Intermolecular Forces Practice Problems

1. **Rank the following substances by increasing polarity and intermolecular forces.**

   a) HF, BF_3, KF, F_2 _____

   b) Na_2O, CO_2, CO, O_2 _____

   c) PCl_3, BCl_3, LiCl, Cl_2 _____

2. **What is the strongest intermolecular force present in each of the following substances?**

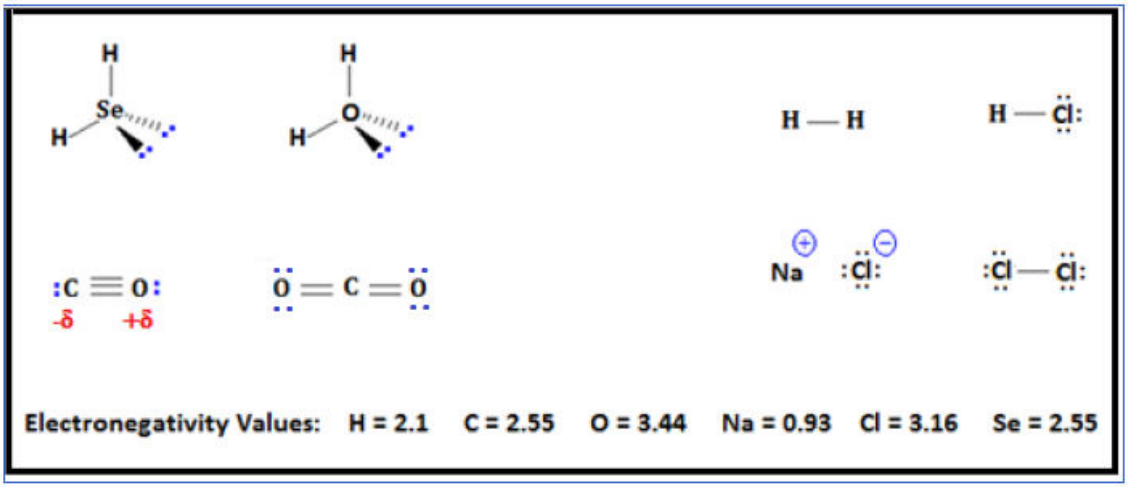
   a) Hydrogen Fluoride (HF) _____

   b) Sodium Oxide (Na_2O) _____

   c) Phosphorus Trichloride (PCl_3) _____

   d) Oxygen Gas (O_2) _____

USE THE VSPER STRUCTURES BELOW TO ANSWER THE FOLLOWING QUESTIONS:



3. **H_2Se** or **H_2O: Which substance will have the highest boiling point and why?** _____

   _____

4. **CO** or **CO_2: Which substance will have the lowest melting point and why?** _____

   _____

5. **H_2O** or **H_2: Which substance will have the highest surface tension and why?** _____

_____

6. **NaCl** or **Cl_2: Which molecule will have the lowest vapor pressure and why?** _____

_____

7. **H_2O** or **HCl: Which substance will have the highest viscosity and why?** _____

_____

8. **List each substance, shown in the image above, in order of increasing intermolecular forces. If two molecules have the same IMF, the one with more MASS will have greater IMF properties.**

Weakest IMF ..... Hydrogen Gas (H_2) (Lowest Mass)

_____

_____

_____

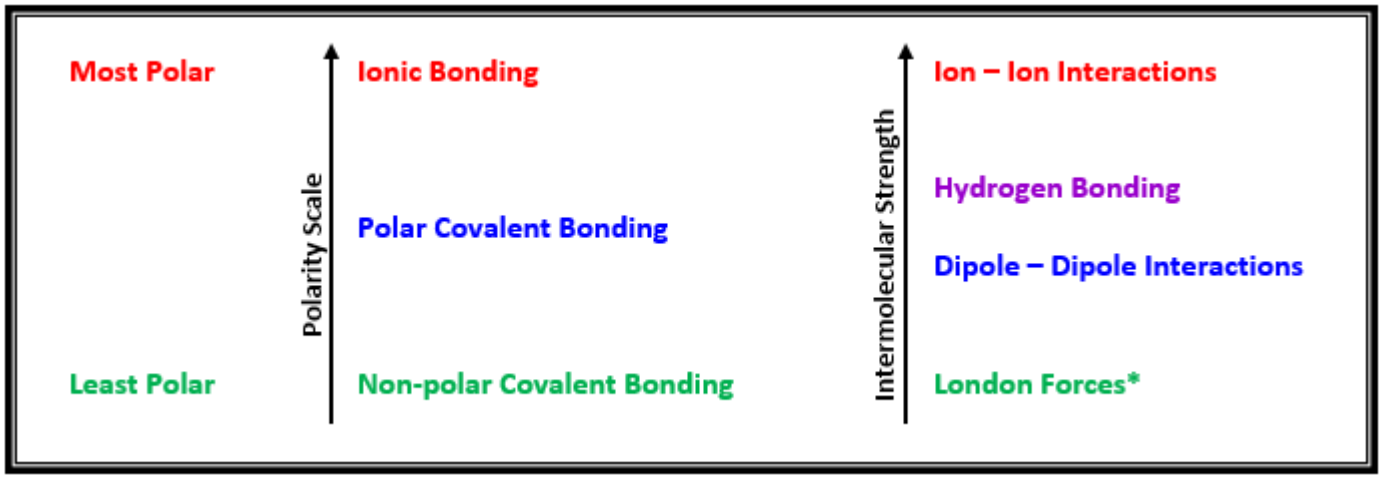
_____

_____

_____

Strongest IMF ..... Sodium Chloride (NaCl) (Ions are most polar)

Intermolecular Forces



***London Forces are also called Dispersion Forces and Induced Dipole Interactions**

Physical Properties depend on Intermolecular Forces!

- The ***stronger*** the force, the _____ the ***melting point***.
- The ***stronger*** the force, the _____ the ***boiling point***.
- The ***stronger*** the force, the _____ the ***viscosity*** (resistance to flow).
- The ***stronger*** the force, the _____ the ***surface tension*** (resistance to increase in surface area.)
- The ***stronger*** the force, the _____ the ***vapor pressure*** (partial pressure of vapor above a liquid at a certain temperature).

London Forces are the weakest because there are _____ internal attractive or repulsive forces within a non-polar covalent molecule. Instead, as one molecule approaches another, there is an instantaneous and _____ shift in electron distribution due to slight _____ forces. This causes an _____ dipole which allows the molecules to temporarily be attracted to one another.

Dipole – Dipole Interactions are not caused by ionic charges! In Dipole – Dipole Interactions the covalently bonded molecules are sharing the electrons _____ causing dipoles to form. As a result, the more _____ side of one molecule aligns with the more _____side of another molecule of the same substance. Unlike the London Forces, the dipoles in this situation are _____.

Hydrogen Bonding is a special type of Dipole –Dipole Polar Covalent Bonding. Hydrogen bonding has an increased intermolecular strength because the hydrogen has an _____ _____. So when it forms a covalent bond, it's almost as if it becomes a _____, allowing it's one valence electron to be completely pulled away by the greater electronegativity of the _____, _____, or _____ atom.

Ion – Ion Interactions are the result of Ionic charges! Ionic compounds are made up of a _____ that _____ its outer electrons to become a positive ion (_____) and a non-metal that _____ the outer electrons to become a negative ion (_____). These ions work like the poles on a magnet to create _____ and _____ forces aligning the ions within the compound.