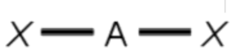
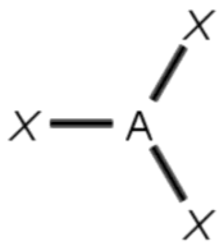
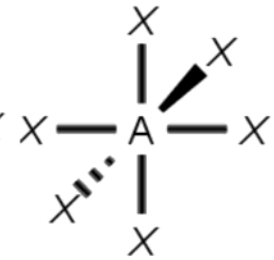
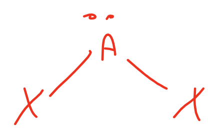
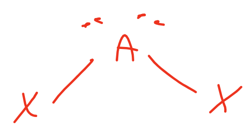
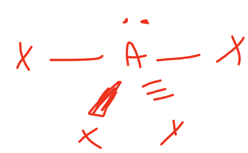
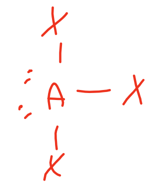
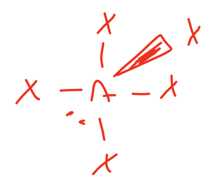
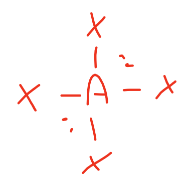
Molecular Shape and Polarity

AX_2	AX_3	AX_4	AX_5	AX_6
Linear	Trigonal Planar	Tetrahedral	Trigonal Bipyramidal	Octahedral
180°	120°	109.5°	120°, 90°, 180°	90°
				

1. The parent geometry of each shape group is shown above. Use these as a reference point to draw and name each of the following.

Electron Groups	Name	Sketch the Shape in 3D
AX_2E	bent	
AX_3E	trigonal pyramidal	
AX_2E_2	bent	
AX_4E	Seesaw	

AX_3E_2	T-shaped	
AX_2E_3	liner	
AX_5E	Square pyramidal	
AX_4E	Square planar	

2. How do you know if a bond is polar?

   $\Delta EN > 0.4$

3. Determine if a covalent bond between each pair of atoms is polar or non-polar:

S and O	O and H	O and F	N and O	C and H	N and Cl
non	polar	polar	polar	Non	Non

4. Covalent bonds that include fluorine, oxygen, and nitrogen are almost always polar.
   a. Why is this a true statement? Consider electronegativity values.

      They are the most EN atoms + are 0.5 away from anything else

   b. What is one example of a polar bond that contains fluorine? C–F: or any other atom bonded to F

   c. What is one example of a non-polar bond that contains fluorine?

      F_2 :F–F:

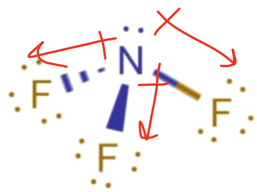
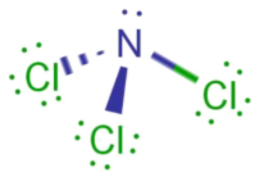
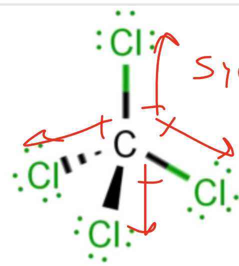
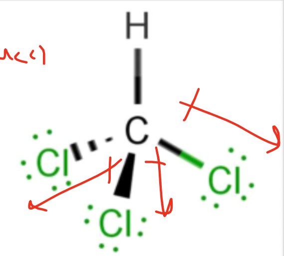
5. True or false. For each false statement, explain why it is not true.
   a. A polar molecule must contain at least one polar bond.

      True

   b. All molecules that contain a polar bond are polar.

      False - if a molecule is perfectly symmetrical, it cannot be polar

6. Consider the following compounds:
   a. Labe all polar bonds with a dipole arrow ($+\!\!\longrightarrow$) pointing toward the negative pole.
   b. Determine if each of these compounds are polar or non-polar. They are drawn with the correct geometry.

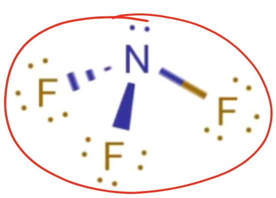
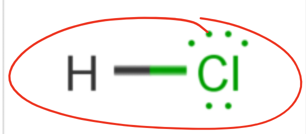
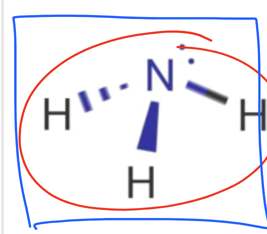
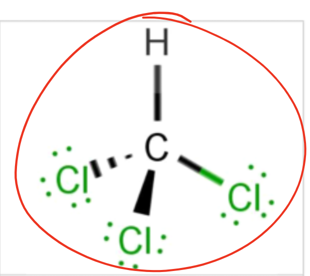
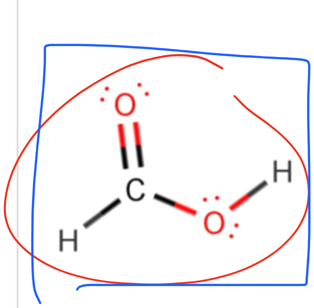
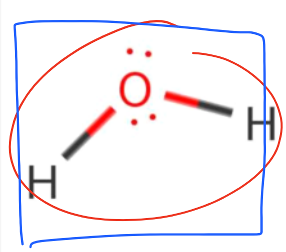
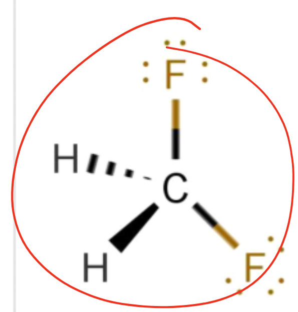
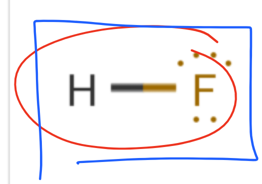
		 Symmetrical	
Polar Nonpolar	Polar Nonpolar	Polar Nonpolar	Polar Nonpolar

7. Rank these four intermolecular forces from weakest to strongest:

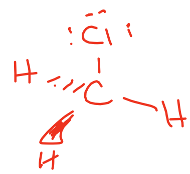
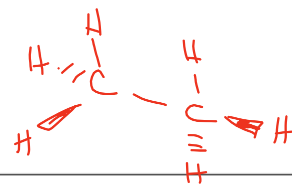
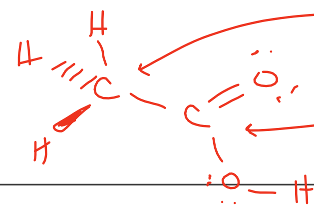
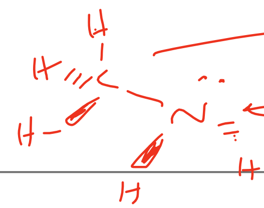
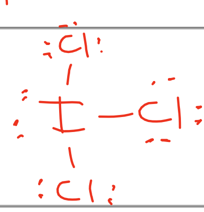
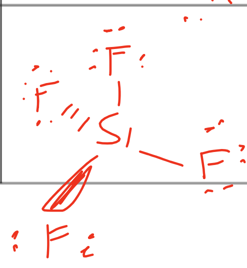
   3 H-bond   4 ion-ion   1 London dispersion forces   2 dipole-dipole

LDF < DD < Hbond < ion   strongest   weakest

8. Consider the following compounds: Circle the compounds that can interact through dipole-dipole and put a box around those that can H-bond.

9. For each of the compounds below, determine the molecular geometry and list all intermolecular forces that help stabilize condensed phases.

Compound	Structure (draw it in in the correct geometry)	Molecular Geometry	Circle all appropriate IMF
CO_2		linear	Ion-ion Dipole-dipole H-bond LDF
CH_3Cl		tetrahedral	Ion-ion Dipole-dipole H-bond LDF
CH_3CH_3		both carbons are tetrahedral	Ion-ion Dipole-dipole H-bond LDF
CH_3CO_2H		tetrahedral trig. planar	Ion-ion Dipole-dipole H-bond LDF
CH_3NH_2		tetrahedral trig. pyramidal	Ion-ion Dipole-dipole H-bond LDF
H_2S		bent	Ion-ion Dipole-dipole H-bond LDF
ICl_3		T-shape	Ion-ion Dipole-dipole H-bond LDF
SiF_4		tetrahedral	Ion-ion Dipole-dipole H-bond LDF