**44.** Since the energy absorbed by the lake equals the solar power times the time, $\Delta t = \Delta Q/P = mc\Delta T/(200\ \text{W/m}^2)A$, where $m/\text{A}$ is the mass per unit area of lake surface. Therefore:

$$\Delta t = (10^3\ \text{kg/m}^3)(10\ \text{m})(4184\ \text{J/kg}\cdot\text{K})(10\ \text{K})/(200\ \text{W/m}^2) = 2.09\times10^6\ \text{s} = 24.2\ \text{d}$$

**52.** $\Delta Q = \Delta K = 2(\frac{1}{2}mv^2) = 2mc\ \Delta T$ (if there are no energy losses), therefore $\Delta T = v^2/2c_{\text{Iron}} = (90\ \text{m}/3.6\ \text{s})^2/(2\times447\ \text{J/kg}\cdot\text{K}) = 0.699\ \text{K}$.

**55.** **INTERPRET** Our system consists of two materials, water and copper, which are initially at different temperatures. They are brought together and reach a thermal equilibrium. We want to find the mass of the copper.

**DEVELOP** Let us assume that all the heat lost by the copper is gained by the water, with no heat transfer to the container or its surroundings. Then $-\Delta Q_{\text{Cu}} = \Delta Q_{\text{H}_2\text{O}}$ (as in Example 16.2), or

$$-m_{\text{Cu}}c_{\text{Cu}}(T - T_{\text{Cu}}) = m_{\text{H}_2\text{O}}c_{\text{H}_2\text{O}}(T - T_{\text{H}_2\text{O}})$$

The specific heats of copper and water can be found in Table 16.1.

**EVALUATE** Expressing all the temperatures in the Kelvin scale and solving for $m_{\text{Cu}}$, one finds

$$m_{\text{Cu}} = \frac{m_{\text{H}_2\text{O}}c_{\text{H}_2\text{O}}(T - T_{\text{H}_2\text{O}})}{c_{\text{Cu}}(T_{\text{Cu}} - T)} = \frac{(1\ \text{kg})(4184\ \text{J/kg}\cdot\text{K})(298\ \text{K} - 293\ \text{K})}{(386\ \text{J/kg}\cdot\text{K})(573\ \text{K} - 298\ \text{K})} = 0.197\ \text{kg}$$

**ASSESS** Since the water has much greater mass and higher specific heat, its temperature change is less compared to copper.

**66.** The average power supplied to the water is $P = \Delta Q/\Delta t = mc\ \Delta T/\Delta t = (430\ \text{g})(1\ \text{cal/g}\cdot\text{C}^\circ)(100^\circ\text{C} - 20^\circ\text{C})\times(4.184\ \text{J/cal})/(5\times60\ \text{s}) = 480\ \text{W}$. This is also the output of the microwave, if we neglect the power absorbed by the container and any leakage in the unit.