Ask What They Think Now: Ask, *Phosphorus is an important element in your body. It’s found in the backbone of your DNA molecules, and in the membranes of your cells. Where did this phosphorus come from?*

2 Guide the Learning

- Remind students that they are biotic reservoirs of phosphorus (and carbon and nitrogen). To help students see a deeper connection between the cycling of matter in ecosystems and their own cells, have them watch the animation *Lipid Bilayer Organization* available on the Nelson Science website.

- Have students compare Figure 3 (the phosphorus cycle) on page 99 of the Student Book with the figure of the carbon cycle on page 87 and the nitrogen cycle on page 93. Ask students to identify the major way the phosphorus cycles differs from the carbon and nitrogen cycles.

- To complement Figure 3 (the phosphorus cycle) on page 99 of the Student Book, have students watch the animation *Phosphorus Cycle* available on the Nelson Science website. The resource can be particularly helpful for auditory learners.

- Connect what students have learned in this section with what they learned in Chapter 2 about symbiotic relationships. Point out that some plant species have a symbiotic association with mycorrhizae, which are fungi that help the plants take up more nutrients from soil by increasing nutrient solubility. Ask students to discuss how this might be especially important in nutrient-poor soils.

3 Consolidate and Extend

- To help students connect the material from Sections 4.2, 4.3, and 4.4, lead a class discussion about processes that are part of all three main processes discussed in these sections: the carbon, nitrogen, and phosphorus cycles.

- Have students compete the Check Your Understanding questions.

**CHECK YOUR UNDERSTANDING—SUGGESTED ANSWERS**

1. Sample answer: Shells, bones and teeth, and the phospholipid bilayer of cell membranes are three places phosphorus is found in living things.

2. Sedimentary and metamorphic rock are the original sources of phosphorus.

3. Weathering produces phosphate ions, which are water soluble and can dissolve into the water found in soil and in bodies of water. Then, phosphate can enter the biotic system when plant roots absorb the phosphate ions.

4. Plants can absorb phosphate ions, $\text{PO}_4^{3-}$. These ions are water soluble and can be transported into plants.

5. A

6. Consumers acquire phosphorus by eating plants that have taken in phosphorus or by eating other animals that have eaten plants.

7. The long phosphorus cycle can take thousands or even millions of years. It starts when animals or plants die and their bodies become buried on the ocean floor. Eventually, they become rock. The phosphates in their fossilized bodies remain trapped until a geological event raises those sediments to the surface, where the rocks are exposed to weathering. A shorter cycle occurs if organisms die, decomposers break down their phosphates, which dissolve into water (including the water in soil) and are made available to producers.

8. B
10. A

11. Fungus increases the solubility of phosphate for the plant, making it easier to take in, and the plant provides carbohydrates from photosynthesis for the fungus.

12. Phosphorus could become limiting in soils if heavy rainfall causes the nutrients to leach out of the soil. In areas where rates of weathering are low, phosphorus could be trapped in rocks, making it unavailable for living things.

13. Animal manure is rich in phosphorus (as well as nitrogen) and acts as a natural fertilizer. Adding these nutrients to soil enhances plant growth by making more of these nutrients available to the crops.

14. Phosphorus stored in the bodies of living organisms is returned to the soil when those organisms die and decompose. The breakdown of the tissues releases phosphorus to the soil, making that phosphorus available to new living organisms.

15. D

16. D

Locate Needed Information

- Have students read the Learning Tip on page 98 of the Student Book. Explain to students that scanning a text is looking for specific information, such as a word or fact within the text and/or text features. Have students work in pairs and make note of the definitions of bolded words in the text.

Extra Support

- Students might have trouble interpreting Figure 3 on page 99 of the Student Book. If they do, have them rewatch the animation Phosphorus Cycle and pause the animation so that they can take notes on each stage or reservoir described. Suggest they compare what they learned from the animation to what is represented in the figure. Ask, What are the main points in both?

Extra Challenge

- Have interested students research the effects of excess phosphorus runoff into aquatic ecosystems, such as freshwater lakes. Have them prepare a television broadcast to inform their classmates of the effects of phosphorus overload in different ecosystems in B.C. Ask them to include in their reports information on some of the steps researchers and farmers are taking to try to reduce phosphorus runoff into freshwater systems.

ASSESSMENT FOR LEARNING

<table>
<thead>
<tr>
<th>What To Look For in Student Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence that students can</td>
</tr>
<tr>
<td>• illustrate the cycling of phosphorus through biotic and abiotic components of an ecosystem</td>
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<tr>
<td>• explain how the phosphorus cycle differs from the nitrogen, carbon, and oxygen cycles</td>
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<tr>
<td>• explain how phosphorus is important to living things</td>
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</tbody>
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