Answer on Question #37948, Physics, Molecular Physics | Thermodynamics

Question:

When resting, a person has a metabolic rate of about 7.84 x 105 joules per hour. The person is submerged neck-deep into a tub containing 2.06 x 103 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 m is mass, $T_2 - T_1$ – change of temperature, Q is amount of heat.

Therefore, final temperature equals:

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

Amount of heat equals:

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

Finally:

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

Answer: 21.2°C