

## Key Concept 1: Cycling of Matter in the Biosphere

### Learning Objectives

*Students will be able to ...*

### Essential Knowledge

*Students need to know that ...*

#### Hydrologic Cycle

**ECO 1.1(a)** Explain how the unique properties and phase changes of water enable and regulate biological reactions and/or processes.

**ECO 1.2(a)** Create and/or use a model to explain how biological systems function in the hydrologic cycle as water is transferred, transported, and/or stored.

**ECO 1.1.1** The polarity of water molecules results in properties on which biological reactions depend. The solvent properties of water dissolve organic and inorganic nutrients.

**ECO 1.2.1** Water cycles between abiotic and biotic systems in a process known as the hydrologic cycle.

- The hydrologic cycle is driven by energy from the sun and gravity.
- The largest reservoir of water in the global hydrologic cycle is the world's oceans.
- A small portion of the water on Earth is fresh water, which is required for life by all terrestrial organisms, including humans.

#### Carbon and Nutrient Cycles

**ECO 1.3(a)** Explain the importance of the cycling of carbon for biological systems.

**ECO 1.3(b)** Create and/or use models to illustrate how energy production in organisms plays a role in the cycling of carbon in ecosystems.

**ECO 1.3(c)** Explain the importance of the cycling of nutrients for biological systems.

**ECO 1.3(d)** Create and/or use models to describe the cycling of nitrogen between biotic and abiotic systems.

**ECO 1.3.1** Elements that are building blocks to macromolecules are transported from abiotic to biotic systems through gaseous and sedimentary cycles.

- The carbon cycle is a series of molecular transformations that includes photosynthesis and cellular respiration.
- The nitrogen cycle is a series of transformations that includes the conversion of nitrogen gas (the largest reservoir of nitrogen on Earth) into biologically available nitrogen-containing molecules (e.g., nitrates).
- Phosphorus is a critical element for organisms, as it helps make up numerous biomolecules (e.g., ATP, DNA).

**Content Boundary:** Understanding of the cycling of sulfur and phosphorus in the ecosystem is *beyond the scope* of this course. Students should understand why phosphorus is an important element, as it serves as a monomer to many important biomolecules (e.g., ATP, DNA), but the understanding of the cycle will be covered in AP Environmental Science. Also, students should be able to model the process of nitrogen from a general standpoint of how biotic and abiotic components interact and depend on one another. However, an understanding of all the chemical conversions during this cycle is *beyond the scope* of this course.