

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

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.

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?