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: $Q_C = 35$ J

Heat exhausted to the surrounding air: $Q_H = 55$ J

To determine: coefficient of performance of heat pump: COP

Use formula:

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

(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):

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

Substituting for Q_C & Q_H in (3):

COP = 35 / (55 - 35) = 1.75