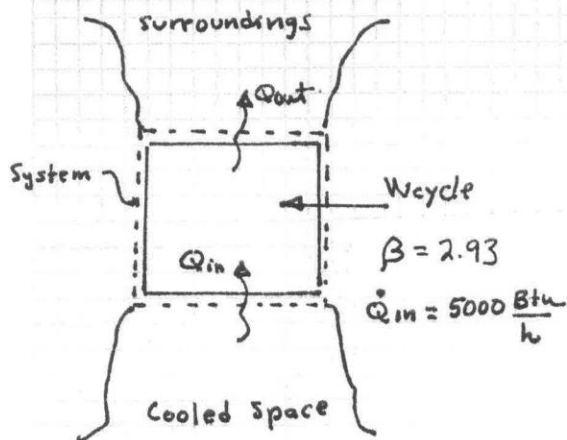


PROBLEM 2.93

KNOWN: Operating and cost data are provided for an air-conditioner providing cooling.

FIND: Determine the cost, in \$, to operate the air-conditioner for a cooling season lasting 125 days.

SCHEMATIC & GIVEN DATA:



Unit cost of electricity =
10 cents per kW·h

ENGINEERING MODEL:

1. The system operates in a refrigeration cycle.
2. Energy transfers are positive in the direction of the arrows.
3. Electricity is valued at 10 cents per kW·h.

ANALYSIS: $\beta = \frac{Q_{in}}{W_{cycle}} \Rightarrow W_{cycle} = \frac{Q_{in}}{\beta}$

$$\therefore W_{cycle} = \frac{(5000 \frac{\text{Btu}}{\text{h}})(8 \frac{\text{h}}{\text{day}})(125 \frac{\text{days}}{\text{season}})}{2.93} \left| \frac{1 \text{ kW}}{3413 \text{ Btu/h}} \right|$$

Unit conversion, $1 \text{ W} = 3.413 \text{ Btu/h}$

$$= 500 \frac{\text{kW} \cdot \text{h}}{\text{season}}$$

Costing,

$$\begin{aligned} \$ &= (500 \frac{\text{kW} \cdot \text{h}}{\text{season}}) \left(\frac{\$0.10}{\text{kW} \cdot \text{h}} \right) \\ &= \$50/\text{season} \end{aligned}$$