PHY 3513 Fall 2000 – Homework 8

Due at the start of class on Friday, November 17.

Answer all questions. To obtain full credit, you must explain your reasoning and show all working. Please write neatly and include your name on the front page of your answers.

1. Callen Problem 4.7-1. For "Example 5" read "the example given in this section".

2. Callen Problem 4.7-4.

3. The Otto cycle for a simple ideal gas (for which $U = cNRT$) was discussed in class. Assume that the auxiliary system (AS) in a particular heat engine operates this cycle between volumes V_A and $V_B < V_A$, and between minimum and maximum temperatures T_A and T_C, respectively. (See Callen Fig. 4.9 for the labeling of points on the cycle.)

   (a) Draw a P-V diagram for the AS.

   (b) Calculate W, the work done by the AS per cycle, as a function of symbols introduced above.

   (c) Re-express the result of (b) in terms of the engine efficiency ϵ_e derived in class, and plot W as a function of ϵ_e.

   (d) Given that there is a theoretical maximum value for ϵ_e, what is the maximum value of W, and for what value of V_B/V_A does it occur?