PHY 3513 Fall 1998 – Homework 4

Due at the start of class on Friday, September 25.

Answer all questions, including any additions to textbook problems. Please explain your reasoning and show all working, write neatly and remember to include your name on the front page of your answers.

1. Callen Problem 1.8-5.

   Clarification: An "adiabat" is a line, or more generally a $(d-1)$-dimensional hypersurface in a d-dimensional parameter space, defined by the condition $đQ = 0$.

   Hint: You may find it useful to calculate the total differential of U from the equation given.

2. Callen Problem 1.8-7.

   Addition: What are the dimensions and SI units of A?

3. Callen Problem 1.10-1.

   Addition 1: to checking for consistency with Postulates II–IV, also check whether the entropy is concave with respect to U and V.

   Addition 2: In some cases, the RHS of the fundamental equation is not extensive. In each such case, fix up the entropy by inserting extra N's where necessary. Then carry on and check whether the modified fundamental equation is physically acceptable.

   Hint: You may find it easiest to work with N and the reduced (dimensionless) molar variables $\tilde{s} = S/(NR)$, $\tilde{u} = U/(NR\theta)$, and $\tilde{v} = V/(Nv_0)$, i.e., to examine the properties of $\tilde{s}(\tilde{u}, \tilde{v}, N)$ rather than of $S(U, V, N)$.

4. Callen Problem 1.10-3.

   Clarification: You should plot the *total* entropy of the composite system.