Homework #2

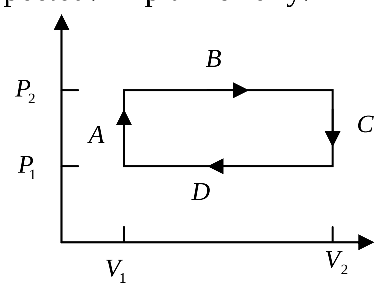
Problem#1

2-2 (problem 1.34 in Schroeder)
An ideal diatomic gas, in a cylinder with a movable piston, undergoes rectangular cyclic process shown in the figure. Assume that the temperature is always such that rotational degrees of freedom are active, but vibrational modes are "frozen out". Also assume that the only type of work done on the gas is quasistatic compression-expansion work.

(a) For each of four steps A through D, compute the work done on the gas, the heat added to the gas, and the change in the energy content of the gas. Express all answers in terms of P_1,P_2,V_1, and V_2. (Hint: Compute ΔU before Q, using the ideal gas law and the equipartition theorem)

(b) Describe in words what is physically being done during the each of the four steps; for example, during step A, heat is added to the gas while the piston is held fixed.

(c) Compute the net work done on the gas, the net heat added to the gas, and the net change in the energy of the gas during the entire cycle. Are the results as you expected? Explain briefly.



Problem #2

F 5.6.5
In a thermally isolated vessel at temperature 800 K there is a mixture of 1 mole of CO_2 and 1 mole of H_2. A chemical reaction takes place
CO_2+H_2=CO+H_2O+40.1 kJ/mole
What will be the ratio of the final to the initial pressure in the vessel after the reaction is completed?
Comments: All degrees of freedom are active in both initial and final stages of the process. CO_2, H_2, and CO are axial molecules, H_2O is not. CO_2 has 4 vibrational degrees of freedom; H_2O has 3 vibrational degrees of freedom. The pressure for a mixture of ideal gases is equal to a sum of pressures of the individual gases.