Problem Set 6
Due date: November 19, 2007

Problem 21)
The boiling point of a binary solution of A and B with x_A=0.5743 is 93 °C. The vapor pressures of pure A and B at this temperature are 978 Torr and 467 Torr, respectively. a) Demonstrate that this solution is ideal. b) What is the initial composition of the vapor above the solution?
(3 points)

Problem 22)
Toluene and xylene form nearly ideal solutions. At 50 °C the vapor pressure of pure toluene and pure xylene are 75 Torr and 24 Torr, respectively. The solution ($x_{Toluene}$=x_{Xylene}) is boiled by reducing the external pressure below the vapor pressure. a) Calculate the pressure when boiling begins, b) calculate the composition of each component in the vapor and, c), the vapor pressure when only a few drops of liquid solution remain. Assume that the rate of vaporization is low enough for the temperature to remain constant at 50 °C.
(4 points)

Problem 23)
Show that two phases are in a) thermal equilibrium only if their temperatures are the same and b) in mechanical equilibrium only if their pressures are equal.
(3 points)

Problem 24)
The following data were obtained for the composition as a function of the temperature for a mixture of two liquids, A and B, at 1.00 atm. x and y are the mole fractions in the liquid and in the vapor at equilibrium, respectively. The boiling points are 122 °C for A and 156 ° C for B. Plot the temperature/composition diagram for the mixture. What is the composition for the vapor in equilibrium with the liquid of composition (i) with x_A =0.45 and of composition (ii) with x_B = 0.3?

Θ / °C	125	130	135	140	145	150
x_A	0.91	0.65	0.45	0.30	0.18	0.098
y_A	0.99	0.91	0.77	0.61	0.45	0.25

(4 points)