

98. Let the initial water temperature be  $T_{wi}$  and the initial thermometer temperature be  $T_{ti}$ . Then, the heat absorbed by the thermometer is equal (in magnitude) to the heat lost by the water:

$$c_t m_t (T_f - T_{ti}) = c_w m_w (T_{wi} - T_f) .$$

We solve for the initial temperature of the water:

$$\begin{aligned} T_{wi} &= \frac{c_t m_t (T_f - T_{ti})}{c_w m_w} + T_f \\ &= \frac{(0.0550 \text{ kg})(0.837 \text{ kJ/kg} \cdot \text{K})(44.4 - 15.0) \text{ K}}{(4.18 \text{ kJ/kg} \cdot \text{C}^\circ)(0.300 \text{ kg})} + 44.4^\circ\text{C} \\ &= 45.5^\circ\text{C} . \end{aligned}$$