10.213 Quiz 4
11/24/99

Problem 1:

A mixture of two liquids is totally miscible at 50°C. Based on their molecular structure, any deviation from an ideal solution is expected to give an excess Gibbs free energy that varies as Bx_1x_2 where B is a constant that is a function of temperature alone. When mixing the equal molar quantities of the two liquids, the vapor pressure is 55 kPa. At 50°C, $P_1^{sat} = 50$ kPa and $P_2^{sat} = 60$ kPa.

a) Determine the value of B that best represents this system.

b) Estimate the vapor composition in equilibrium with this liquid mixture, i.e. $x_1=0.5$.

c) Allowing 50% of the liquid to evaporate at 50°C, estimate the composition of the liquid and vapor?

Problem 2:

Consider a liquid mixture of water containing a 1% mole fraction of an inert salt at 300°C. This liquid mixture is in equilibrium with steam that contains no salt. You may use the generalized-correlation appendix E to calculate any deviation from an ideal system if needed and the property values for water given in appendix B.

a) Estimate the fugacity of pure liquid water at 300°C and 8592.7 kPa (the saturated conditions for a pure water system).

b) What is the fugacity of the liquid water in the salt-water mixture?

c) What is the expected steam pressure of the salt-water mixture at 300°C?