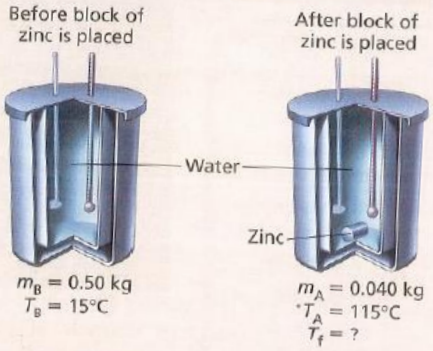
EXAMPLE Problem 2

Transferring Heat in a Calorimeter A calorimeter contains 0.50 kg of water at 15°C. A 0.040-kg block of zinc at 115°C is placed in the water. What is the final temperature of the system?



1 Analyze and Sketch the Problem

- Let zinc be sample A and water be sample B.
- Sketch the transfer of heat from the hotter zinc to the cooler water.

Known:

$m_A = 0.040$ kg
$C_A = 388$ J/kg·°C
$T_A = 115°C$
$m_B = 0.50$ kg
$C_B = 4180$ J/kg·°C
$T_B = 15.0°C$

Unknown:

$T_f = ?$

Math Handbook
Operations with Significant Digits
pages 835–836

2 Solve for the Unknown

Determine the final temperature using the following equation.

$$T_f = \frac{m_A C_A T_A + m_B C_B T_B}{m_A C_A + m_B C_B}$$

$$= \frac{(0.040\text{ kg})(388\text{ J/kg·°C})(115°C) + (0.50\text{ kg})(4180\text{ J/kg·°C})(15.0°C)}{(0.040\text{ kg})(388\text{ J/kg·°C}) + (0.50\text{ kg})(4180\text{ J/kg·°C})}$$

$$= 16°C$$

Substitute $m_A = 0.040$ kg, $C_A = 388$ J/kg·°C, $T_A = 115°C$, $m_B = 0.50$ kg, $C_B = 4180$ J/kg·°C, $T_B = 15°C$

PRACTICE Problems

- Additional Problems, Appendix B
- Solutions to Selected Problems, Appendix C

6. A 2.00×10^2-g sample of water at 80.0°C is mixed with 2.00×10^2 g of water at 10.0°C. Assume that there is no heat loss to the surroundings. What is the final temperature of the mixture?

7. A 4.00×10^2-g sample of methanol at 16.0°C is mixed with 4.00×10^2 g of water at 85.0°C. Assume that there is no heat loss to the surroundings. What is the final temperature of the mixture?

8. Three metal fishing weights, each with a mass of 1.00×10^2 g and at a temperature of 100.0°C, are placed in 1.00×10^2 g of water at 35.0°C. The final temperature of the mixture is 45.0°C. What is the specific heat of the metal in the weights?

9. A 1.00×10^2-g aluminum block at 100.0°C is placed in 1.00×10^2 g of water at 10.0°C. The final temperature of the mixture is 25.0°C. What is the specific heat of the aluminum?