

NAME: _____

SOLUTION

This is an open book quiz. You may use a four function calculator. An unsigned honors pledge will result in a zero.

1. A heat pump keeps a house at 25°C on a day when the outside temperature is -5°C . Because the house is not perfectly insulated, heat leaks out of the house at a rate of 2.3 kW . If the coefficient of performance for the heat pump is 54% of the coefficient of performance for a perfectly reversible heat pump, compute the power input for the actual heat pump in Watts.

GIVEN: Heat pump; $T_H = 25^{\circ}\text{C}$; $T_C = -5^{\circ}\text{C}$; $\dot{Q}_H = 2.3\text{ kW}$
 $\eta = 0.54 \eta_{\text{max}}$

FIND: $\dot{W}_{\text{cyc}} = ?\text{ W}$

ASSUME: Inside and outside are thermal reservoirs.

ANALYSIS: $\eta_{\text{max}} = \frac{T_H}{T_H - T_C} = \frac{298\text{ K}}{298\text{ K} - 268\text{ K}} = \underline{9.933}$

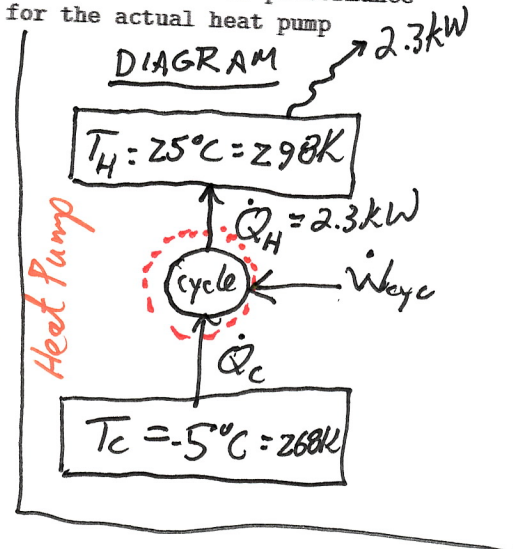
$$\eta = 0.54 (9.933) = 5.364$$

$$\eta = \frac{\dot{Q}_H}{\dot{W}_{\text{cyc}}} = \underline{5.364}$$

$$\frac{2.3\text{ kW}}{\dot{W}_{\text{cyc}}} = 5.364$$

$$\dot{W}_{\text{cyc}} = 0.4288\text{ kW}$$

$$\dot{W}_{\text{cyc}} = \underline{428.8\text{ W}} \leftarrow \text{ANS.}$$



I HAVE NEITHER PROVIDED OR RECEIVED HELP DURING THIS QUIZ.

SIGNATURE