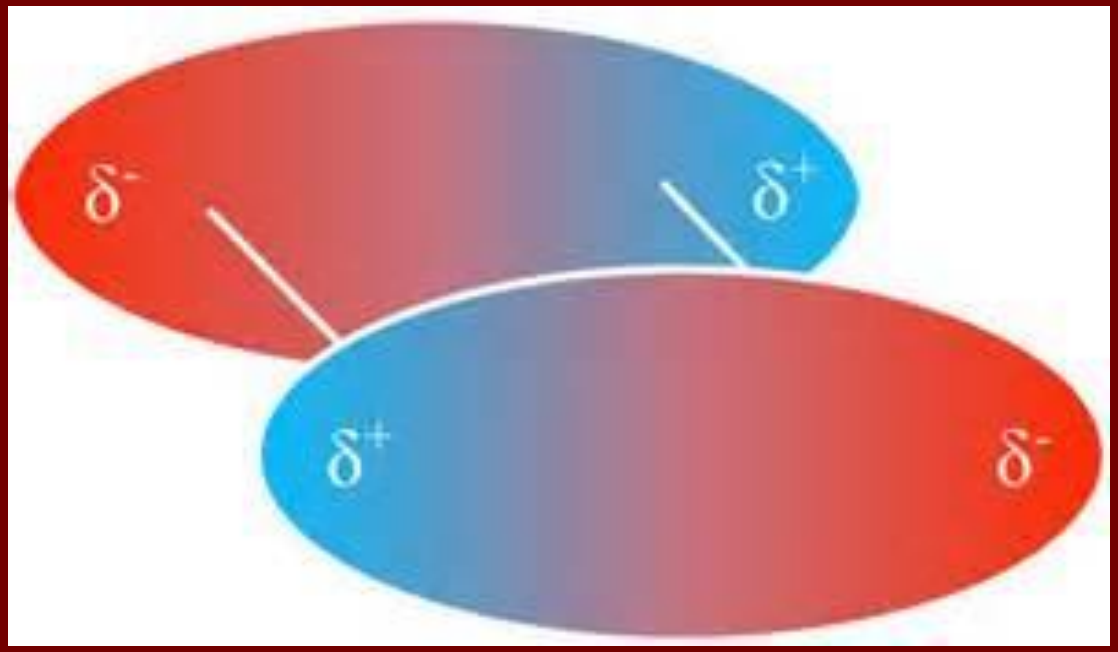
Polarity

Andy Schweitzer

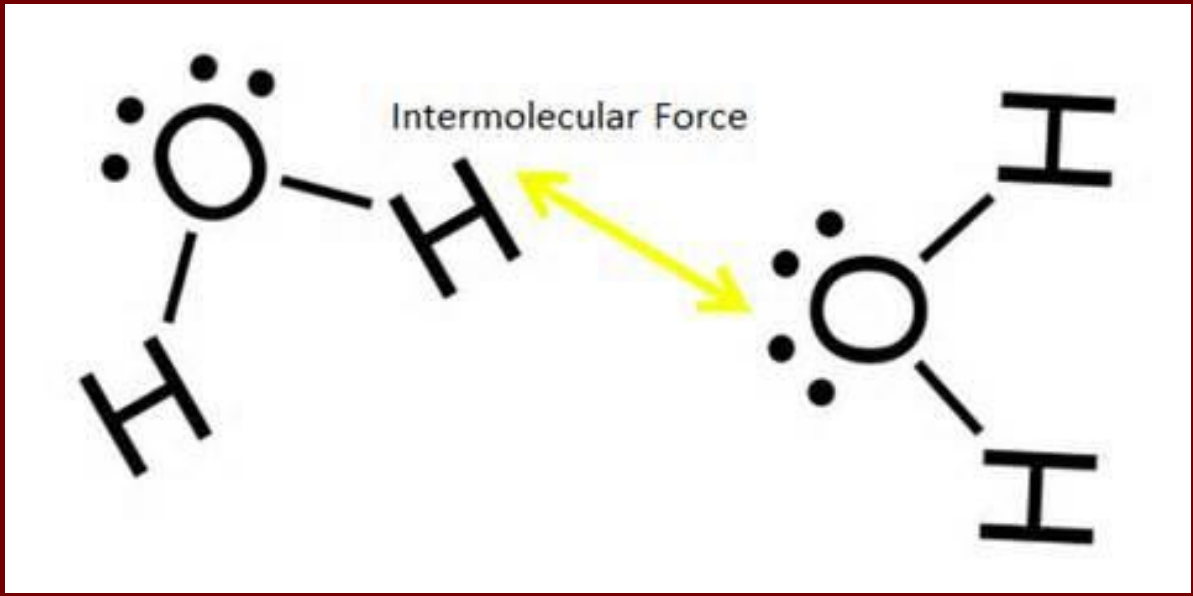
What does it mean to be polar?

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



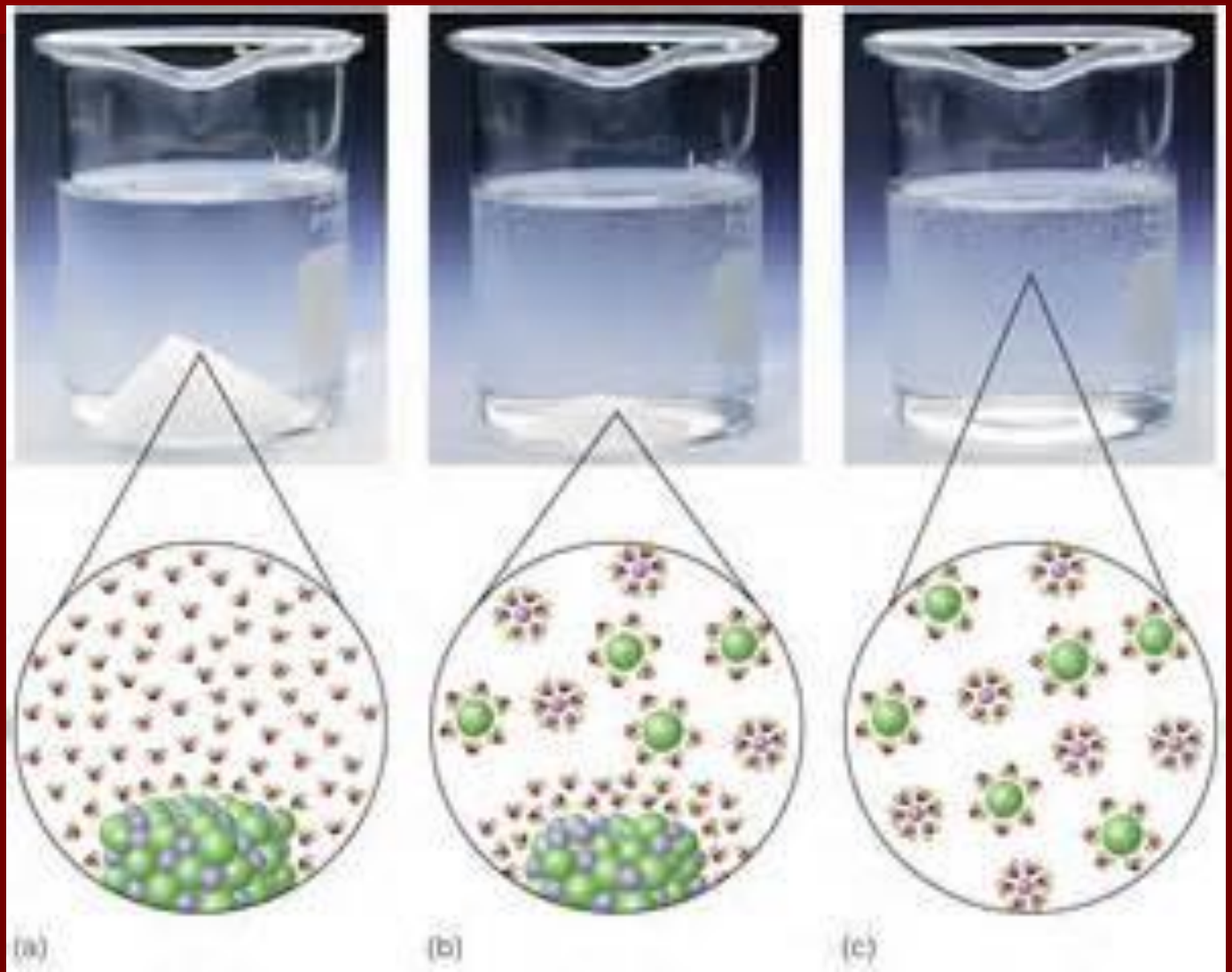
IMF vs. Covalent

- IMF vs. Covalent



How does polarity affect a molecules properties?

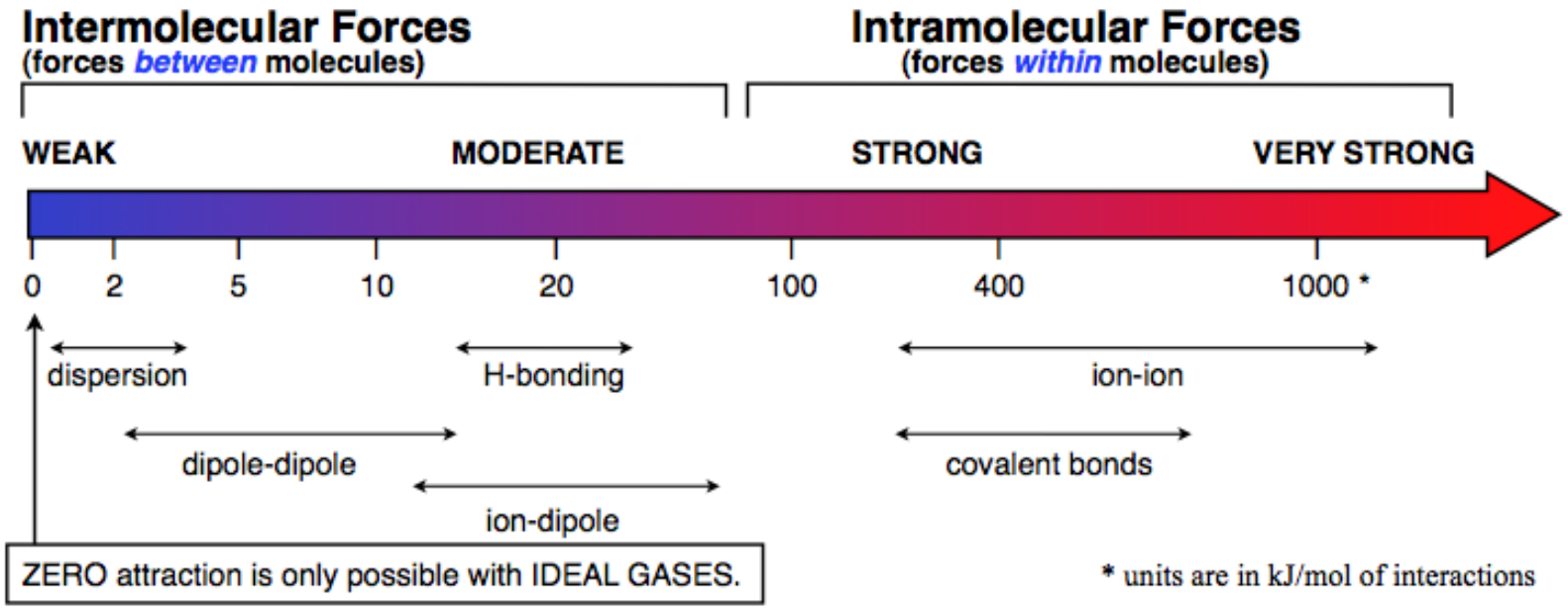
- Solute dissolving in a solvent?



Relative strength of Forces

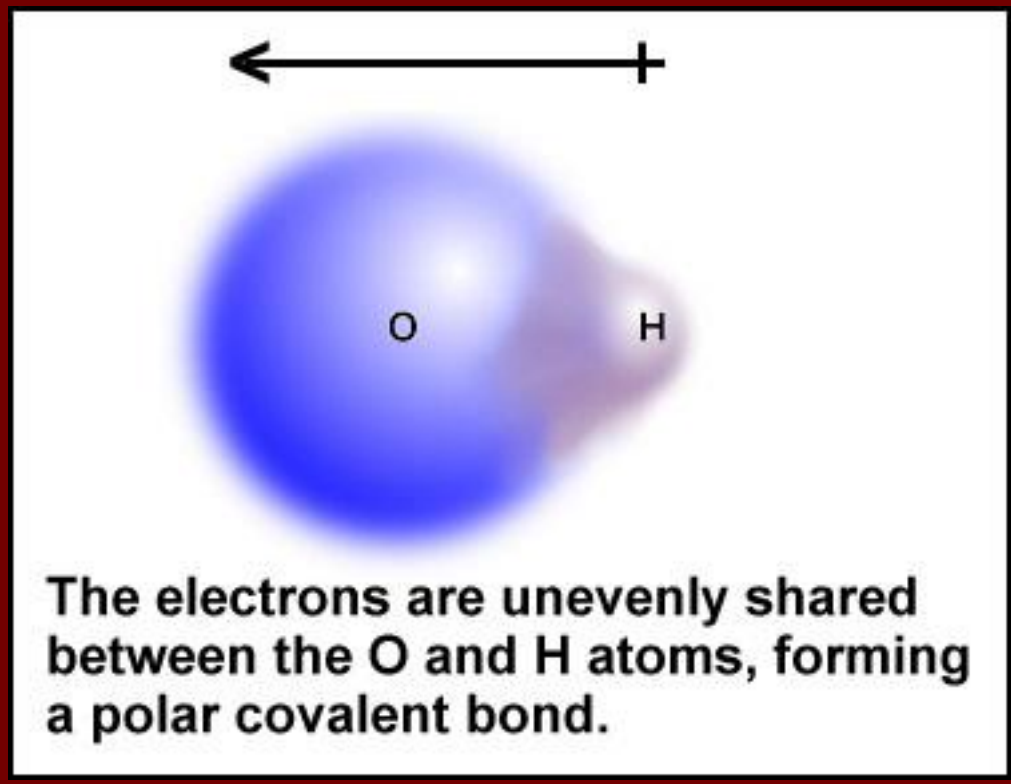
Intermolecular and Intramolecular Forces

Do realize in the following diagram that dispersion forces are capable of much more when the molecule containing them increases in size. Polarizability will increase considerably with a molecule's surface area (size). One should always access what the conditions are as to which force is the governing force and what its magnitude is.



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.



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?

Mr. Schweitzer

Baby

$1000 dollars

Who gets the money????

Electronegativity difference?

Mr. Schweitzer

$1000 dollars

Superman

Who gets the money????

Electronegativity difference?

Mr. Schweitzer

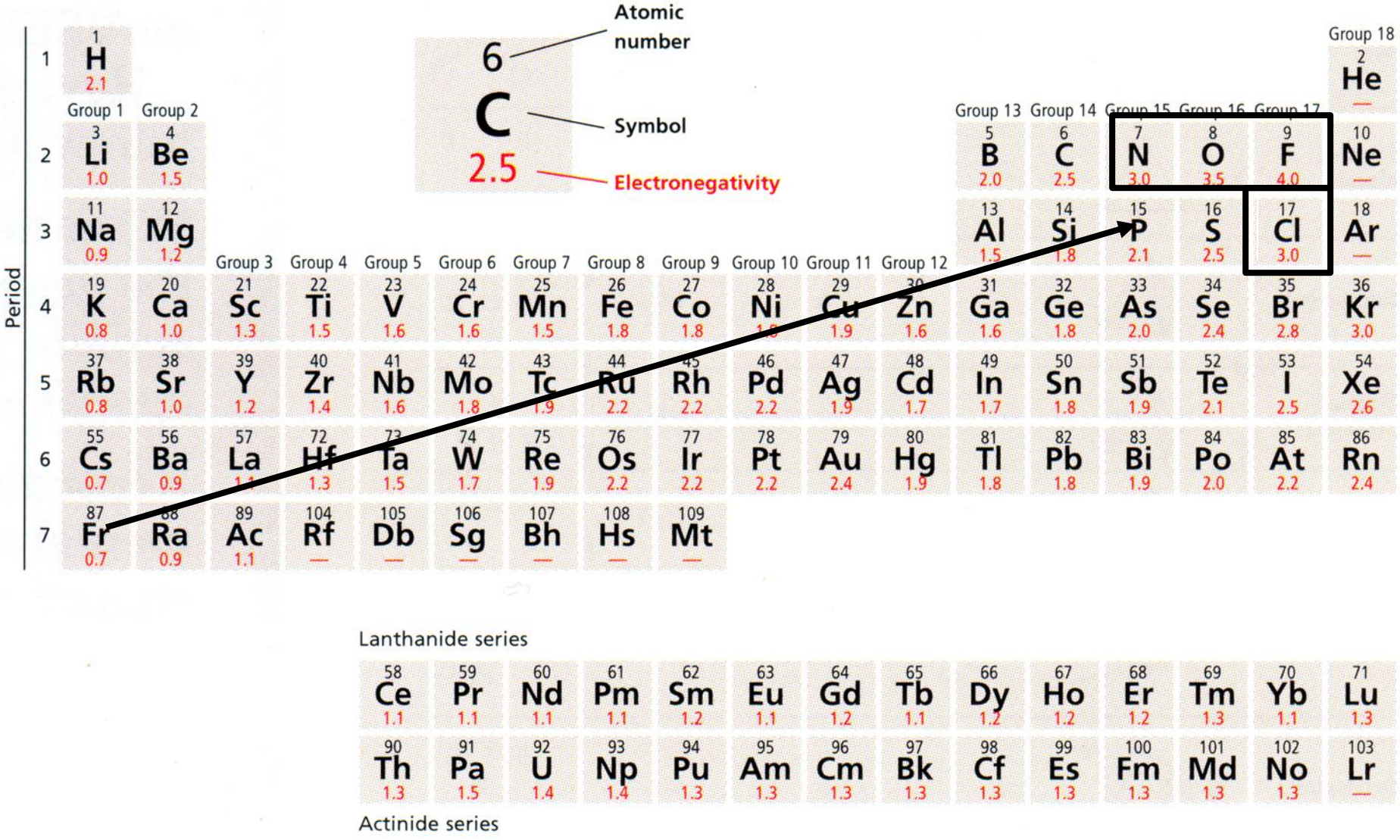
$500 dollars

Superman

$500 dollars

Who gets the money????

Electronegativity



Electronegativity

- When ever you have an atom with a large electronegativity bonded to one that is small you will have an unequal sharing of electrons.
- Big Four
  - N, O, F, Cl -- any atom bonded to one of these three will cause a polar bond

    H-F H-Cl NO_2

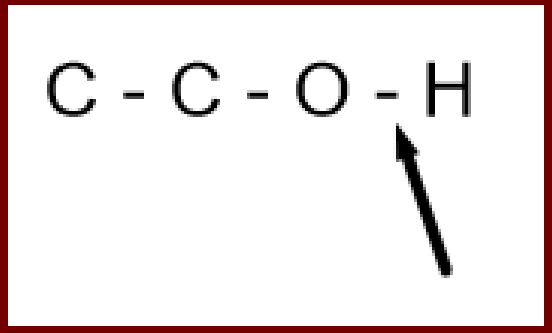
Dipole moment

- Dipole moment is an actual numerical value for the dipole.
- Here is how you calculate?
- Each bond is done by itself

O = 3.5

H = 2.1

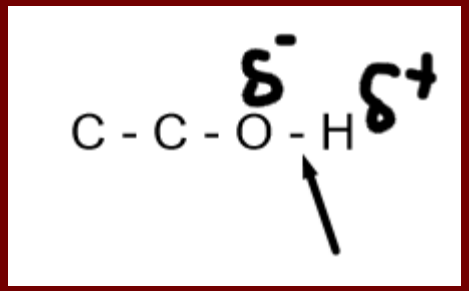
1.4 is dipole moment



Dipole moment

- Ionic: above 1.7
- Polar covalent: above 0.45
- Pure covalent: below 0.45

This is a polar bond and a Polar molecule.



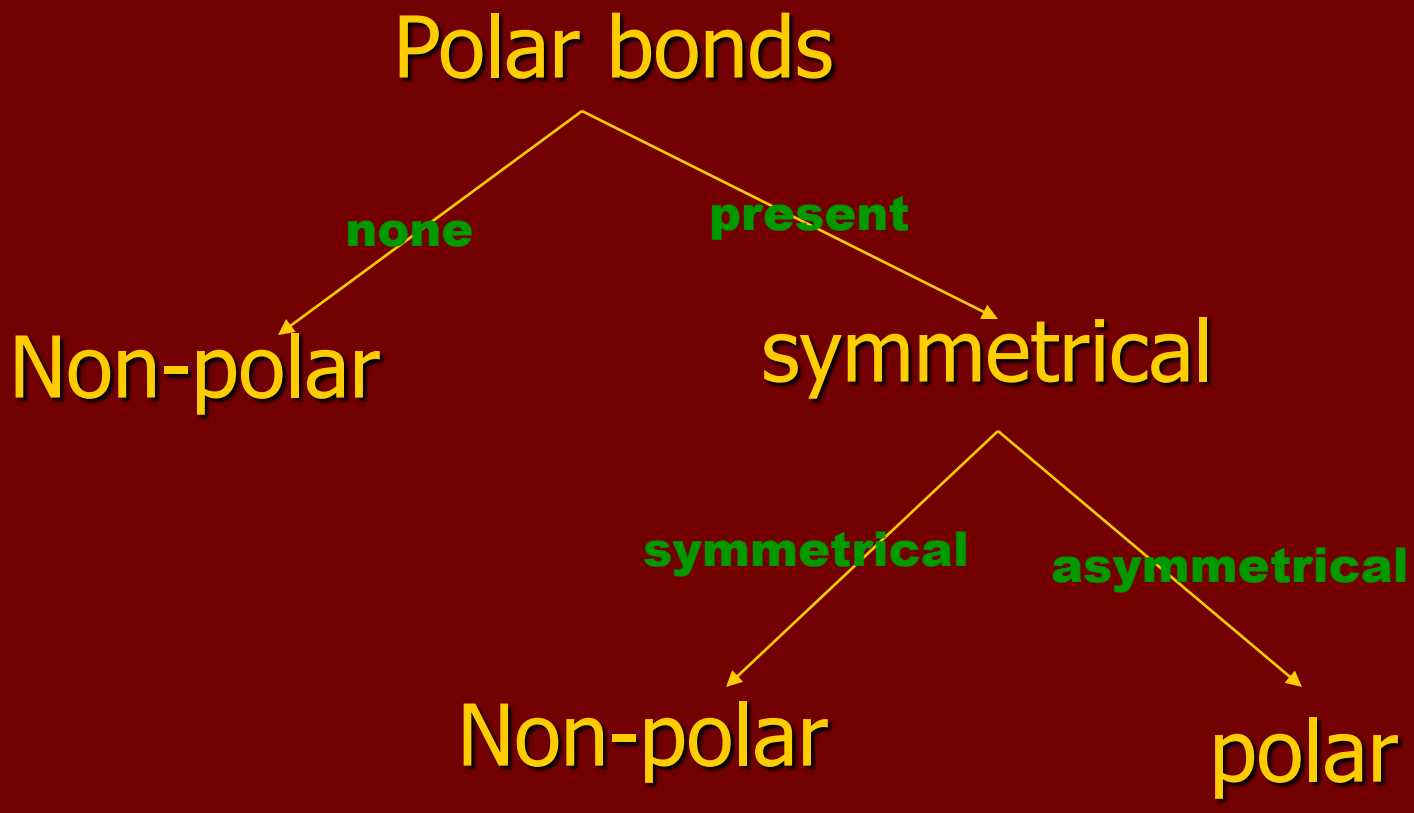
Where will be see Dipole moment?

- We won't ever calculate in class on a test!
- F-F What is the dipole moment of this?

Question: List the following substances in order of increasing dipole moment.

F_2 HF, HCl

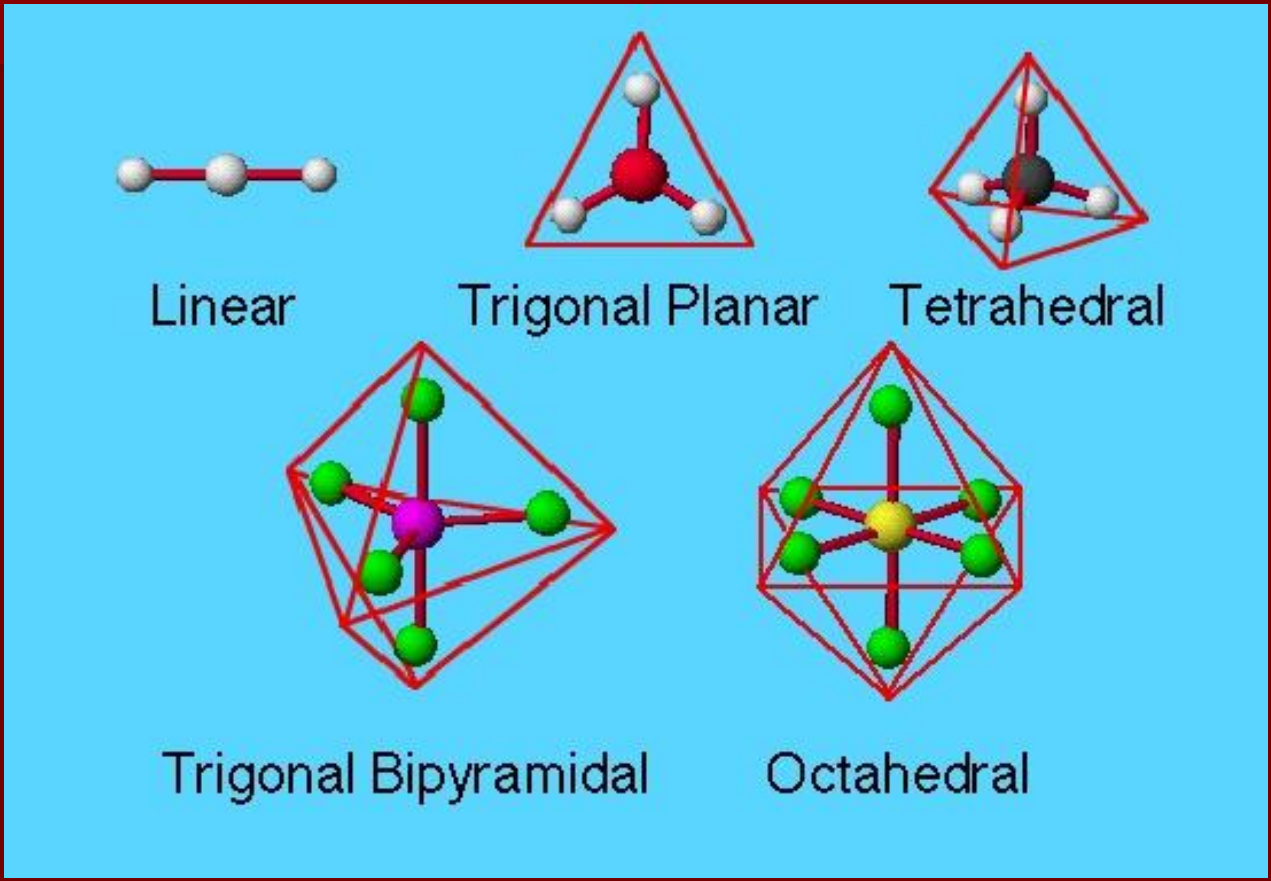
Structure also affects polarity



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?

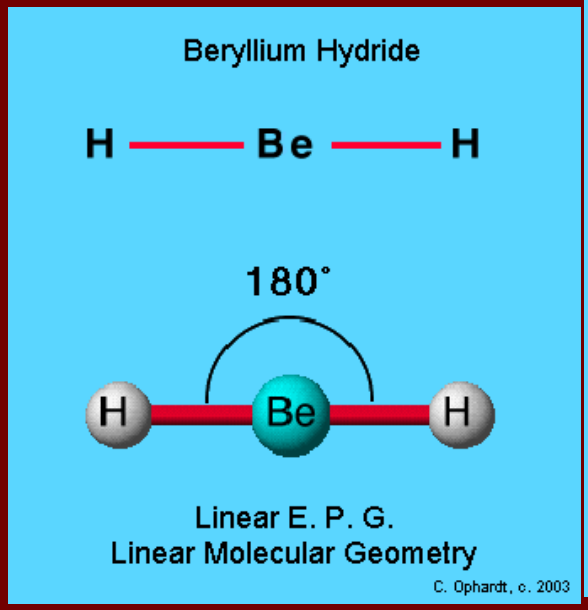
Structures

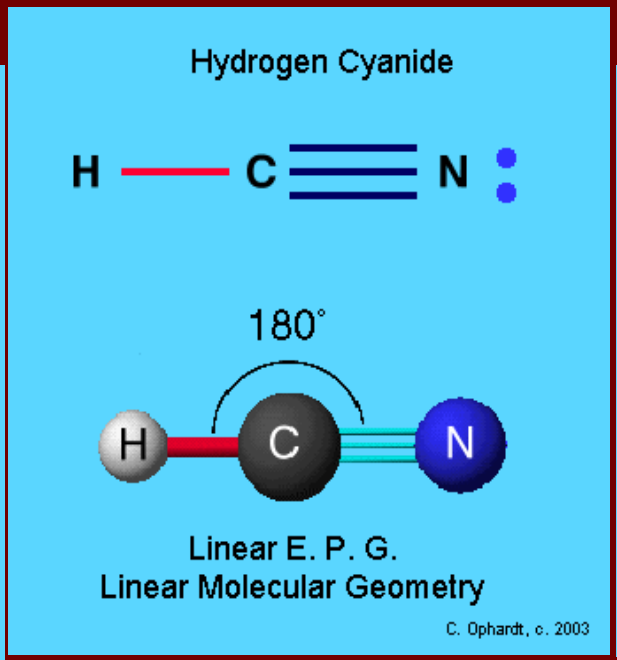


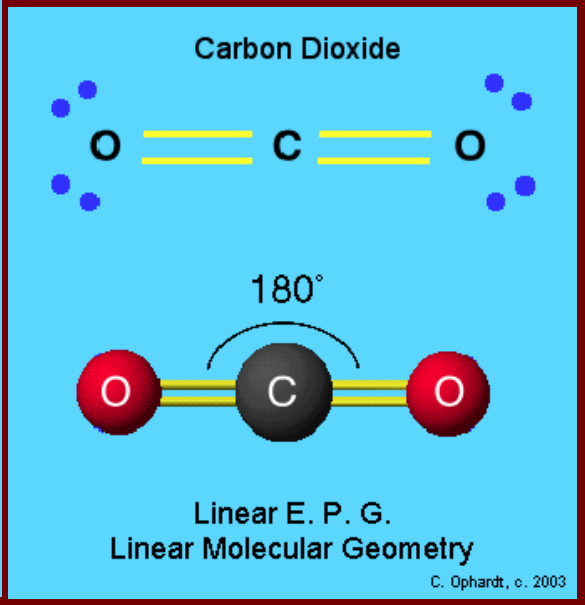
- These are the general structures. They all start out symmetrical.

MOLECULAR GEOMETRY
LINEAR
2 BONDED/0 NON-BONDED

Symmetrical

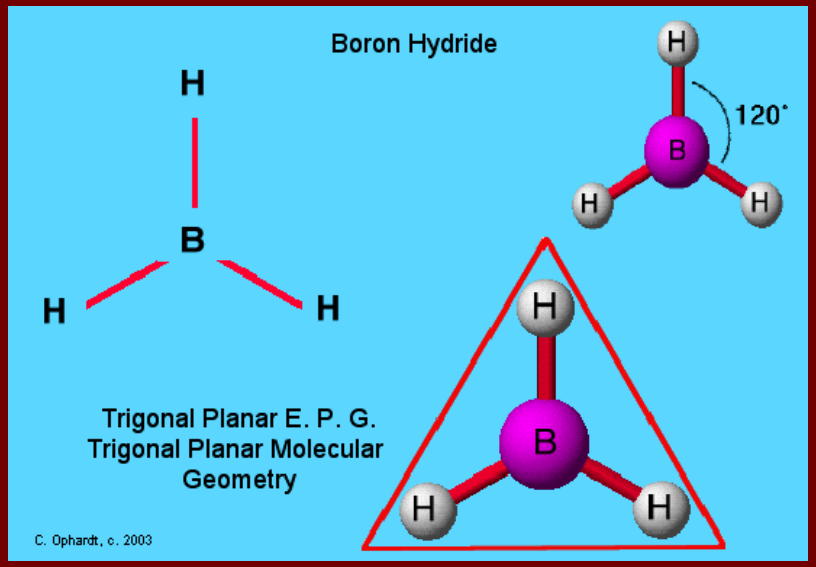


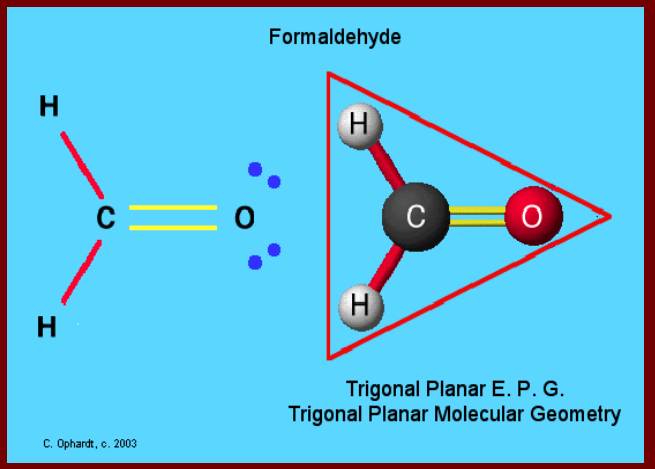


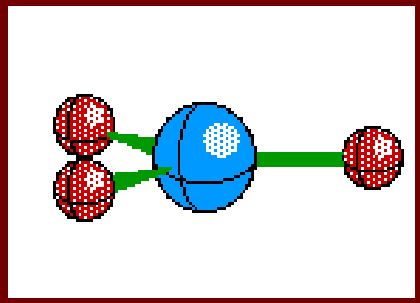


MOLECULAR GEOMETRY
TRIGONAL PLANER
3 BONDED/0 NON-BONDED

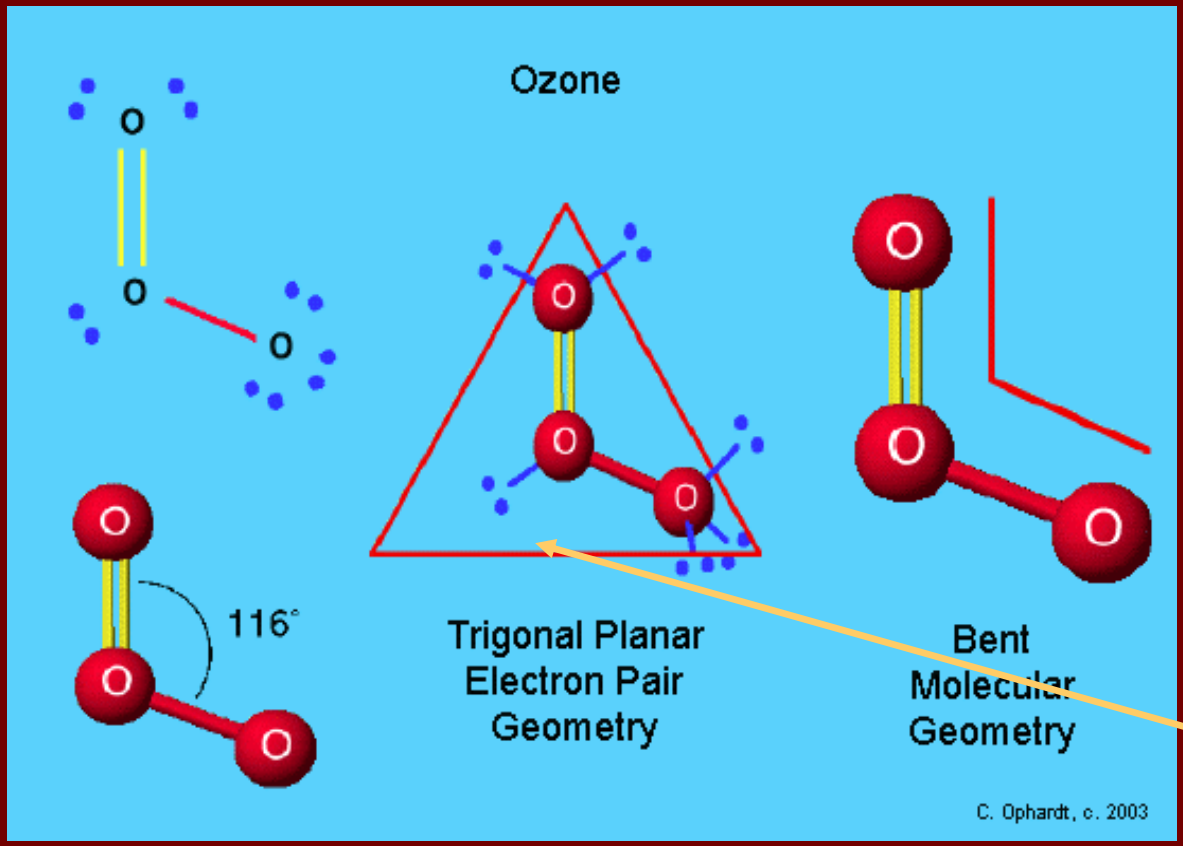
Symmetrical
120° Bond angle







Molecular Geometry
Bent
2 Bonded/1 Non-Bonded



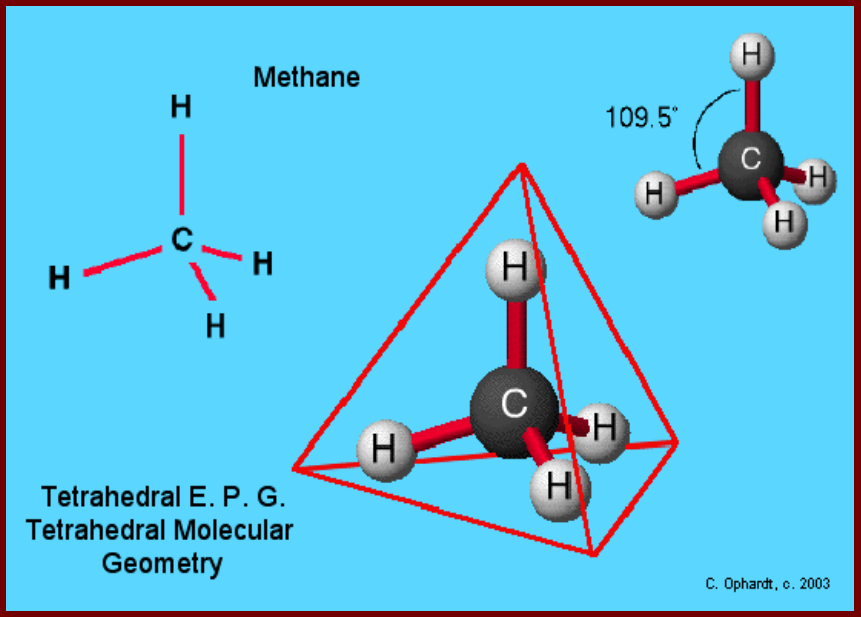
Asymmetrical
Bond angle <120

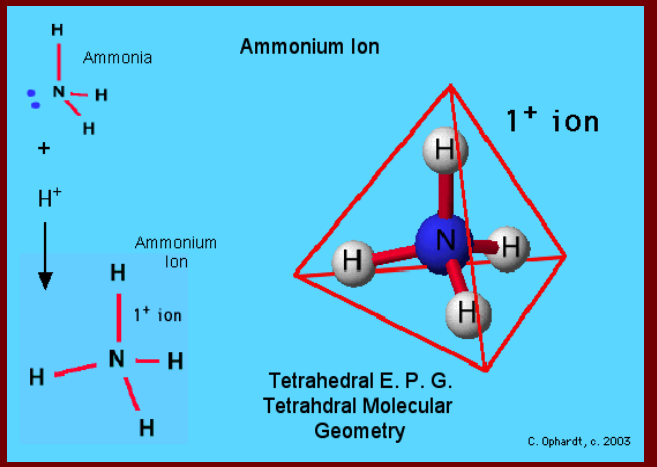
Un-bonded pairs take more space then bonded pushing angle to slightly less then 120

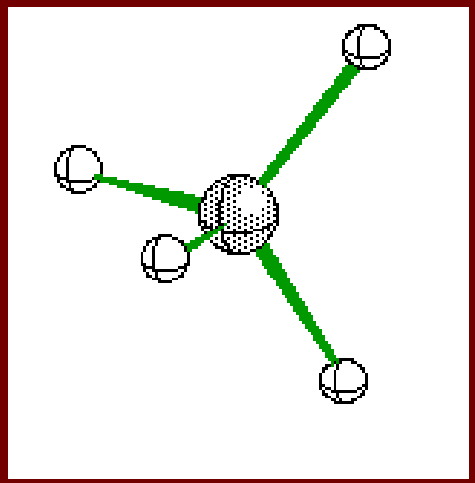
Molecular Geometry
Tetrahedral
4 Bonded/0 Non-Bonded

Symmetrical

Bond angle: 109.5°

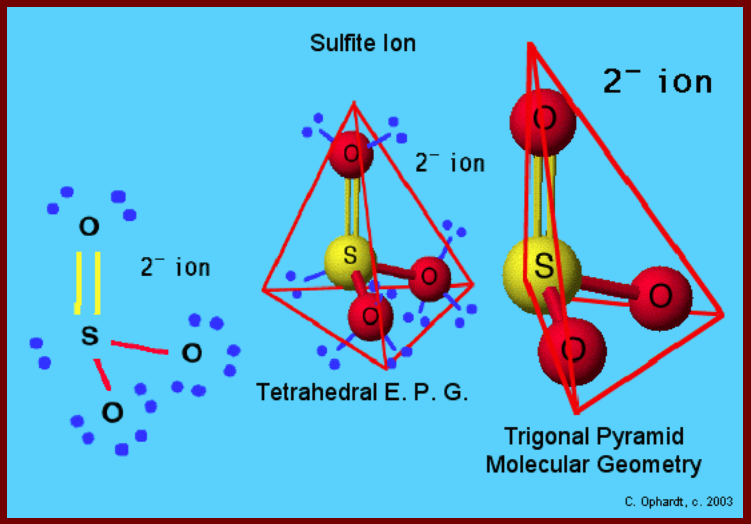


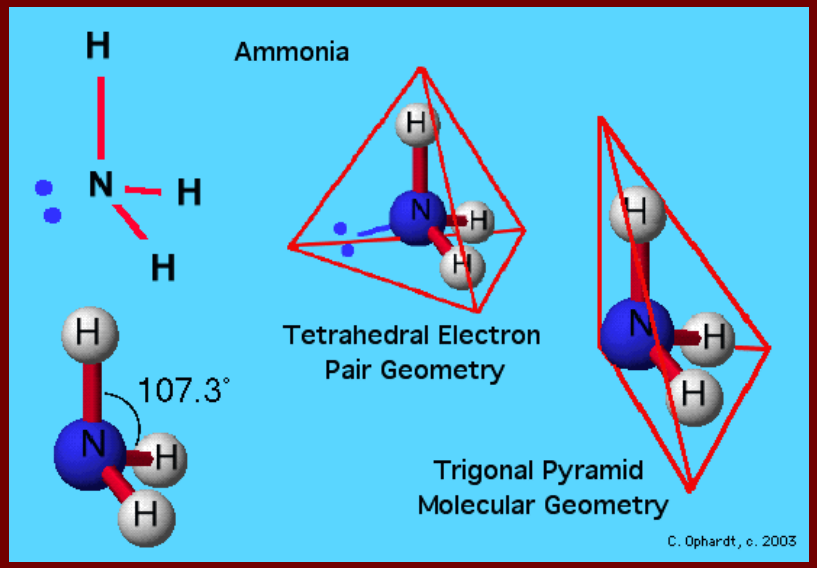


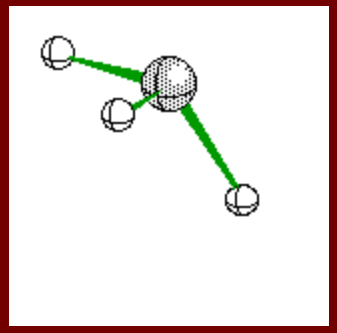


Molecular Geometry
Trigonal Pyramidal
3 Bonded/1 Non-Bonded

Bond angle < 109.5
Asymmetrical

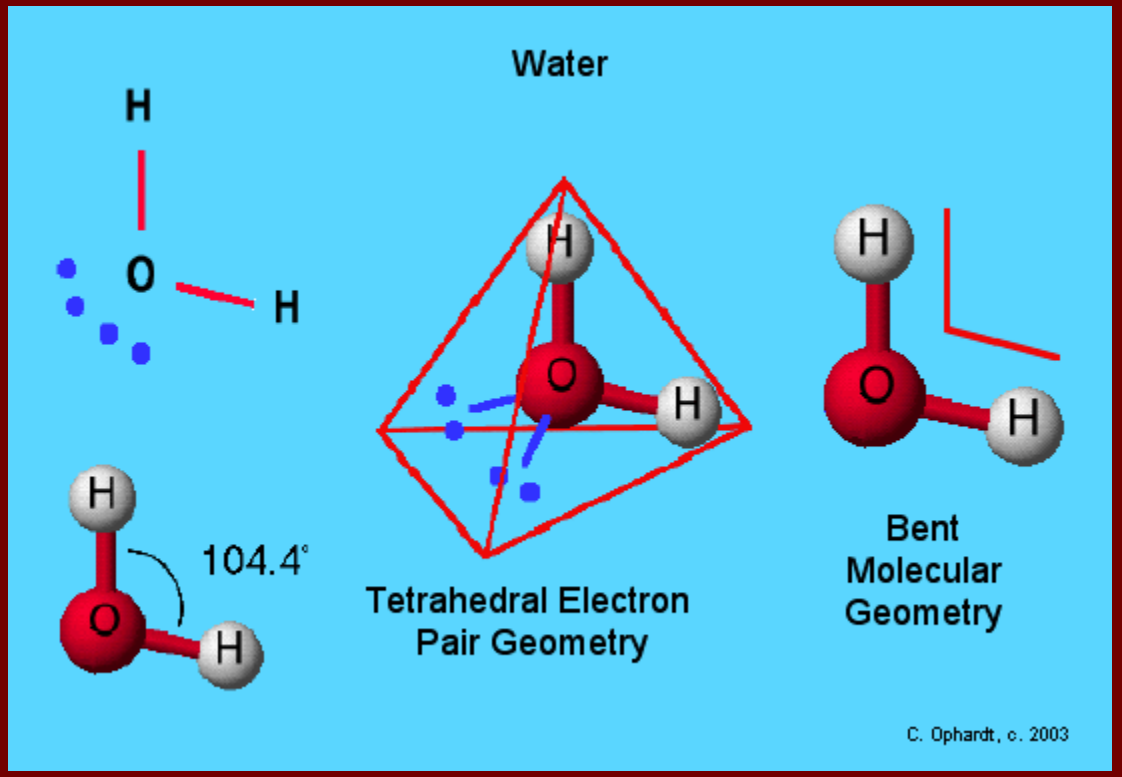






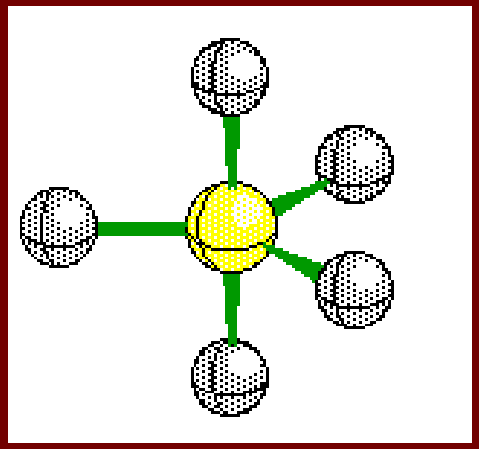
Molecular Geometry
Bent
2 Bonded/2 Non-Bonded

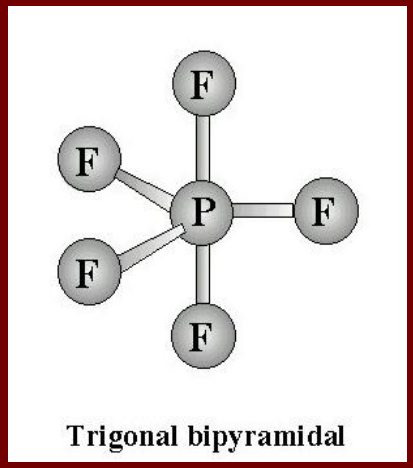
Bond angle: < 109.5
Asymmetrical



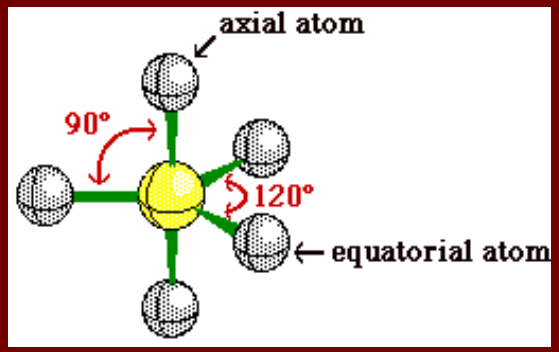
Molecular Geometry
Trigonal Bipyramidal
5 Bonded/0 Non-Bonded

Bond angle
Equatorial: 120°
vertical: 90°
symmetrical





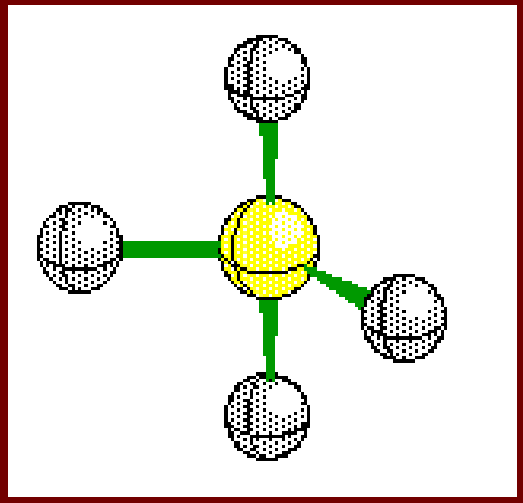
Trigonal bipyramidal

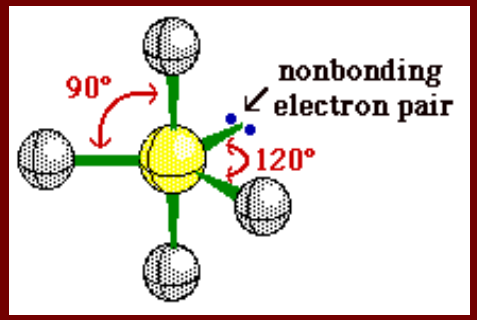


Molecular Geometry
See-Saw
4 Bonded/1 Non-Bonded

Bond angle
- Equatorial: 120°
- vertical: 90°

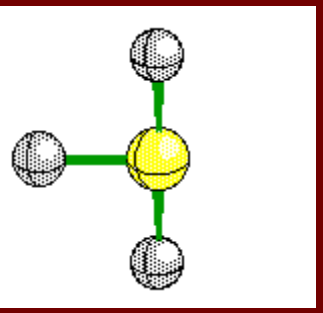
Asymmetrical

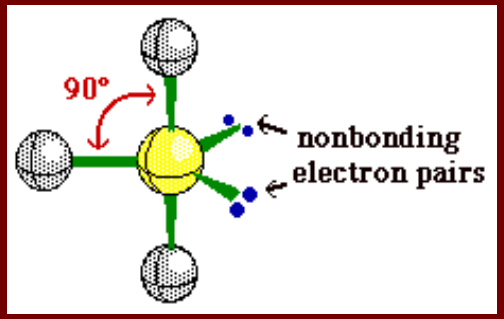




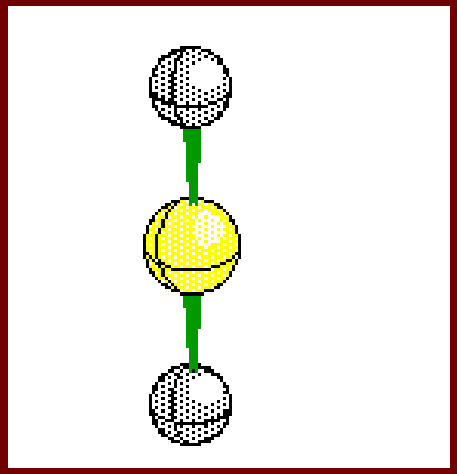
Molecular Geometry
T-Shaped
3 Bonded/2 Non-Bonded

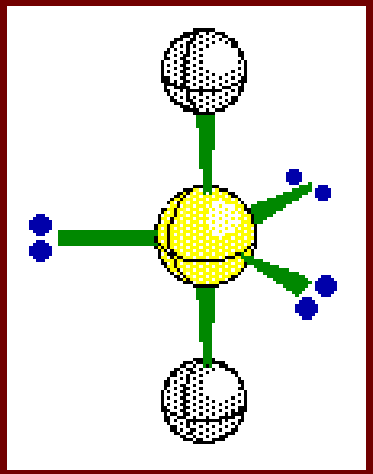
Bond angle
Equatorial: 120°
Vertical: 90°
asymmetrical



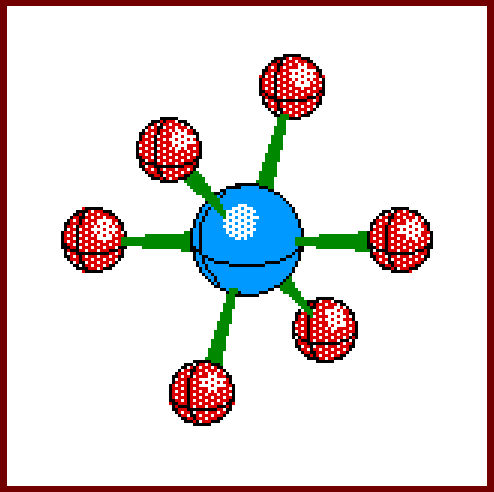


Molecular Geometry
Linear
2 Bonded/3 Non-Bonded



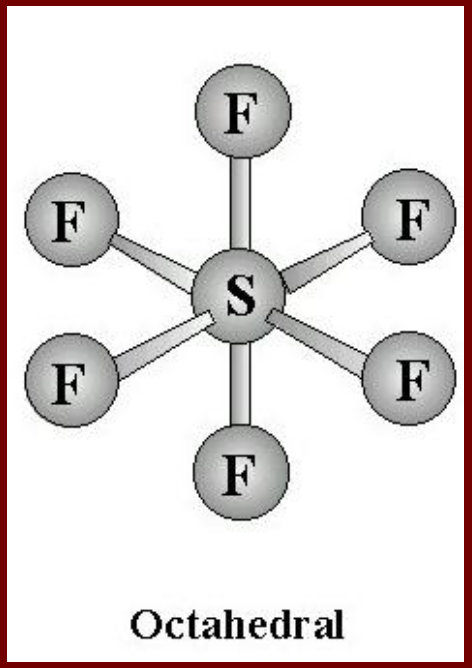


Molecular Geometry
Octahedral
Or
Square Bipyramidal
6 Bonded/0 Non-Bonded



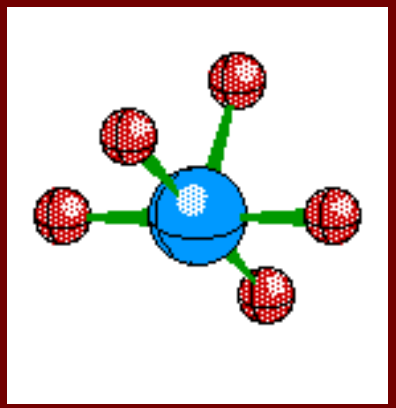
Bond angle
- equatorial: 90°
- vertical: 90°

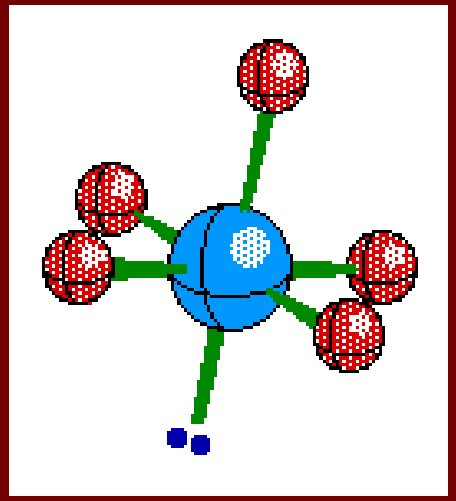
Symmetrical



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