

Physics 10154 - Quiz 13D

When you are exercising to burn calories, the temperature of your environment can make a difference in how many calories you burn. For this problem, assume 1 food calorie = 1 kcal = 4186 Joules.

A person with a normal body temperature of 98°F has an emissivity of 0.85 and exposed skin area of 1.2 square meters.

Calculate how many Calories are burned in 1.0 hour of exercise in a room...

- a) With a temperature of 72°F.
- b) With a temperature of 60°F.

$$T = 98^{\circ}\text{F} = 36.7^{\circ}\text{C} = 309.7\text{K}$$

$$\text{a) } T_{\text{env}} = 72^{\circ}\text{F} = 22.2^{\circ}\text{C} = 295.2\text{K}$$

$$P = (0.85)(5.67 \times 10^{-8})(1.2)(309.7^4 - 295.2^4) \\ = 92.86\text{W}$$

$$E = P \cdot t = (92.86)(3600) = 334,300\text{J}$$

$$= 334,300\text{J} \cdot \frac{1\text{Cal}}{4186\text{J}} = \boxed{80\text{Cal}}$$

$$\text{b) } T_{\text{env}} = 60^{\circ}\text{F} = 15.6^{\circ}\text{C} = 288.6\text{K}$$

$$P = (0.85)(5.67 \times 10^{-8})(1.2)(309.7^4 - 288.6^4) \\ = 130.84\text{W} =$$

$$E = 471,000\text{J} = \boxed{110\text{Cal}}$$