1. Indicate the types of intermolecular forces present for each of the following:

a. BH$_3$  
   *LDF, dip-dip, nonpolar*

b. HF  
   *H-bonding, dipole-dipole, LDF*

c. NH$_4$Br  
   *ionic*

d. Ar  
   *LDF*

e. H$_2$S  
   *dip-dip, LDF, H-S-H polar*

f. SO$_2$  
   *dip-dip, LDF, O=S=O polar*

g. H$_2$CO  
   *dip-dip, LDF, H-C-H polar (no H-bonding)*

2. Pick the best answer:

a. Highest melting point  
   *Br$_2$, Cl$_2*, I_2*biggest molecule*

b. Lowest freezing point  
   *NaCl, CO$_2$, CH$_3$OH*

c. Highest boiling point  
   *H$_2$O, H$_2$Se, H$_2$S, CH$_2$Cl$_2*, CH$_2$F$_2*di-polar*

d. Highest vapor pressure  
   *CH$_4$, CH$_2$Cl$_2$, CH$_2$F$_2*di-polar*

e. Greatest ΔH$_{vaporization}$  
   *CH$_4$, NH$_3$, SO$_2*di-polar*

f. Greatest viscosity  
   *CH$_3$CH$_2$CH$_3$, CH$_3$CH$_2$CH$_2$CH$_3*, CH$_3$CH$_2$CH$_2$CH$_2$CH$_3*linear & bigger molec*
3. Assume the two-dimensional structure of an ionic compound is $\text{M}_x\text{A}_y$, where $\text{M}$ is the cation and $\text{A}$ is the anion. What is the empirical formula of this compound?

![Diagram of ionic compound structure]

4. Silver crystallizes in a cubic closest packed structure. The radius of a silver atom is 1.44 Å. Calculate the density of solid silver in $\text{g/cm}^3$. ($1 \text{ Å} = 10^{-10} \text{ m}$)

5. The density of gold is 19.32 $\text{g/cm}^3$. If gold forms a face-centered cubic structure, what is the radius of a gold atom in pm? ($1 \text{ pm} = 10^{-12} \text{ m}$)
6. The enthalpy of vaporization of water is 40.7 kJ/mole.

a. What is the vapor pressure of water at 25 °C?

b. On top of a mountain, the atmospheric pressure is 0.75 atm. What is the boiling point of water at this location?

7. Consider the following phase diagrams for water and carbon dioxide, respectively. Which phase is the most dense for each substance? How does pressure affect the MP and BP for each substance?
8. How much energy does it take to convert 180 g of ice at -20.0 °C to steam at 150 °C?
(Specific heat capacities: ice, 2.1 J/g°C; liquid, 4.2 J/g°C; vapor, 2.0 J/g °C, \(\Delta H_{\text{vap}} = 40.7 \text{ kJ/mol}\), 
\(\Delta H_{\text{fusion}} = 6.02 \text{ kJ/mol}\))

9. Determine the final temperature if a 25 g cube of ice at -7 °C is placed in 180 g of water at 64 °C and allowed to come to equilibrium.
Equations

\[ \ln\left(\frac{P_2}{P_1}\right) = \frac{-\Delta H^0}{R} \left( \frac{1}{T_2} - \frac{1}{T_1} \right) \]

- q = m C ΔT
- q = n ΔH

<table>
<thead>
<tr>
<th>Unit Cell</th>
<th>Image</th>
<th>Atoms/unit cell (%) by volume</th>
<th>Coordination Number</th>
<th>Edge Length vs. radius</th>
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<tbody>
<tr>
<td>Simple Cubic</td>
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<td>1 (52.4%)</td>
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<td>( e = \frac{4r}{\sqrt{3}} ) (e = 2.309r)</td>
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<td>( e = rv\sqrt{8} )   (e = 2.828r)</td>
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Periodic Table: