Name Key

Intermolecular Forces

Summary: Intermolecular forces hold molecules in the liquid and solid state. In general, the stronger this force, the higher the boiling point and melting points of the substance. If molecules have the same type of intermolecular force than the larger one will usually have the higher boiling or melting point. Intermolecular forces are weaker than intramolecular forces.

1. What are the four types of intermolecular forces?
   Which types of molecules are involved in each?
   Give an example of each.
   a. ion-dipole ion + polar molecule $Cl^- - H_2O$ $Na^+ - H_2O$ ← this one is not on quiz or test
   b. dipole-dipole 2 polar molecules $CO + CO$ $HCl + HCl$
   c. London dispersion 2 nonpolar molecules $CO_2 + CO_2$ $F + F$
   d. hydrogen bonding HF, HO, HN $H_2O + H_2O$ $HF + HF$

2. Which is stronger a dipole-dipole attraction between two molecules or a covalent bond between two atoms with the same molecule?
   intra > inter

3. What are the combinations that hydrogen bonding can occur between?
   HF; HO; HN

4. List the following from strongest to weakest: dipole-dipole, London dispersion forces (LDF), covalent bond, hydrogen bonding Covalent → H-bond → dip-dip → LDF

5. What type of intermolecular force is present in each of the following molecules

HCl	dipole-dipole	P_4	LDF
HF	H-bond	NH_3	H-bond
N_2	LDF	CO_2	LDF

6. Would you expect the boiling point to be higher in: H_2O or H_2S or H_2? Why?
   —H-bonds

7. Would you expect to have the highest boiling point in: H_2, O_2, Cl_2, and I_2? Why?
   largest b/c all nonpolar so LDF

8. What is a metallic bond? What is the key factor about metallic bonds that make it so that they can conduct electricity/ heat? bet metal atoms sea of e^- (mobile e-)

9. What is an ionic bond? Draw a Lewis structure for Li and Cl together.
   between metal + nonmetal
   Cation + anion
   Li^+ $:\ddot{Cl}:^-$
   ← space between them.