
Problem Set 12

Problem 10.53

The molar volume ($\text{cm}^3 \text{mol}^{-1}$) of a binary liquid mixture at T and P is given by:

$$V = 120 x_1 + 70 x_2 + (15 x_1 + 8 x_2) x_1 x_2$$

- (a) Find expressions for the partial molar volumes of species 1 and 2 in terms of x_1 .
- (b) Show that the given equation for V is recovered when these expressions are combined using Eq. 10.11.
- (c) Show that these expressions satisfy Eq. 10.14.
- (d) Show that $(d\bar{V}_1/dx_1)_{x_1=1} = (d\bar{V}_2/dx_1)_{x_1=0} = 0$.
- (e) Make a plot of V, \bar{V}_1 , and \bar{V}_2 versus x_1 .
- (f) Label points V_1 , V_2 , $(\bar{V}_1)_{x_1 \rightarrow 0}$, and $(\bar{V}_2)_{x_2 \rightarrow 0}$ on the plot and show their values.

Problem 10.18

Estimate the fugacity of isobutylene gas at 280 °C and

- (a) 1 bar
- (b) 20 bar, and
- (c) 100 bar.

Use the SRK equation of state.

Problem 10.21

From the data in the steam tables, determine a good estimate of f/f^{sat} for liquid water at 150 °C and 150 bar, where f^{sat} is the fugacity of saturated liquid at 150 °C.