

Q- A heat pump is used to maintain a house at a constant temperature of  $23^{\circ}\text{C}$ . The house is losing heat to the outside air through the walls and the windows at a rate of  $60000 \text{ kJ/h}$  and the energy generated within the house from lights and appliances amounts to  $5000 \text{ kJ/h}$ . For COP of 2.5, determine the power input to the heat pump.

The heat loss is  $60,000 \text{ kJ/h}$  and the heat generated is  $5000 \text{ kJ/h}$  hence the heat input required per hour will be

$$Q_H = 60,000 - 5000 = 55,000 \text{ KJ}$$

Now as COP is the ratio of the amount of heat delivered to the hot room  $Q_H$  to the work done by compressor  $W$  we get

$$K = Q_H/W$$

Or  $W = Q_H/K$

Hence the input energy per hour to the pump will be

$$W = 55.000 \text{ KJ}/2.5 = 22000 \text{ KJ}$$

Or the power input will be

$$P = W/t = 22000 \text{ KJ}/3600 \text{ s} = 6.11 \text{ KW} = 6111 \text{ W}.$$

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