

Name \_\_\_\_\_

**8.1**

## Phosphates in Our Waterways

Phosphates are essential to the growth of all living things. **Phosphate** (FAHS fayt) refers to compounds containing the phosphate ion ( $\text{PO}_4^{-3}$ ). The phosphate ion is found in various minerals, such as calcium phosphate,  $\text{Ca}_3(\text{PO}_4)_2$ , as well as in shells, bones, and animal teeth.

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### Why Test Water for Phosphate?

A plant must receive a sufficient supply of phosphate in order to grow and mature properly. That is why farmers add fertilizers containing phosphate to the soil.

Phosphate is also essential for aquatic plants, such as algae. **Algae** (AL jee) is a general term for chlorophyll-containing plants like seaweed and pond scum. When a waterway has a high level of phosphate (greater than 0.1 mg/L), however, aquatic plants, including algae, mature and reproduce rapidly. Algae may grow so densely across the surface of the water that it prevents the light necessary for photosynthesis from reaching the plants and algae beneath, causing them to die. Then, as you will recall from Lesson 3, that decomposing organic matter reduces the amount of dissolved oxygen in the water. Finally, as discussed in Lesson 6, the decrease in the amount of dissolved oxygen may produce death for aquatic life such as fish.

So, if testing river or stream water reveals a high level of phosphate, it is reasonable to assume that the amount of dissolved oxygen will decrease when the plant population dies, reducing the ability of the waterway to support a variety of aquatic life.

This process of overgrowth of aquatic vegetation followed by death, decay, oxygen depletion, and an imbalance of plants and animals in the water is called **eutrophication** (yoo troh fuh KAY shuhn). Eutrophication that occurs because of human influences is called **cultural eutrophication**.

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### How Do Excess Phosphates Get into Waterways ?

Excess levels of phosphates in waterways are the result of human activity. Of the several human sources of phosphates in waterways, the main two are fertilizers and detergents. When a phosphate fertilizer is applied to farmlands or lawns, some of the phosphate is absorbed by land plants. The remaining portion may be transported to a river or stream by runoff or groundwater seepage.

Industries and homes often use detergents for cleaning dishes, clothes, floors, automobiles, and so forth. Many detergents contain phosphates as builders, compounds that enhance cleaning ability. After detergents are used for cleaning, the waste is released down drains and sewers, or sometimes poured out onto the ground. Once in the water system, that detergent waste, and the phosphate it contains, may end up in a river or stream. In 1990, 475 million pounds of phosphate were used in detergent products in the United States. Much of this ended up in rivers and streams.

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### How Can Phosphate Levels in Waterways Be Reduced?

One way to reduce phosphate levels in waterways is to remove phosphates from sewage before the sewage is placed into a river or stream. To remove phosphates, the industrial or public treatment plant adds iron (III) chloride ( $\text{FeCl}_3$ ) to wastewater that contains phosphate. An insoluble precipitate, iron(III) phosphate ( $\text{FePO}_4$ ), is formed. The treatment plant removes this precipitate before releasing the wastewater. This process can reduce the amount of phosphate in wastewater about 90 percent. The only drawback is that removal of the phosphate increases the cost of sewage treatment.

Reduction of the amount of fertilizer used on farms and lawns would decrease phosphate runoff into waterways. A balance must be struck, therefore, between maintaining the productivity of farms and safeguarding rivers and streams. To achieve such a balance requires careful testing and monitoring of phosphate levels in soil and water samples.

The amount of phosphates in detergents has declined in recent years, in response to environmental concerns. Some detergent manufacturers have replaced phosphates with other compounds, such as sodium carbonate (washing soda), silicates, citrates, and zeolites. These compounds are less environmentally harmful, though they may not clean as effectively. As of 1993, 23 states had banned or limited the use of phosphates in detergents. This means that about 40 percent of the population of the United States are using detergents with reduced amounts of phosphate.

### DRIFTWOOD

Commercial detergents are available with phosphorus concentrations varying from zero percent to over ten percent by weight. Detergents specially formulated for camping and backpacking contain no phosphorus.

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### Questions

1. Explain in your own words the difference between eutrophication and cultural eutrophication.
2. Describe two sources of phosphate pollution in rivers and streams.
3. Suggest what can be done in your own community to prevent cultural eutrophication.