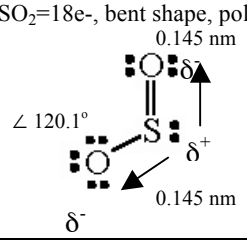
Name(s): _____

Worksheet: The Structure of Molecules

Molecular models consist of colored spheres (atoms) that are connected and correspond to various common geometries and connections that link them together. The connections come in longer and shorter lengths that represent longer and shorter bonds.

***SEE**: http://chemconnections.org/general/chem120/VSEPR/*

1. Complete the following table with Lewis structures for the respective compounds: **1A.** CO_2, **1B.** SO_3, **1C.** H_2O, **2A.** NH_3, **2B.** CCl_2F_2, **2C.** N_2O, **3A.** IF_5, **3B.** O_3, **3C.** BF_3, **4A.** SO_2, **4B.** SF_6, **4C.** PF_3Cl_2. B) View the molecule by clicking on the link below and accurately describe the shape of the molecule, **[The images must be manipulated in order to get an accurate view of the molecules.]** For example, **4A: *SO_2, bent shape***

	A	B	C
1			
2			
3			
4	SO_2, S=6e-, O=6e-, SO_2=18e-, bent shape, polar 		

2. View H_2O, CCl_2F_2, CO_2, BF_3, and NH_3 in the table. Using the respective *Jmol* images, determine bond lengths by double clicking on one atom and then single clicking an attached atom. Determine bond angles by then clicking on a third atom in the bonded sequence. Record the bond lengths and bond angles in each molecule. Enter them in the table. Draw each of the moleules in 3-d. ***Consider the electronegativities of the bonded atoms.*** Indicate which bonded atoms are relatively more electronegative and which are more electropositive using δ^- and δ^+ to represent the respective partial charges. Use an arrow to represent the dipole vector for each bond. Indicate if the molecule is polar or non-polar. Rank the molecules: 1 to 5, from the lowest dipole moment, which equals 0 D, to the highest, which equals 1.85 D.

	3-d Structure	*Bond length(s) nm*	*Bond angle(s) ∠ °*	*Polar or Non-polar*	*Dipole Moment Rank*
H_2O					
CCl_2F_2		C-Cl C-F	C-Cl C-F		
CO_2					
BF_3					
NH_3					

3. In sulfur dioxide the bond lengths for each of the S-O bonds is the same, 0.145 nm, Explain how this difference can be reconciled.Show resonance structures that illustrate your explanation.

4. In sulfur trioxide the bond lengths for each of the S-O bonds are the same, 0.157 nm. Briefly explain the difference between the longer bond length in sulfur trioxide versus sulfur dioxide, and also why sulfur trioxide is non-polar but sulfur dioxide is polar.