

Çankaya University
Mechanical Engineering Department
ME 211 Thermodynamics I
Quiz 5-Solution

An inventor claims to have developed a heat engine that receives 800 kJ of heat from a source at 600K and rejects heat of 450 kJ to a sink at 300K. Is this reasonable?

Solution:

$$Q_H - Q_C = W_{\text{cycle}}$$

$$W_{\text{cycle}} = 800 - 450 = 350 \text{ kJ}$$

$$\eta = W_{\text{cycle}} / Q_H = 350 / 800 = 0.4375 = 43.75\%$$

We should find the maximum efficiency a cycle can have operating between these reservoirs (Carnot cycle)

$$\eta_{\text{max}} = 1 - T_H / T_C = 1 - 300 / 600 = 0.5 = 50\%$$

Inventors claim is true. Maximum efficiency this cycle can have is 50%. This is reasonable since $43.75 < 50\%$