

# PHYC - 505: Statistical Mechanics

## Homework Assignment 5

Due March 25, 2014

1. **Pathria 4.10** A surface with  $N_0$  adsorption centers has  $N(\leq N_0)$  gas molecules adsorbed on it. Show that the chemical potential of the adsorbed molecules is given by

$$\mu = k_B T \ln \frac{N!}{(N_0 - N)a(T)}$$

where  $a(T)$  is the partition function of a single adsorbed molecule. Solve the problem by constructing the grand partition function as well as the partition function of the system. [Neglect the intermolecular interaction among the adsorbed molecules.]

2. **Pathria 4.13** Define a quantity  $J$  as

$$J = E - N\mu = TS - PV$$

Show that for a system in the grand canonical ensemble

$$\overline{(\Delta J)^2} = kT^2 C_V + \left\{ \left( \frac{\partial U}{\partial N} \right)_{T,V} - \mu \right\}^2 \overline{(\Delta N)^2}$$

3. Read the Boltzmann equation material posted on the course website (in the “Excerpts from Books” section), thoroughly understand it, and rewrite in a single page in your own words what is presented there. This is to ensure that you really do that reading assignment.