Intermolecular Forces Worksheet

1) Each of the following statements describes an intermolecular force. For each statement indicate if it describes London Forces (L), dipole forces (D) or hydrogen bonding (H).

_____ Occurs in all molecules

_____ is the strongest intermolecular force

_____ occurs in polar molecules

_____ occurs when a temporary dipole is formed

_____ strength of the force depends on the size of the molecule (ie # of protons and electrons)

_____ occurs in molecules where hydrogen is covalently bonded to O, N, or F

2) Rank the following from strongest to weakest:

i. Covalent Bond
ii. Dipole-dipole force
iii. Hydrogen bond
iv. Ionic Bond
v. London Dispersion force

Weakest _____ _____ _____ _____ _____ Strongest

3) For each of the following pairs of compounds, identify which one would have the higher boiling point, giving a reason for your answer.

a) CS_2 or SiH_4

b) Cl_2 or F_2

c) CH_4 or NH_3

d) HI or KI

e) $CHCl_3$ or CF_4

4) Suggest, with a reason, why the boiling point of Cl_2 is -35^{o}C and the boiling point of C_4H_{10} is -0.50^{o}C.

5) The industrial production of ammonia, NH_3, from H_2 and N_2 is called the Haber process, named for Fritz Haber, the German chemist who developed it just before World War I. During the process, in a gaseous mixture of all three substances, NH_3 must be separated from H_2 and N_2. This is done by cooling the gaseous mixture so as to condense only the NH3. This leaves the elemental nitrogen and hydrogen as gases to be recycled and produce more ammonia. Why does only the ammonia liquefy upon cooling, but not the H_2 or N_2?

6) Rank the following from weakest intermolecular forces to strongest. Justify your answers.

H_2Se, H_2S, H_2Po, H_2Te

7) Surface tension is the ability of a fluid to act as a thin elastic membrane at its surface. Explain why non-polar molecules usually have much lower surface tension than polar ones.

8) Ionic compounds such as NaCl have very high melting points because a great deal of energy is required to overcome the many attractive forces between the oppositely charged ions in an ionic crystal lattice. NaCl melts at 801°C, yet its ions will readily separate from each other at room temperature when the solid is added to water. Explain this by discussing the predominant force that allows an ionic compound to dissolve in water.