Answer on Question 60518, Physics, Mechanics, Relativity

Question:

A person with external body temperature 35℃ is present in a room at temperature 25℃. 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:

We can find the radiant power of the person from the Stefan-Boltzmann Law:

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

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

Then, from this formula we can calculate the radiant power of the person:

$$P = \varepsilon\sigma A(T_1^4 - T_2^4) =$$
$$= 0.5 \cdot 5.672 \cdot 10^{-8} \frac{J}{s \cdot m^2 \cdot K^4} \cdot 2.0m^2$$
$$\cdot ((35 + 273.15K)^4 - (25 + 273.15K)^4) = 63.2W.$$

Answer:

$P = 63.2W$.