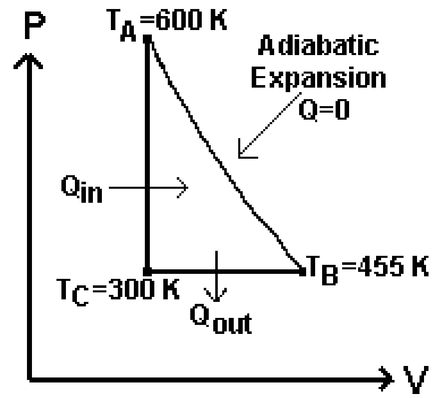
Given one mole of a monatomic ideal gas taken through the following cycle.



$$Q_{in} = nC_V\Delta T = (1)\left(\frac{3}{2}8.314\right)(600-300) = 3741\text{ J}$$

$$Q_{out} = nC_P\Delta T = (1)\left(\frac{5}{2}8.314\right)(300-455) = -3222\text{ J}$$

$$e = 1 - \frac{|Q_{out}|}{Q_{in}} = 1 - \frac{3222}{3741} = .14$$ the efficiency of the cyclic process.

The Carnot efficiency between the highest and lowest temperatures is

$$e_{Carnot} = 1 - \frac{T_L}{T_H} = 1 - \frac{300}{600} = .5 \ .$$

Work done by the engine is

$$\text{Work} = Q_{in} - |Q_{out}| = 3741 - 3222 = 519\text{ J} \ .$$

$$\Delta S_{AB} \xrightarrow{\text{adiabatic}} \Delta Q = 0 \quad \Rightarrow \quad \Delta S = 0$$

$$\Delta S_{BC} \xrightarrow{\text{isobaric}} P \text{ constant}, \ \Delta S = nC_P \ln\frac{T_C}{T_B} = \frac{5}{2}R\ln\frac{300}{455} = -1.04\text{ R}$$

$$\Delta S_{CA} \xrightarrow{\text{isovolumetric}} V \text{ constant}, \ \Delta S = nC_V \ln\frac{T_A}{T_C} = \frac{3}{2}R\ln\frac{600}{300} = 1.04\text{ R}$$

$\Delta S_{total} = 0$ implies the engine is reversible.