

A heat pump removes 35-J of energy from the inside of a refrigerator and exhausts 55-J of energy to the outside surrounding air. What is the coefficient of performance of the refrigerator's heat pump?

Given:

Heat removed from the refrigerator:  $Q_C = 35 \text{ J}$

Heat exhausted to the surrounding air:  $Q_H = 55 \text{ J}$

Determine: coefficient of performance of heat pump: COP

Use formula:

$$\text{COP} = Q_C / W_{\text{in}} \text{-----}(1)$$

( Here  $W_{\text{in}}$  is the work required to transfer heat energy from a region of lower temperature to a region of higher temperature. )

$$W_{\text{in}} = Q_H - Q_C \text{-----}(2)$$

Substituting (2) in (1):

$$\text{COP} = Q_C / Q_H - Q_C \text{-----}(3)$$

Substituting for  $Q_C$  &  $Q_H$  in (3):

$$\text{COP} = 35 / ( 55 - 35 ) = 1.75$$