PAL Worksheet – Chem 6A
Molecular polarity and shape

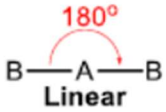
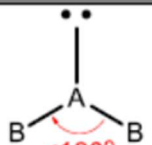
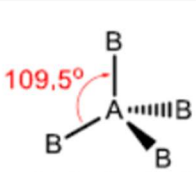
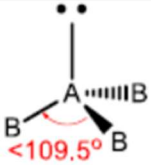
I. Electron geometry and molecular shape.

Principle: Molecules exist in three-dimensions with characteristic shapes.

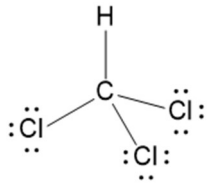
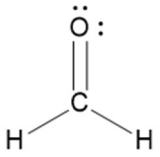
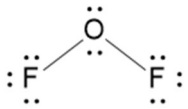
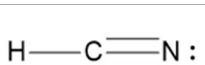
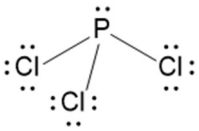
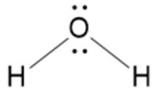
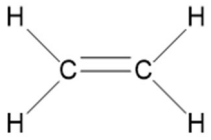
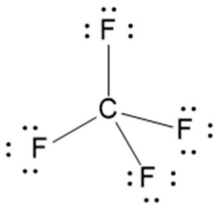
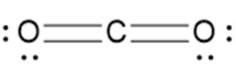
1. What is VSEPR theory?

2. Differentiate between molecular geometry (aka molecular shape) and electron geometry.

3. For each of the molecules on the next page, determine the electron geometry. Then determine the molecular shape. Refer to the table for assistance.

MOLECULAR GEOMETRY			
	No lone pairs	1 lone pair	2 lone pairs
2 Electron Domains	 Linear		
3 Electron Domains	 Trigonal Planar	 Bent	
4 Electron Domains	 Tetrahedral	 Trigonal Pyramidal	 Bent

https://www.chadsprep.com/chads-high-school-chemistry-videos/electron-domain-geometry/?srsltid=AfmBOooeSTQJzD5mfPomwjJsNFcm9fv0MzmY9sx22XCtq8SF7xpHcX6H

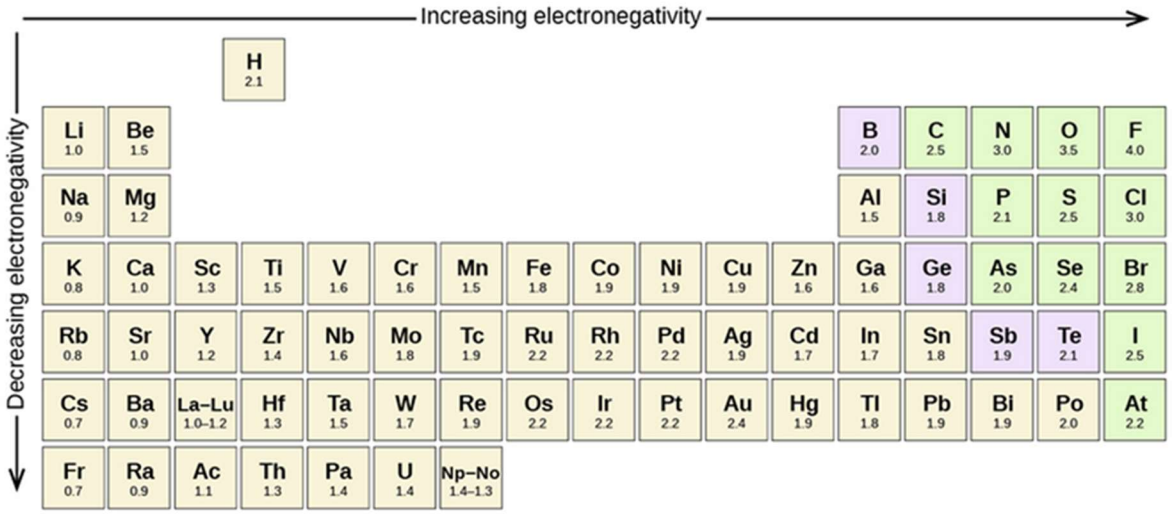
Molecule	Electron geometry	Molecular shape
		
		
		
		
		
		
		
		
		

II. Molecular polarity

Principle: Some molecules have a molecular dipole based on the molecular shape and presence of bond dipoles.

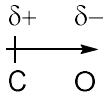
1. Define “electronegativity”. What is the electronegativity trend in the periodic table?

2. A bond can be considered to be polar if the difference in electronegativity between the two atoms in the bond is greater than 0.4 (unitless quantity). Using the table below, determine which of the bonds listed in question # 2 are polar. (Note: some instructors will not cover this type of calculation and you may skip this question),



Bonding atoms	Polar or non-polar
H-O	
C-S	
N-H	
O-F	
C-Br	
N-C	

3. Draw representations of bond dipoles in the following molecules (polar bonds only, Use LDS structures from previous question). Use both dipole arrows and partial charges to illustrate the bond dipole. Example for a C-O bond:



a. H_2O

b. CH_2O

c. NH_3

d. HCN

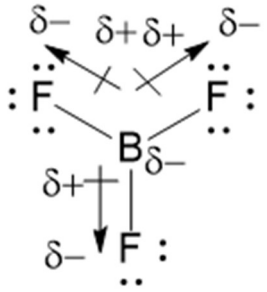
e. OF_2

f. CO_2

g. CF_4

A molecular is polar if:

- It has at least one polar bond.
- Its polar bonds do not cancel each other out. Polar bonds cancel in molecules that contain the same polar bond in every bonding position. For example, the molecule BF_3 contains three B-F bonds, all polar, and no lone pairs. The symmetry of the three BF bonds cancels out the bond dipoles and the molecule as a whole is non-polar.



4. Determine for each molecule in the table below whether the molecule is polar.

Molecule	Polar bonds	Molecular dipole (Y/N)
H_2O		
CH_2O		
NH_3		
HCN		
OF_2		
CO_2		
CF_4		

5. Explain why CO_2 and CF_4, each having polar bonds, are non-polar molecules whereas OF_2 is a polar molecule.