Phys 741
Statistical Mechanics
Problem Set # 2

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1. Pathria 1.8

2. Pathria 1.11

3. Pathria 1.16

4. Using the general definition of the density of states for a spinless particl,

$$\omega(E) = \int dq^{dN} \, dp^{dN} \, \delta(E - H(q, p)),$$

   Find

   (a) The density of states $\omega(E)$ for a particle of mass m moving freely in a 1D - box of size L.

   (b) The density of states $\omega(E)$ for a particle of mass m moving freely in a 2D - box of size $L \times L$.

   (c) The density of states $\omega(E)$ for a particle of mass m moving freely in a 3D - box of size $L \times L \times L$.

   Hint: it is easier to work the integrals over the energy dE rather than over the momentum dp

5. Using the results of problem 5 and defining the total number of accessible states, $\Omega(E) = \omega(E)\delta E$, in the energy interval of $E \to E + \delta E$, and using $S = k_B \ln \Omega(E)$, find

   (a) The entropy for a particle of mass m moving freely in a 1D - box of size L

   (b) The entropy for a particle of mass m moving freely in a 2D - box of size $L \times L$.

   (c) The entropy for a particle of mass m moving freely in a 3D - box of size $L \times L \times L$.

6. Pathria 2.7

Good Luck