

The reduced residual enthalpy is

$$\frac{H^R}{RT_c} = (-4.15072) + (0.0866)(-4.23095) = -4.53164,$$

from which we obtain

$$H^R = (RT_c)(-4.53164) = (8.314 \text{ J/mol K})(282.35 \text{ K})(-4.53164) = -10637.8 \text{ J/mol}.$$

The reduced entropy is

$$\frac{S^R}{R} = (-4.39868) + (0.0866)(-4.43083) = -4.61466,$$

residual

and the ~~reduced~~ entropy is

$$S = -4.61466R = (-4.61466)(8.314 \text{ J/mol K}) = -38.3663 \text{ J/mol K}.$$

Comments These values are in very good agreement with those calculated by the SRK equation in Example 5.10. This should not be surprising since generalized graphs also employ an equation of state (the modified Benedict-Webb-Rubin equation). Of course, using the generalized graphs is simpler than performing the numerical calculations in the SRK. However, the charts cannot be read with great accuracy, especially when the desired state does not lie on one of the plotted isotherms. The values of $h^{(0)}$, $h^{(1)}$, $s^{(0)}$, and $s^{(1)}$, used in the solution above, were actually computed with the equations used to produce the charts. The Lee Kesler charts should be viewed as a graphical shortcut to the calculation of residuals when high accuracy is not of great importance. Otherwise, a more detailed numerical calculation should be used.

5.11 Reference States

The equations we have developed up to this point can be used to calculate differences in enthalpy and entropy between states. To calculate absolute values we must also know the actual value of enthalpy and entropy at some state. This actual value, however, is not important if our ultimate interest is in calculating differences. Indeed, in all problems of practical interest, this will be the case.⁶ And yet, it is convenient to calculate properties on absolute scale, as the steam tables demonstrate, because then differences can be calculated simply as algebraic differences between the values of a property at two states. Absolute properties are really differences from a state

6. In fact, both the first and the second law were formulated in terms of differences, rather than absolute values.