

Solution

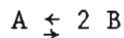
Ch.E. 3173

FINAL

May 9, 1988

I. 40 points

Consider the liquid phase reaction:



a. 10 points

How would you write K_a in terms of liquid properties?

b. 20 points

Given that the solution of A and B obeys the Margules 3-suffix equation:

$$\ln \gamma_A = [\alpha + 2 (\beta - \alpha) x_A] x_B^2$$

$$\ln \gamma_B = [\beta + 2 (\alpha - \beta) x_B] x_A^2$$

where α and β are constants (independent of T, P, and x_i 's), and given that equilibrium measurements give the following results:

<u>K_a</u>	<u>$T^\circ\text{C}$</u>	<u>x_A (equilibrium)</u>
0.7	100	0.500
0.6	120	0.622

Find α and β .

c. 10 points

Assuming ΔH_R° is independent of T, find ΔH_R° and the composition of the equilibrium liquid at 140°C.

II. 30 points

At 35°C, a liquid solution containing 40.5 mole % ethanol (A) and 59.5% methylcyclohexane (B) exerts a pressure of 152.4 mmHg. The vapor phase composition under these conditions is 54.7 mole % ethanol (A) and 45.3 mole % methylcyclohexane (B). Vapor pressures of the pure components at 35°C are:

Ethanol (A)	103.1 mmHg
Methylcyclohexane (B)	73.6 mmHg

Using the Van Laar equation to predict activity coefficients, find y_A and y_B in equilibrium with a liquid of composition $x_A = 0.6$, $x_B = 0.4$ at 35°C.

III. 30 points

Find the fugacity of pure n-hexane at 500°C and 20 atm of pressure.