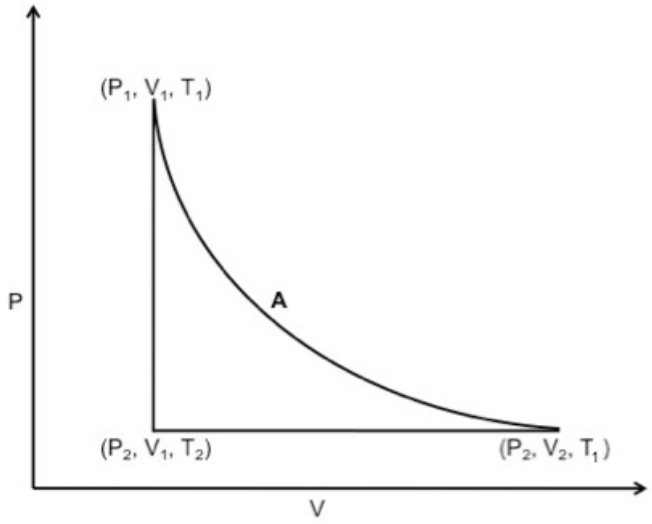
Discussion Section #6 – February 28, 2014 (Chapter 7)

1. Calculate q_{rev}, ΔU, and ΔS for a reversible cooling of one mole of an ideal gas at a constant volume V_1 from (P_1, V_1, T_1) to (P_2, V_1, T_2) followed by a reversible expansion at constant pressure P_2 from (P_2, V_1, T_2) to (P_2, V_2, T_1) (the final state for all the processes are shown in the figure below). Compare you result for ΔS with that of path A.



Useful Equations (For the system doing work)

$$U = \frac{3}{2}NkT \qquad dU = \delta w + \delta q \qquad dS = \frac{\delta q_{rev}}{T} = \frac{C_V}{T}dT \qquad C_v = \left(\frac{dU}{dT}\right)_V = \left(\frac{\delta q}{dT}\right)_V$$

Constant Volume: $q = \frac{C_V}{Nk}V(p_f - p_i)$

Constant Pressure: $q = \Delta U - w = \frac{C_V}{Nk}p(V_f - V_i) + p(V_f - V_i)$

Constant Temperature: $q = -w = NkT\ln\frac{V_2}{V_1}$