Chem. 2440 – HW # 2
Assigned Jan. 17, due Jan. 26

(1) The van der Waals equation is given by
$$p/RT = \rho/(1-b\rho) - a\rho^2/RT$$
where $\rho = n/V$ and a and b are constants.

Show that there is a region in the $T - \rho$ plane where this
equation violates stability. Determine the boundary of this
region.

(2) Two systems have the equations of state
$$1/T^{(1)} = \frac{3}{2}\left[RN^{(1)}/U^{(1)}\right]$$
and
$$1/T^{(2)} = \frac{5}{2}\left[RN^{(2)}/U^{(2)}\right]$$
where R is the gas constant and $N^{(1)}=2$ and $N^{(2)}=3$. The two systems are brought into
contact and heat is allowed to flow between them. If the total energy in the composite
system is 2500 J. What is the internal energy of each system after equilibrium is
achieved?

(3) Consider the same two systems as in problem (2) but suppose system (1) starts at $T^{(1)}$
250Kand $T^{(2)}$ starts at 350K. What is the temperature after equilibration?