
Ninth Problem Set for Physics 846 (Statistical Physics I)

Fall quarter 2003

Important dates: Nov 27 no class, Dec 11 9:30am-11:18am final exam

Due date: Tuesday, Dec 2

24. Ideal gas

12 points

Consider a gas of classical particles of mass m in thermal equilibrium at a temperature T , and with density $\rho = N/V$.

- What is the average speed $\langle |\vec{V}| \rangle$?
- A clean metal surface is introduced into the container. Particles hitting this surface with normal velocity less than v_T are reflected back into the gas, while particles with normal velocity larger than v_T are absorbed by it. Find the average number of particles hitting the surface per unit area and per unit time from one side.
- Find the average number of particles absorbed by the surface in b) on one side per unit area and per unit time.

25. Entropy of a simple magnetic system

8 points

Consider a lattice with N spin-1 atoms. Each atom can be in one of three spin states, $S_z = -1, 0, +1$. Let n_{-1} , n_0 , and n_1 denote the respective number of atoms in each of those spin states. Assume that no magnetic field is present, so all atoms have the same energy.

- Find the total entropy as a function of n_{-1} , n_0 , and n_1 . Expand any factorials using Stirling's formula.
- Which configuration (n_{-1}, n_0, n_1) maximizes this entropy.
- What is the entropy in this maximized configuration?