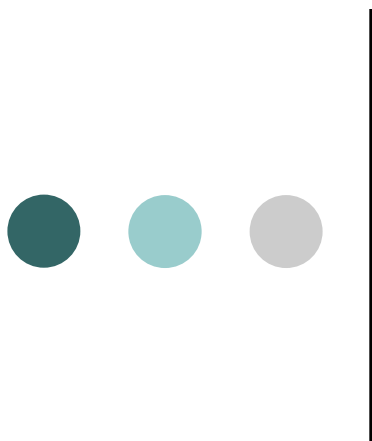
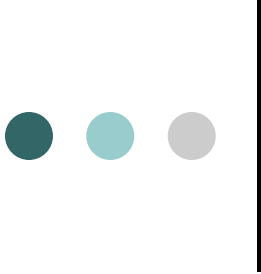




NOTES: 8.3 – **VSEPR Theory**



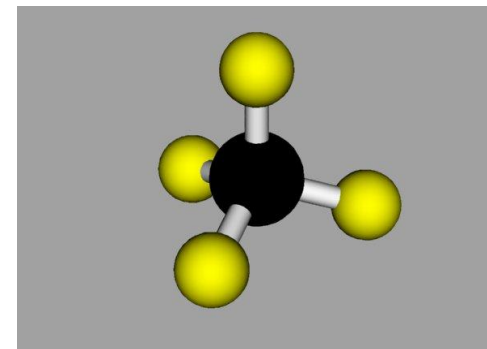
Molecular Shape

- Lewis structures (electron dot structures) show the structure of molecules...but only in 2 dimensions (flat)...

Molecular Shape

BUT, molecules are 3 dimensional!

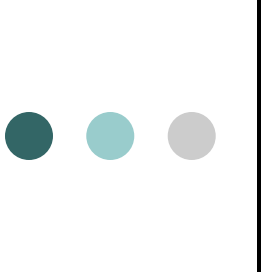
- in 3D it is:
a tetrahedron!



= coming out of page

= going into page

= flat on page

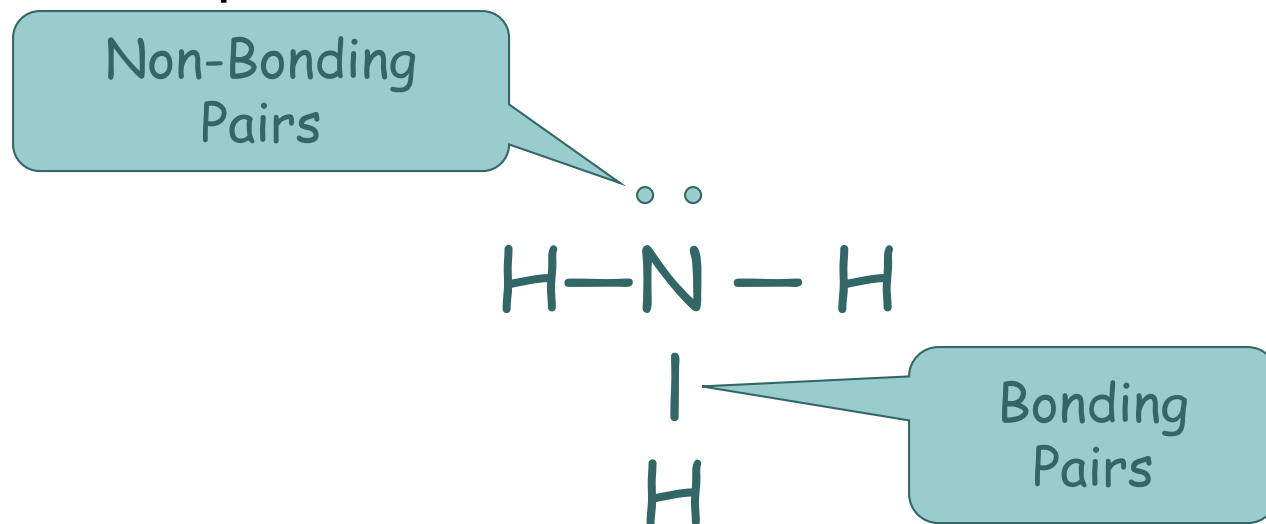


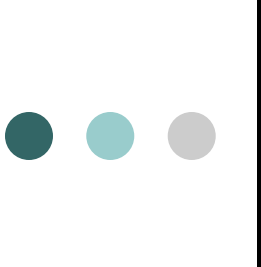
Why do molecules take on 3D shapes instead of being flat?

- **Valence Shell Electron Pair Repulsion theory**
- *“because electron pairs repel one another, molecules adjust their shapes so that the valence electron pairs are as far apart from another as possible.”*

Why do molecules take on 3D shapes instead of being flat?

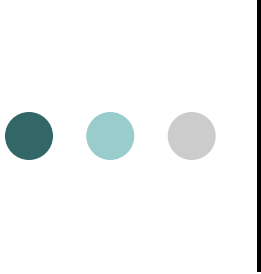
- Valence Shell Electron Pair Repulsion theory
- Remember: both shared and unshared electron pairs will repel one another.





VSEPR Theory

- Predicts molecular geometry by examining bonding and non-bonding electron pairs of electrons on a molecule
 - ➔ **Bonding pair of electrons – electron pair used in a bond**
 - ➔ **Non-bonding pair of electrons – lone pair of electrons not used in bonding**
- The assumption is electron pairs will be spaced out **as far apart as possible** (negatives charges repel) giving rise to particular molecular geometries

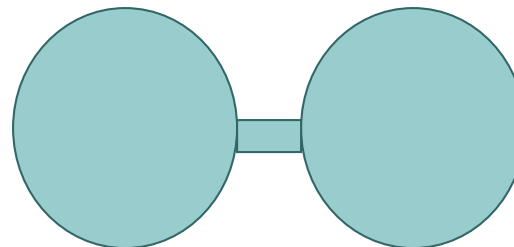
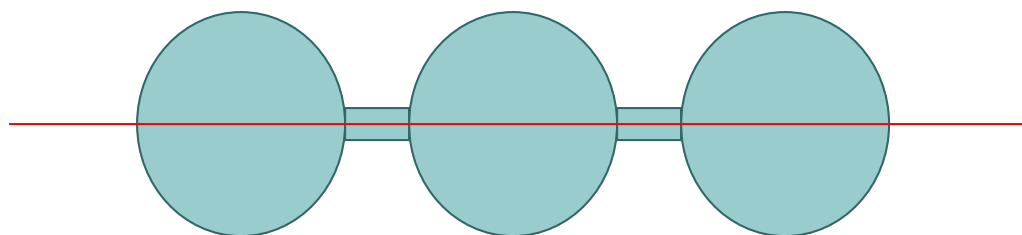


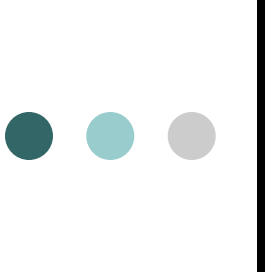
How to determine molecule shape:

- Draw electron dot or structural formula
- Count the number of bonding and non-bonding pairs of electrons around the central atom (number of places electrons are found)
- Multiple (double, triple) bonds count as one “location” or “region”
- Apply the correct geometry predicted by VSEPR Theory based on the number of bonding and non-bonding electron pairs

5 Basic Molecule Shapes

1) Linear

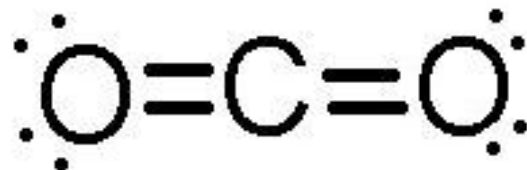




5 Basic Molecule Shapes

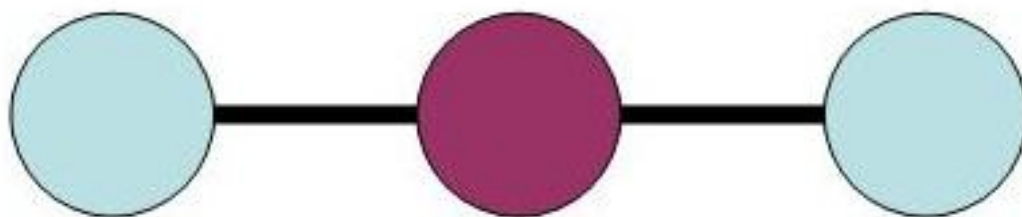
1) Linear

- Example: CO₂





Two pairs of electrons
Both bonding

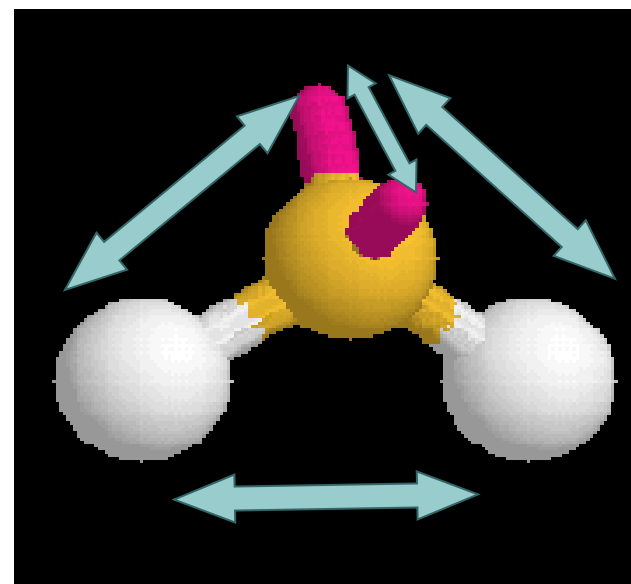
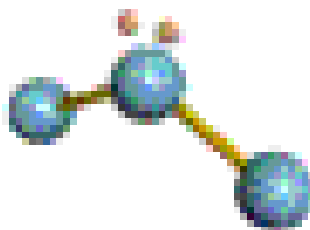


Linear

Bond angle 180°
eg BeCl_2

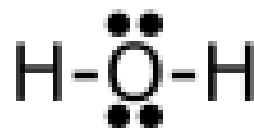
5 Basic Molecule Shapes

2) Bent



5 Basic Molecule Shapes

2) Bent

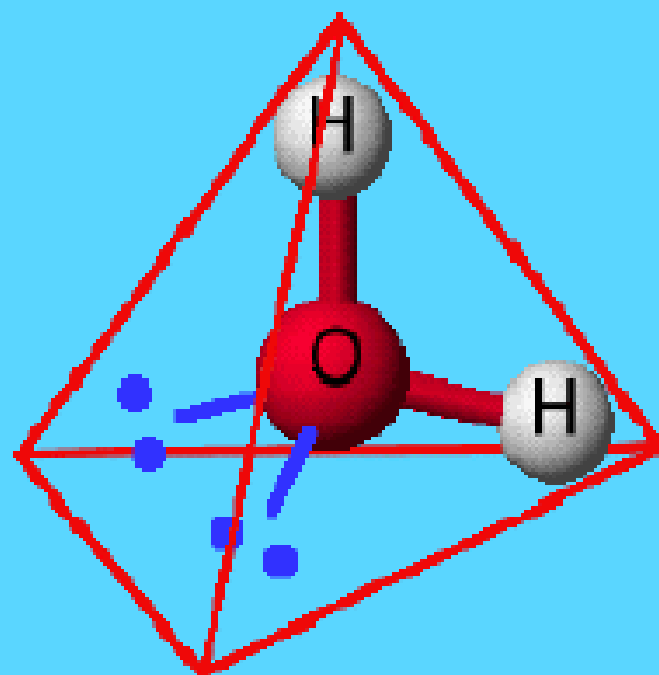
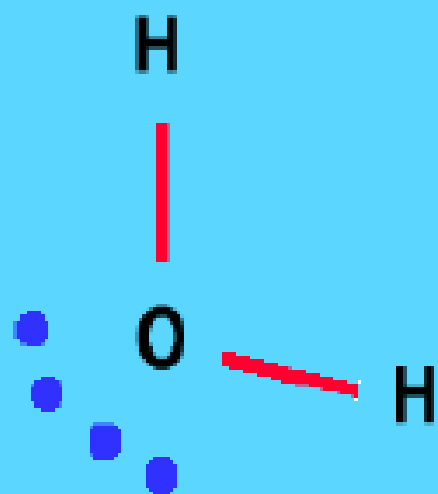


- Example: H_2O

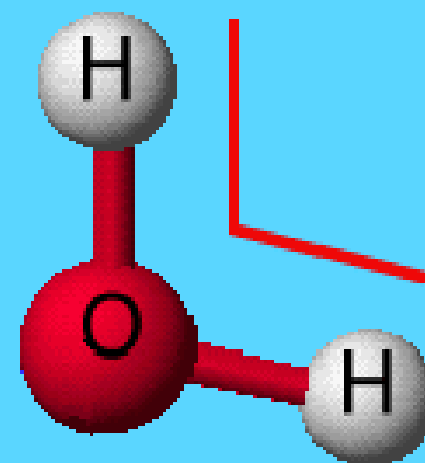
*****Notice electron pair repulsion!!!***



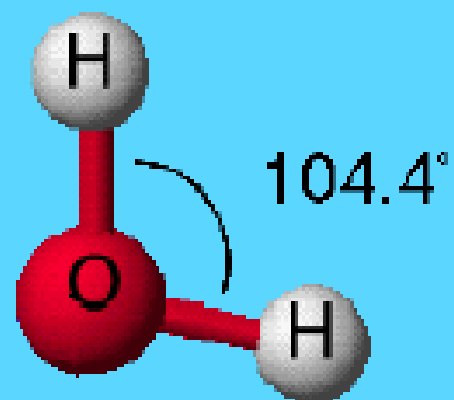
Water



Tetrahedral Electron
Pair Geometry

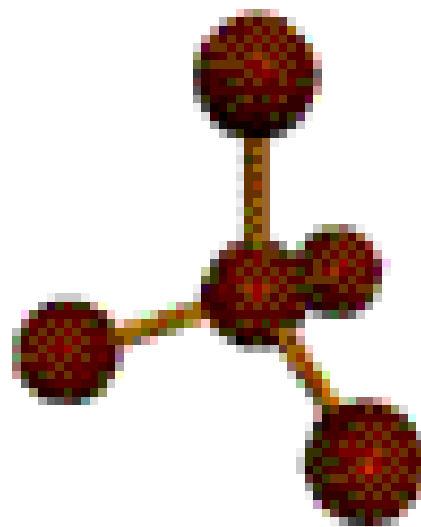


Bent
Molecular
Geometry



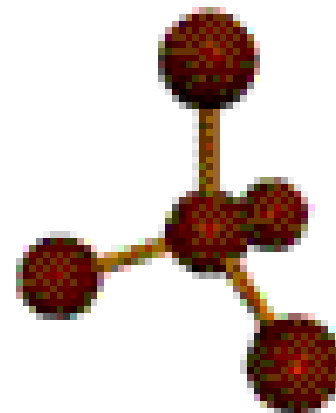
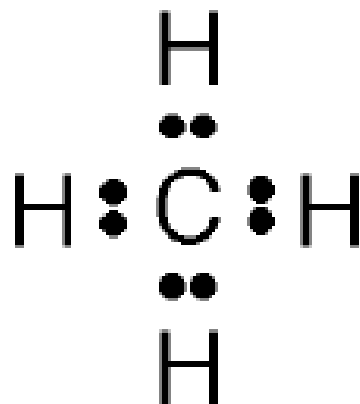
5 Basic Molecule Shapes

3) **tetrahedral**



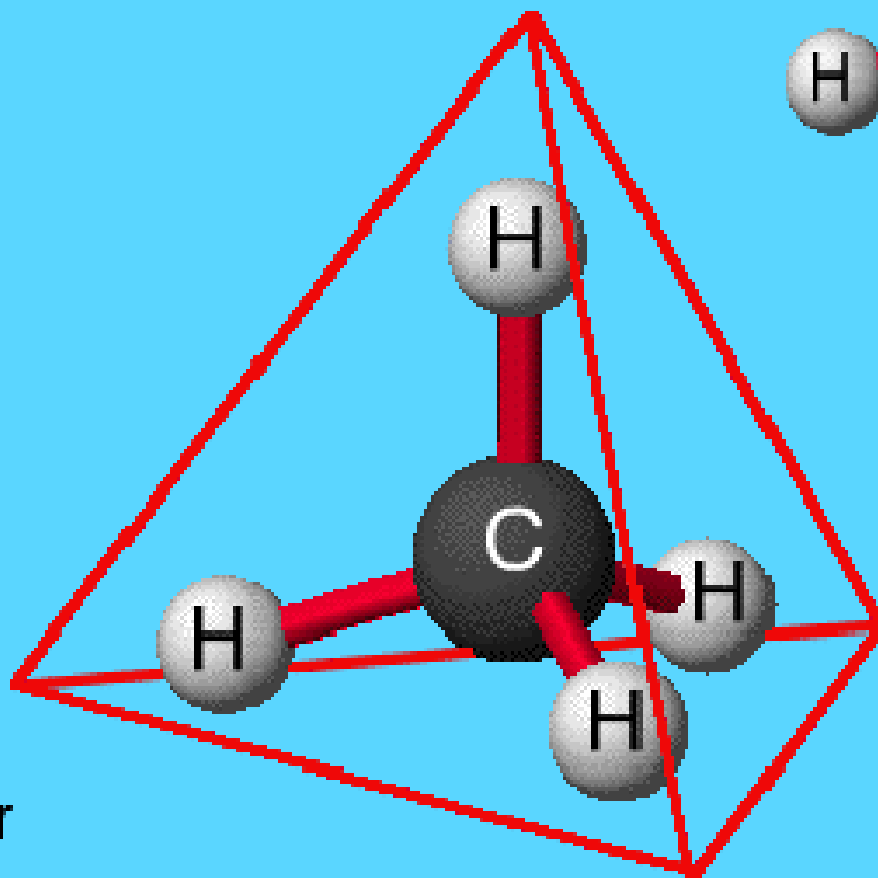
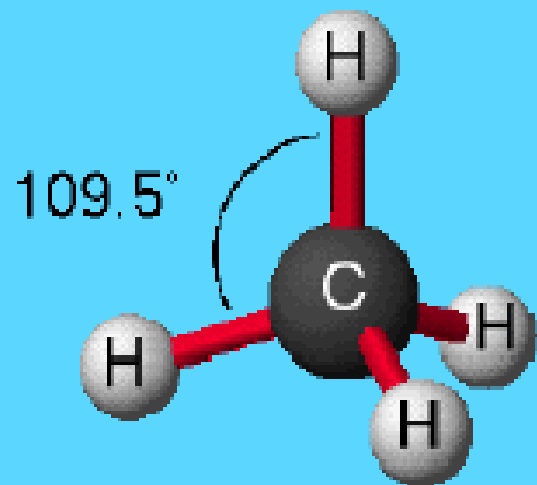
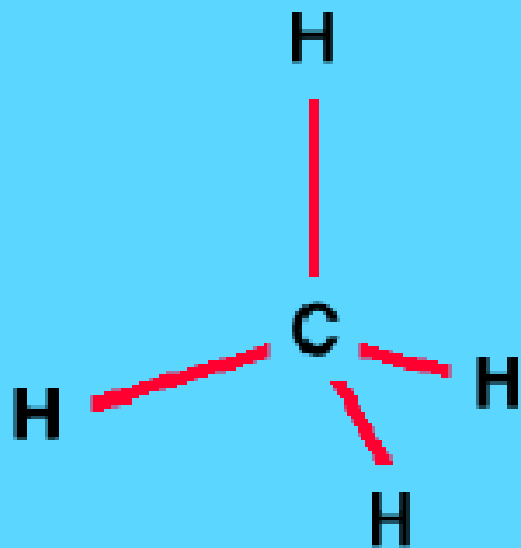
5 Basic Molecule Shapes

3) tetrahedral



- example: CH_4

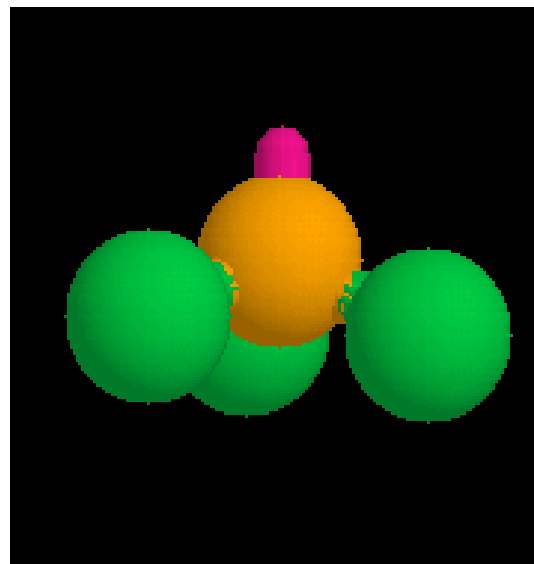
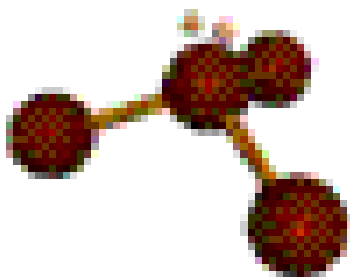
Methane



Tetrahedral E. P. G.
Tetrahedral Molecular
Geometry

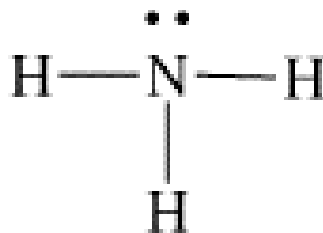
5 Basic Molecule Shapes

4) Pyramidal



5 Basic Molecule Shapes

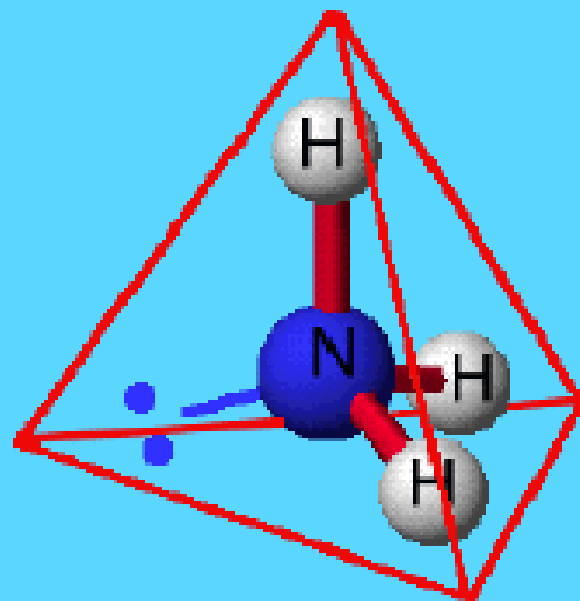
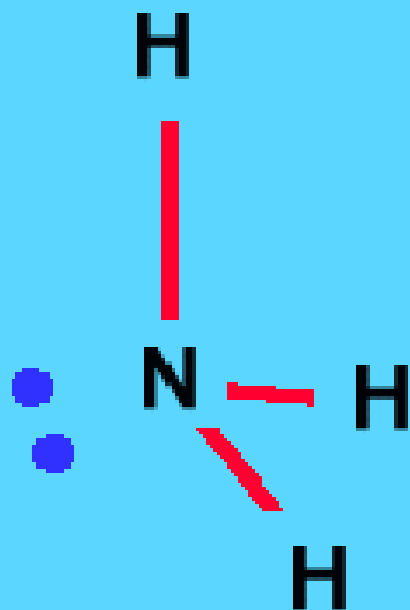
4) Pyramidal



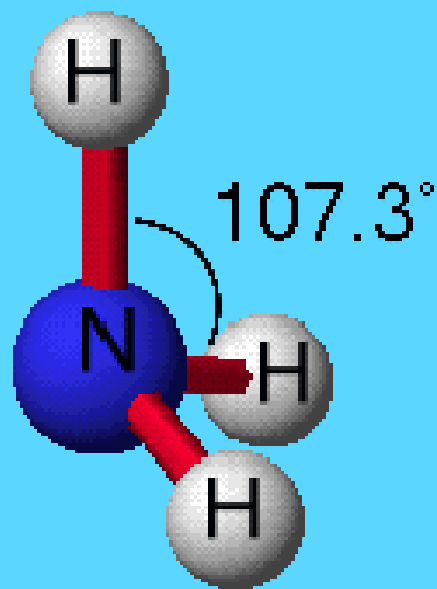
- Example: NH_3

(note: unshared pair of electrons repels, but is not considered part of overall shape; no atom there to contribute to the shape)

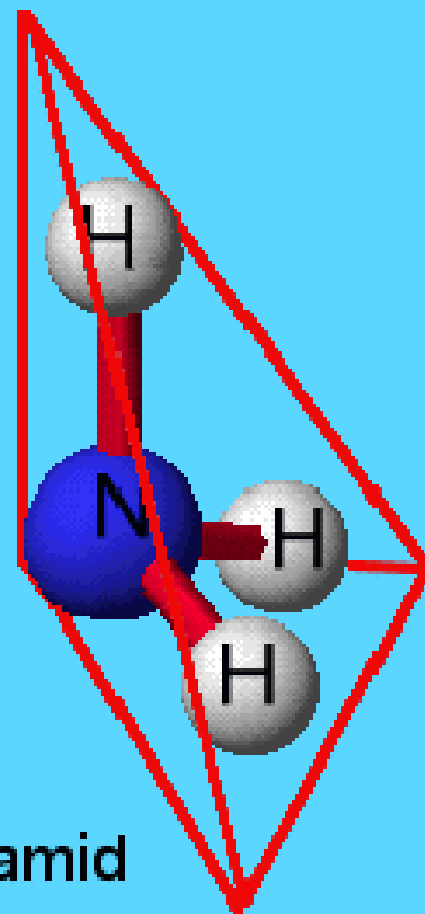
Ammonia



Tetrahedral Electron
Pair Geometry

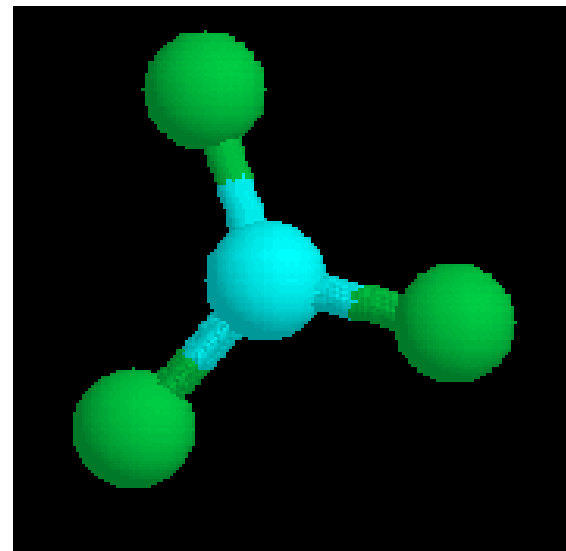
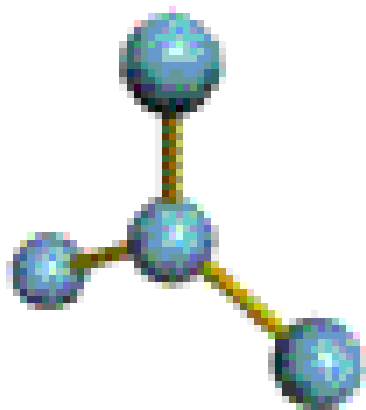


Trigonal Pyramid
Molecular Geometry



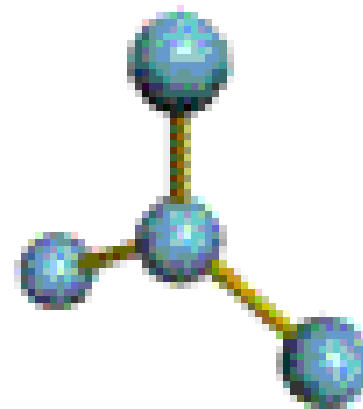
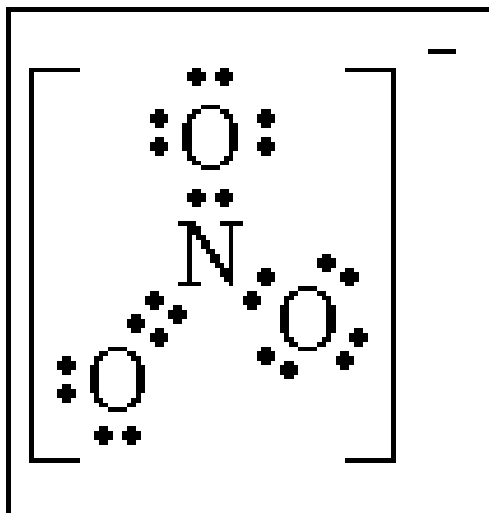
5 Basic Molecule Shapes

5) Trigonal planar

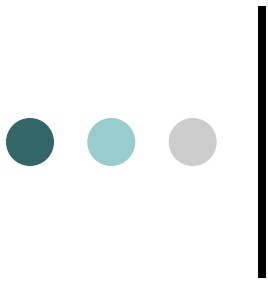


5 Basic Molecule Shapes

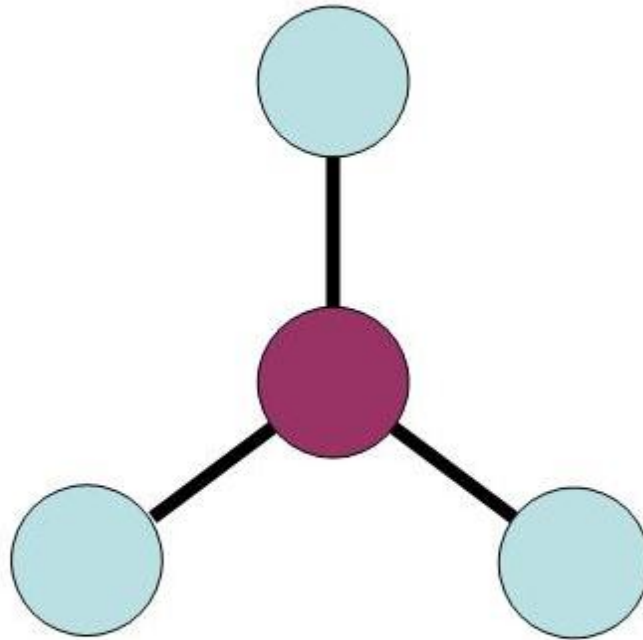
5) Trigonal planar



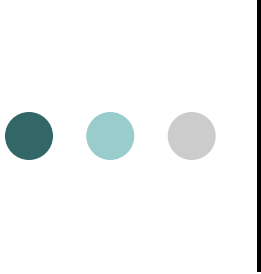
- Example: NO_3^-



Three pairs of electrons
All bonding



Trigonal planar
Bond angle 120°
eg BF_3



Online molecule shape tutorial!