Phy 410
Quiz #11, April 23, 2010

(1) A power plant operates at an efficiency of 40% (η=0.4). If it releases 1 MW of power at the cold temperature end then how much power it is generating?

$$\text{Re}late\ Power\ P = \frac{dW}{dt}\ to\ \frac{dQ_l}{dt}\ and\ \eta$$

$$W = \eta Q_h = \eta(Q_l + W) \rightarrow W = \frac{\eta}{1-\eta}Q_l$$

$$P = \frac{dW}{dt} = \frac{\eta}{1-\eta}\frac{dQ_l}{dt} = \frac{0.4}{0.6}1MW = 2/3MW$$

(2) If the above power plant is an ideal Carnot machine then what is the ratio of the cold temperature to the hot temperature?

$$\eta = 1 - \frac{\tau_l}{\tau_h} = 1 - \frac{T_l}{T_h} \rightarrow \frac{T_l}{T_h} = 1 - \eta = 0.6$$