Homework 5, due Oct. 26, 2006

1. One system has $n = 1$ kilomole of monatomic ideal gas ($\gamma = 5/3$), and is at temperature $T_1 = 300K$. Another system has $n = 2$ kilomoles of diatomic ideal gas ($\gamma = 7/5$) and is at temperature $T_2 = 600K$. Each system is enclosed in a container, and the volume of the two containers is unchanging. The walls of the two containers do not allow any leakage. The two containers are placed in thermal contact.

   (a) Compute the final temperature of the combined system, when they reach thermal equilibrium. (Express your answer in Kelvin.)

   (b) Compute the change in the entropy in each of the two containers. (Express your answers in units of J/K.)

2. A system initially has $U_i = 3 \times 10^5 J$, $V_i = 1m^3$, and $S_i = 10^3 J/K$. It undergoes a process, surrounded by the outside environment, which is at pressure $P_0 = 1atm$ and $T_0 = 300K$. In the final state, the system has internal energy $U_f = 2 \times 10^5 J$, $V_f = 2m^3$, and $S_f = 2 \times 10^3 J/K$. What is the maximum work that this system can do (without violating one of the laws of thermodynamics)? Hint: this was discussed in lecture.

3. Problem 8.4 in book. (Note, there is a typo in part a: the + should be a $-$.)

4. Problem 8.7 in book. Recall "specific" means divide the extensive quantity by n, e.g. the specific entropy is $s = S/n$.

5. Problem 8.13 in book.