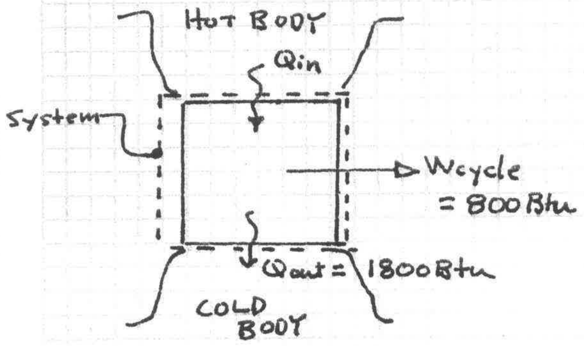
PROBLEM 2.80

KNOWN: For a power cycle, W_{cycle} and Q_{out} are provided.

FIND: Determine the thermal efficiency.

SCHEMATIC & GIVEN DATA:



ENGINEERING MODEL:

1. The system undergoes a power cycle.
2. Energy transfers are positive in the direction of arrows on the schematic.

ANALYSIS: Cycle energy balance: $W_{cycle} = Q_{cycle} = Q_{in} - Q_{out}$

$\therefore \; Q_{in} = Q_{out} + W_{cycle} = 1800 \text{ Btu} + 800 \text{ Btu} = 2600 \text{ Btu}.$

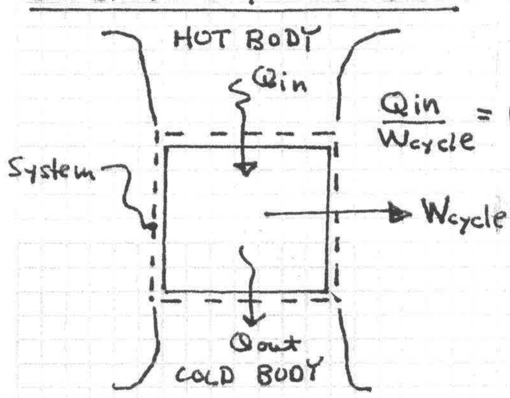
Thermal efficiency: $$\eta = \frac{W_{cycle}}{Q_{in}} = \frac{800 \text{ Btu}}{2600 \text{ Btu}} = 0.308 \quad (30.8\%)$$

PROBLEM 2.81

KNOWN: Operating data are provided for a system undergoing a power cycle.

FIND: Determine the thermal efficiency.

SCHEMATIC & GIVEN DATA:



$\frac{Q_{in}}{W_{cycle}} = 10^4 \frac{\text{Btu}}{\text{kW}\cdot\text{h}}$

ENGINEERING MODEL:

1. The system undergoes a power cycle.
2. Energy transfers are positive in the direction of arrows on the schematic.

ANALYSIS: The thermal efficiency is $\eta = \frac{W_{cycle}}{Q_{in}}$.

With given data,

See unit conversions: 1 W = 3.413 Btu/h

$$\eta = \left[\frac{1}{10^4 \frac{\text{Btu}}{\text{kW}\cdot\text{h}}}\right]\left|\frac{3413 \text{ Btu}}{1 \text{ kW}\cdot\text{h}}\right| = 0.3413 \quad (34.13\%)$$