

Chapter 11-12: The Phosphorus Cycle

Although nitrogen and carbon exist as gases, certain elements that cycle in the biosphere do not exist in gaseous form. These elements accumulate in rocks and soil, and participate in what are called biogeochemical cycles.

Among the elements that undergo sedimentary cycles are calcium, sulfur, magnesium, and phosphorus. As you will see in this plate, phosphorus is one of the key elements in organic matter.

In this plate, we will follow the cycling of phosphorus in nature. The arrows should be the most prominent feature in the final, colored drawing.

Phosphorus is one of the critical elements in biological molecules. For example, it is a component of adenosine triphosphate (ATP) and the coenzyme NADP, which are used in important cellular processes such as photosynthesis. Phosphorus is also present in the sugar-phosphate backbone of nucleic acids, and is an essential element of phospholipids, which make up the cell membrane.

The main reservoir of phosphorus is rock and soil, so we will begin the cycle with **erosion from rocks (A)**. Erosion occurs as water rushes over rock, dissolving phosphorus and washing it into rivers and streams. Phosphorus unites with oxygen to form phosphate and enters a major body of water, depicted here as a lake.

In the plate, we see plants growing along the border of the lake. Here, the water gives up its phosphates, which are **absorbed by the plants (B)** and used in the synthesis of organic molecules. Some of the phosphates also enter the soil along the margins of the lake. Dissolved phosphate is readily absorbed by the roots of plants, concentrated by cyanobacteria and protists such as *Euglena*, and then incorporated into organic molecules.

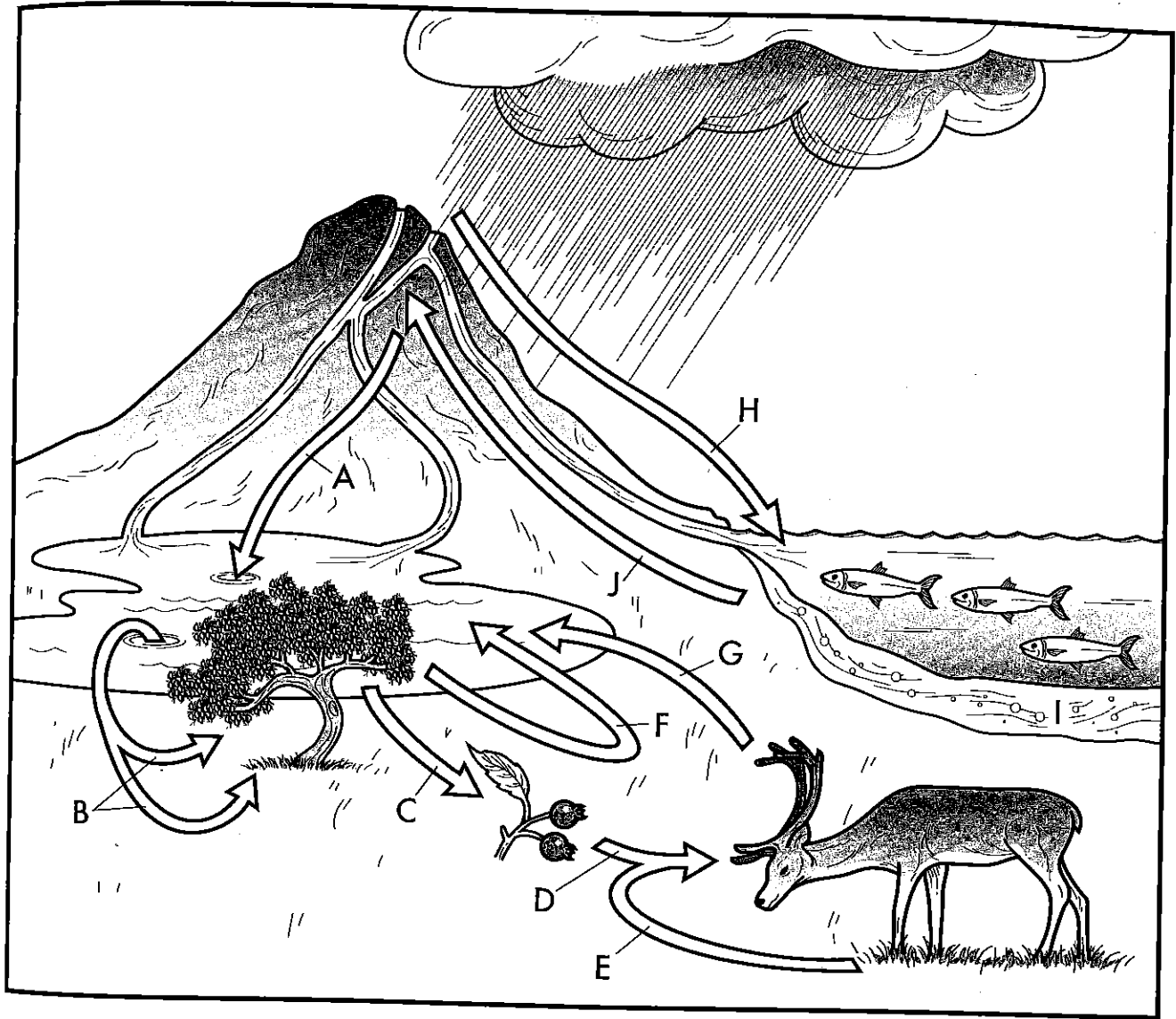
The plant is the primary producer in the phosphorus cycle. The phosphate is **concentrated in plant tissues (C)**, and then the **plant is consumed (D)** by an animal, which is seen **grazing (E)**.

Phosphates are returned to the lake when the plants and animals die. **Plant waste (F)** and **animal waste (G)** return phosphate to the water. Once again it may be reabsorbed by plants that line the lake, and it enters the cycle again.

Having explored the passage of phosphorus through various aspects of the biosphere, we now turn to the marine environment to see how phosphorus cycles there. Continue your reading as you color the plate.

Large amounts of phosphorus are carried by rivers and streams as **runoff to the ocean (H)**. Phosphorus exists in the form of phosphate here, as it does on land. Much of this phosphate then concentrates in **marine sediment (I)**. Some of the phosphate is eventually incorporated into the bodies of marine animals such as fish. For example, the scales and bones of bony fish contain phosphorus. As is the case on land, primary producers in the ocean incorporate phosphates into organic compounds. These primary producers are eaten by fish and other invertebrates. For instance, sea birds consume the fish and return phosphorus to the ocean in the form of excrement.

As we have seen, the atmosphere is not involved in the phosphorus cycle. In order for the phosphorus to leave the oceanic environment, geologic upthrust must occur. Upthrust is the process through which once-submerged sedimentary rock rich in phosphorus is exposed because of the movement of the Earth's plates. This rock then enters the terrestrial ecosystem and begins to weather, participating in the phosphorous cycle.



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| <input type="radio"/> Absorbtion by Plants ..B | <input type="radio"/> GrazingE | <input type="radio"/> Runoff to OceanH |
| <input type="radio"/> Concentration in Plant TissuesC | <input type="radio"/> Plant WasteF | <input type="radio"/> Marine SedimentI |
| | | <input type="radio"/> Geologic UpthrustJ |