Example 7  
200.0 g of silver is heated to 90.0°C. The hot silver is then placed into 300.0 g of ethyl alcohol that has an initial temperature of 5.0°C. Determine the final temperature of the silver-alcohol mixture.

\[ T_2 \text{ is the same for both} \]

\[ m_s c_s (T_2 - T_s) = -m_A c_A (T_2 - T_A) \]

\[ m_s c_s T_2 - m_s c_s T_s = -m_A c_A T_2 + m_A c_A T_A \]

\[ m_s c_s T_2 + m_A c_A T_2 = m_A c_A T_A + m_s c_s T_s \]

Factor out \( T_2 \)

\[ T_2 = \frac{m_s c_s + m_A c_A}{m_s + m_A} \]

\[ T_2 = \frac{1180}{1.05} = 112.3°C \]

Example 8  
An electric kettle is used to heat up 1.5 kg of water for tea from 8.0°C to 100°C.

(a) How much energy did it take?

\[ Q = m c \Delta T \]

\[ = (1.5 \text{ kg})(4.18 \times 10^3 \text{ J/(kg°C)})(100°C - 8.0°C) \]

\[ = 57,684 \text{ J} \]

(b) The kettle has a power of 2000 W. Assuming 100% efficiency, how long did it take?

\[ P = \frac{\Delta E}{\Delta t} \]

\[ 2000 \text{ W} = \frac{6 \times 10^5 \text{ J}}{\Delta t} \]

\[ \Delta t = 300 \text{ s} \]

6.3 Questions

1. What is specific heat capacity? What does it tell you? ☒

2. Calculate the amount of thermal energy required to increase the temperature of 25.0 g of silver from 50.0°C to 80.0°C. ☒

3. Calculate the amount of thermal energy released when 260.0 g of ice cools from −1.0°C to −20.0°C. ☒

4. A 50.0 g sample of metal releases 1500 J of thermal energy when its temperature drops from 100.0°C to 20.0°C. What is the metal? ☒

5. Calcium has a specific heat capacity of 6.3 × 10^3 J/(kg°C). Determine the final temperature of a 60.0 g sample of calcium if it starts at 10.0°C and absorbs 302 J of thermal energy. ☒

6. A bar of pure gold is heated to 95.0°C. The specific heat capacity of gold is 1.29 × 10^2 J/(kg°C). The gold is placed into 500.0 mL of ethyl alcohol initially at a temperature of 25.0°C. The final temperature of the mixture is 27.0°C. What is the mass of the gold? ☒

7. Danielle cools a 2.0 kg metal object to a temperature of −25.0°C. She places the metal in 3.0 L of pure water initially at a temperature of 40.0°C. The final temperature of the mixture is 36.0°C. What is the specific heat capacity of the metal? ☒

8. A 1.50 × 10^2 g piece of brass (specific heat capacity 3.80 × 10^3 J/(kg°C)) is submerged in 400.0 mL of water at 27.7°C. What is the original temperature of the brass if the mixture has a temperature of 28.0°C? ☒

9. Explain why temperature changes are important for civil engineers to consider when designing and evaluating building structures. ☒

10. Research more about thermal expansion and contraction and how it is dealt with in the design of homes, schools, or other structures. Choose one innovation related to this topic and write a brief report. ☒

Homework: pg. 262 #1 – 3  pg. 275 #5, 8, 24 - 27