solution

Ch.E. 3173 EXAM I March 3, 1988

I. 30 points

A binary mixture of gases follows the equation of state:

$$p(v-b) = RT$$

where: $b = y_1 b_1 + y_2 b_2$

Find the fugacity of component 1 in this mixture. Does the gas follow the Lewis Fugacity rule?

II. 30 points

Find the fugacity of pure liquid n-hexane at 100°C and 300 atm assuming ϕ_i^s for n-hexane is 1.0 and that the specific volume of the liquid is independent of pressure.

Data:

$\rho = 0.6603$ gr/cm^3

$MW = 86.18$

$\ln P_i^s = A - B/(T + C)$

where: p_i^s is in mmHg

T is in °K

$A = 15.8366$

$B = 2697.55$

$C = -48.78$

III. 40 points

The CRC handbook lists constants for the vapor pressure of a compound in the form:

$$\log_{10} P = (-0.2185\ A/K) + B$$

where P = pressure in torr (760 torr = 1 atm)

K = temperature in °K

A = molar heat of vaporization in cal/mole

B = constant

For cis- and trans-2-butene, the constants are:

Component	Name	A	B
1	trans-2-butene	6221.6	7.882542
2	cis-2-butenet	6401.0	7.976585

Use Raoult's law for calculations:

a) 15 points

Suppose we start with a 40/60 mole percent trans-2-butene/cis-2-butene gas mixture at 300°K and 0.1 atm and compress it isothermally until condensation begins to occur. What is the pressure at which condensation occurs?

b) 15 points

What is the composition of the liquid that forms in part a)?

c) 10 points

If we continue to compress isothermally, eventually all becomes liquid. What is the pressure at which the last bit of vapor becomes liquid?