

Name:
March 27, 2007

Physics 233
Microstates and Macrostates

Consider the situation where the number of atoms in solid A , N_A , is 5 and the number of atoms in solid B , N_B , is also 5. Let the total amount of energy be 20 times the energy difference between energy levels of the Einsteinian oscillator.

1. How many different ways are there to divide this total energy between the two solids?

Use the program StatMech to answer the following questions about this system. For some questions, the table will be most helpful, for others the graph will. Switch between Table and Graph using the buttons on the top.

2. What are the number of microstates corresponding to each of the first 4 macropartitions?
3. How many total microstates are available to the system?
4. Which is the most probable macropartition, and how many microstates are available to the system in this macropartition?
5. What is the average energy per atom in each solid in this macropartition?
6. What range of values of the ration U_A/U corresponds to macropartitions whose probabilities are at least one-half as large as the most probable macropartition?

Use your answers to the above questions to fill in the first column of the table below:

N_A	5	50	500	5000	50000
N_B	5	50	500	5000	50000
U	20ϵ	200ϵ	2000ϵ	20000ϵ	200000ϵ
Total # of microstates					
Most probable macropartition					
# of microstates in most probable					
Average energy per atom in most prob.					
Range of U_A/U for $\frac{1}{2}$ prob. of most					

Fill in the remainder of the table for the systems given.

7. How does the energy per atom change in these systems as you go from smaller to larger system?
8. Carefully and completely describe any trends you see in how the other values change as the system becomes larger.

9. What is the entropy of an Einstein solid with 5 atoms and an energy of 15ϵ ?
Express your answer as a multiple of k_B .

10. What is the entropy of an Einstein solid with 50 atoms and an energy of 100ϵ ?
Express your answer as a multiple of k_B .

11. How could you use StatMech to assist in answering the above questions?