

# Thermodynamics HW #9

Due October 28

1. Schroeder 5.26

2. Schroeder 5.38

Replace the first two sentences with, “Use Figure 5.17 to estimate the difference in entropy between graphite and diamond at 500K.” Answer the other two questions as they are.

3. Schroeder 5.41

4. (a) Suppose we have a system  $S$  in contact with a reservoir  $R$  and that they can exchange not only energy but also volume. Consider two micro-states of the system  $S$ , one with energy  $E_1$  and volume  $V_1$  and the other with energy  $E_2$  and volume  $V_2$ . Show that the relative probabilities  $\frac{p_2}{p_1}$  of finding the system in second microstate vs. the first is given by

$$\frac{p_2}{p_1} = e^{-\frac{(E_2 - E_1) + P(V_2 - V_1)}{kT}}$$

where  $T$  and  $P$  are the temperature and pressure of the reservoir, respectively.

(b) Now suppose that the reservoir can exchange particles with the system in addition to energy and volume. Suppose that the first microstate has energy, volume, and particle number  $E_1, V_1, N_1$  and likewise for the second microstate. Find their relative probabilities  $\frac{p_2}{p_1}$  in this case.