

## ANSWERS TO PROBLEM SET No. 9: LIQUIDS, SOLIDS AND SOLUTIONS

1. The stronger the intermolecular forces the higher the boiling point of a liquid.
2.  $\Delta H_{\text{vap}} = 32.3 \text{ kJ/mol}$
3.  $\Delta H_{\text{vap}}$  - deals with the energy required to overcome the lattice forces in the crystals.  
 $\Delta H_{\text{fus}}$  - involves the energy required to overcome the intermolecular forces in the liquid state as well as the work required to push back the atmosphere due to the volume change in going from the liquid to the gas state.
4. See phase diagram (Figure 12.9) in your textbook.
5. NO! Because the triple point is above a pressure of 1 atm. SEE PHASE DIAGRAM in QUESTION #4.
6. The density of potassium is  $0.899 \text{ g/cm}^3$ .
7. In the body-centered-cubic structure (bcc) it is  $1.26 \times 10^{-8} \text{ cm}$ .  
In the face-centered-cubic structure (fcc) it is  $1.28 \times 10^{-8} \text{ cm}$ .
8.  $i = 1.00$ . This means that HCl does not dissociate in benzene and this is not an electrolyte in benzene.
9.  $\text{C}_2\text{H}_4(\text{s})$  is more dense than the liquid phase
10. 42 atm
11. a) Osmotic pressure:  $\pi_{\text{II}} < \pi_{\text{I}} < \pi_{\text{III}}$   
b) Boiling point:  $\text{bp}_{\text{II}} < \text{bp}_{\text{I}} < \text{bp}_{\text{III}}$   
c) Freezing point:  $\text{fp}_{\text{III}} < \text{fp}_{\text{I}} < \text{fp}_{\text{II}}$   
d) Vapor pressure at  $50^\circ\text{C}$ :  $\text{vp}_{\text{III}} < \text{vp}_{\text{I}} < \text{vp}_{\text{II}}$
12. 11.8 kg of ethylene glycol
13. (a)  $0.171 \text{ m}$  and  $i = 1.86$   
(b)  $0.0833 \text{ m}$  and  $i = 1.03$
14.  $\Pi = 0.249 \text{ atm}$
15. (a)  $T_{\text{fp}} = -0.0186^\circ\text{C}$   
(b) 4.8% ionization  
(c)  $K_{\text{a}} = 2.3 \times 10^{-5}$