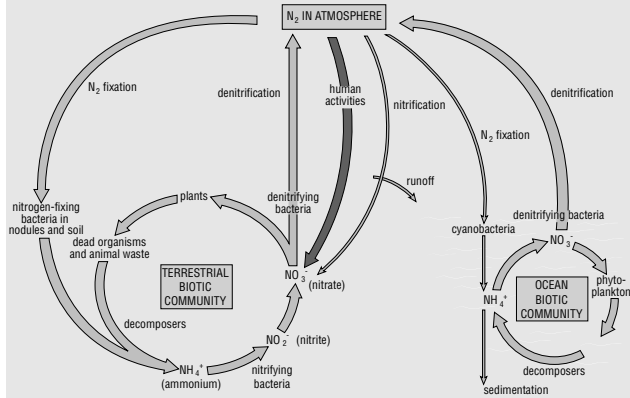


Section 2.2 Review Answers

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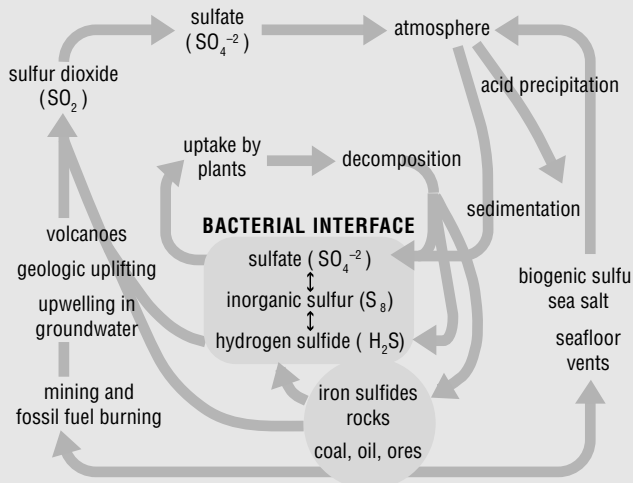
1. (a) Carbon moves relatively quickly through producers, consumers, decomposers, and the atmosphere. Carbon does not accumulate for long periods in any of these components of the environment, making this part of the carbon cycle an example of the rapid cycling of matter.
(b) It takes many years for organic matter to accumulate and form a fossil fuel. As a fossil fuel, the carbon is not available to living organisms, and so is part of the slow cycling of matter.
2. Nitrogen and oxygen enter the atmosphere, but phosphorous and calcium do not. Instead, phosphorous and calcium move through the biosphere in water, organisms, and soil only.
3. (a) Bacteria convert sulfur from one form to another. Sulfate reducers convert sulfate to sulfide and elemental sulfur, while sulfur oxidizers convert sulfide to elemental sulfur and sulfate.
(b) Through nitrogen fixation, bacteria convert nitrogen gas to ammonium. Through ammonification, bacteria break down organic matter and produce ammonium. Other bacteria further convert ammonium into nitrite and then to nitrate. Through denitrification, bacteria convert nitrate and nitrite into nitrogen gas.
4. All biogeochemical cycles move through both the abiotic and biotic environment by rapid and slow cycling, include nutrient reservoirs, and involve transport by water.
5. (a) Green plants need nitrogen to make DNA and proteins.
(b) Green plants need sulfur for proteins and vitamins.
(c) Green plants need phosphorous to make DNA and ATP.

6. (a)



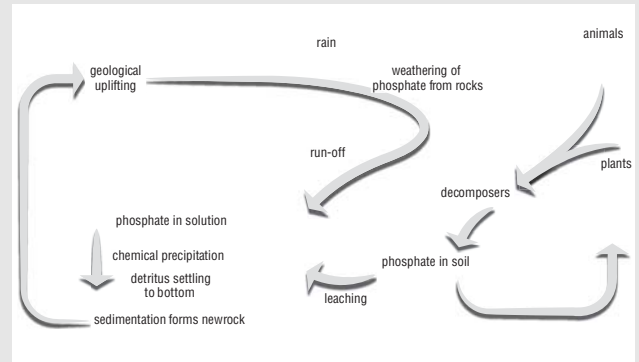
(b) Through nitrification, nitrifying bacteria convert ammonium to nitrite and then into nitrate. Plants use nitrate to make organic compounds requiring nitrogen, such as DNA and proteins. Consumers can get nitrogen by eating plants or other consumers. This is a tricky question as the conversion of ammonium to nitrite and then into nitrate is not specifically identified as nitrification in the text, but most students should be able to make the association.

7. (a)



(b) Burning fossil fuels releases sulfur to the atmosphere as sulfur dioxide. Sulfur dioxide reacts with oxygen and water vapour in the atmosphere to form sulfurous acid and sulfuric acid. These acids return to Earth's surface in acid deposition.

8. (a)



(b) Producers readily use phosphate, but the scarcity of phosphate in the environment tends to limit their growth. As a result, phosphate from detergents that enters the environment through sewage and wastewater run-off can cause algal blooms in lakes and other natural bodies of water. Algal blooms block sunlight, resulting in the death of aquatic plants, which can no longer photosynthesize. Decomposition of the resulting organic matter depletes oxygen in the water, thereby killing fish and other aquatic life.