

EXAMPLE CALCULATION: HEAT

A beaker contains 375 mL of water at 18.6°C. Calculate the new temperature of the water after 88 kJ of thermal energy is transferred to the water.

$$m = 375 \text{ g} \quad \{\text{density of water is 1g/mL}\}$$

$$T_1 = 18.6^\circ\text{C}$$

$$c = 4.18 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1} \quad \{\text{specific heat capacity of water}\}$$

$$q = 88 \text{ kJ}$$

$$T_2 = ?$$

$$q = m c \Delta T$$

$$q = m c (T_2 - T_1)$$

$$\frac{q}{m c} = T_2 - T_1 \quad \{\text{divide both sides by } mc\}$$

$$\frac{q}{m c} + T_1 = T_2 \quad \{\text{add } T_1 \text{ to both sides}\}$$

$$\begin{aligned} T_2 &= \frac{q}{m c} + T_1 \\ &= \frac{88\,000 \cancel{\text{J}}}{(375 \cancel{\text{g}})(4.18 \cancel{\text{J g}^{-1}} \text{ }^\circ\text{C}^{-1})} + 18.6^\circ\text{C} \quad \{\text{convert kJ to J}\} \\ &= 56.140\dots^\circ\text{C} + 18.6^\circ\text{C} \\ &= 74.740\dots^\circ\text{C} \end{aligned}$$

Therefore, the new temperature of the water is 75°C.