

Physics 831 - 2002  
**Statistical Physics**  
Problem Set 6

1. Problem 7.2 (5 pt)
2. A classical harmonic oscillator of mass  $m$  and angular frequency  $\omega_0$  is in equilibrium with a thermal bath at temperature  $T$ . Find the probability distributions of the oscillator over its coordinate  $q$  (2 pt) and over its momentum  $p$  (2pt)
3. Two identical ideal atomic gases with same temperature  $T$  and number of particles  $N$ , but with different pressures  $P_1, P_2$ , occupy two separate volumes. Find the change of entropy when the gases are combined and come to equilibrium (5 pt)
4. An ideal classical monatomic gas, with  $N$  atoms at temperature  $T$ , occupies a volume  $V$ . Use the Maxwell distribution to calculate the momentum transferred to a wall of unit area per unit time, assuming that collisions are elastic. Use the result to obtain the equation of state (8 pt). Why does the result apply to an ideal gas only, given that the Maxwell distribution is the same even if the gas is non-ideal? (2 pt)

The problems are from Kerson Huang, *Statistical Mechanics*, 2nd edition, (Wiley, NY 1987).