PART II

SCIENCE AND ECOLOGICAL PRINCIPLES

CHAPTER 3

SCIENCE, SYSTEMS, MATTER, AND ENERGY

Summary

1. Science is an attempt to discover the natural world's orderly patterns. Scientists ask a question or identify a problem to investigate, and then they collect scientific data through observation and measurement. Frontier science includes unconfirmed scientific results, and the results of consensus science have been tested thoroughly and are generally accepted.

2. Experiments are often used to study specific phenomena. Mathematical models are useful when there are many interacting variables, and when it is not feasible to carry out controlled experiments.

3. In synergistic interactions, the combined effects of a process, or a reaction, are greater than the sum of the separate effects.

4. The basic forms of matter are elements and compounds. Matter is useful to us as a resource because it makes up every material substance. The major forms of energy are kinetic energy and potential energy. Energy is useful to us as a resource because it moves matter.

5. The law of conservation of matter states that matter is neither created nor destroyed when a physical or chemical change occurs. The first law of thermodynamics states that in all physical and chemical changes, energy may be converted from one form to another, but it is neither created nor destroyed. The second law of thermodynamics states that when energy is changed from one form to another, there is always less usable energy left. These laws show that energy goes from a more useful to a less useful form and that high-quality energy cannot be recycled. This means that the quality, as well as the quantity, of our resources and environment, are being reduced.

6. Matter can undergo three types of nuclear changes: natural radioactive decay, nuclear fission, and nuclear fusion.

7. High-throughput (high-waste) economies are found in advanced industrialized countries. We need to shift to more sustainable low-throughput (low-waste) economies.

