity difference? Tug of war

Mr. Schweitzer

Baby

Who wins this contest????

Electronegativity difference? Tug of war

Mr. Schweitzer

Superman

Who wins this contest????

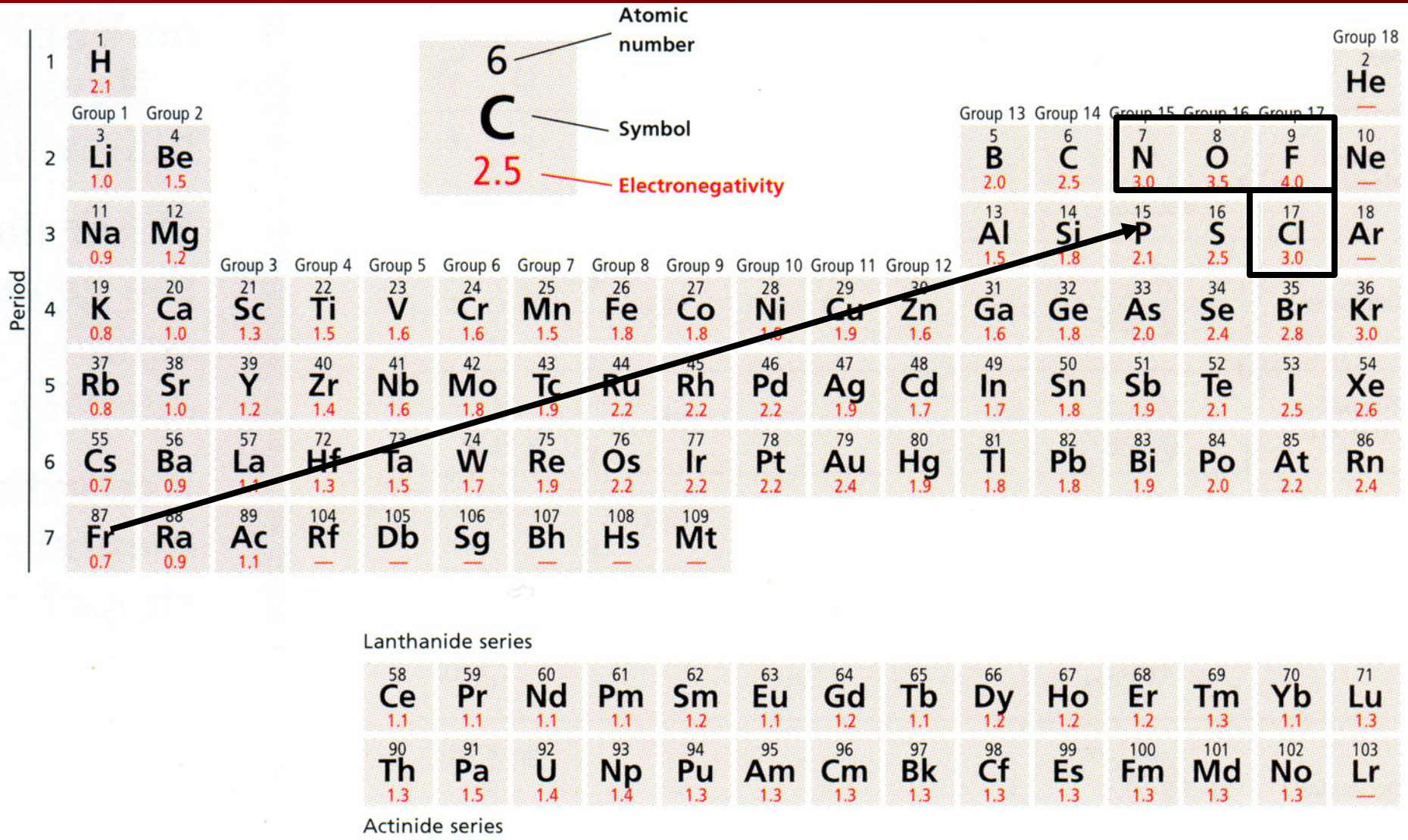
Electronegativity difference? Tug of war

Mr. Schweitzer

Superman

STALEMATE

Electronegativity



Electronegativity

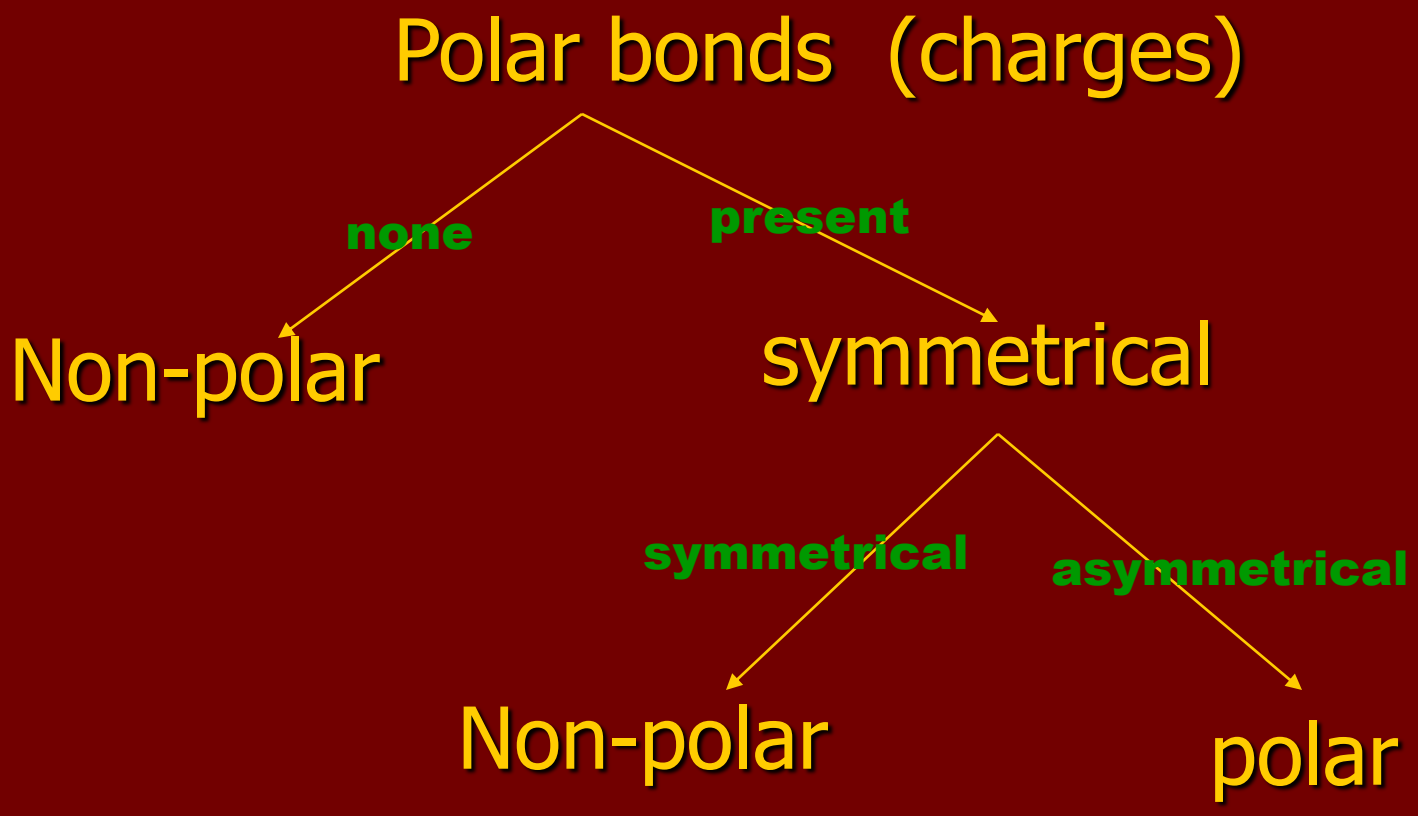
- Electronegativity difference
- Dipole moment: numerical measurement of the difference of charge.
  - Ionic dipole moment: (> 1.7)
    - NaCl = 3-.9 = 2.1
  - Polar covalent (.5 > x <1.7)
  - Pure covalent (<.5)

  These values are estimates

Which of these are polar covalent molecules

- Dipole moments
- H-F 1.9
- H-Cl .9
- NO_2 .5
- H_2 0

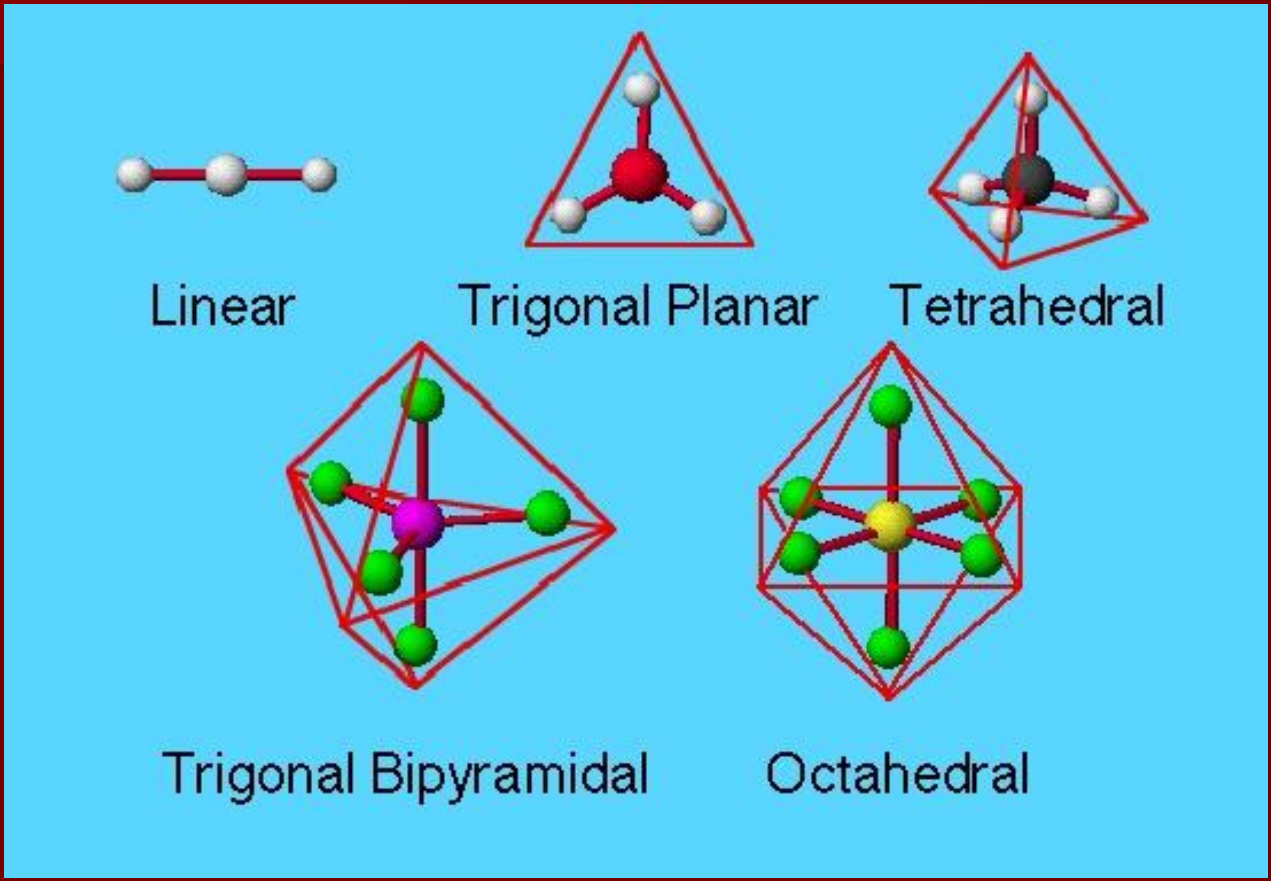
Structure also affects polarity



Symmetrical vs. Asymmetrical

- If a molecule is symmetrical then there will not be any unequal disposition of charges.
- How do you know if a molecule is symmetrical?

Structures

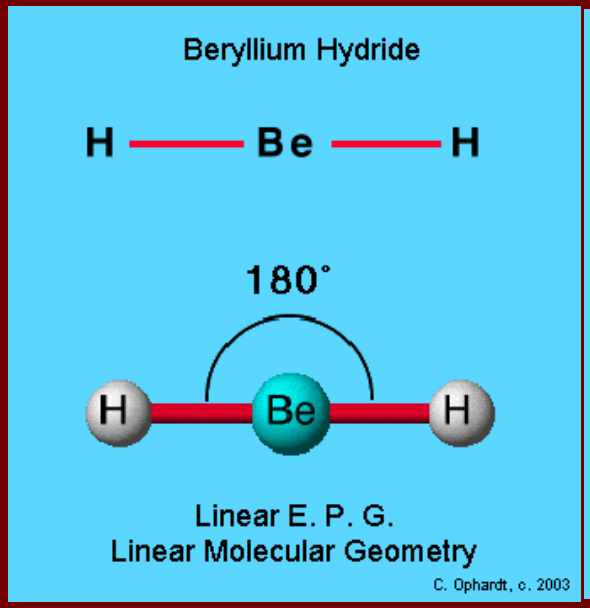


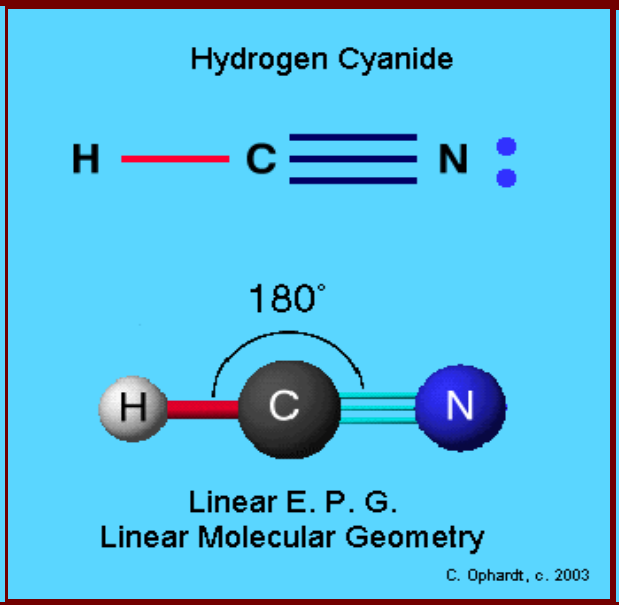
- These are the general structures. They all start out symmetrical.

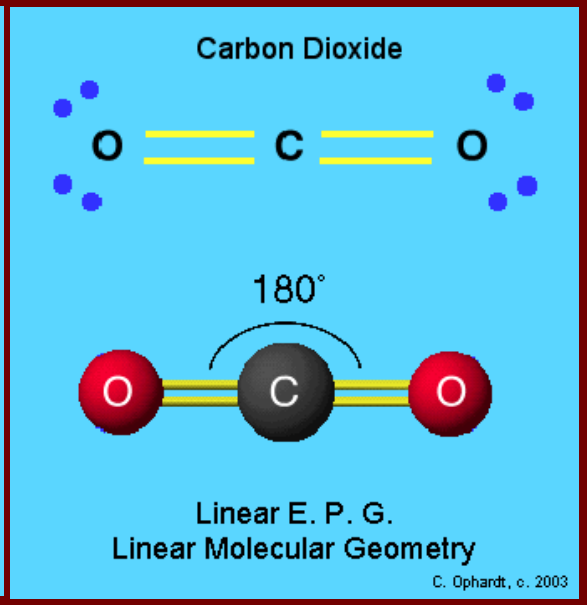
MOLECULAR GEOMETRY

2 bonded/0 non-bonded
Linear
Symmetrical
Hybridiztion = sp

Are these polar molecules?
What do we need to be polar?





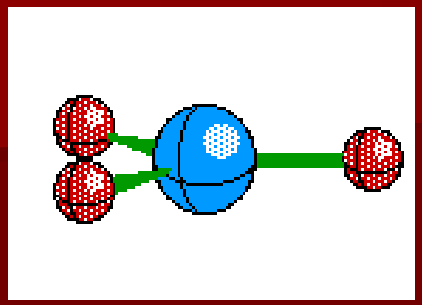


No stealers so not polar

Stealer + not symmetrical = polar

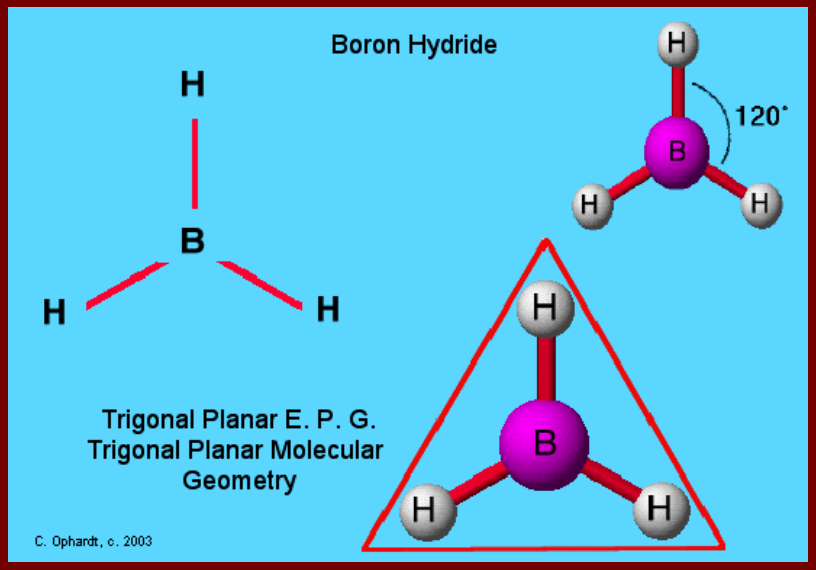
Stealers = yes
Symmetrical = yes
Polar = no

MOLECULAR GEOMETRY

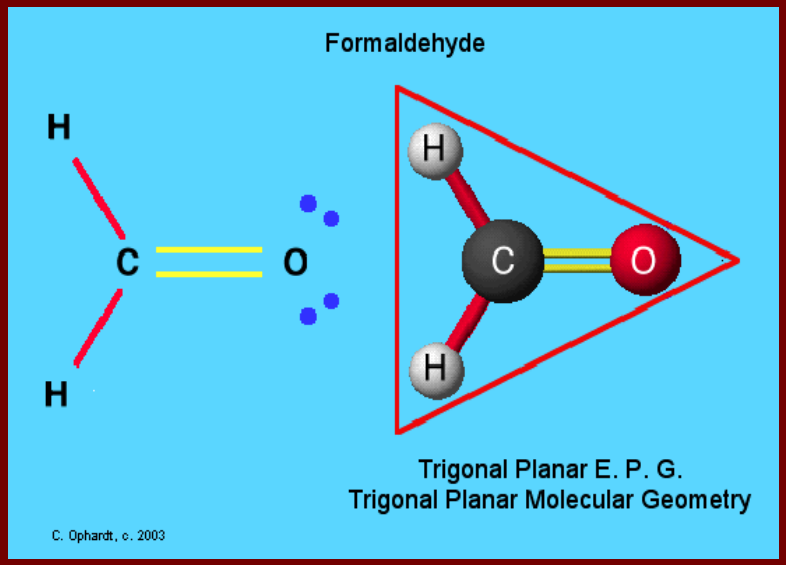


2 bonded/0 non-bonded
Trigonal planer
Symmetrical
Hybridization = sp^2

Are these polar?



No stealer!
Non-polar

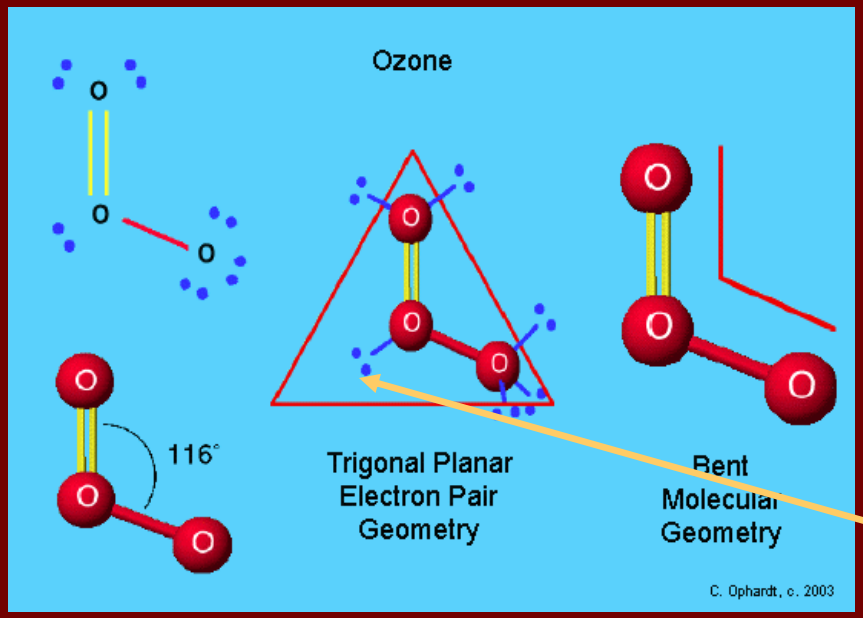


Stealer = yes
Symmetrical = no
Polar

MOLECULAR GEOMETRY

Bent
2 bonded/1 non-bonded
Asymmetrical
Bond angle <120
Hybridization = sp^2

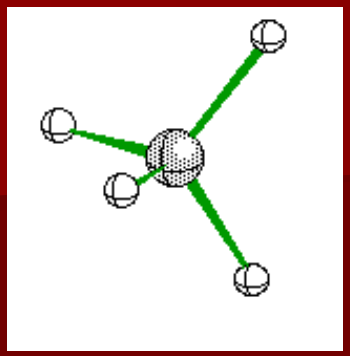
Are these polar?



Dipole moment = 0
Non-polar

Un-bonded pairs take more space then bonded pushing angle to slightly less then 120

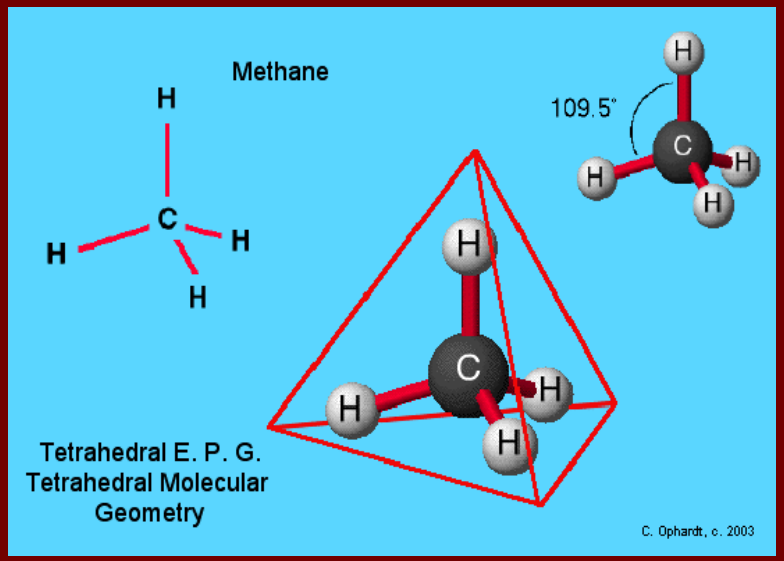
MOLECULAR GEOMETRY



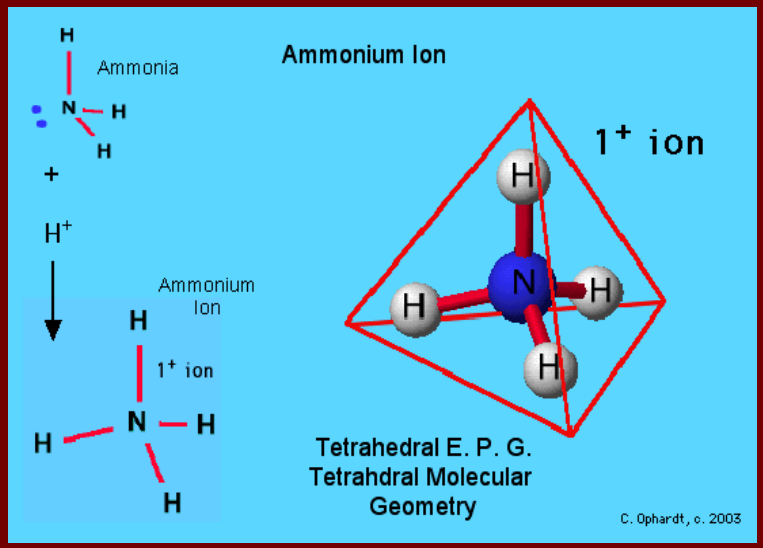
tetrahedral
Symmetrical
4 bonded/0 non-bonded
Bond angle: 109.5°

Are these polar?

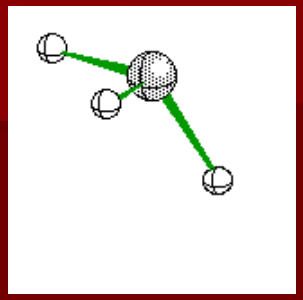
2 bonded/0 non-bonded
Linear
Symmetrical



2 bonded/0 non-bonded
Linear
Symmetrical

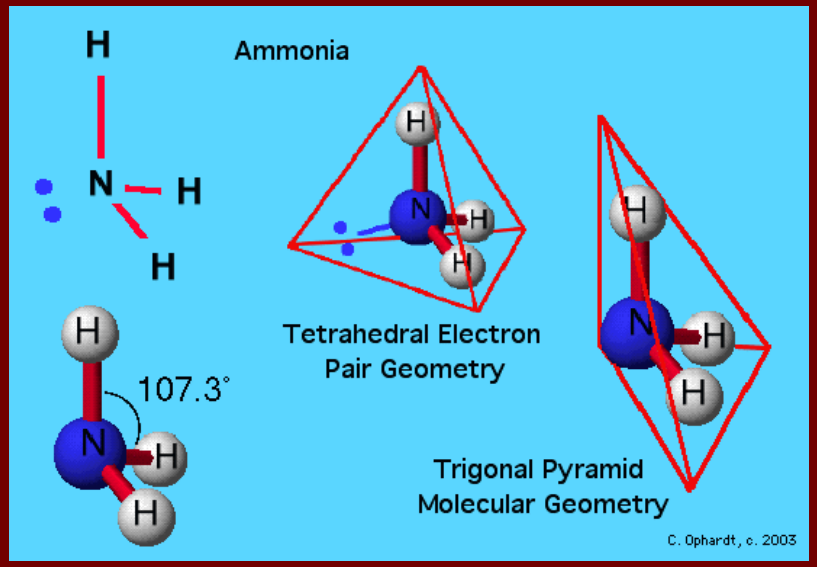


MOLECULAR GEOMETRY

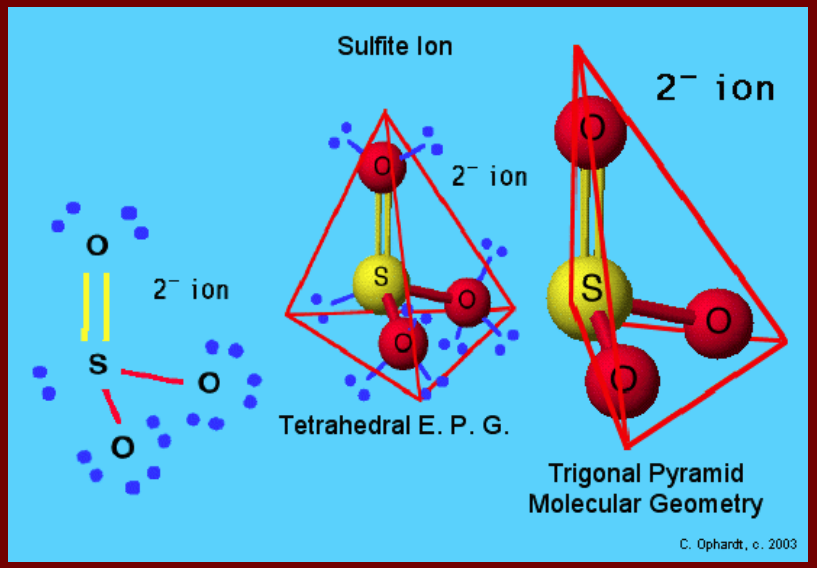


Trigonal pyramidal
3 bonded/ 1 non-bonded
Bond angle < 109.5
Asymmetrical

Stealer = Yes
Symmetrical = No
Polar

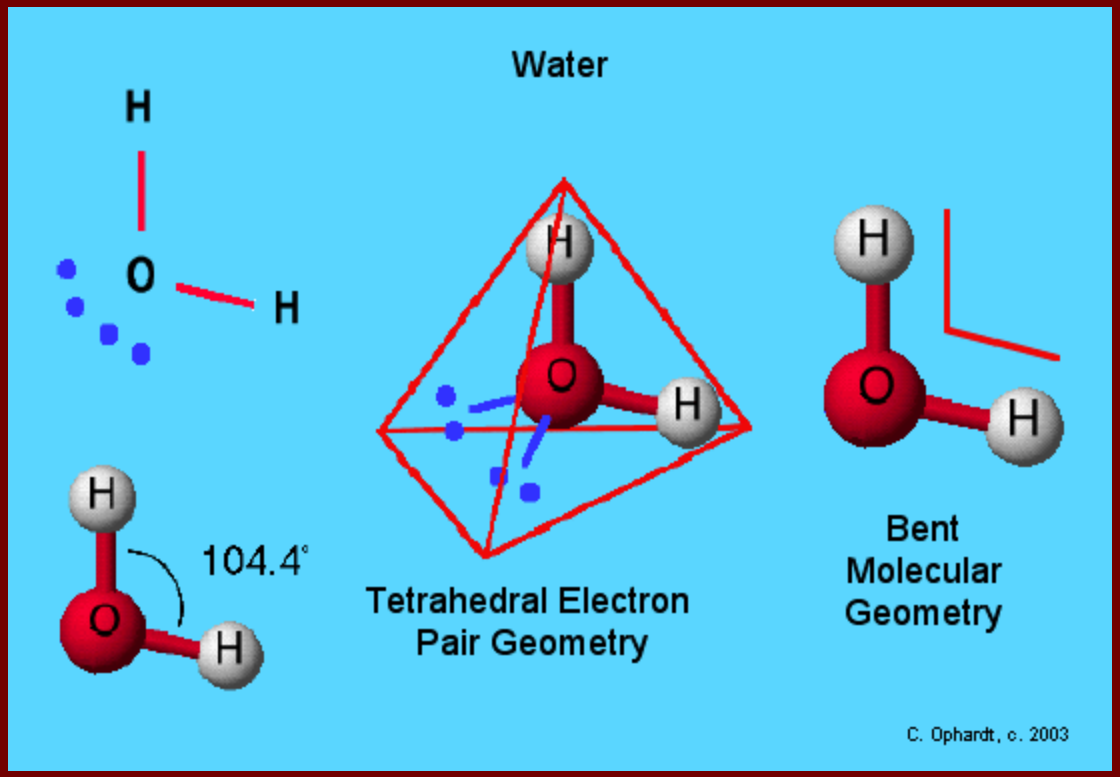


Stealer = Yes
Symmetrical = no
Polar



MOLECULAR GEOMETRY

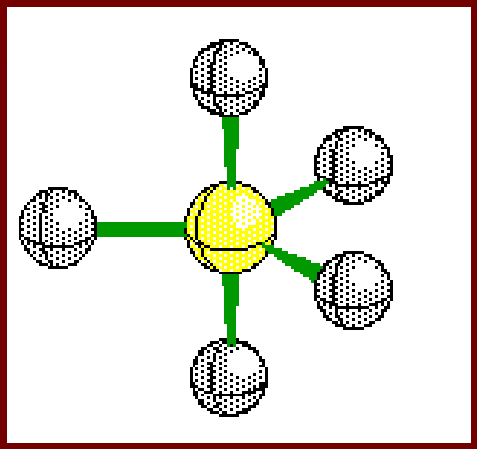
Bent
2 bonded/ 2 non-bonded
Bond angle: < 109.5
Asymmetrical



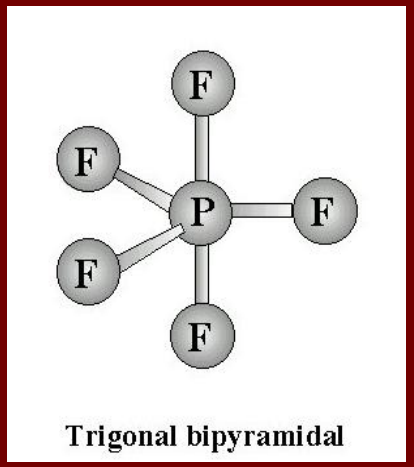
Stealer = yes
Symmetrical = no
Polar

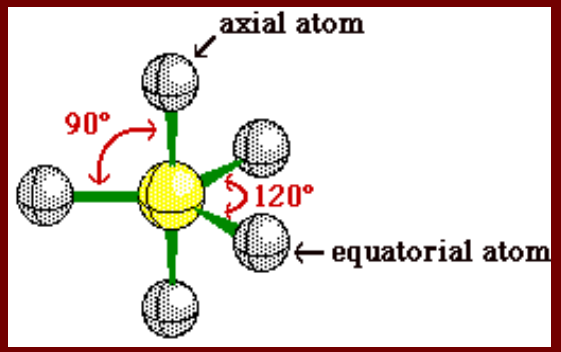
Molecular Geometry

Trigonal bipyramidal
Bond angle
Equatorial: 120°
vertical: 90°
Symmetrical
Hybridization = sp^3d



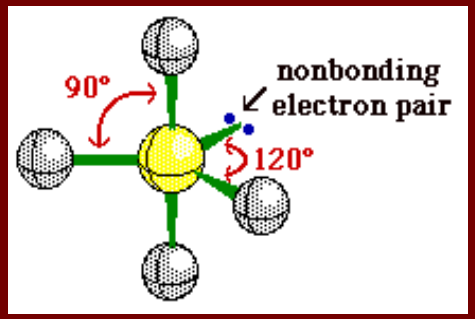
Polar molecule?

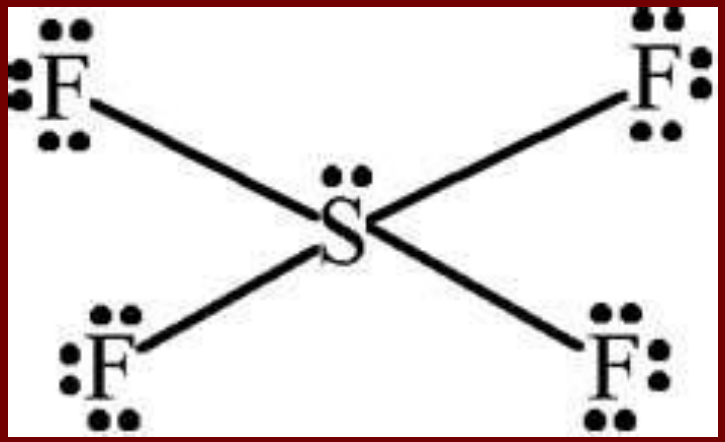




Molecular Geometry

See-Saw
4 Bonded/1 Non-bonded
Bond angle
Equatorial: 120°
vertical: 90°
Asymmetrical

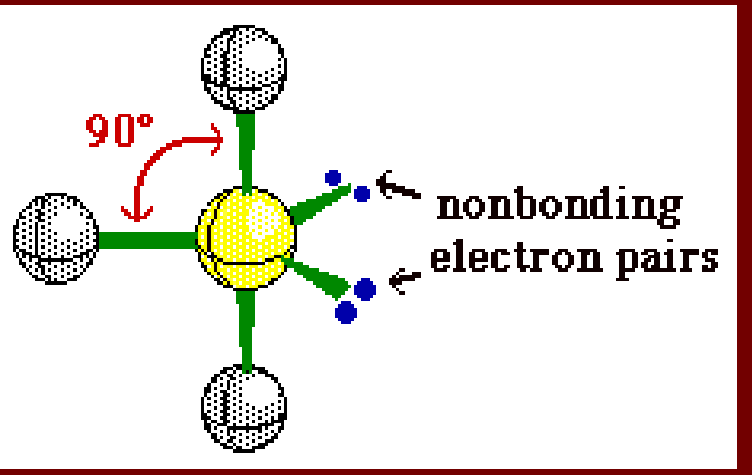


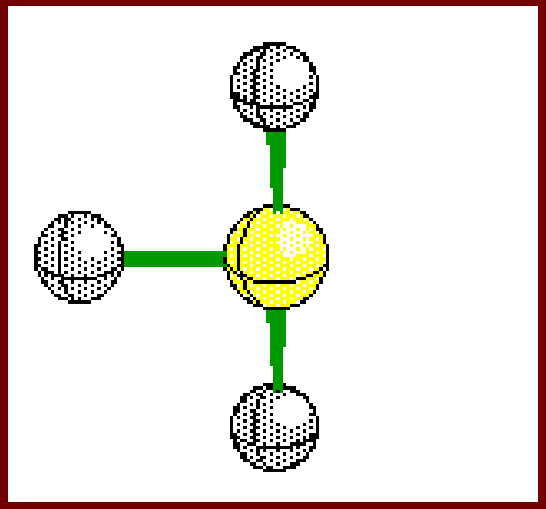


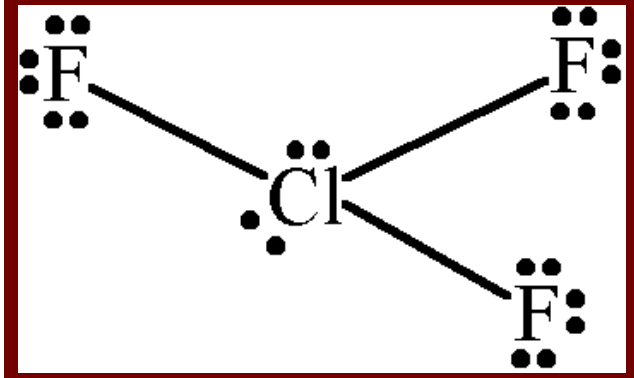
MOLECULAR GEOMETRY

T-Shaped
3-bonded/2 non-bonded
Bond angle
Equatorial: 120°
Vertical: 90°
asymmetrical

Polar?



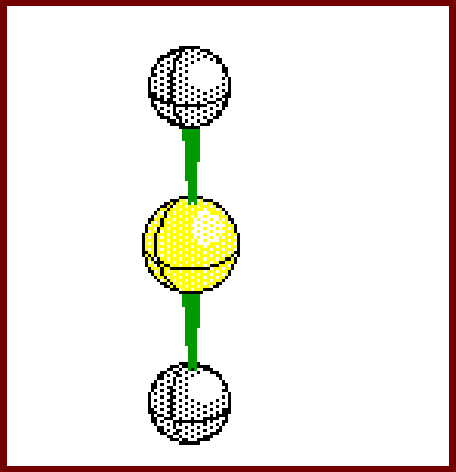


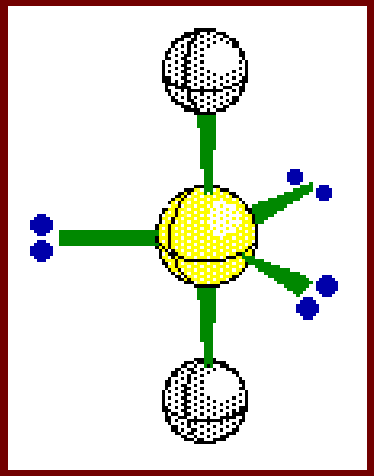


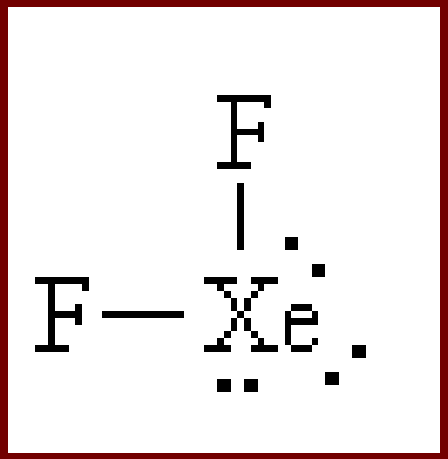
MOLECULAR GEOMETRY

2-bonded/3 non-bonded
Linear
Bond angle: 180
Symmetrical
Hybridization = sp^3d

Polar?

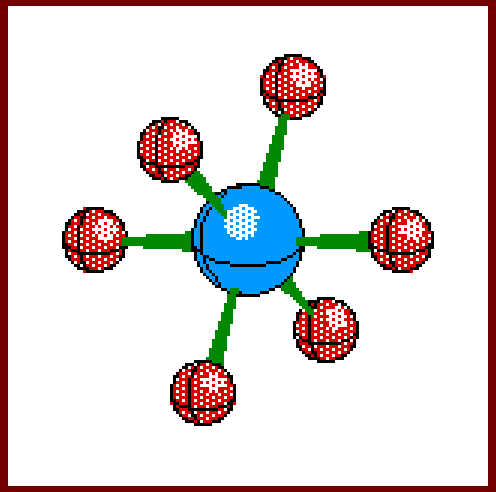




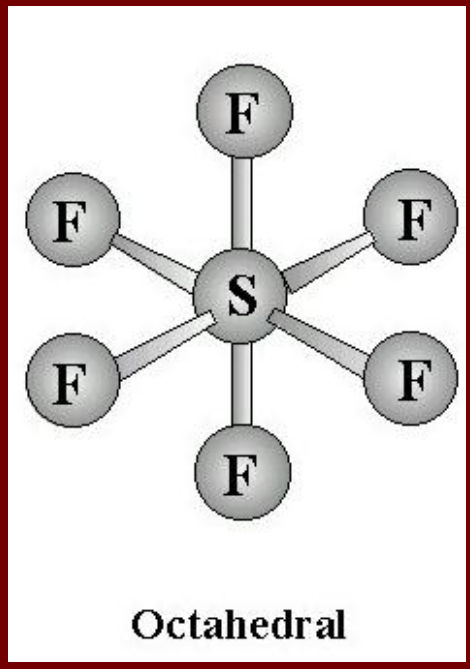


Molecular Geometry

Octahedral or square bipyramidal
6 bonded/ 0 non-bonded
Bond angle
    equatorial: 90°
    vertical: 90°
Symmetrical
Hybridization = sp^3d^2

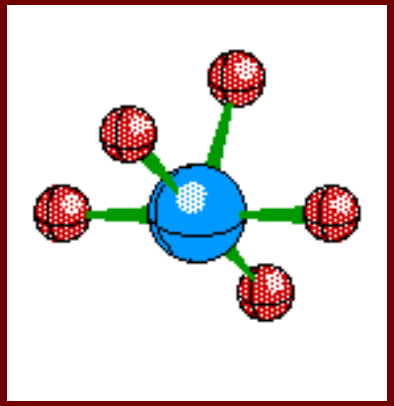


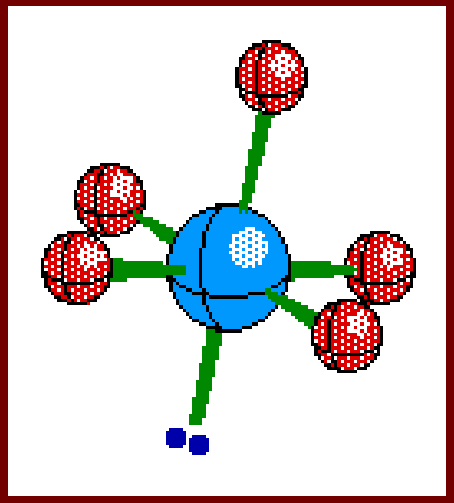
Polar?



MOLECULAR GEOMETRY

Square pyramidal
5 bonded/1 non-bonded
Bond angle
Equatorial: 90°
Vertical: 90°
Asymmetrical





Molecular Geometry

Square Planar

4 bonded / 2 non-bonded

Bond angle

Equatorial: 90°

vertical: 90°

Symmetrical

Polar?