N22 – Bonding

VSEPR Shapes, Effects of Lone Pairs, Polarity

Link to YouTube Presentation: https://youtu.be/xlo2xTQmrKQ

N22 – Bonding

Some reminders about:

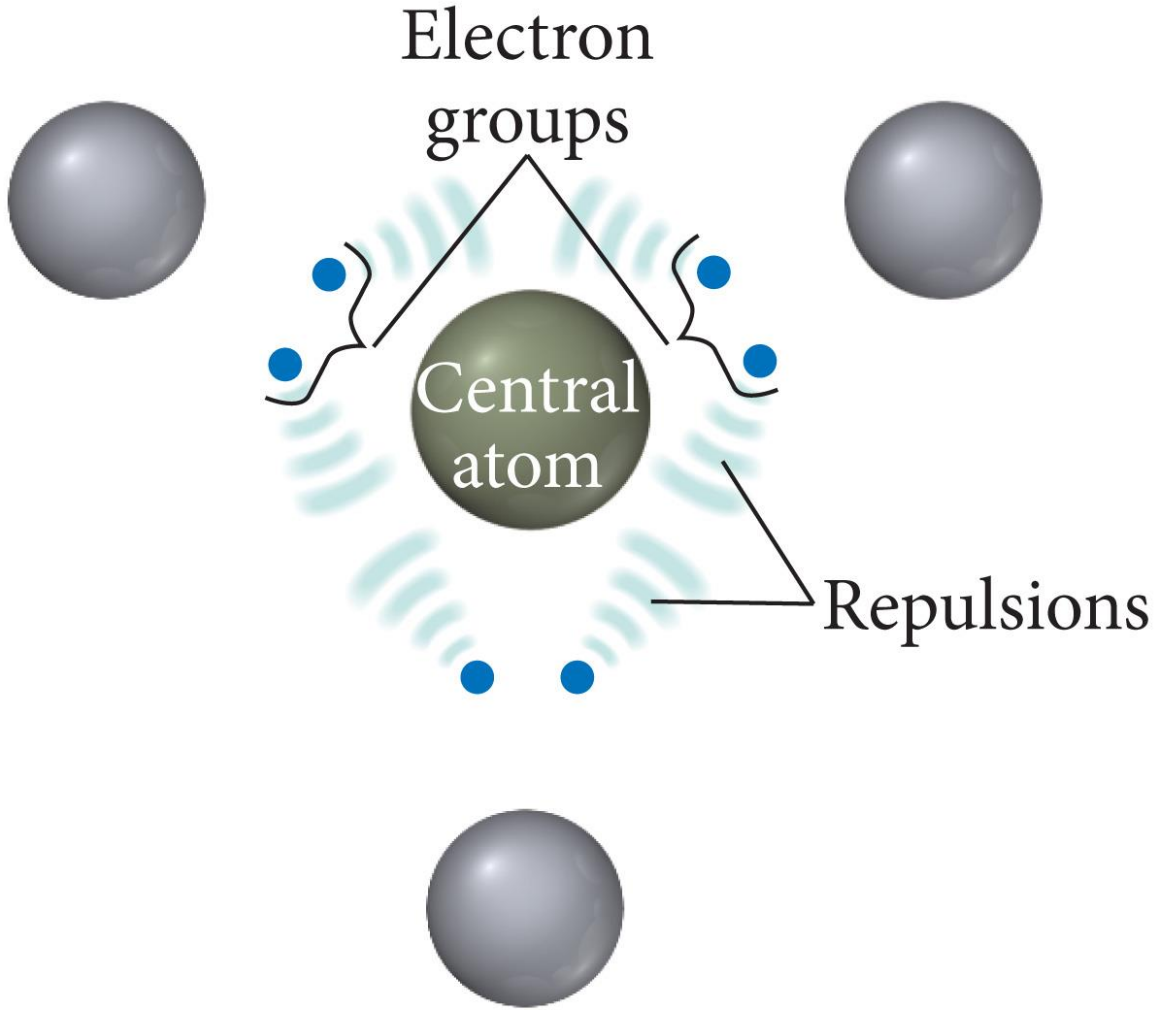
VSEPR Shapes, Effects of Lone Pairs, Polarity

Target: I can describe the importance of the VSEPR shape and presence of lone pairs on the polarity and behavior of molecules.

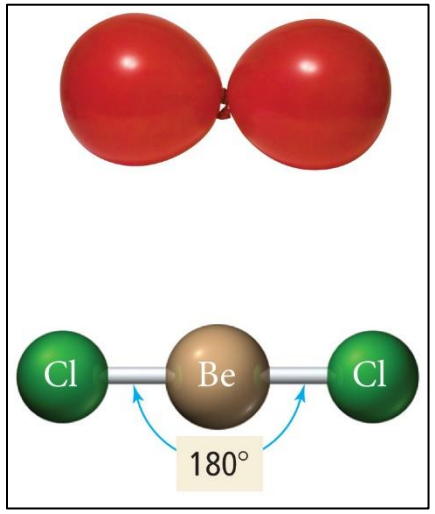
Electron Repulsions

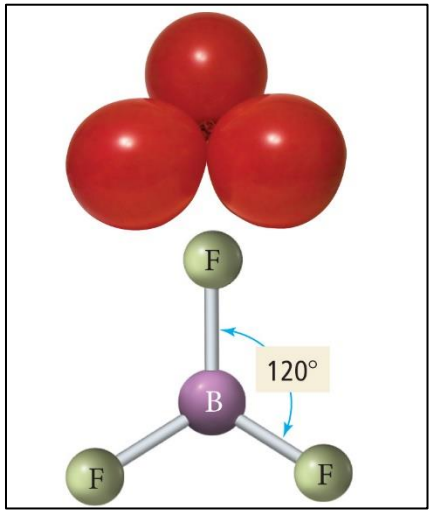
Electron Repulsions help determine the shapes and bond angles in molecules.

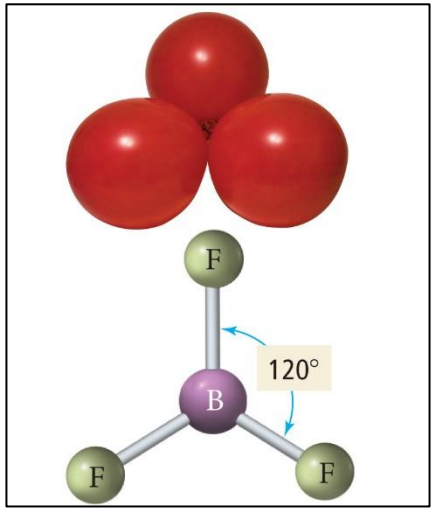
Molecules take the shapes they do to minimize the repulsive forces!

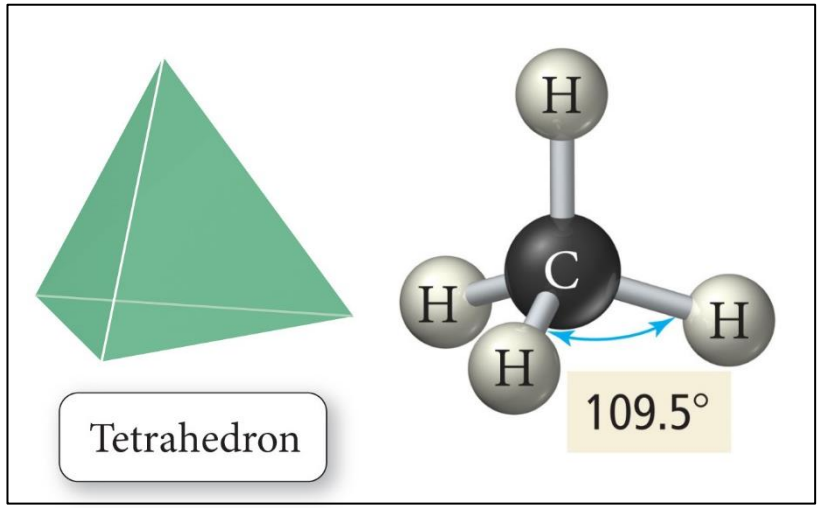


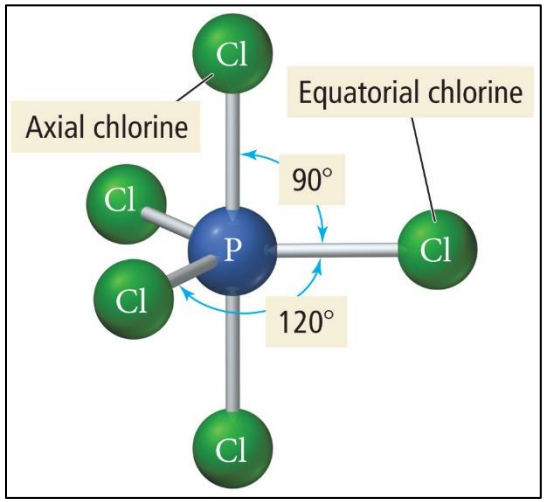
MEMORIZE YOUR VSEPR!!!

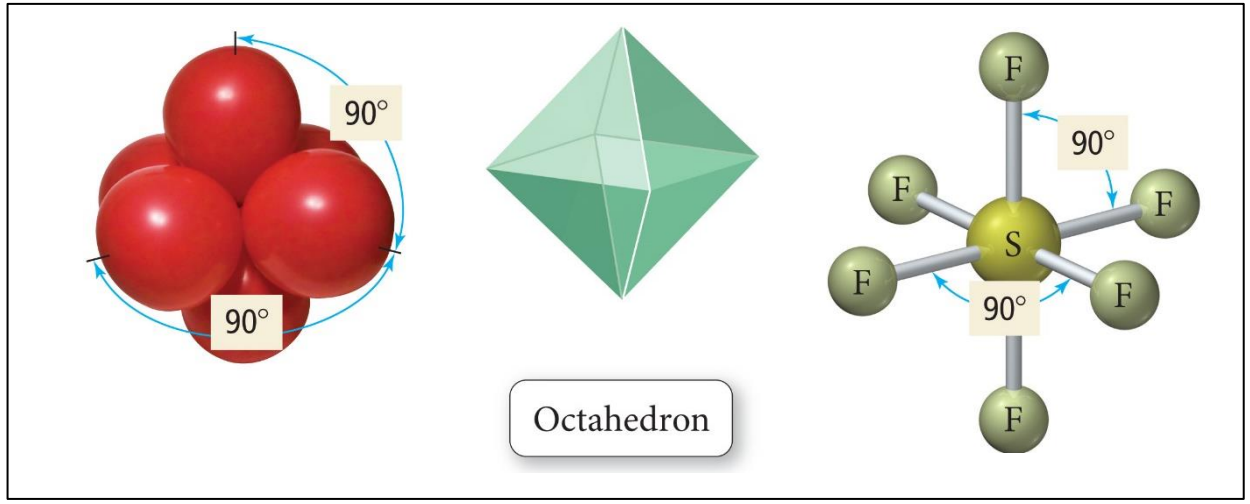












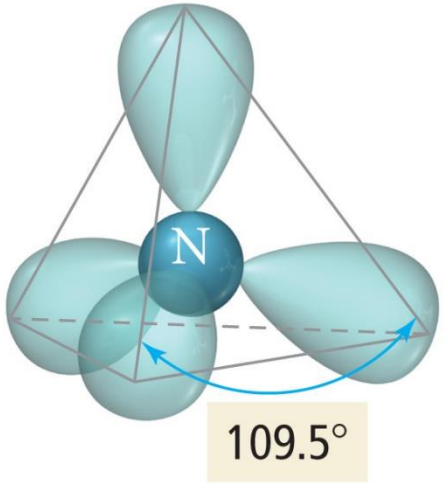
The Effect of Lone Pairs

- Lone pair = “occupy more space”
- Pushes the atoms out of the way
- This affects the bond angles, making the bonding pair angles smaller than expected.

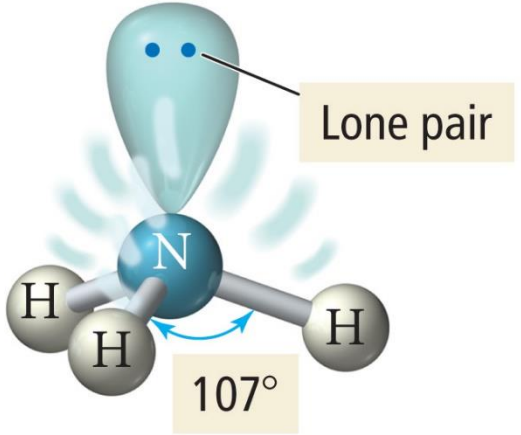
Relative sizes of repulsive force interactions:

Lowest: Bonding Pair – Bonding Pair
Medium: Lone Pair – Bonding Pair
Highest: Lone Pair – Lone Pair

Bond Angle Distortion from Lone Pairs

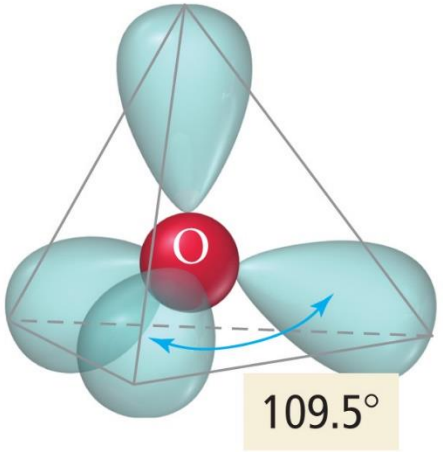


Ideal tetrahedral geometry

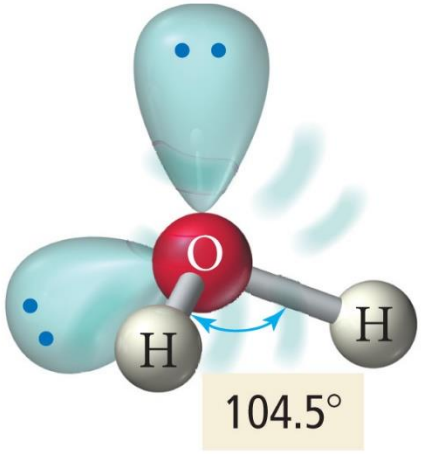


Actual molecular geometry

< 109.5



Ideal tetrahedral geometry



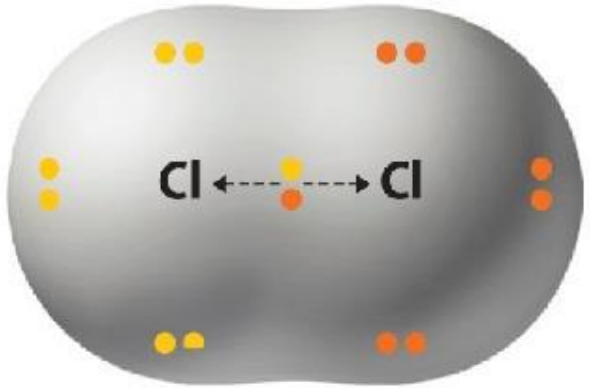
Actual molecular geometry

<< 109.5

Polarity of Molecules

Sharing of electrons is a spectrum!

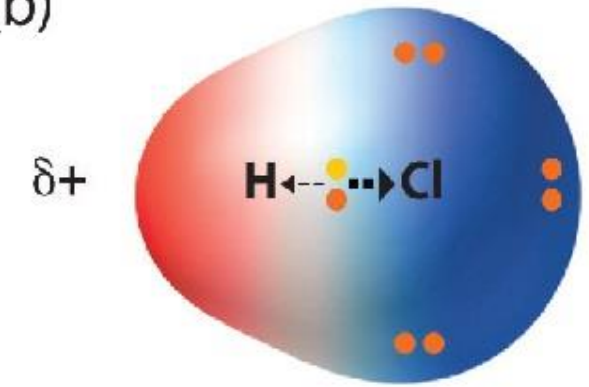
(a)



Nonpolar covalent bond

Bonding electrons shared equally between two atoms.
No charges on atoms.

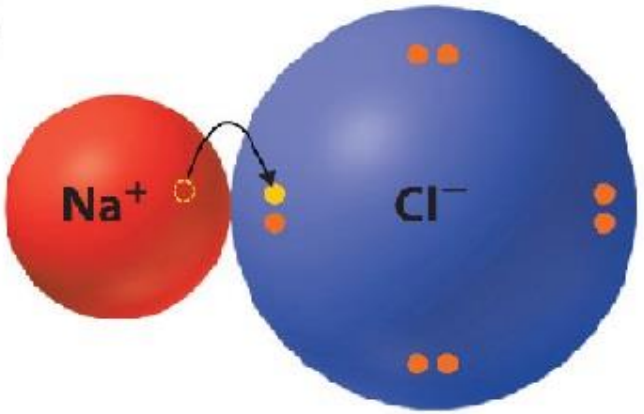
(b)



Polar covalent bond

Bonding electrons shared unequally between two atoms.
Partial charges on atoms.

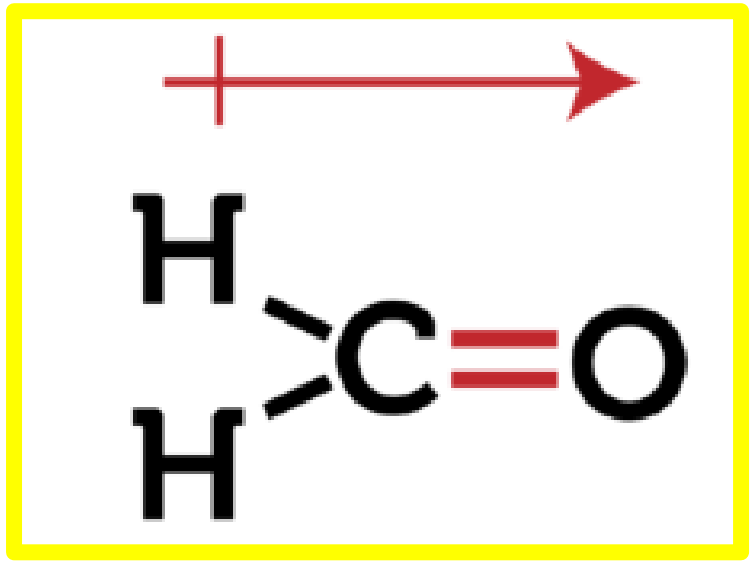
(c)

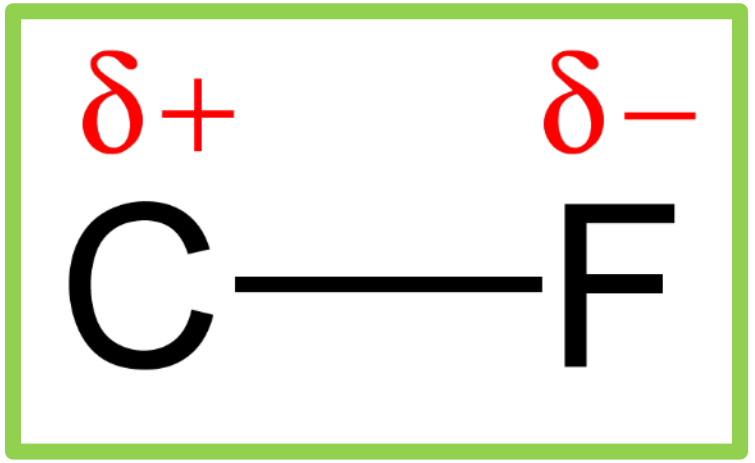


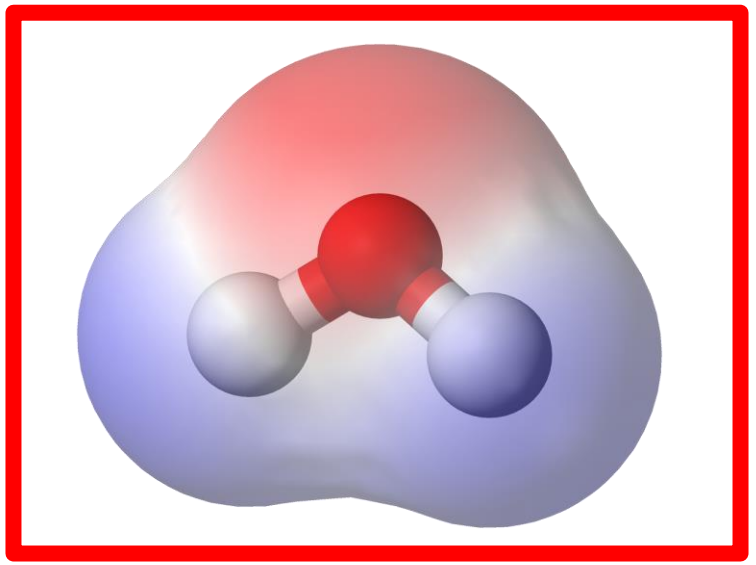
Ionic bond

Complete transfer of one or more valence electrons.
Full charges on resulting ions.

Three ways to diagram “dipoles”



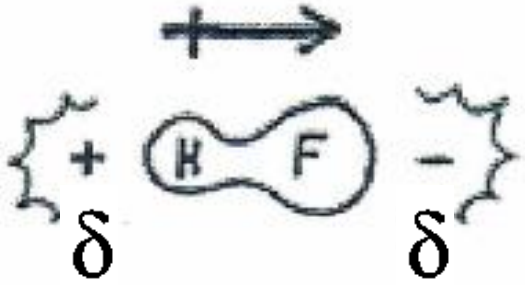




Example: HF

HF is covalent but electrons are *not* shared equally

Molecules become *POLAR* when electrons are not shared equally

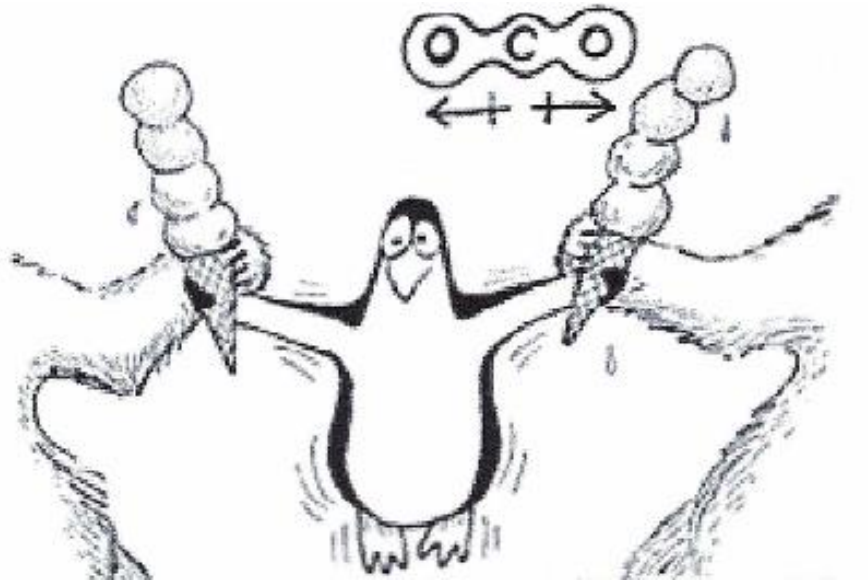


DO NOT REFRENCE POLAR BEARS AND PENGUINS IN YOUR FRQ ANSWERS!

Symmetry…the pole destroyer!

CO_2

Has 1 carbon surrounded by 2 electronegative Oxygens, but is NOT polar?!?!



Electron density is still SYMETRICAL which makes it a non-polar molecule

THE SYMMETRY CANCELS OUT THE BOND DIPOLES SO THERE IS NO NET DIPOLE

Polarity of Molecules

For a molecule to be polar it must

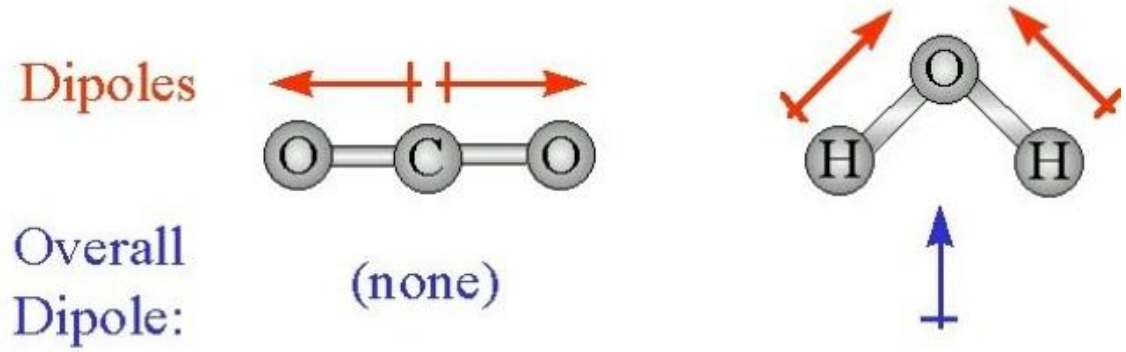
1. Have polar bonds.

- Electronegativity difference – theory
- Bond dipole moments – measured

2. Have an asymmetrical shape.

- "Vector addition" – if the polar bonds are equal but opposite direction they cancel out. **SO THERE IS NO NET DIPOLE**

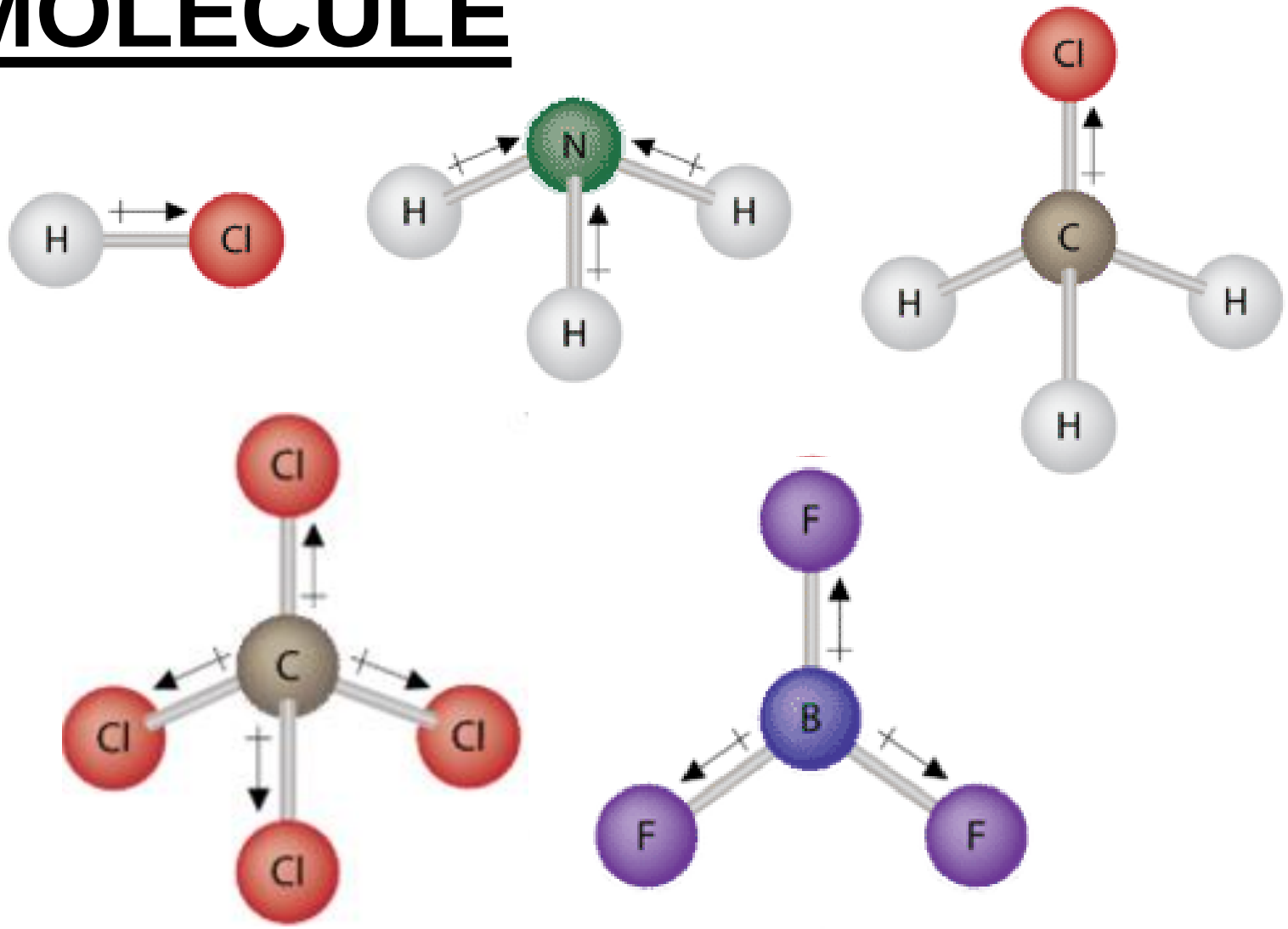
MENTION BOTH!!!!!!!



Careful about polar BOND versus polar MOLECULE

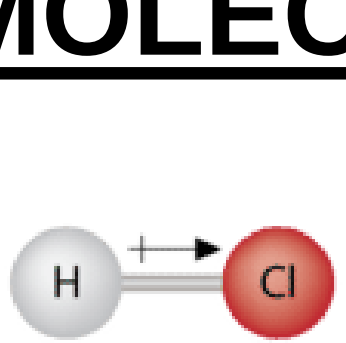
You need to talk about how the BOND dipoles do, or do not, cancel out due to the 3D VSEPR geometry of the molecule.

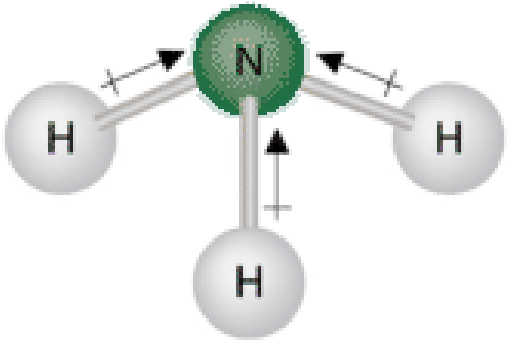
Is there a NET dipole or not????

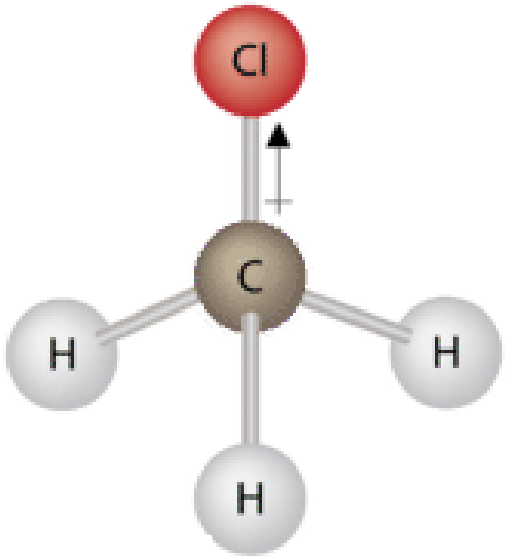


Careful about polar BOND versus polar MOLECULE

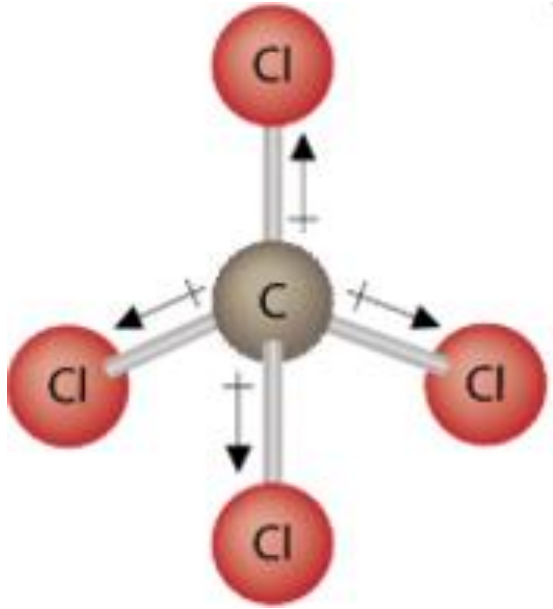
Polar bond AND
Polar molecule

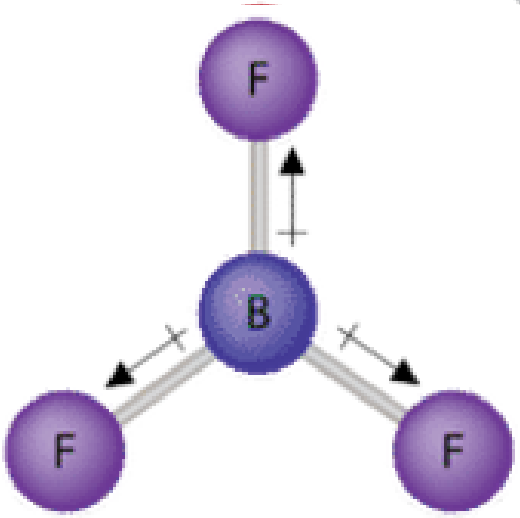






Polar bond and
NON-polar molecule





Polarity of Molecules

Polarity affects the intermolecular forces of attraction.

- Therefore, boiling points and solubility
  - "Like dissolves like"
  - **"Things with similar polarity and IMFs are miscible."**

Non-bonding pairs affect molecular polarity, strong pull in its direction.

YouTube Link to Presentation:

https://youtu.be/xIo2xTQmrKQ