

Answer on Question #37951 – Physics – Thermodynamics

Question:

During a brisk run, an adult human generates heat at a rate of about 1270 W. To remove this heat by evaporative cooling, what mass of water per second m/t must be evaporated from the body as sweat? The latent heat of vaporization of water at 37 °C (typical body temperature) is 24.2×10^5 J/kg.

Answer:

Amount of heat equals:

$$Q = Lm$$

where L is latent heat of vaporization of water, m – mass of the water.

Dividing by time:

$$\frac{Q}{t} = P = L \left(\frac{m}{t} \right)$$

Therefore mass of water per second $\left(\frac{m}{t} \right)$ equals:

$$\frac{m}{t} = \frac{P}{L} = \frac{1270 \text{ W}}{24.2 * 10^5 \frac{\text{J}}{\text{kg}}} = 5.25 * 10^{-4} \frac{\text{kg}}{\text{s}}$$

Answer: $5.25 * 10^{-4} \frac{\text{kg}}{\text{s}}$