Name _____ **Period** _____

Chapter 55: Ecosystems and Restoration Ecology

Remember this: Energy flows, and chemicals cycle! For most ecosystems, energy comes from the sun, and is lost at every conversion. Productivity is an important topic to study. Be sure you have a firm grasp on photosynthesis and cellular respiration and understand energy flow through an ecosystem. The final concept is important for its look at human impact on ecosystems and how ecological damage is being remediated.

Overview

1. What is an *ecosystem*?

2. Where does energy enter most ecosystems? How is it converted to chemical energy and then passed through the ecosystem? How is it lost? Remember this: *Energy cannot be recycled.*

3. Besides the energy flow that you described in question 2, chemicals such as carbon and nitrogen *cycle* through ecosystems. So energy _____ through an ecosystem and matter _____.

4. It seems amazing, but how did the introduction of foxes onto arctic islands convert grassland to tundra?

***Concept 55.1** Physical laws govern energy flow and chemical cycling in ecosystems*

5. Both energy and matter can be neither _____ nor _____.

6. We can measure the efficiency of energy conversion in an ecosystem, as well as whether a given nutrient is being gained or lost from an ecosystem. Let us take a second look at *trophic levels.* What trophic level supports all others?

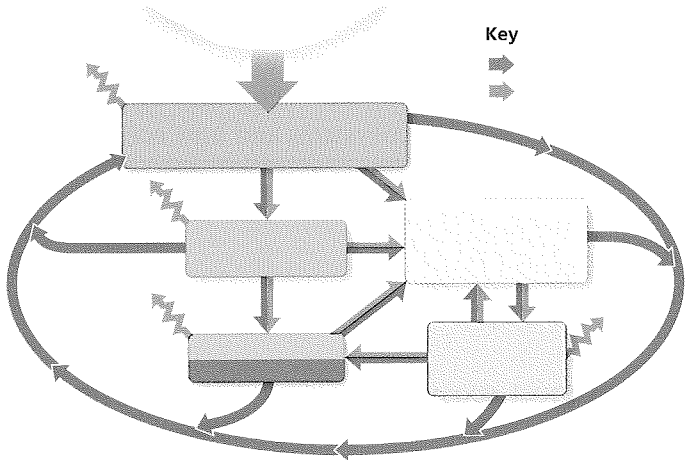
7. List three groups of organisms that are *photosynthetic autotrophs.*

8. This concept reviews trophic relationships. Know all terms in your textbook that are bolded. What are *trophic levels*? What is always at the first trophic level?

9. What are *detritivores*? What is their importance in chemical cycling?

10. What are the two main categories of detritivores?

11. To reemphasize the idea that energy flows through ecosystems whereas nutrients cycle, label the following figure.



***Concept 55.2** Energy and other limiting factors control primary production in ecosystems*

12. What is *primary production*? Distinguish between *gross primary production* and *net primary production*.

13. Write an equation here that shows the relationship between gross and net primary production.

14. You may recall from Chapter 54 that *biomass* is the total mass of all individuals in a trophic level. Another way of defining net primary production is the amount of *new* biomass added in a given period of time. Why is net primary production, or the amount of new biomass/unit of time, the key measurement to ecologists?

15. Which ecosystem would tend to have a greater biomass/unit area, a prairie or a tropical rain forest? Explain.

16. Net primary productivity is the amount of new biomass/unit of time, and is the result of photosynthesis. To understand what can affect productivity, begin by writing the summary equation for photosynthesis.

17. As you look at the equation for photosynthesis, note that you could measure the rate of photosynthesis, and therefore indirectly productivity, in several ways. List them here.

18. What are some factors that limit primary productivity in aquatic ecosystems?

19. What is a *limiting nutrient*? What is the limiting nutrient off the shore of Long Island, New York? What is the limiting nutrient in the Sargasso Sea? Note that the limiting nutrient is always the one that, when added, results in increased productivity.

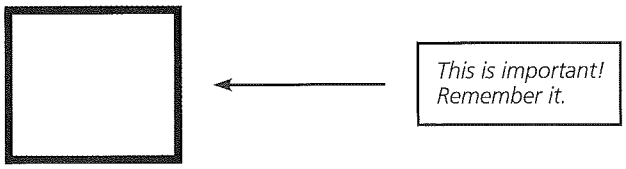
20. Phytoplankton growth can often be increased by additional nitrates and phosphates. What are common sources of each of these?

21. What is *eutrophication*? What are factors that contribute to eutrophication?

***Concept 55.3** Energy transfer between trophic levels is typically only 10% efficient*

22. What is *trophic efficiency*?

23. Generally, what percentage of energy available at one trophic level is available at the next?



24. Consider a food chain with 1,000 *joules* (an energy unit) available at the producer level. If this food chain is grass → grasshopper → lizard → crow, how much energy would you predict would be found at the level of the crow? (See the answer at the end of this *Reading Guide* chapter.) Show your work here.

25. Notice that most biomass pyramids have the greatest biomass on the bottom of the pyramid. Label the trophic levels on both of the following figures. Explain why the second pyramid of biomass is inverted.

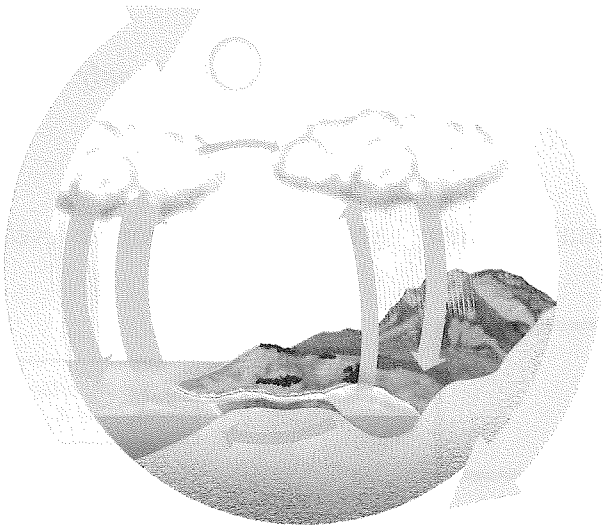
26. Why do people who have limited diets in overpopulated parts of the world eat low on the food chain?

27. The Making Connections Figure 55.13 is an excellent way to review some of the basic ideas from the central core of ecology. After reviewing the figure, why do you think the tundra is considered an ecosystem sensitive to disturbance?

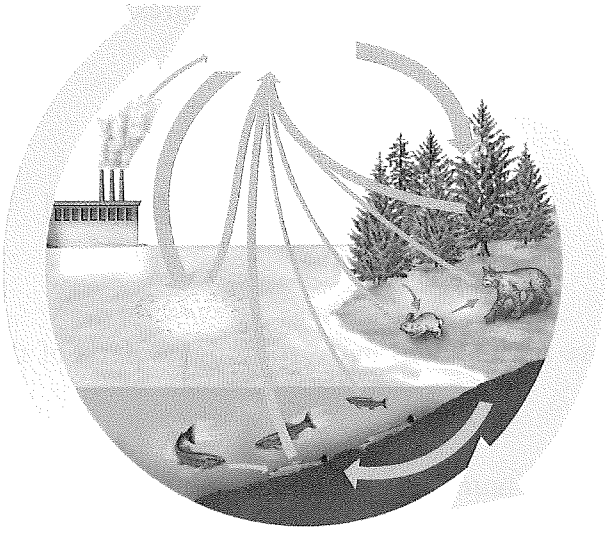
***Concept 55.4** Biological and geochemical processes cycle nutrients and water in ecosystems*

Pay particular attention to the nutrient cycles in Figure 55.14 in your text. Note the key processes in each cycle.

28. Use the following figure to describe the water cycle. Specify the roles of *evaporation*, *transpiration*, and *rainfall*.



29. Use this figure to describe the carbon cycle. In doing so, explain how carbon enters the living system and how it leaves, indicate the role of microorganisms in the cycle, and identify the reservoir for carbon. Give some thought to how concepts from the chapters on photosynthesis and cellular respiration are tied to the carbon cycle.

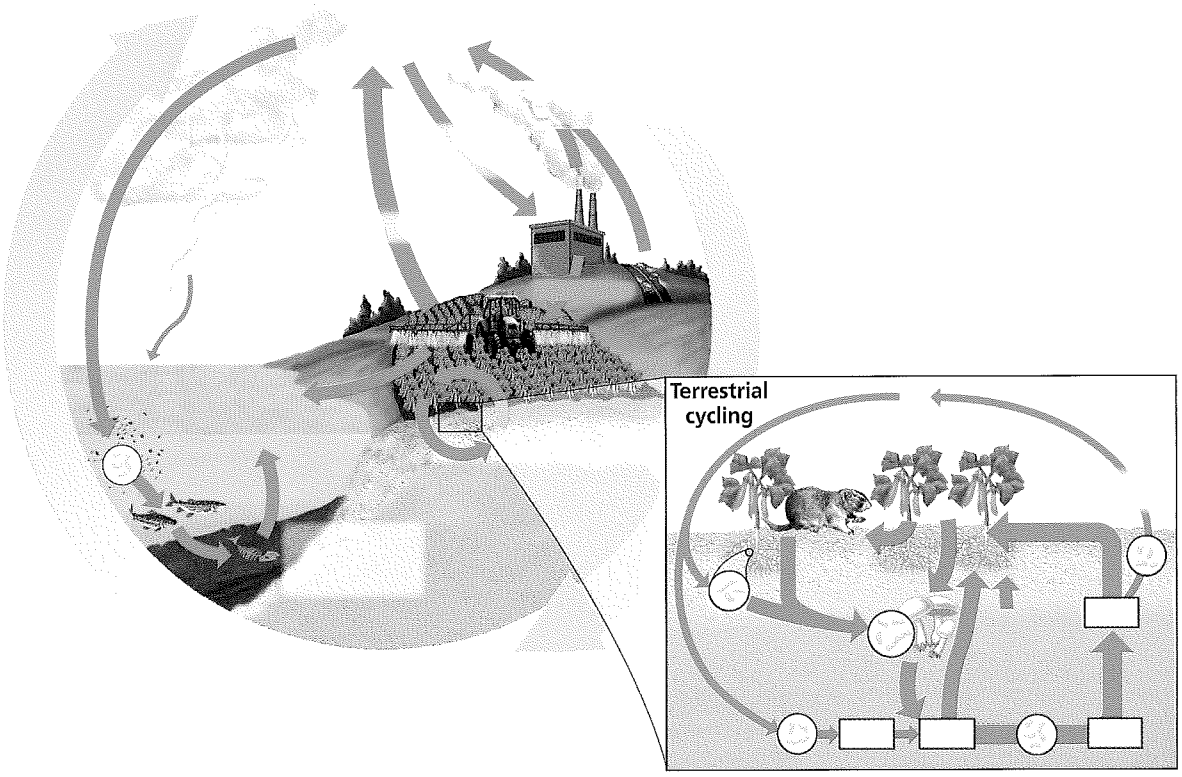


Write the equation for photosynthesis here:

Write the equation for cellular respiration here:

Note that the raw materials for photosynthesis are the products of cellular respiration. The organic molecules used in cellular respiration are the result of photosynthesis. Matter cycles!

30. Use the following diagram to describe the nitrogen cycle. In doing so, indicate the role of microorganisms in *nitrogen fixation*, *nitrification*, and *denitrification*.



31. Review the Case Study: Nutrient Cycling in the Hubbard Brook Experimental Forest. What effect has deforestation been shown to have on chemical cycling?

Concept 55.5 *Restoration ecologists return degraded ecosystems to a more natural state*

32. What is the goal of restoration ecology?

33. Restoration ecology uses two key strategies. Explain how each strategy works:

bioremediation

biological augmentation

Test Your Understanding Answers

Now you should be ready to test your knowledge. Place your answers here:

1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____

7. _____ 8. _____

Solution to Question 24: Grass (1,000 J) → grasshopper (100 J) → lizard (10 J) → crow (1 J)