**LESSON 1  Our Island, Earth**

- Environmental scientists study how the natural world works, and how humans and the environment affect each other. Environmentalism, on the other hand, is a social movement dedicated to protecting the natural world from negative human influences.
- In the last several hundred years, both human population and natural resource consumption have risen dramatically.
- A natural resource is any material or energy source provided by nature that humans need to survive.

**environment (4) environmental science (5) environmentalism (6) natural resource (6) renewable natural resources (7) nonrenewable natural resources (7) sustainable (7) fossil fuel (8) ecological footprint (9)**

**LESSON 2  The Nature of Science**

- Science is both an organized and methodical way of studying the natural world and the body of knowledge gained from such studies.
- The process of science involves making observations, asking questions, developing hypotheses, making and testing predictions, and analyzing and interpreting results—often many times and in many changing orders.
- Experiments and observational studies involve variables. Independent variables are manipulated by a scientist. Dependent variables depend on the conditions of the experiment or study. Controlled variables are kept constant. Controlled studies and experiments involve only one manipulated variable—all other variables are held constant.

**hypothesis (15) prediction (16) independent variable (17) dependent variable (17) controlled study (18) data (19)**

**LESSON 3  The Community of Science**

- The scientific community, through peer review and replication, helps to verify the accuracy of results and contributes to the establishment of scientific theories.
- Environmental ethics explores how environmental science interacts with, and is guided by, a society’s morals and principles.
- There are three important ethical standards involved in environmental ethics: anthropocentrism, biocentrism, and ecocentrism. Anthropocentrism is a human-centered view of the world in which humans and human welfare are given the highest value. Biocentrism gives value to all living things equally. Ecocentrism assigns less value to individual organisms than to whole populations, species, communities, and ecosystems.

**peer review (22) theory (23) ethics (24) environmental ethics (25)**

**INQUIRY LABS AND ACTIVITIES**

- **Modeling Finite Resources**
  How does the “tragedy of the commons” really work? See it in action by simulating fishing in a shared lake.

- **Green vs. Conventional Cleaners**
  Can homemade, environmentally friendly cleaners work as well as toxic ones? Design an experiment to find out.

- **Local Research Studies**
  What current environmental studies are happening near you? Find out how, where, and why one local study is being conducted.
An Introduction to Environmental Science

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The Central Case in this chapter explored how science led to the discovery of how certain chemicals were affecting the ozone layer. Use examples from the Central Case to illustrate how science often relies not merely on individuals, but on the entire scientific community and beyond to achieve its goals.

Make Your Case

6. Experiments or observational studies in which only one variable is manipulated are described as
   a. controlled.  c. dependent.
   b. observed.  d. independent.

7. The branch of philosophy that deals with good, bad, right, and wrong is called
   a. logic.  c. science.
   b. ethics.  d. culture.

8. Which of the following is the primary difference between a theory and a hypothesis?
   a. A theory deals only with the natural world, a hypothesis does not.
   b. A theory is tested, a hypothesis is not.
   c. A theory is not tested, a hypothesis is.
   d. A theory is broader than a hypothesis, dealing with a wider range of situations and observations.

9. The variable a scientist manipulates in an experiment is called the
   a. controlled variable.
   b. observation variable.
   c. dependent variable.
   d. independent variable.

Modified True/False

Write true if the statement is true. If it is false, change the underlined word or words to make the statement true.

10. Environmentalism is the study of how the natural world works, how our environment affects us, and how we affect our environment.

11. At the start of the Industrial Revolution, about 10,000 years ago, humans began planting crops and domesticating animals.

12. Independent variables depend on experimental conditions.

13. The process by which the scientific community examines a paper before its publication is called peer review.

14. Anthropocentrism describes a worldview in which all components of an ecosystem have value.

Review Concepts and Terms

1. The environment contains
   a. living things only.
   b. nonliving things only.
   c. both living and nonliving things.
   d. only artificial things.

2. Which of the following is NOT an example of a natural resource?
   a. coal  c. timber
   b. sunlight  d. plastic

3. Which of the following is ALWAYS a nonrenewable natural resource?
   a. wind  c. oil
   b. fresh water  d. soil

4. “A testable idea that attempts to explain a phenomenon or answer a scientific question” is the definition of a (an)
   a. prediction.
   b. hypothesis.
   c. theory.
   d. experiment.

5. Which of the following phrases is missing below?

   a. supports hypothesis
   b. proves hypothesis
   c. refutes hypothesis
   d. disproves hypothesis

6. Predicted results/observations ≠ Actual results/observations

   a. supports hypothesis
   b. proves hypothesis
   c. refutes hypothesis
   d. disproves hypothesis

ANSWERS

Chapter Assessment

For answers to the Chapter Assessment, see page A–1 at the back of the book.
Chapter 3: Assessment

Reading Comprehension

Read the following selection and answer the questions that follow.

There is historical evidence that civilizations can crumble when pressures from population and consumption overwhelm resource availability. Indeed, many great civilizations have fallen after depleting resources from their environments, and each has left devastated landscapes in its wake. Plato wrote of the deforestation and environmental degradation accompanying ancient Greek cities, for example. Archaeologists, historians, and paleoecologists study past societies and landscapes and have accumulated evidence of environmental collapse, from the Greek and Roman empires to the Maya, the Anasazi, and other civilizations of the New World. Scientist and author Jared Diamond in his 2005 book, *Collapse*, formulated sets of reasons why civilizations succeed and persist, or fail and collapse. Success and persistence, it turns out, depend largely on how societies interact with their environments.

15. From the passage, it is possible to infer that the Anasazi were an ancient civilization that
   a. collapsed after the Greek Empire.
   b. lived in the New World.
   c. were part of the Roman Empire.
   d. persisted and live in the New World today.

16. Which of the following would be the BEST title for this passage?
   b. “Paleoecology Today”
   c. “The Danger of Depleting Resources”
   d. “Plato’s Warning”

17. Which of the following is a synonym (word with a similar definition) for the word *degradation*, used in line 8 of the passage?
   a. health
   b. ruin
   c. gradation
   d. evaluation

Short Answer

18. What is “the tragedy of the commons”?
19. Who was Thomas Malthus, and what did he suggest about human population growth?
20. What does it mean to use a resource sustainably?
21. Why do scientists use models?
22. Sometimes variables are described as “manipulated” and “responding.” Which do you think is the alternative name for the independent variable? Explain.
23. What is the environmental justice movement?

Critical Thinking

24. Compare and Contrast Briefly explain the Agricultural and Industrial revolutions and how they affected the human population.
25. Classify Classify each of the following natural resources as renewable, nonrenewable, or "in between": (a) wave energy, (b) oil, (c) soil, (d) sunlight, (e) fresh water, and (f) timber. Explain what it means to be an “in between” resource.
26. Compare and Contrast What are the similarities and differences between experiments and observational studies?
27. Apply Concepts Why do scientists try to control most variables in an experiment or observational study?
28. Evaluate A scientist repeats an experiment ten times. Nine out of ten times, the results support her predictions. She thinks she knows what caused the one trial to produce the unexpected result. Should she report all of the results in her paper, or just the nine that supported her hypothesis? Explain your reasoning.
29. Explain What does it mean that science is “self-correcting”?
30. Relate Cause and Effect What is a worldview, and what impact does it have on science?
Mathis Wackernagel and his colleagues at the Global Footprint Network reported in 2006 that the average person has an ecological footprint of about 2.23 hectares (5.4 acres). That means that each person on Earth, on average, requires 2.23 hectares of functioning ecosystem to recycle wastes and produce the energy and resources required to live. The ecological footprints of several nations are shown in the table.

1. Which nation included in the table has an ecological footprint closest to the world’s average? Which nation has the smallest footprint? Which nation has the largest footprint?

2. Why do you think that there is such a large difference in footprint size between the nation with greatest footprint and the nation with the smallest footprint?

3. In 2005, Wackernagel estimated that there are about 1.8 hectares (4.4 acres) available to each person in the world, but the average footprint is 2.23 hectares. By these calculations, by about what percentage are we “overshooting” the resources available to us?

### Ecological Footprints

<table>
<thead>
<tr>
<th>Nation</th>
<th>Ecological Footprint (hectares per person)</th>
<th>Proportion Relative to World Average Footprint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Colombia</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>Mexico</td>
<td>2.6</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>6.1</td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>1.4</td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>9.6</td>
<td></td>
</tr>
</tbody>
</table>


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31. **Interpret Graphs** What impression does Graph A give about population change over the 900 generations shown? What impression does Graph B give?

32. **Apply Concepts** Describe a situation in which you would use Graph A. Describe a situation in which you would use Graph B.

### Write About It

33. **Creative Writing** There are many misconceptions about what science is. To help address them, create a full-page ad called “This Is Science.” Use images, words, or a combination of images and words to accurately describe what science is and is not.

34. **Apply the BIG QUESTION** Science almost always starts with observations and asking questions. In this way, nearly every person participates in the process of science every day. Think of three observations you have made or questions you have asked recently. Write them down and then briefly describe a way you might investigate each further. Remember, to be science, these observations and questions need to be about the natural world.