

Answer on Question #37942, Physics - Thermodynamics

Question:

A person has a metabolic rate of about 7.84×10^5 joules per hour. The person is submerged neck-deep into a tub containing 2.06×10^3 kg of water at 20.9°C . If the heat from the person goes only into the water, find the water temperature in degrees Celsius after half an hour.

Answer:

$$Q = cm(T_2 - T_1)$$

where $T_2 - T_1$ – change of temperature, Q is amount of heat, m is mass.

Amount of heat equals:

$$Q = 7.84 \cdot 10^5 \frac{J}{h} \cdot 0.5 h = 3.92 \cdot 10^5 J$$

Therefore, final temperature equals:

$$T_2 = T_1 + \frac{Q}{cm}$$

Finally:

$$T_2 = T_1 + \frac{Q}{cm} = 20.9 + \frac{3.92 \cdot 10^5}{4183 \cdot 2.06 \cdot 10^3} = 21.16^\circ\text{C}$$

Answer: 21.16°C