

## 17.1

THE FLOW OF ENERGY—  
HEAT AND WORK

## Section Review

## Objectives

- Explain the relationship between energy, heat, and work
- Distinguish between exothermic and endothermic processes
- Distinguish between heat capacity and specific heat

## Vocabulary

- |                             |                                 |                      |
|-----------------------------|---------------------------------|----------------------|
| • thermochemistry           | • surroundings                  | • exothermic process |
| • chemical potential energy | • law of conservation of energy | • heat capacity      |
| • heat                      | • endothermic process           | • specific heat      |
| • system                    |                                 |                      |

## Key Equations and Relationships

- 1 Calorie = 1 kilocalorie = 1000 calories
- 1 J = 0.2390 cal and 4.184 J = 1 cal
- $C = \frac{q}{m \times \Delta T} = \frac{\text{heat (joules or calories)}}{\text{mass (g)} \times \text{change in temperature (}^{\circ}\text{C)}}$

## Part A Completion

Use this completion exercise to check your understanding of the concepts and terms that are introduced in this section. Each blank can be completed with a term, short phrase, or number.

- The energy that flows from a warm object to a cool object is called 1. The energy stored within the structural units of chemical substances is called chemical 2. The study of heat transfer during chemical reactions and changes of state is called 3. One of the units used to measure heat flow is the 4, defined as the amount of heat needed to raise 1 g of water 1°C. The SI unit of heat and energy is the 5, which is equal to 0.2390 cal. The 6 of a substance is the amount of heat it takes to change the temperature of 1 g of the substance 1°C. Substances like 7, with low heat capacities, take a shorter time to heat up than substances with high heat capacities, such as 8.
1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_

## Part B True-False

Classify each of these statements as always true, AT; sometimes true, ST; or never true, NT.

- \_\_\_\_\_ 9. The joule is the SI unit of force.
- \_\_\_\_\_ 10. Endothermic processes absorb heat from the surroundings.
- \_\_\_\_\_ 11. The law of conservation of energy states that in a chemical process, energy is sometimes created and sometimes destroyed.
- \_\_\_\_\_ 12. A system that loses heat to its surrounding is said to be exothermic, and the value of  $q$  is negative.
- \_\_\_\_\_ 13. A calorie is defined as the quantity of heat needed to raise the temperature of 1 gram of pure water 1°C.

## Part C Matching

Match each description in Column B to the correct term in Column A.

### Column A

- \_\_\_\_\_ 14. heat
- \_\_\_\_\_ 15. exothermic process
- \_\_\_\_\_ 16. heat capacity
- \_\_\_\_\_ 17. system
- \_\_\_\_\_ 18. endothermic process

### Column B

- a. a process that absorbs heat from the surroundings
- b. the amount of heat required to change the temperature of an object by exactly 1°C
- c. energy that transfers from one object to another because of a temperature difference between them
- d. the part of the universe being studied
- e. a process that loses heat to the surroundings

## Part D Questions and Problems

Answer the following in the space provided.

19. Distinguish among the various forms of energy: chemical potential energy, work, and heat.

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20. The temperature of a piece of unknown metal with a mass of 18.0 g increases from 25.0°C to 40°C when the metal absorbs 124.2 J of heat. What is the specific heat of the unknown metal? Compare your answer to the values listed in Table 17.2 of your textbook. What is the identity of the unknown metal?