

**Chapter 3 The Biosphere**

**Section 3–1 What Is Ecology? (pages 63–65)**

*This section identifies the different levels of organization that ecologists study. It also describes methods used to study ecology.*

**Interactions and Interdependence (page 63)**

1. What is ecology? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
2. What does the biosphere contain? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**Levels of Organization (page 64)**

3. Why do ecologists ask questions about events and organisms that range in complexity from an individual to the biosphere? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
4. Complete the table about levels of organization.

**LEVELS OF ORGANIZATION**

| Level     | Definition   |
|-----------|--|
| Species   |  |
|           | A group of individuals that belong to the same species and live in the same area |
| Community |  |
| Ecosystem |  |
|           | A group of ecosystems that have the same climate and dominant communities        |

5. What is the highest level of organization that ecologists study? \_\_\_\_\_

\_\_\_\_\_

**Ecological Methods** (page 65)

6. What are the three basic approaches scientists use to conduct modern ecological research?

a. \_\_\_\_\_ b. \_\_\_\_\_ c. \_\_\_\_\_

7. Why might an ecologist set up an artificial environment in a laboratory?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

8. Why are many ecological phenomena difficult to study? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

9. Why do ecologists make models? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

10. Is the following sentence true or false? An ecological model may consist of a mathematical formula. \_\_\_\_\_

## Section 3–2 Energy Flow (pages 67–73)

*This section explains where the energy for life processes comes from. It also describes how energy flows through living systems and how efficient the transfer of energy is among organisms in an ecosystem.*

### Introduction (page 67)

1. What is at the core of every organism’s interaction with the environment?

\_\_\_\_\_

### Producers (pages 67–68)

2. What source of energy do organisms use that don’t use the sun’s energy?

\_\_\_\_\_

3. What are autotrophs? \_\_\_\_\_

\_\_\_\_\_

4. Why are autotrophs also called producers? \_\_\_\_\_

5. What do autotrophs do during photosynthesis? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

6. For each of the following, write which kind of autotroph is the main producer.

a. Land: \_\_\_\_\_

b. Upper layers of ocean: \_\_\_\_\_

c. Tidal flats and salt marshes: \_\_\_\_\_

7. What is chemosynthesis? \_\_\_\_\_

\_\_\_\_\_

8. Where do bacteria that carry out chemosynthesis live? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### Consumers (pages 68–69)

9. Heterotrophs are also called \_\_\_\_\_.

10. Plant and animal remains and other dead matter are collectively called

\_\_\_\_\_.

11. Complete the table about types of heterotrophs.

**TYPES OF HETEROTROPHS**

| Type        | Definition                    | Examples            |
|-------------|-------------------------------|---------------------|
| Herbivore   |                               | Cows, rabbits       |
|             | Heterotroph that eats animals |                     |
| Omnivore    |                               | Humans, bears, crow |
| Detritivore |                               |                     |
| Decomposer  |                               |                     |

**Feeding Relationships (pages 69–71)**

12. How does energy flow through an ecosystem? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

13. Complete the table about feeding relationships.

**FEEDING RELATIONSHIPS**

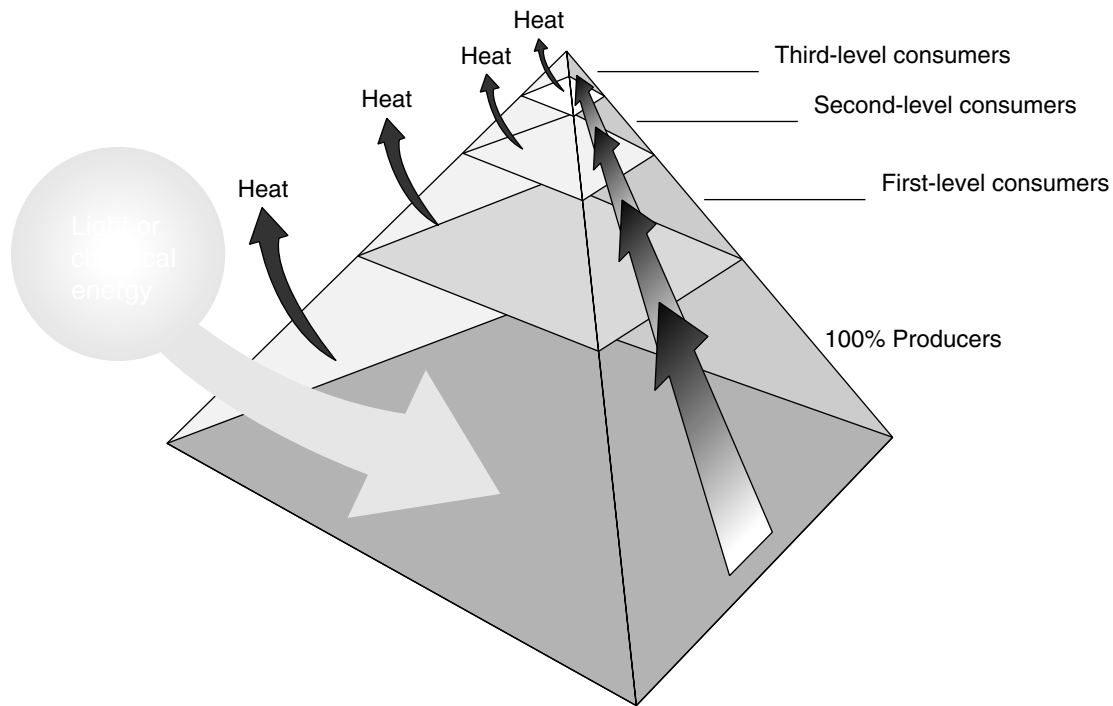
| Relationship | Description |
|--------------|-------------|
| Food Chain   |             |
| Food Web     |             |

14. What does a food web link together? \_\_\_\_\_  
 15. What is a trophic level? \_\_\_\_\_  
 16. In a food web, what organisms make up the first trophic level? \_\_\_\_\_  
 17. What does a consumer in a food chain depend on for energy? \_\_\_\_\_  
 \_\_\_\_\_

**Ecological Pyramids (pages 72–73)**

18. What is an ecological pyramid? \_\_\_\_\_  
 \_\_\_\_\_  
 19. Why is it that only part of the energy stored in one trophic level is passed on to the next level? \_\_\_\_\_  
 \_\_\_\_\_

20. Complete the energy pyramid by writing the source of the energy for the food web and how much energy is available to first-, second-, and third-level consumers.



- 21. What is biomass? \_\_\_\_\_  
\_\_\_\_\_
- 22. What does a biomass pyramid represent? \_\_\_\_\_  
\_\_\_\_\_
- 23. What does a pyramid of numbers show? \_\_\_\_\_  
\_\_\_\_\_
- 24. Why can each trophic level support only about one tenth the amount of living tissue as the level below it? \_\_\_\_\_  
\_\_\_\_\_

**Reading Skill Practice**

When you read about complex topics, writing an outline can help you organize and understand the material. Outline Section 3-2 by using the headings and subheadings as topics and subtopics and then writing the most important details under each topic. Do your work on a separate sheet of paper.

## Section 3–3 Cycles of Matter (pages 74–80)

*This section describes how matter cycles among the living and nonliving parts of an ecosystem. It also explains how nutrients are important in living systems.*

### Introduction (page 74)

1. What are the four elements that make up over 95 percent of the body in most organisms? \_\_\_\_\_

### Recycling in the Biosphere (page 74)

2. How is the movement of matter through the biosphere different from the flow of energy? \_\_\_\_\_  
\_\_\_\_\_
3. Matter moves through an ecosystem in \_\_\_\_\_.
4. What do biogeochemical cycles connect? \_\_\_\_\_  
\_\_\_\_\_

### The Water Cycle (page 75)

5. Water can enter the atmosphere by evaporating from the leaves of plants in the process of \_\_\_\_\_.
6. Circle the letter of each process involved in the water cycle.  
a. precipitation   b. evaporation   c. runoff   d. fertilization

### Nutrient Cycles (pages 76–79)

7. What are nutrients? \_\_\_\_\_  
\_\_\_\_\_
8. What are the three nutrient cycles that play especially prominent roles in the biosphere?
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
9. Why is carbon especially important to living systems? \_\_\_\_\_  
\_\_\_\_\_
10. What are three large reservoirs where carbon is found in the biosphere?
  - a. As carbon dioxide gas in the \_\_\_\_\_
  - b. As dissolved carbon dioxide in the \_\_\_\_\_
  - c. As coal, petroleum, and calcium carbonate rock found \_\_\_\_\_
11. In what process do plants use carbon dioxide? \_\_\_\_\_

12. Why do all organisms require nitrogen? \_\_\_\_\_

13. Complete the table about the kinds of processes involved in the carbon cycle.

**KINDS OF PROCESSES IN THE CARBON CYCLE**

| Kind                           | Examples  |
|--------------------------------|---|
| Biological processes           |   |
|                                | Release of CO <sub>2</sub> to the atmosphere by volcanoes |
| Mixed biogeochemical processes |   |
| Human activity                 |   |

14. What is the main reservoir of nitrogen in the biosphere? \_\_\_\_\_

15. What is nitrogen fixation? \_\_\_\_\_

16. What is denitrification? \_\_\_\_\_

17. What role does denitrification play in the nitrogen cycle? \_\_\_\_\_

18. Circle the letter of each sentence that is true about the phosphorus cycle.

- a. Phosphate is released as rocks and sediments wear down.
- b. Plants absorb phosphate from the soil or from water.
- c. Phosphorus is abundant in the atmosphere.
- d. Organic phosphate cannot move through food webs.

19. Why is phosphorus essential to living things? \_\_\_\_\_

**Nutrient Limitation (page 80)**

20. What is the primary productivity of an ecosystem? \_\_\_\_\_

21. If a nutrient is in short supply in an ecosystem, how will it affect an organism?

22. When is a substance called a limiting nutrient? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
23. In the ocean and other saltwater environments, what is often the limiting factor?  
\_\_\_\_\_
24. What is the typical limiting factor in streams, lakes, and freshwater environments?  
\_\_\_\_\_
25. When an aquatic ecosystem receives a large input of a limiting nutrient, what is often the result, and what is this result called? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
26. Why do blooms occur? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### WordWise

Complete the sentences by using one of the scrambled words below.

dcreuorps  
mtssyceoe

meiob  
ythnssieoemhcs

aieoeoibgchmcl yeccl  
ttnreiu

The process by which organisms use chemical energy to produce carbohydrates is \_\_\_\_\_.

A collection of all the organisms that live in a particular place, together with their physical environment, is a(an) \_\_\_\_\_.

A chemical substance that an organism requires to live is a(an) \_\_\_\_\_.

Autotrophs, which make their own food, are also called \_\_\_\_\_.

A group of ecosystems that have the same climate and dominant communities is a(an) \_\_\_\_\_.

A process in which elements, chemical compounds, or other forms of matter are passed from one organism to another and from one part of the biosphere to another is a(an) \_\_\_\_\_.