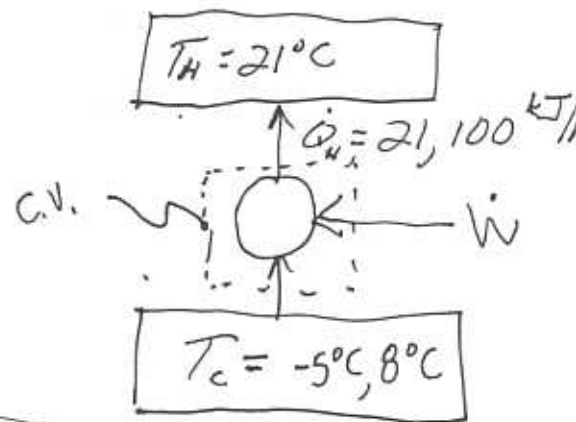


5.57 Given: Heat pump

$$\text{cost} = \$0.08/\text{kW}\cdot\text{hr}$$

Find: Minimum theoretical operating cost per day.



$$\eta = \frac{\dot{Q}_H}{\dot{W}_{\text{cycle}}} = \frac{\dot{Q}_H}{\dot{Q}_H - \dot{Q}_C}$$

$$\eta_{\text{max}} = \frac{T_H}{T_H - T_C}$$

$$(a) \eta_{\text{max}} = \frac{294\text{K}}{294\text{K} - (273 + (-5))\text{K}} = 11.31$$

$$11.31 = \frac{21,100\text{kJ/hr}}{\dot{W}_{\text{cycle}}}$$

$$\dot{W}_{\text{cycle}} = 1866\text{kJ/hr} \\ = 0.518\text{kW}$$

$$\text{cost} = (\$0.08/\text{kW}\cdot\text{hr})(0.518\text{kW}) = \$0.04/\text{hr}$$

$$\boxed{\text{daily cost} = \$0.994}$$

(b) Same procedure, for  $T_C = 8^\circ\text{C}$

$$\boxed{\text{answer} = \$0.50/\text{day}}$$