Stat Mech (PHYS 370) Guide 4

Fall 2024 v1.5

We have just started with entropy, which will be a central figure in our work from now on. Curious how "just counting" sneaks into the very foundations of this subject!

Our first quiz will be in class on Thursday September 26. The topics will be on material we have discussed through Thursday September 19. It will be on the short side and at the end of class.

Reading:

Chapter 1 pages 46 - 48 - On diffusion!

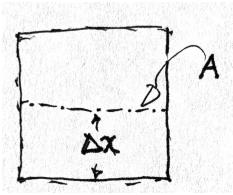
On Thursday September 19 we discussed Appendices B 1-3 and Chapter 2 sections 4 and 5

On Tuesday September 24 we will discuss Chapter 2 sections 5 and 6

On Thursday September 26 we will likely move on to Chapter 3

Problems: (Due on Thursday September 26 before class)

(1) You drop red simple syrup, made of coloring, water, and sugar, into a glass of water. Estimate how far the syrup will diffuse through the water in 1 minute. To start consider the syrup to be at the bottom of a jar, occupying a depth $\Delta x = 1$ cm and volume $V = A \cdot \Delta x$ as shown.



(2) 2.16 Stirling's approximation on a 1000 coin toss

(3) In class we found the approximation for the multiplicity of an Einstein solid when $q \gg N \gg 1$. Now to the other case when there is not so much energy, $N \gg q \gg 1$.

(4) 2.29 Entropy of a pair of Einstein solids. Figure 2.5 is a handy reference for you.

(5) 2.31 Deriving the Sackur-Tetrode equation. We did some of this in class.

(6) 2.36 Estimating entropies. By "fundamental units" Schroeder means in units where $k = 1$

(7) 2.40 Types of processes

(8) 2.42 Starting a series of questions on black holes! By "fundamental units" Schroeder means in units where $k = 1$. Add part (e) If all the particles were confined to the horizon, what would the area each particle be?