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:

$$B = -140.\,\mathrm{cm^3\,mol^{-1}} \quad \text{and} \quad C = 7,200\,\mathrm{cm^6\,mol^{-2}}$$

(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 deg C and 6,000 kPa? How does this result compared with the ideal gas value?

The best way to answer this question is to run the calculation for several different methods and compare. So the problem is answered in parts:

(a) - Lee-Kesler
(b) - Soave/Redlich/Kwong equation
(c) - Ideal Gas

Lesson 14 - Bonus - 5 Points

Use CHEMCAD to calculate the molar volume of ethanol vapor at 480 deg C and 6,000 kPa using the SRK equation of state. How does your answer compare with your Mathematica results?

Problem 3.78

The *Boyle temperature* is the temperature for which:

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

(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.