



1. List the three intermolecular forces in order of increasing strength. Describe under which conditions each exists as well as the relative strengths of IMF's in the three states of matter.
2. What are two types of bonds that we have discussed in class? What is the difference between a polar bond and a nonpolar bond?
3. How do intermolecular forces differ from bonds?
4. If two different compounds both have London dispersion forces between its molecules, how do you determine which will have the stronger intermolecular forces?
5. Be able to write the Lewis Dot Structure of a given compound including the bond dipoles if the bonds are polar (using dipole arrows or partial charges...see answer to #6 for an example of this). Also be able to determine the molecular geometry of molecules of the substance based on VSEPR Theory. Then be able to determine whether the molecule is polar or non-polar based on its molecular geometry and the type of intermolecular forces that will exist between molecules of the substance.

Practice:

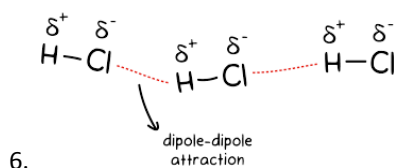
Substance	Formula	Lewis Dot Structure With Bond Dipoles Drawn In	Molecular Geometry	Bond Polarity (Polar or Nonpolar)	Molecular Polarity (Polar or Nonpolar)	Type of Intermolecular Forces Present in Substance
nitrogen trihydride						
silicon dioxide						
carbon tetrachloride						
sulfur difluoride						
phosphorous trichloride						
phosphorous pentachloride						
iodine						
dihydrogen monoxide						

6. Be able to draw multiple representations of molecules and show the intermolecular forces between the dipoles of the molecules using dotted lines.
Example) Draw three molecules of HCl and show the intermolecular forces between adjacent molecules using dotted lines to represent the IMFs.
7. Define each of the following terms of how the strength of the intermolecular forces present in a substance affects each property.
 - a) boiling point
 - b) melting/freezing point
 - c) viscosity
 - d) evaporation rate
8. What are the 7 diatomic elements? Be able to draw Lewis structures of each.

Answers:

1. London dispersion forces (between nonpolar molecules); dipole-dipole (between polar molecules); hydrogen bonding (between molecules containing O-H, N-H, or F-H bond); solids have the strongest IMFs and gases have the weakest.
2. Covalent (sharing of electrons between two nonmetals) and ionic (transfer of electrons from metal to nonmetal and then attraction of resulting cation and anion); polar covalent bonds are an unequal sharing of electrons between two nonmetal atoms with different electronegativities whereas nonpolar covalent bonds are an equal sharing of electrons between two nonmetal atoms with the same electronegativity.
3. Intermolecular forces are weak forces of attraction between the opposite dipoles of neighboring molecules whereas bond are strong forces of attraction within a molecule due to sharing electrons.
4. The molecules with more total electrons will form stronger London dispersion forces between the molecules.
- 5.

Substance	Formula	Lewis Dot Structure With Bond Dipoles Drawn In	Molecular Geometry	Bond Polarity	Molecular Polarity	Type of Intermolecular Forces
nitrogen trihydride	NH ₃		trigonal pyramidal	polar	polar	hydrogen bonding
silicon dioxide	SiO ₂		linear	polar	nonpolar	dispersion forces
carbon tetrachloride	CCl ₄		tetrahedral	polar	nonpolar	dispersion forces
sulfur difluoride	SF ₂		bent	polar	polar	dipole-dipole
phosphorous trichloride	PCl ₃		trigonal pyramidal	polar	polar	dipole-dipole
phosphorous pentachloride	PCl ₅		trigonal bipyramidal	polar	nonpolar	dispersion
iodine	I ₂		none	nonpolar	nonpolar	dispersion
dihydrogen monoxide	H ₂ O		bent	polar	polar	hydrogen bonds



7. a) stronger IMFs, higher bp (direct relationship); b) stronger IMFs, higher mp/fp (direct relationship); c) stronger IMFs, higher viscosity (direct relationship); d) stronger IMFs, slower evaporation rate (inverse relationship)

8. Br₂, I₂, N₂, Cl₂, H₂, O₂, F₂