Lesson Self-Check

CAN YOU SOLVE IT?

FIGURE 15: Biosphere 2

The Biosphere 2 research center was originally built with five separate ecosystems: rain forest, ocean, wetlands, grassland, and desert. Scientists thought that by replicating Earth's ecosystems they would be able to make a self-sustaining ecosystem in which humans could live and grow their own food. Almost immediately, however, Biosphere 2 began suffering from a lack of oxygen and increased carbon dioxide concentrations.

Explain Refer to the notes in your Evidence Notebook to explain how matter changes form as it flows within the Biosphere 2 system. Use this information to help you answer the following questions:

1. How do matter and energy change form as they cycle through ecosystems and Earth's spheres?
2. Why do you think researchers had problems with low oxygen in Biosphere 2?
3. How would you solve this problem?

The Biosphere 2 experiment never recovered. The scientists built CO_2 scrubbers to try to remove excess carbon dioxide from the air and eventually had to pump in oxygen to stay alive. The ecosystems inside Biosphere 2 suffered and never flourished as scientists had hoped they would. The original purpose of the experiment failed: A group of people could not survive in a self-sustained system. However, scientists did learn that Earth's ecosystems are extremely complex and there is much the scientific community has yet to learn. Today researchers use Biosphere 2 as a place to study Earth's ecosystems to better understand carbon and oxygen cycles, water recycling, and more.

CHECKPOINTS

Check Your Understanding

1. The steps of the carbon cycle are described below. Place the steps in the correct order.

- **a.** Animals and plants release carbon dioxide and water as a result of cellular respiration.
- **b.** Carbon dioxide is released by plants and animals and moves into the biosphere.
- **c.** Plants use water and carbon dioxide from the atmosphere to make sugar and oxygen through the process of photosynthesis.
- **d.** Animals and plants use sugar and oxygen for the process of cellular respiration.
- **e.** Cellular respiration transforms sugar and oxygen into carbon dioxide and water.

2. Which statement describes a difference between the nitrogen and carbon cycles?

- **a.** The carbon cycle involves only plants.
- **b.** The nitrogen cycle requires a process called fixation that is carried out by certain bacteria.
- **c.** The carbon cycle requires that temperatures be above 27 °C (80 °F).
- **d.** The nitrogen cycle occurs entirely in the ocean.

3. What are the potential effects of introducing too much nitrogen and phosphorus into an aquatic ecosystem? Select all correct answers.

- **a.** Fish populations would increase.
- **b.** Aquatic organisms would die off.
- **c.** Water would become clearer.
- **d.** Algae would grow out of control.
- **e.** Oxygen levels would increase.

4. Which of the following things are common to all of the biogeochemical cycles? Select all correct answers.

- **a.** reservoirs and processes
- **b.** an atmospheric component
- **c.** photosynthesis and respiration
- **d.** living things as a reservoir
- **e.** the sun as a source of energy
- **f.** can be affected by human activities

5. Complete the sentence by filling in the correct substance in each blank.

In the carbon cycle, the role of photosynthesis is to take in _____, and the role of cellular respiration is to give off _____.

6. Recently, some areas in the United States have seen an increase in trees due to reforestation efforts. Draw a "before" and "after" model to show how the carbon cycle might be altered after a large-scale reforestation effort.

7. Draw a diagram of the water cycle, labeling each process. Add arrows and labels to show how energy drives the cycle and is transferred through it.

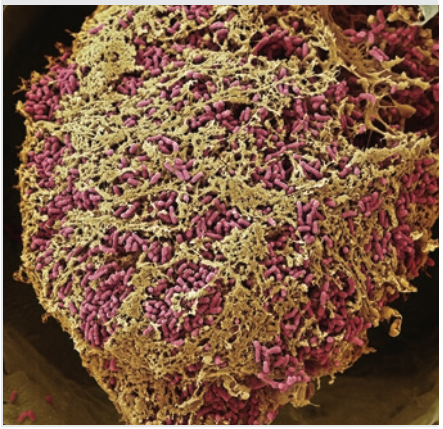
FIGURE 16: Biosphere model

8. How is matter changing form in the biosphere model shown in Figure 16? How many different types of matter cycles do you think are being shown in the model?

9. There is evidence that the increasing carbon dioxide levels in the atmosphere are affecting phytoplankton, which are tiny photosynthetic organisms in the ocean. Explain how the carbon cycle might be affected if phytoplankton were to decrease in number.

10. Decomposers are an important part of many biogeochemical cycles. Some carry out aerobic respiration and some use anaerobic respiration as they break down organic matter. Explain why decomposers are so crucial for the cycling of matter in ecosystems. Cite specific examples to support your answer.

FIGURE 17: Rhizobia bacteria



11. Explain the crucial role bacteria, such as those shown in Figure 17, play in the nitrogen cycle. What would happen to the nitrogen cycle if the bacteria were no longer present?

12. How might Earth's biogeochemical cycles help scientists to understand the early history of life on Earth?

13. Develop a model that explains how energy from Earth drives the biogeochemical cycles.

MAKE YOUR OWN STUDY GUIDE

In your Evidence Notebook, design a study guide that supports the main ideas from this lesson:

Biogeochemical cycles are processes that move matter through and among Earth's spheres. These cycles can be impacted by human activity.

Remember to include the following information in your study guide:

- Use examples that model main ideas.
- Record explanations for the phenomena you investigated.
- Use evidence to support your explanations. Your support can include drawings, data, graphs, laboratory conclusions, and other evidence recorded throughout the lesson.

Consider how matter and energy transform, but are not destroyed, as they move through and among ecosystems and Earth's spheres.