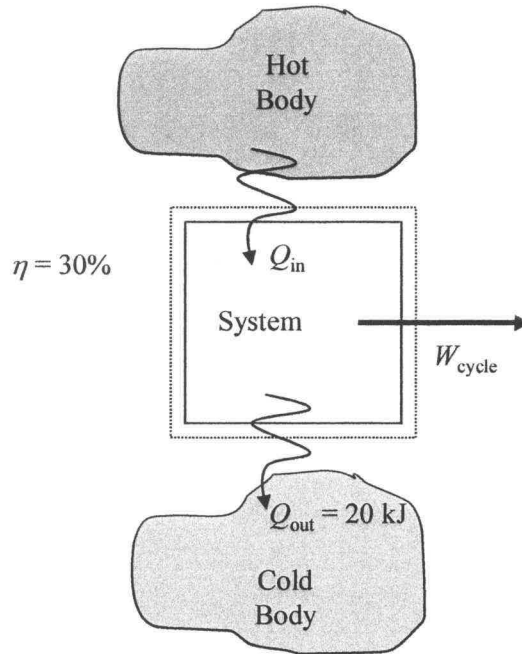


PROBLEM 2.79

KNOWN: Power cycle operates with given thermal efficiency and heat transfer from the system.

FIND: Determine the cycle net work and the heat transfer into the system.

SCHEMATIC AND 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:

The heat transfer into the system can be determined from the definition of thermal efficiency expressed in terms of heat transfers

$$\eta = W_{cycle}/Q_{in} = 1 - (Q_{out}/Q_{in})$$

Rearranging the equation to solve for Q_{in} and substituting thermal efficiency and Q_{out} values yield

$$Q_{in} = Q_{out} / (1 - \eta) = (20 \text{ kJ}) / (1 - 0.3) = \underline{\underline{28.6 \text{ kJ}}}$$

Net work for the power cycle is determined from an energy balance for the cycle

$$W_{cycle} = Q_{cycle} = Q_{in} - Q_{out} = 28.6 \text{ kJ} - 20 \text{ kJ} = \underline{\underline{8.6 \text{ kJ}}}$$