

Answer on Question 57165, Physics, Other

Question:

A person with external body temperature 35°C is present in a room at temperature 25°C . Assuming the emissivity of the body of the person to be 0.5 and surface area of the body of the person as 2.0m^2 , calculate the radiant power of the person.

Solution:

The person radiates energy at a rate:

$$P = \frac{Q}{\Delta t} = \varepsilon \sigma A (T_1^4 - T_2^4), T_1 > T_2$$

here, P is the radiant power of the person, $\varepsilon = 0.5$ emissivity of the body of the person, $\sigma = 5.672 \cdot 10^{-8} \frac{\text{J}}{\text{s} \cdot \text{m}^2 \cdot \text{K}^4}$ is the Stefan – Boltzmann constant, $A = 2.0\text{m}^2$ is the surface area of the body of the person and T_1 is the temperature of the person, and T_2 is the temperature of the surroundings.

Then, the radiant power of the person will be:

$$P = \varepsilon \sigma A T^4 = 0.5 \cdot 5.67 \cdot 10^{-8} \frac{\text{J}}{\text{s} \cdot \text{m}^2 \cdot \text{K}^4} \cdot 2.0\text{m}^2 \cdot ((35 + 273.15\text{K})^4 - (25 + 273.15\text{K})^4) = 63.2\text{W}.$$

Answer:

$$P = 63.2\text{W}.$$