

Physics 418
Homework 1 - Due Jan. 30, 2009

Problem 1: Callen, 2.2-6.

Problem 2: Given the equations of state

$$U = PV/2, \quad T^2 = \frac{AU^{3/2}}{VN^{1/2}}, \quad (1)$$

find the entropy $S(U, V, N)$. (A is a constant).

Problem 3: Van der Waals gas. The equation of state is

$$P = \frac{k_B T}{v - b} - \frac{a}{v^2} \quad (2)$$

where a and b are constants. a models the strength of short-range interactions, while b models the excluded volume from the finite size of the atoms. Find (a) $T(u, v)$, (b) $s(u, v)$, and (c) use these results to eliminate a, b to find the hypersurface in the phase space (u, v, s, T, P) describing the family of van der Waals gases.