Name: _____

Molecular Models

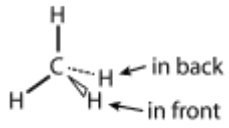
Background: Models are useful in visualizing the three-dimensional structure of molecules. In this exercise you will construct models of some common covalent molecules.
Objective: To construct models of common molecules and examine the polarity of their bonds and molecules.

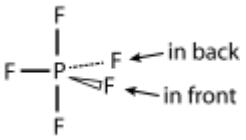
Materials
- Internet-accessing device
- Table of electronegativities (Figure 7.6 in Section 7.2 of the OpenStax chemistry textbook, and Figure 12.3 on p. 362 your Zumdahl and Decoste textbook)
- Molecular models (optional)

Procedure- For each molecule
A Draw Lewis structures -
1. Find (A), total actual number of valence electrons
   a) How many atoms of each element?/ How many valence electrons does each element have?
   c)if the structure is an ion, add one electron for each negative charge, and subtract one electron for each positive charge.
2. Find (N), the total number of electrons needed for each atom to have a filled outer shell.
3. The difference will determine the number of (S) shared electrons. S= N-A.
4. Draw lines to represent each shared pair of electrons between atoms
5. Subtract the number of bonded electrons (S) from total valance (A) to find out how non-bonding electrons are in the valence shell. Then the number of non-bonding electron pairs is (A–S)/2.

B. Construct each molecule
Use the online molecule structure generator to find the geometry about each atom.
If you have access to physical molecular models, build the structure and see how it bends.

C. Complete the data sheet
1. Sketch the 3-dimensional structure of each molecule. Use bond perspective conventions to indicate placement in front of or behind the plane of the page.





2. Determine the electronegativity difference for each type of bond present by subtracting the lower E.N. of one atom from that of the higher E.N.
3. Draw arrows on the bonds of your sketch to show direction of polarity (if any)
4. Use VSEPR to determine the name given to the molecular shape of the molecule.
5. Using the bond orientation(s) and the polarity of the bond(s), determine if the molecule is polar. Draw an arrow (positive to negative) beside the 3D structure to indicate the direction of the dipole moment.

Molecular Models Table

Molecular formula	Lewis Structure	3D sketch	Polarities	
			Bond	Δ(EN)
HCl			H-Cl	
CH_4			C-H	
NH_3			N-H	
H_2O			O-H	
CCl_4			C-Cl	
$CH_3CH_2CH_2OH$			C-H	
			C-O	
			O-H	
			C-C	
CH_2Cl_2			C-Cl	
			C-H	

Molecular formula	Lewis Structure	3D sketch	Polarities	
			Bond	Δ(EN)
$(CH_3)_2CO$			C-C	
			C-H	
			C-O	
PF_3			P-F	
PF_5			P-F	

Now let us look at some small molecules and molecular ions with interesting bonding patterns. Indicate formal charges in the Lewis structures. Indicate the directions of dipole moments.

Formula	Lewis structure	3D sketch
N_2		
CO		
$[CN]^-$		
$[NO_3]^-$		
N_3^-		

$[OCN]^-$		
$[ClO]^-$		
$[ClO_2]^-$		
$[ClO_3]^-$		
$[ClO_4]^-$		