PHYS 328
HOMEWORK #5

Due : 27 Sept. 2012

1. Starting with the observation that the specific heat of water is 4.2 J/g/C (or 4200 J/kg/C), determine what fraction of the specific heat derives from quadratic forms of energy and the fraction due to hydrogen bonding. There are 12 degrees of freedom in a water molecule.

2. Calculate the number of possible microstates for the cases shown in text problem 2.5, parts a) - e) inclusive. 2 pts each part.

3. Without doing any explicit calculations or making any reference to equation 2.9 in the text, determine the answers for text problem 2.5, parts f) and g). Explain your reasoning. 10 pts for the question.

4. Consider a system A with 300 particles and a system B with 200 particles. The systems share a total of 100 units of energy. Write a *Mathematica* program that reproduces the plot on p. 59 of the text (you needn't worry about aesthetics such as shading and axis labels).

5. For the system described in problem 4 above, write a short Mathematica program to determine the probability of finding all the energy in A; what is the probability of finding all the energy in B? Your graph above should show that the maximum probability occurs when $q_A = 60$. What is the probability of finding 60 units in system A? (Use *Mathematica* programs to solve all parts to the question; clearly define all the variables and functions you use in your programs).

6. Problem 2.16 from the text. Use Stirling' s approximation even if your calculator can handle the factorials. You may use a calculator or Mathematica to check your results, but show your work and compute your values using Stirling' s approximation. 10 pts for part a), 5 pts for part b).

7. Text problem 2.17

8. Text problem 2.18