Physics 418
Homework 3 - Due Feb. 23, 2010

Problem 1: Patheria 1.1

Problem 2: Patheria 1.7.

Problem 3: Patheria 2.7. In addition, derive the exact number of ways in which the energy can be divided amount the N oscillators (before taking the asymptotic limit). Calculate the entropy for this system in the thermodynamic limit. Express the internal energy E in terms of the temperature T and oscillator number N, and plot this function versus T. Also, plot the heat capacity versus temperature. Find the asymptotic limits of the energy for large and small temperature.

Problem 4: In the above problem 2, calculate the number of states $\tilde{\Omega}(E)$ with energy less than (or equal to) the energy E. Find the number of states with energies between $E - \Delta$ and E, where $\Delta < E$. Show that for $N \gg 1$ (i.e. $\sim 10^{23}$) that $\Omega(E) = \tilde{\Omega}(E) - \tilde{\Omega}(E - \Delta) \approx \tilde{\Omega}(E)$. How can this be? What does it imply for statistical mechanics calculations?