1. Think of an example of an environmental problem not mentioned in this chapter that a good knowledge of chemistry might help us solve. How could chemistry help us address the problem?
2. Think about the ways we harness and use energy sources in our society—both renewable sources such as geothermal energy and nonrenewable sources such as coal, oil, and natural gas. What implications does the first law of thermodynamics have for our energy usage? How is the second law of thermodynamics relevant to our use of energy?
3. Referring to the chemical reactions for photosynthesis and respiration, provide an argument for why increasing amounts of carbon dioxide in the atmosphere due to global climate change (Chapter 18) might potentially increase amounts of oxygen in the atmosphere. Now give an argument for why it might potentially decrease amounts of atmospheric oxygen. What would you need to know to determine which of these two outcomes might occur?
4. Describe how plate tectonics accounts for the formation of (a) mountains, (b) volcanoes, and (c) earthquakes. Why do you think it took so long for scientists to discover an environmental system of such fundamental importance as plate tectonics?
5. For each of the following natural hazards, describe one thing that can be done to minimize or mitigate their impacts on our lives and property:
   - Earthquakes
   - Landslides
   - Flooding
6. **THINK IT THROUGH** You live in a community just outside a national park famous for its geysers, and you sit on the board of your regional electric utility. The utility is considering drilling for heated underground water and steam and constructing a geothermal power plant in your town. Many of your fellow citizens are enthusiastic about the idea of clean renewable energy. However, some fear that the project could deplete the steam reservoirs that power the geysers and bring visitors to the national park. Others fear that earthquakes may be caused. Others worry that salts in the underground water could corrode pipes and render the plant unworkable. As a member of the utility board, what specific information would you insist on obtaining from geologists and other scientists before you cast your vote on the project? What assurances from scientific research would you feel you need before voting in favor of the project?

CALCULATING ECOLOGICAL FOOTPRINTS

In ecological systems, a rough rule of thumb is that when energy is transferred from plants to plant-eaters or from prey to predator, the efficiency is only about 10% (p. 85). Much of this inefficiency is a consequence of the second law of thermodynamics. Another way to think of this is that eating 1 Calorie of meat from an animal is the ecological equivalent of eating 10 Calories of plant material.

Humans are considered omnivores because we can eat both plants and animals. The choices we make about what to eat have significant ecological consequences. With this in mind, calculate the ecological energy requirements for four different diets, each of which provides a total of 2,000 dietary Calories per day.

Diet	Source of Calories	Number of Calories consumed	Ecologically equivalent Calories	Total ecologically equivalent Calories
100% plant	Plant			
0% animal	Animal			
90% plant	Plant	1,800	1,800	3,800
10% animal	Animal	200	2,000	
50% plant	Plant			
50% animal	Animal			
0% plant	Plant			
100% animal	Animal			

1. How many ecologically equivalent Calories would it take to support you for a year, for each of the four diets listed?
2. How does the ecological impact from a diet consisting strictly of animal products (e.g., milk, other dairy products, eggs, and meat) compare with that of a strictly vegetarian diet? How many additional ecologically equivalent Calories do you consume each day by including as little as 10% of your Calories from animal sources?
3. What percentages of the Calories in your own diet do you think come from plant versus animal sources? Estimate the ecological impact of your diet, relative to a strictly vegetarian one.
4. Describe some challenges of providing food for the growing human population, especially as people in many poorer nations develop a taste for an American style diet rich in animal protein and fat.