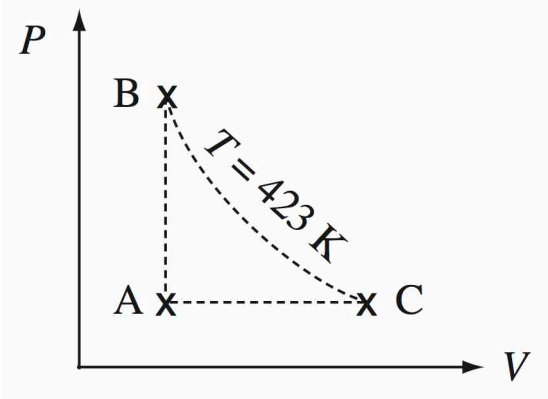
General Physics II: Tutorial Material 12

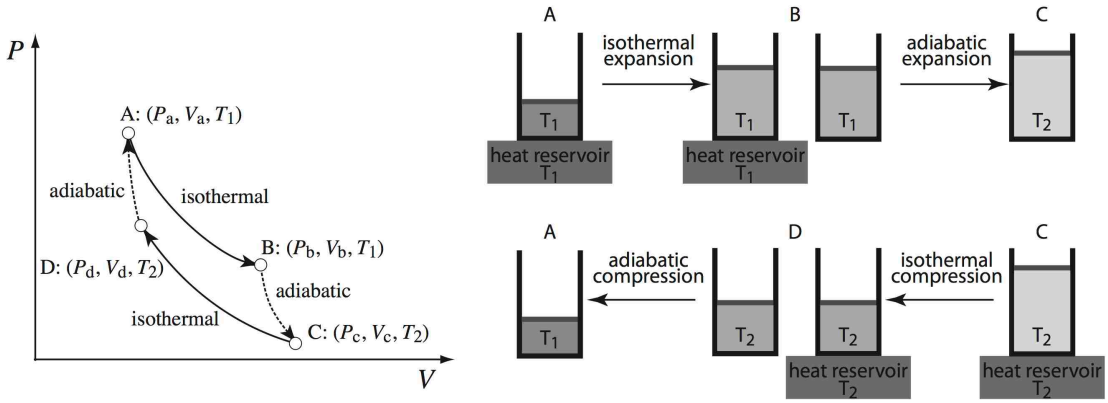
1) The temperature of n-mol ideal gas has changed from T_1 to T_2 degrees. Determine the entropy change for 1) under constant pressure and 2) under constant volume.

2) Figure below is the V-P diagram of a heat engine with 1 mol of a diatomic molecule ideal gas. At point A, it is at STP (273 K and 1 atm). Points B and C are on the isothermal line at T = 423 K. The process A-B is with a constant volume and A-C with a constant pressure.
   a) Obtain the volume, pressure and temperature for the state B and C.
   b) Which is the path to generate the work, A-B-C or A-C-B, and why?
   c) What is the efficiency, ε, of the engine where ε = W / Q (positive)?
   d) Show that total heat minus total work is zero.



3) We consider now a similar heat engine starting from A as defined above, but the B-C path is done adiabatically. The temperature of B is kept at T = 423 K and on the isovolumetric line with A. The state C remains on the isobaric line with A.
   a) Obtain the volume, pressure and temperature of C.
   b) Calculate the efficiency.

4) Calculate the change of the total entropy of the Carnot cycle after one cycle, i.e. that of the Carnot engine plus the two heat reservoirs.



5) For the Otto Cycle shown in the figures below, calculate the efficiency of the Otto cycle engine and compare with that of the Carnot cycle engine, $\varepsilon_{\text{Carnot}} = 1 - T_a/T_c$, where T_a and T_c, the lowest and highest temperature of the system, respectively. Which one of the two engines is more efficient?