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## Problem Set 5

### Problem 3.44

Calculate Z and V for ethylene at 25 deg C and 12 bar by the following equations:

(a) The truncated virial equation (Eq. 3.38) with the following experimental values of virial coefficients:

$$B = -140. \frac{\text{cm}^3}{\text{mol}} \text{ and } C = 7,200 \frac{\text{cm}^6}{\text{mol}^2}$$

(b) The truncated virial equation (Eq. 3.36), with a value of B from the generalized Pitzer correlation (Eqs. 3.58-3.62)

(c) The Redlich/Kwong equation.

(d) The Soave/Redlich/Kwong equation.

(e) The Peng/Robinson equation.

### Problem 3.58

To a good approximation, what is the molar volume of ethanol vapor at 480 °C and 6,000 kPa? How does this result compare with the ideal gas value?

Compare the results from (a) the Lee-Kesler method, (b) SRK equation of state, and (c) ideal gas equation of state.

### Problem 3.78

The *Boyle temperature* is the temperature for which:

$$\lim_{P \rightarrow 0} \left( \frac{\partial Z}{\partial P} \right)_T = 0$$

(a) Show that the second virial coefficient B is zero at the Boyle temperature.

(b) Use the generalized correlation for B, Eqs. 3.58 to 3.62, to estimate the reduced Boyle temperature for simple fluids.