Consider a system of N non-interacting distinguishable particles at a given temperature T. Each particle can be in one of the three states, with the energies, 0, ε, 2ε. Their degeneracy numbers are 1, 2, and 1, respectively.

1. Write the expression for the molecular partition function q.
2. What are the values of q at
$T \rightarrow 0$ and at $T \rightarrow \infty$?
3. What is the probability to find the particle in each of these states?
4. What is the average energy of a particle in such a system? What is it at $T \rightarrow 0$ and at $T \rightarrow \infty$?
5. Calculate the total energy of this system.
6. What is the entropy of this system? What is it at $T \rightarrow 0$ and at $T \rightarrow \infty$?