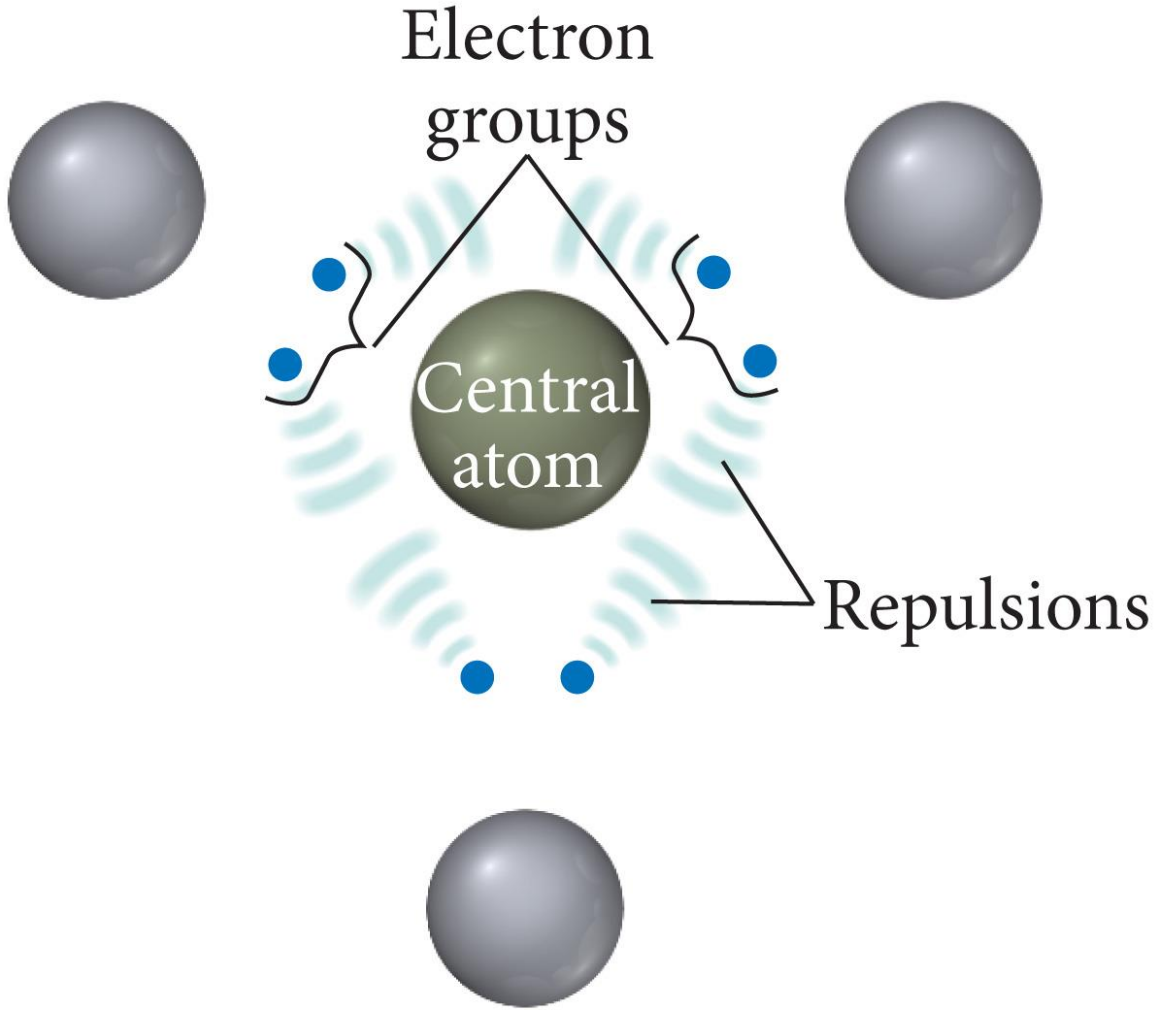
N22 – Bonding

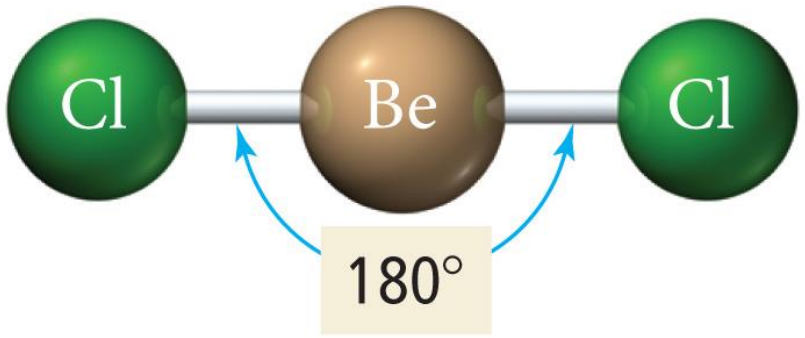
VSEPR Shapes, Effects of Lone Pairs, Polarity

Electron Repulsions

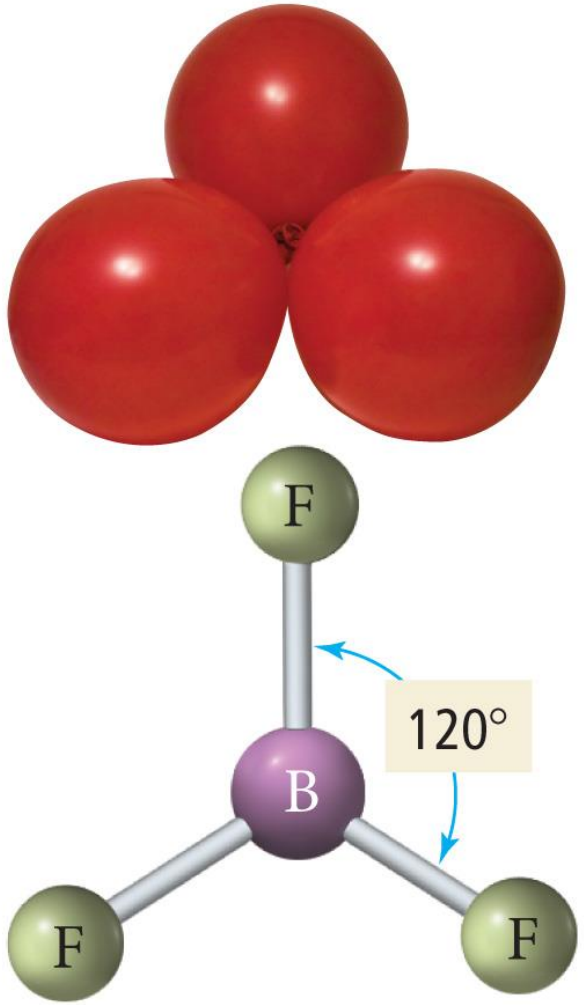
Electron Repulsions help determine the shapes and bond angles in molecules.



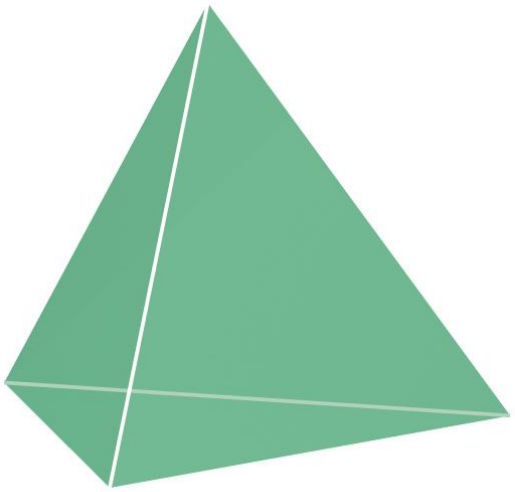
Linear Geometry



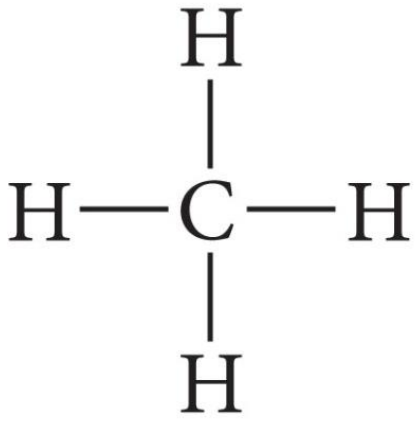
Trigonal Planar Geometry

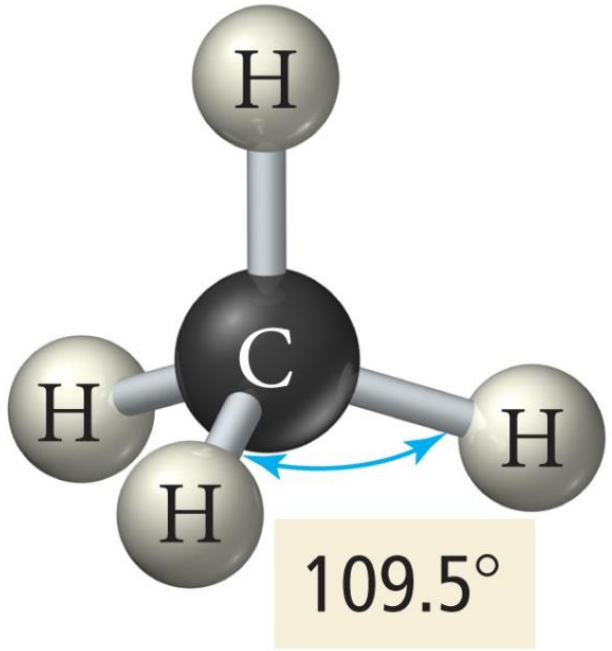


Tetrahedral Geometry

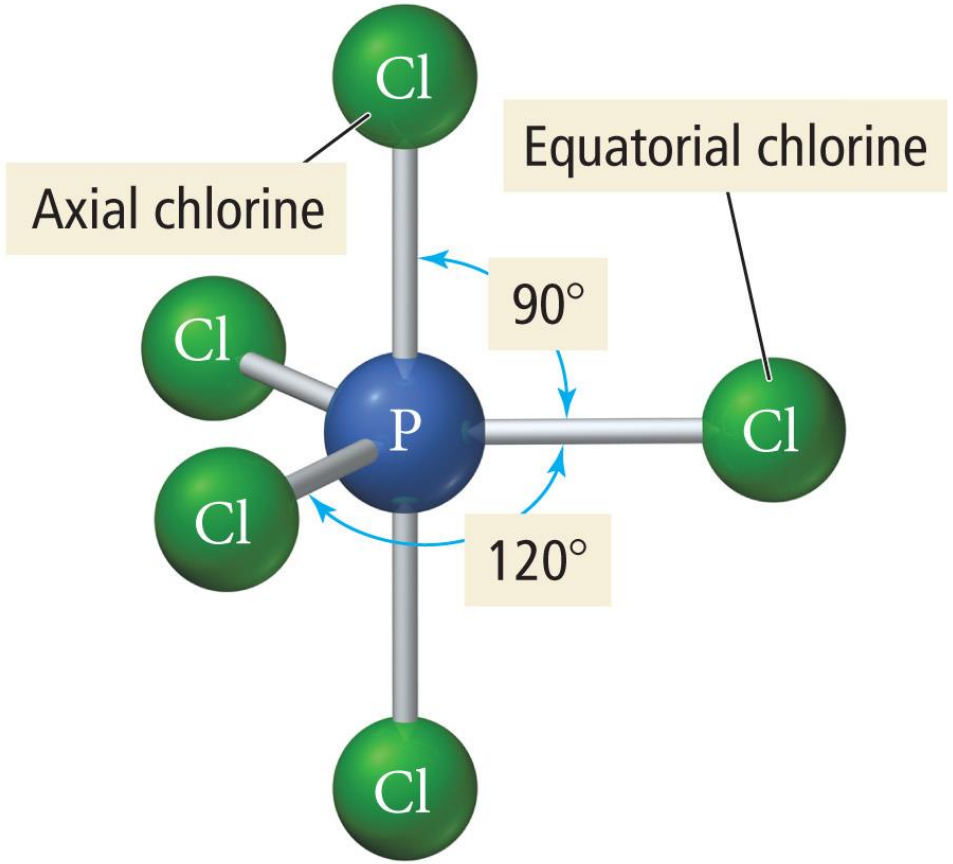


Tetrahedron

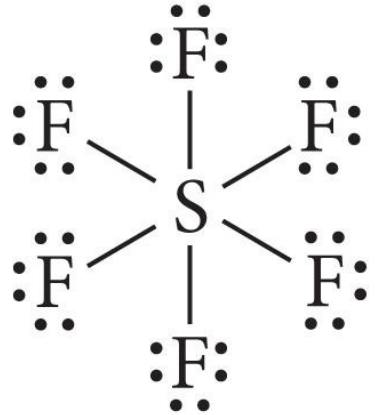


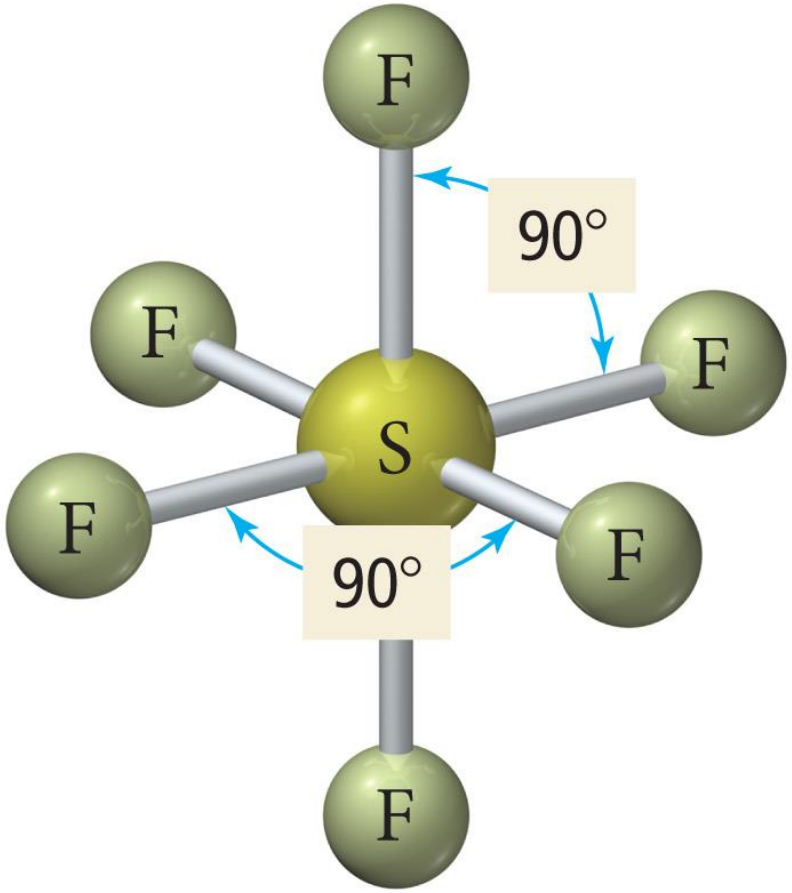


Trigonal Bipyramidal Geometry

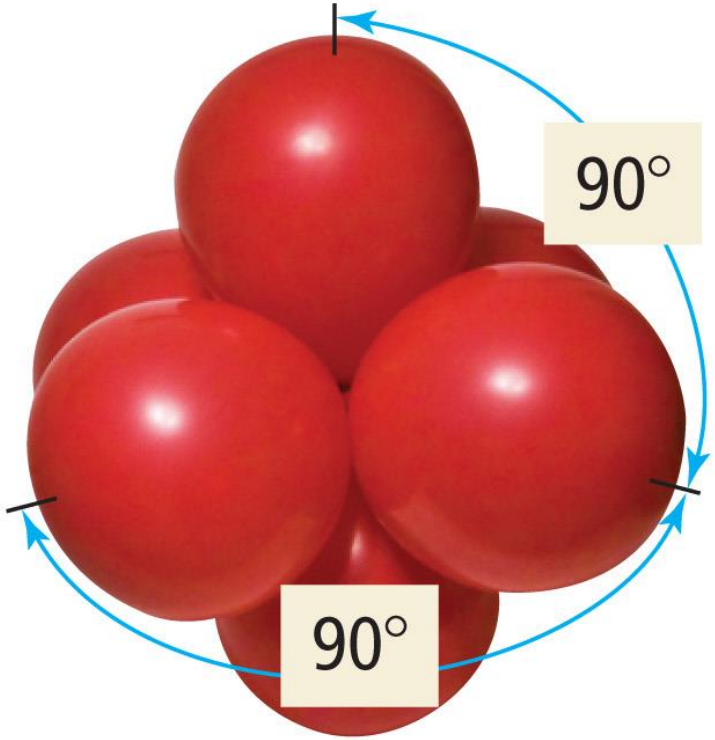


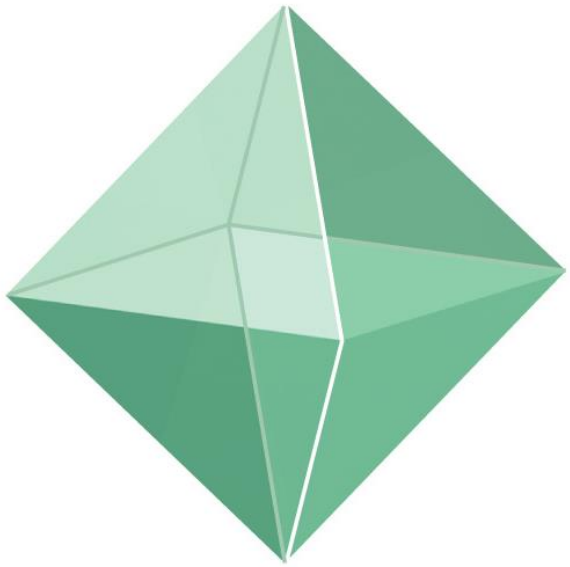
Octahedral Geometry





Octahedral Geometry





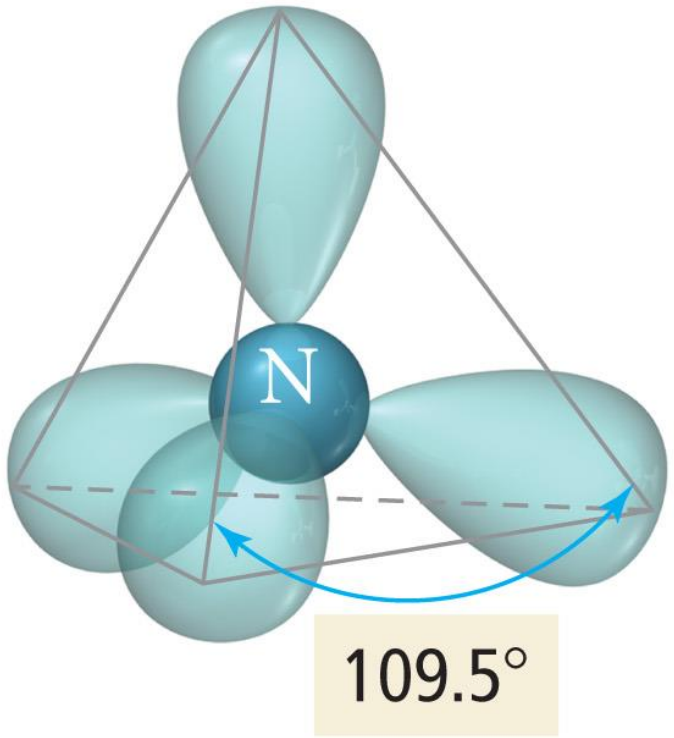
Octahedron

The Effect of Lone Pairs

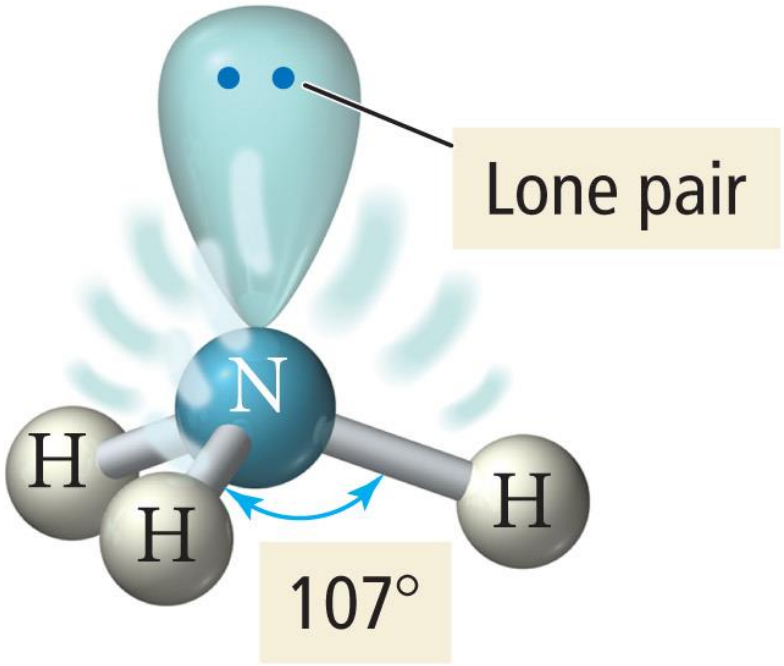
- **Lone pair = “occupy more space”**
- **This affects the bond angles, making the bonding pair angles smaller than expected.**
- **Pushes the atoms out of the way**
- **Relative sizes of repulsive force interactions is as follows:**

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

Bond Angle Distortion from Lone Pairs

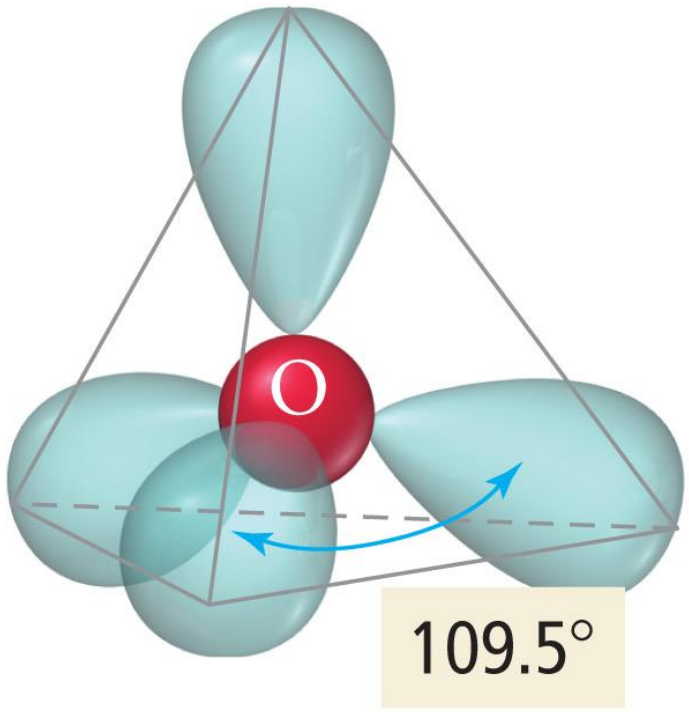


Ideal tetrahedral geometry

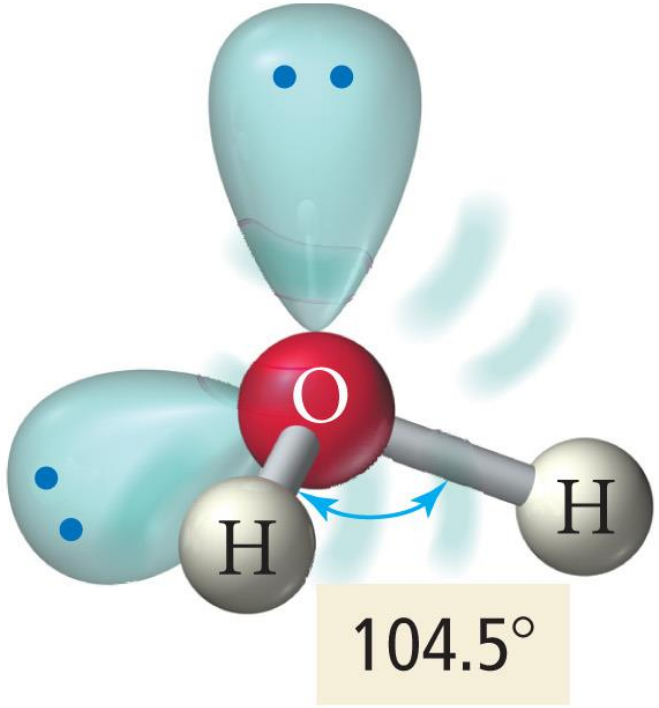


Actual molecular geometry

Bond Angle Distortion from Lone Pairs



Ideal tetrahedral geometry



Actual molecular geometry

Polarity of Molecules

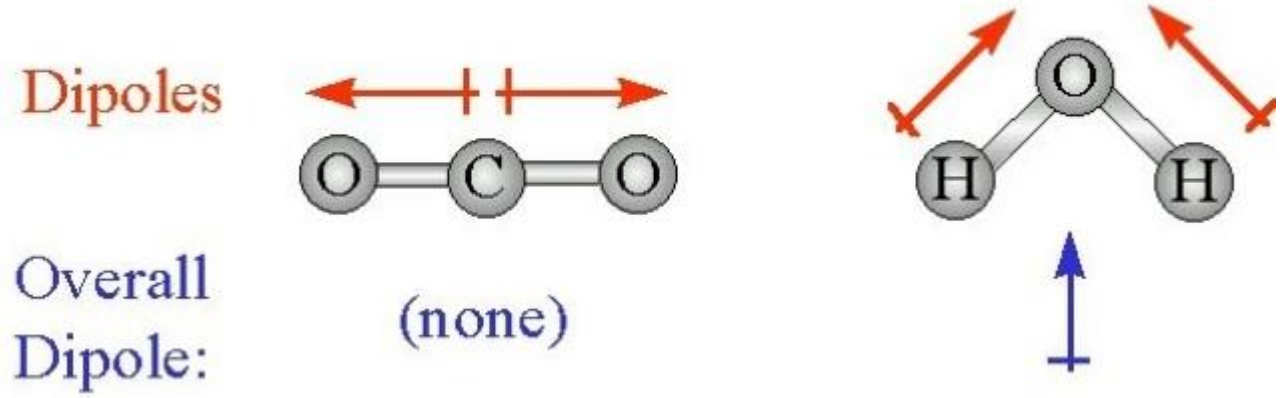
For a molecule to be polar it must

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.



Polarity of Molecules

Polarity affects the intermolecular forces of attraction.

- Therefore, boiling points and solubility
  - “Like dissolves like”

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