P 130

2. *a)* From the blue toward the yellow.

   b) The blue cup because it contains the most heat.

3. *a)* Thermal energy derived from gasoline combustion. The heat from the motor is released into the environment outside the car. The temperature of the car decreases while the outside temperature close to the car increases slightly.

   b) The Sun emits radiation and thermal energy. It is gradually transmitted to the inside of the car, where the temperature increases.

   c) The water heater contains electric elements (electric potential energy) at a high temperature that transmit heat to the water in the heater, causing the water temperature to increase. The electric elements only cool when the electric current is turned off, otherwise they always receive energy and remain practically stable.

P 133

1. *a)* Beaker, water and acid: all open systems.

   b) Six bottles of soft drinks: six closed systems. Box: open system.

   c) A hot water bottle full of water: closed system.

   d) A cylinder filled with nitrogen: isolated system.

   e) A neon tube: closed system.

   f) A reaction vessel filled with gas: closed system. Calorimeter: isolated system.

P 137

1. *1. Calculation of the temperature change:*

$$\Delta T = T_f - T_i$$
$$= -5°C - (-2)°C$$
$$= -3°C$$

2. Calculation of the thermal energy:

$$Q = mc\Delta T$$
$$= 500\ g \cdot 0.74\ J/(g \cdot °C) \times -3°C$$
$$= 1110\ J$$

Answer: 1110 J of energy is transferred from the ice cream to the air in the freezer and to the outside in the form of heat.

2. *1. Calculation of the temperature change:*

$$\Delta T = T_f - T_i$$
$$= -10°C - 35°C$$
$$= -45°C$$

2. Calculation of the thermal energy:

$$Q = mc\Delta T$$
$$= 2.35\ g \cdot 0.385\ J/(g \cdot °C) \times -45°C$$
$$= -40.714\ J$$

Answer: The amount of heat released by the piece of copper is 41 J.

3. $Q = mc\Delta T$

$$m = \frac{Q}{c\Delta T}$$
$$= \frac{6000\ J}{1.09\ J/(g \cdot °C) \cdot 10°C}$$
$$= 550.46\ g$$

Answer: 550 g of gypsum.

4. $Q = mc\Delta T$

$$c = \frac{Q}{m\Delta T}$$
$$= \frac{45\ J}{1.35\ g \cdot 10°C}$$
$$= 3.3\ J/(g \cdot °C)$$

Answer: Its specific heat capacity is 3.3 J/(g · °C).

5. *1. Calculation of the temperature change:*

$$Q = mc\Delta T$$
$$\Delta T = \frac{Q}{mc}$$
$$= \frac{9690\ J}{2500\ g \cdot 1.76\ J/(g \cdot °C)} = 2.2°C$$

2. Calculation of the final temperature:

$$T_f = T_i + \Delta T$$
$$= 22.2°C + 2.2°C = 24.4°C$$

Answer: The final temperature of the plank of wood will be 24.4°C.

6. *1. Calculation of the temperature change:*

$$Q = mc\Delta T$$

$$\Delta T = \frac{Q}{mc}$$

$$= \frac{50\ \cancel{J}}{5.5\ \cancel{g} \cdot 0.24\ \cancel{J}/(\cancel{g}\cdot°C)} = 37.9°C$$

2. Calculation of the initial temperature:

$$T_i = T_f - \Delta T$$

$$= 45°C - 37.9°C = 7.1°C$$

Answer: The initial temperature of the ring was 7°C.

8. $Q = mc\Delta T$

$$m = \frac{Q}{c\Delta T}$$

$$= \frac{0.02\ \cancel{J}}{0.1395\ \cancel{J}/(g\cdot\cancel{°C}) \cdot 100\cancel{°C}} = 1.43 \times 10^{-3}\ g$$

Answer: 1×10^{-3} g of mercury (Hg) should be used.

10. *1. Calculation of the temperature change:*

$$\Delta T = T_f - T_i$$

$$= 23.3°C - 20°C = 3.3°C$$

2. Calculation of the specific heat capacity:

$$Q = mc\Delta T$$

$$c = \frac{Q}{m\Delta T}$$

$$= \frac{92.3\ J}{12.50\ g \cdot 3.3°C} = 2.238\ J/(g\cdot°C)$$

Answer: Of the three substances mentioned, it is most likely that it would be the antifreeze, since the specific heat capacity is the closest to the value obtained.

13. *a) 1. Calculation of the temperature change:*

$$\Delta T = T_f - T_i$$

$$= 85.0°C - 24.5°C = 60.5°C$$

2. Calculation of the specific heat capacity:

$$Q = mc\Delta T$$

$$c = \frac{Q}{m\Delta T}$$

$$= \frac{343\ J}{23.9\ g \cdot 60.5°C} = 0.237\ J/(g\cdot°C)$$

Answer: The specific heat capacity of solid silver is 0.237 J/(g·°C).

b) Calculation of the temperature change:

$$Q = mc\Delta T$$

$$\Delta T = \frac{Q}{mc}$$

$$= \frac{343\ \cancel{J}}{23.9\ \cancel{g} \cdot 4.184\ \cancel{J}/(\cancel{g}\cdot°C)} = 3.43°C$$

Answer: The temperature change of the water is 3.43°C.