

Read about hybridizing orbitals before Tues lecture!!!!

No review for final, slides from last year up on website

- Coffee provided at exam
- 120 minute **timed** exam, all multiple choice (ACS Study Guide style)
- Bring aluminum foil to exam if you need to model molecules and are a visual thinker

A Bond is a link between 2 atoms

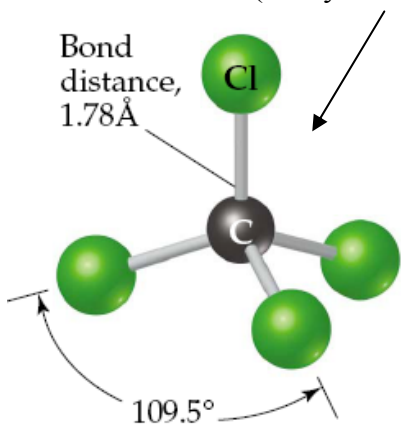
Molecules can have many bonds

-If there are more than 2 atoms present, then there will be more than one bond

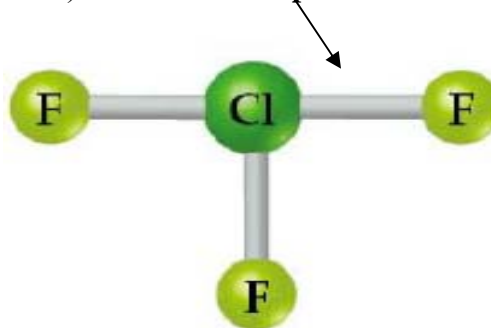
Because of the *d* orbital, it's possible to have more than an octet (4 electron pairs) around it if 3rd shell or higher ($n \geq 3$)

You **must** know 3-D molecular geometries (all the shapes!! Like in lab)

- **Tetrahedral** (always makes triangle faces)

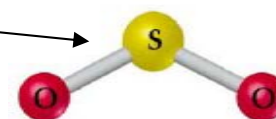


T-shaped



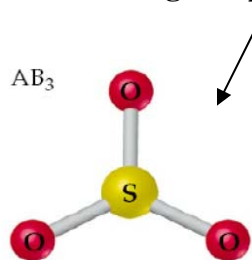
T-shaped

- **Bent shape** (any shape that's not linear, 2 bonds between 3 atoms)



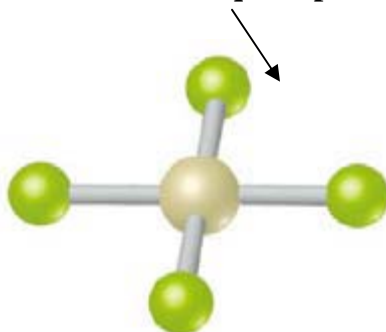
Bent

- **Trigonal planar**

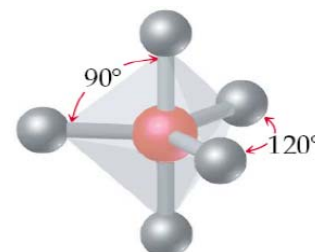


Trigonal planar

Square planar

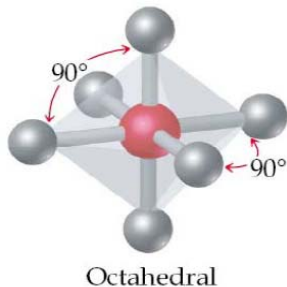


- **Trigonal Bipyramidal** (bond angle of 120° on equator, 90° between top and any other atom)



Trigonal bipyramidal

- **Octahedral** (has 8 faces)



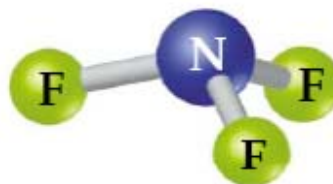
- **Linear** (straight line)



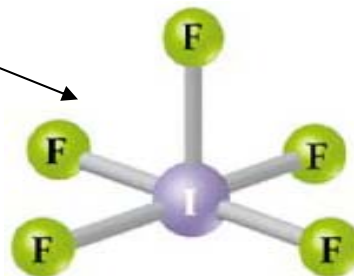
- **See-saw**



- **Trigonal pyramidal** (3 sets of bonding electrons and 1 set of nonbonding)



- **Square pyramid** (1 bond subtracted from octahedral)



When drawing SF_6 , and ClF_3 , it is necessary to realize how many valence electrons you need to draw in a Lewis Dot structure before you start.

When drawing a structure with atoms in period 3 or higher, 6 is the MAXIMUM pairs of electrons allowed

SF_6 is in need of 48 valence electrons total. When drawing the Lewis Dot structure, you make 6 bonds with F and S, thus extending the octet because S is on the 3rd period.

- The electron domain geometry is octahedral
- The molecular shape is octahedral

ClF_3 should have a total of 28 valence electrons. When drawing the Lewis Dot structure, you will find that you will only have 24 valence electrons. Since you're missing 4 valence electrons, meaning 2 bonds, you can add them to Cl since it lies on period 3.

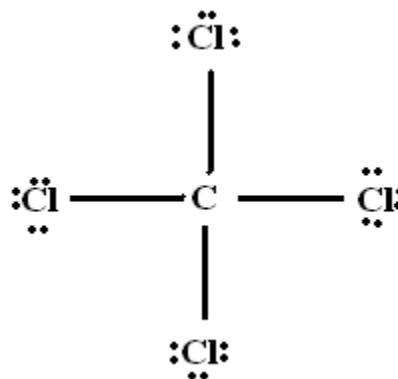
- The electron domain geometry is trigonal bipyramid
- Its molecular shape is T-shaped

The molecular shape of I_3^- is linear and not bent because electrons repel each other as far as possible, so they're "happier" the further apart from each other they are. The underlying electron domain geometry is trigonal bipyramid.

Practice Problems

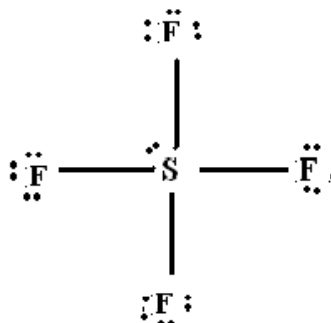
CCl_4 needs 32 valence electrons to make it complete

- Electron domain geometry: tetrahedral
- Molecular geometry: tetrahedral



SF_4 needs a total of 34 valence electrons

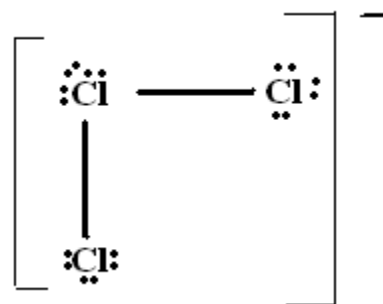
- Domain geometry: trigonal bipyramid
- Molecular geometry: see-saw



Cl_3^- needs 22 valence electrons

Domain geometry: trigonal bipyramid

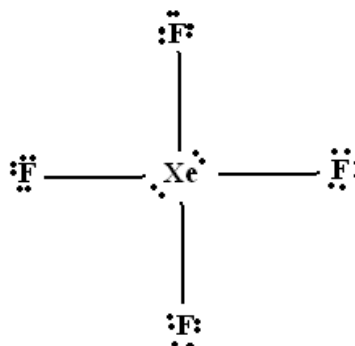
Molecular geometry: linear (note: the drawing at the right is not drawn with the correct bond angle; see note about I_3^- up above which explains that nonbonding electron pairs are more stable on the equator than the poles)



XeF_4 needs 36 valence electrons

Domain geom.: octahedral

Molecular shape: square planar

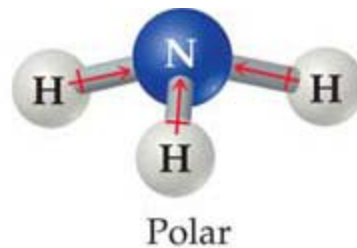


Nonbonding electron pairs have greater density because they have less space

The polar part of a molecule is readily dissolvable in water (which is polar)

Demonstration in class:

- If bond polarities cancel each other out, the entire molecule is nonpolar
- If bond polarities don't cancel out, then it is like one or more atoms can "push" or "pull" the central atom, so entire molecule is polar



For NH_3 , the H atoms are not on the same plane as the N, so there is a pull on top of N as well. Thus, the NH_3 molecule is polar

Shape of orbitals:

s: spherical p: dumbbell d: 4 parts

Hybrid: mixture

Breaking bonds is endothermic

Forming bonds is exothermic