

Problem 10.53

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

$$V = 120x_1 + 70x_2 + (15x_1 + 8x_2)x_1x_2$$

- (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 deg C and

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

Bonus Op (+5): Repeat this calculation in CHEMCAD by creating streams and calculation fugacity coefficients. Report your results in Mathematica using screenshots of the stream box.

Problem 10.21

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