Homework 1, due Oct. 4, 2007

1. System A is in equilibrium and has $V_A = 2m^3$ and $P_A = 0.01$ bar. System B is in equilibrium, and has $V_B = 3m^3$ and $P_B = 0.02$ bar. Systems A and B are put in thermal contact with each other, and it is found that they are also in thermal equilibrium with each other. Suppose that the densities of each system are very dilute. Moreover, suppose that the gas in each system happens to be N_20 (nitrous oxide). Throughout in what follows, suppose that the systems remain *closed*, i.e. they do not leak or exchange gasses.

   (a) Compute the ratio M_A/M_B of the masses of the gas in each container.

   (b) System A is kept in contact with system B. The volume V_A is slowly changed to $V_A' = 4m^3$, and the pressure P_A is changed to $P_A' = 0.03$ bar. The volume V_B is unchanged, $V_B' = 3m^3$. What should the new pressure P_B' be, in order for the systems A and B to remain in thermal equilibrium?

   (c) Is the temperature of the systems, in their final state of part (b), hotter or colder than they were in their initial state? Compute the ratio $T_{final}/T_{initial}$, where the temperatures are measured in Kelvin.

2. A tank of volume $10m^3$ contains nitrous oxide at a pressure $1000Pa$ and temperature of 20^oC. Assume that it behaves like an ideal gas.

   (a) How many kilomoles of N_2O are in the tank?

   (b) How many kilograms?

   (c) Find the pressure if the temperature is increased to 50^oC.

   (d) At a temperature of 20^oC, how many kilomoles should be withdrawn from the tank for the pressure to become $100Pa$?