CHE313A: Mass Transfer & Its Applications
Assignment

Date:
Due:

1. (a) In a binary mixture containing components A and B, the relative volatility of A with respect to B is 2.5 when mole fractions are used. The molecular weights of A and B are 78 and 92 respectively. If the compositions are however expressed in mass fractions, what will be the value of relative volatility?

   (b) The vapor pressure data for n-Hexane (A) and n-Octane (B) system is given below. Compute the equilibrium data and relative volatility for the system at a total pressure of 101.32 kPa.

Temperature	Vapour pressure (kPa)	
T (°C)	n-Hexane, P_A^s	n-Octane, P_B^s
68.7	101.32	16.1
79.4	136.7	23.1
93.3	197.3	37.1
107.2	284.0	57.9
125.7	456.0	101.32

2. The vapour pressures of acetone (A) and acetonitrile (B) can be evaluated by the Antoine equations

$$ln\ P_A^S = 14.5463 - \frac{2940.46}{T - 35.93}$$

$$ln\ P_B^S = 14.2724 - \frac{2945.47}{T - 49.15}$$

   where T is in K and P^s is in kPa. Assuming that the solutions formed by these are ideal, calculate
   (a) x_A and y_A at 327 K and 65 kPa
   (b) T and y_A at 65 kPa and $x_A = 0.4$
   (c) P and y_A at 327 K and $x_A = 0.4$
   (d) T and x_A at 65 kPa and $y_A = 0.4$
   (e) P and x_A at 327 K and $y_A = 0.4$
   (f) The fraction of the system that is liquid and the composition of the liquid and vapour in equilibrium at 327 K and 65 kPa when the overall composition of the system is 70 mole per cent acetone.

3. Mixtures of n-Heptane (A) and n-Octane (B) are expected to behave ideally. The total pressure over the system is 101.3 kPa. Using the vapour pressure data given below,

Temperature	Vapour pressure (kPa)	
T (°C)	n-Hexane, P_A^s	n-Octane, P_B^s
371.4	101.3	44.4
378	125.3	55.6
383	140.0	64.5
388	160.0	74.8
393	179.9	86.6
398.6	205.3	101.3

   (a) Construct the boiling point diagram and
   (b) The equilibrium diagram and
   (c) Deduce an equation for the equilibrium diagram using an arithmetic average value of relative volatility.

4. Binary system of acetonitrile (A) and nitromethane (B) conforms closely to Raoult's law. Vapour pressures for the pure species are given by the following Antoine equations.

$$ln\ P_A^S = 14.2724 - \frac{2945.47}{T - 49.15}$$

$$ln\ P_B^S = 14.2043 - \frac{2972.64}{T - 64.15}$$

where T is in K and P^s is in kPa. Prepare a graph showing T vs x_A and T vs y_A for a pressure of 70 kPa.