PHY 540 **Statistical Mechanics** Spring 2007

Homework 03

(due Tuesday Feb. 20)

Problem 3.1. (To be graded of 15 points.) An ideal classical gas, confined in a container with the linear size scale L, had been in thermal equilibrium at temperature T. Then a small hole of size a was opened in the wall of the container for a short time interval t such that $a << v_0 t << L$, where v_0 is the r.m.s. velocity of the molecules in equilibrium:

$$v_0 \equiv \left\langle v^2 \right\rangle^{1/2} = \left(\frac{3T}{m} \right)^{1/2} .$$

Find the r.m.s. velocity of the escaped molecules. Compare it with v_0. On the basis of the comparison, what would be the most immediate observable effect of the gas emission?

Problem 3.2. (15 points.) A vessel with an ideal classical gas is separated by a partition so that the number N of molecules in both parts in the same but their volumes are different. After the system has reached thermal equilibrium, the gas pressure in one part is p_1, and in another, p_2. Calculate the change of entropy caused by a fast removal of the partition. Analyze the result.