- 1. How is the concept of *energy* defined? There is no heat in an insulated system at a constant temperature of 400.°C. Explain.
- 2. As a ball rolls down a hill _____ energy decreases, _____ energy increases, and _____ energy remains the same. Explain how Figure 10.1 shows the law of conservation of energy.
- 3. What is meant by the term *state function*? Provide an example. Why isn't heat a state function? What does *temperature* measure?
- 4. Explain what is meant by the terms exothermic and endothermic. At the end of Section 10.3, an exothermic reaction is explained. Write an analogous explanation of an endothermic reaction.
- 5. Define the terms system and surroundings. You start a fire in a fireplace by striking a match and lighting crumpled paper under some logs. Explain all of the energy transitions in this scenario using the terms exothermic, endothermic, system, surroundings, potential energy, and *kinetic energy* in the discussion.
- 6. What are some common *units* of energy and how are these units defined?
- 7. For each of the following amounts of energy, perform the indicated conversion of units.
 - a. 459 J to calories

d. 7031 cal to kilojoules

- b. 55.31 kJ to ioules
- c. 84.1 kJ to kilocalories

- e. 78.3 kcal to kiloioules
- f. 4541 cal to kilocalories
- 8. Calculate ΔE for each of the following cases.
 - a. q = 34 J, w = -22 J
 - b. q = -28 J, w = -23 cal
 - c. q = -15 J, w = +12 J
 - d. A system releases 23 J of heat while 12 J of work is done on it.
 - e. 14 J of work is done on a system and 5.0 calories of heat are released.
 - f. A system absorbs 87 J of heat and performs 32 J of work.
- 9. For an endothermic process, q is reported with a ______ sign, and for an exothermic process, q is reported with a _____ sign.
- 10. What is meant by the *specific heat capacity* of a material? How is specific heat capacity used to calculate the energy change when a substance is heated?
- 11. Calculate the mass (in grams) of each of the following substances that could be warmed over the indicated temperature range by application of exactly 1.0 kJ of energy.
 - a. water, from 15°C to 42°C

d. gold, from 56°F to 74°F

- b. iron, from 25°C to 125°C
- c. carbon, from -10°C to 47°C

- e. silver, from 289 K to 385 K
- f. aluminum, from -10°C to 85.0°F
- 12. You heat a 5.00 g sample of iron in a boiling water bath. You then quickly and carefully place the iron into 125.0 mL of water at 25.0°C in a coffee cup calorimeter. Determine the final temperature of the water and explain all assumptions.

Sections Review 10.1-10.3

- 1. Your text defines energy as "the ability to do work or to produce heat". Another definition of energy is "the ability to resist a natural tendency". Explain this definition and provide an example.
- 2. Look at Figure 10.1 in your text. Ball A has stopped moving. However, energy must be conserved. So what happened to the energy of Ball A?
- 3. A friend of yours reads that the process of water freezing is exothermic. This friend tells you that this can't be true because exothermic implies "hot", and ice is cold. Is the process of water freezing exothermic? If so, explain it so your friend can understand it. If not, explain why not.
- 4. The text uses distance traveled and change in elevation to discuss the idea of a state function. Explain which of these is a state function and which is not.
- 5. You place hot metal into a beaker of cold water. Answer the following.
 - a. Eventually what is true about the temperature of the metal compared to that of the water? Explain why this is true.
 - b. Label this process as endothermic or exothermic if we consider the system to be the metal. Explain. the water. Explain.

Sections Review 10.4-10.5

- 1. The text describes the law of conservation of energy (first law of thermodynamics). Is there a law of conservation of heat? Explain why or why not.
- 2. The internal energy of a system is said to be the sum of the kinetic and potential energies of all the particles in the system. The text discusses "potential energy" and "kinetic energy" in terms of a ball on a hill is Section 10.1. Explain "potential energy" and "kinetic energy" for a chemical reaction.
- 3. What does it mean when the heat for a process is reported with a negative sign?
- 4. You place 100.0 g of a hot metal in 100.0 g of cold water. Which substance (metal or water) undergoes a larger temperature change? Why is this?