

Physics 3410 Homework #3

4 problems

Due by February 8

▷ **1.**

Simplify

$$\frac{\pi(2N+3)^{2N+1}}{N^{3/2}}$$

assuming that N is a large number.

▷ **2.**

Suppose I have 400 A's, 300 B's, 200 C's, and 1 D. How many ways can I rearrange them? Use Stirling's Approximation.

▷ **3.**

Consider a paramagnet with 6 dipoles, in the energy macrostate $U = 3$.

(a) What is the multiplicity of this macrostate?

(b) What is the probability that the paramagnet has three adjacent spins pointing upward, if it's in this macrostate? (Enumerating the possible microstates might be easiest.)

(c) Suppose that U can change freely (because energy can flow in or out of the solid). What is the maximum amount of energy that can be stored in this paramagnet? Which value of U has the largest multiplicity?

▷ **4.**

Consider an Einstein solid with $N = 5$ oscillators, with total energy $q = 4$.

(d) What is the multiplicity of this macrostate?

(e) What is the probability that the first oscillator contains 1 quantum of energy? (i.e. $q_1 = 1$)

(f) Suppose that q can change freely (because energy can flow in or out of the solid). What is the maximum amount of energy that can be stored in this solid? Which value of q has the largest multiplicity?