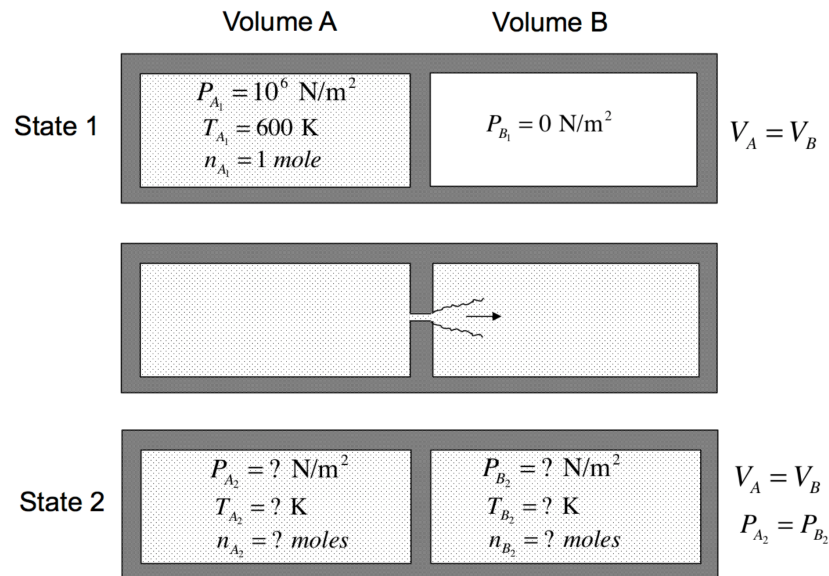Due Wednesday September 30

Read: Chapter 2

Problem – In the figure below one mole of Argon gas is contained in Volume A at State 1. Volume B is at vacuum. A small leak is opened between Volumes A and B. The gas in A expands slowly while the jet of gas from the leak fills B until the pressures in Volume A and B are equal. At that point the leak is sealed. The volumes and the wall between them are adiabatic. The two volumes are equal.

Volume A   Volume B

State 1
$P_{A_1} = 10^6$ N/m^2
$T_{A_1} = 600$ K
$n_{A_1} = 1$ mole
$P_{B_1} = 0$ N/m^2
$V_A = V_B$

State 2
$P_{A_2} = ?$ N/m^2
$T_{A_2} = ?$ K
$n_{A_2} = ?$ moles
$P_{B_2} = ?$ N/m^2
$T_{B_2} = ?$ K
$n_{B_2} = ?$ moles
$V_A = V_B$
$P_{A_2} = P_{B_2}$

1) Use the first law of thermodynamics to relate the internal energy of the gas in Volume A at State A_1 to the gases in A at State A_2 and B at State B_2.
2) Relate the pressures and temperatures in Volume A at States 1 and 2.
3) Determine T_{A_2}, T_{B_2}, n_{A_2}, n_{B_2} and P_{A_2}.
4) Determine the dimensionless entropy change of the system $\Delta S / (nC_p)$ where n is the number of moles of gas in the system. Note that C_p is the molar heat capacity.
5) How would your answers change if the gas were Helium?

Chapter 2 – Work problems 6, 7, 9 and 10. Work out your answer to 10 then check out YouTube for the video.

http://www.youtube.com/watch?v=y8mzDvpKzfY