1. The addition of 100 g of a compound to 750 g of CCl₄ lowered the freezing point of the solvent by 10.5 K. Calculate the molar mass of the solvent. \( K_f = 30 K \cdot kg/mol \).

2. What volumes of ethanol and water should be mixed to form 100 ml of a mixture which is fifty percent by mass of ethanol? \( \overline{V}_{\text{EtOH}} = 57 cm^3/mol \), \( \overline{V}_{\text{water}} = 17 cm^3/mol \)

3. The vapor pressure of pure liquid A is at 293 K is 60 kPa, and that of pure liquid B is 80 kPa. These two compounds form ideal liquid and gaseous mixtures. Calculate the total pressure of the vapor and the composition of the gas and the liquid when (a) \( x_A = 0.20 \); and (b) \( y_A = 0.40 \).

4. Benzene and toluene form nearly ideal solutions. Consider an equi-molar solution of benzene and toluene. At 20°C, the vapor pressures of benzene and toluene are 10 kPa and 4 kPa, respectively. The solution is boiled by reducing external pressure below the vapor pressure. Calculate (a) the pressure when boiling begins; (b) the composition of each component in the vapor, and (c) the vapor pressure when only a few drops of liquid remain.

5. The vapor pressure of water over the domain, 0°C to 100°C, can be fit to

\[
\ln P = \frac{a}{T} + b \ln T + cT + d
\]

(a) Derive the equation relating the vapor pressure to the enthalpy of vaporization; and (b) calculate the enthalpy of vaporization in terms of \( a, b, c, d \).


7. State what substances exist at each of the labeled points in the binary T, s phase diagrams shown below. One point on the third diagram corresponds to AB(S),A(L),B(L), meaning that the AB(S) precipitate coexists with a liquid of A and B.