

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:

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

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

Determine: coefficient of performance of heat pump: COP

Use formula:

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

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

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

Substituting (2) in (1):

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

Substituting for Q_C & Q_H in (3):

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