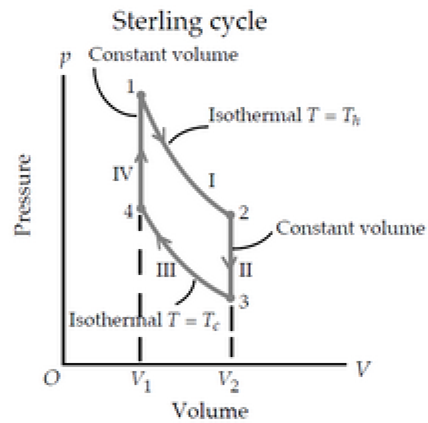
Problem 3.

A P-V Diagram of the Stirling cycle described in problem 3 is shown to the right.



If the efficiency of the cycle, $\eta = W/Q_{pos}$, where Q_{pos} is total positive heat flow to the engine, what is the efficiency of the cycle when T_h is 700 K, T_c is 400 K, V_i is 0.5 L, and V_f is 1.5 L. Using the results above, we may calculate the work done during the cycle:

$$W = nR(T_h - T_c)ln(\frac{V_f}{V_i})$$

$$W = (0.1\ mol)(8.314\ \frac{J}{mol*K})(700K - 400\ K)ln(\frac{1.5\ L}{0.5\ L}) = 274.016\ Joules$$

When calculating total positive heat flow to the engine, it is important to note that unlike a Carnot cycle where heat flows discontinuously (flows to system only during isothermal processes), heat flows to the gas of a Stirling engine both during isothermal expansion and isochoric heating.

$$Q_{pos} = C_V(T_h - T_c) + nRT_h ln(\frac{V_f}{V_i})$$

$$Q_{pos} = (5/2 * 8.314\ \frac{J}{mol*K})(700\ K - 400\ K) + (0.1\ mol)(8.314\ \frac{J}{mol*K})(700K)ln(\frac{1.5\ L}{0.5\ L})$$

$$Q_{pos} = 6874.87\ Joules$$