

PROBLEM SET No. 9: LIQUIDS, SOLIDS AND SOLUTIONS

1. What is the relationship between intermolecular forces in liquids and their boiling points?
2. The vapor pressure of CCl_4 is 55% greater at 30°C than it is at 20°C . Calculate the heat of vaporization of carbon tetrachloride.
3. The heat of fusion of a substance is typically much less than its heat of vaporization. Explain why this is so.
4. Use the following data to sketch the phase diagram of carbon dioxide.

Triple point: 216 K and 5.1 atm

Critical temperature and pressure: 304 K and 73 atm

Melting point at the critical pressure: 218 K

Vapor pressure of the solid at 195 K: 1.0 atm

5. Does a substance such as liquid CO_2 have a normal boiling point? EXPLAIN.
6. Potassium crystallizes in a body-centered cubic crystal structure. The atomic radius of potassium is 2.272×10^{-8} cm. Calculate the density of potassium.
7. At 1000°C iron changes from a body-centered cubic unit cell with a length of 2.90×10^{-8} cm to a face-centered unit cell with a length of 3.63×10^{-8} cm. Calculate the radius of an iron atom in each structure.
8. A one molal solution of HCl in benzene has a freezing point of 0.4°C . Is HCl an electrolyte in benzene? EXPLAIN.

$$K_f(\text{benzene}) = 5.1^\circ\text{C/molal} \quad \text{and} \quad T_f(\text{benzene}) = 5.5^\circ\text{C}$$

9. Silberberg 12.25
10. Silberberg 12.28
11. Silberberg 13.94
12. Silberberg 13.102
13. Silberberg 13.104
14. Silberberg 13.106
15. (a) Calculate the freezing point of a 0.0100 m aqueous acetic acid solution assuming that the acetic acid does not ionize.
(b) The actual freezing point of a 0.0100 m acetic acid solution has been reported as -0.0195°C .
What fraction of the acetic acid molecules are ionized?
(c) Determine K_a for acetic acid based on the above data.