

Warm-Up

Biogeochemical Cycles in Ecosystems



Lesson Question

How does matter cycle through an ecosystem?



Lesson Goals

Identify the four **spheres** of Earth.

Explain how water, carbon, and nitrogen **cycle** through an ecosystem.

Describe the importance of the **water**, carbon, and nitrogen cycles.



Words to Know

Fill in this table as you work through the lesson. You may also use the glossary to help you.

evaporation	the change of state from a liquid to a gas
condensation	the change of state from a gas to a liquid
infiltration	the process by which water soaks into the ground

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2K**Words to Know**

nitrogen fixation	a process by which bacteria convert nitrogen gas into a usable form
precipitation	any form of water that falls from the clouds to Earth's surface
runoff	the water from rain or snow that flows over the ground's surface
transpiration	the process by which water is lost from the leaves of plants

Six Fundamental Elements

There are **six** fundamental **elements** found in all living things.

- **Carbon**

- **Hydrogen**

- **Oxygen**

- **Nitrogen**

- Phosphorus

- Sulfur

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Atmosphere

The **atmosphere** refers to the air surrounding Earth.

- Is a mixture of **gases** and particles
- Protects Earth's **surface**

Hydrosphere

The **hydrosphere** refers to Earth's water.

- **Covers** about 71% of Earth's surface
- Includes **oceans**, lakes, glaciers, **rivers**, streams, and groundwater

Biosphere

The **biosphere** refers to all organisms on Earth.

- Includes **organisms** in the air, on land, and in water

Geosphere

The **geosphere** refers to the mostly **solid** part of Earth.

- Includes **rocks**, minerals, landforms, and Earth's **interior**

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The Water Cycle

The **water cycle** ensures that all organisms have access to the water they need.

- All **organisms** need water to carry out cell processes.
- **Plants** also need water to carry out **photosynthesis**.

Evaporation

The change of state from a liquid to a gas is **evaporation**.

Evaporation from oceans, lakes, streams, and puddles forms water **vapor** in the atmosphere.

- Water is lost from plant leaves through **transpiration**.
- Water vapor is released when animals **breathe**.
- Animal **waste** contains water.

Condensation

Condensation of water in the atmosphere forms clouds.

- Water **vapor** condenses on particles in the air.

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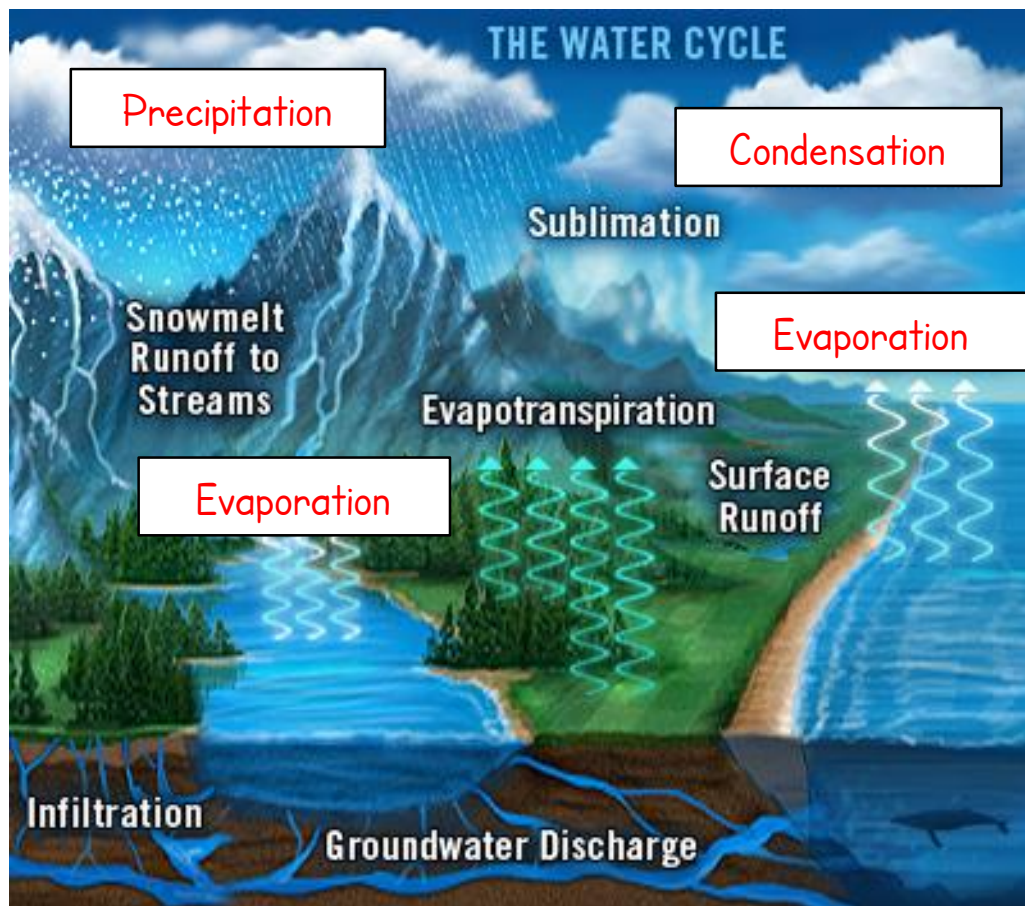
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Precipitation

As more water vapor condenses, the drops of water in the cloud get larger and may eventually fall to Earth as **precipitation**.

- Some soaks into the ground through **infiltration**.
- Some flows over the ground as **runoff**.

Complete the diagram.



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Human Impact on the Water Cycle

REAL-WORLD CONNECTION

Human activity can affect the amount of available water.

- Water **use**
 - Even though water cycles through ecosystems, the total amount of fresh water is very **limited**. Only 3 percent of the water on our planet is **fresh** water.
 - Humans use **billions** of gallons of fresh water every day for watering lawns, for **drinking**, for watering crops, and in industry.
 - Water conservation helps ensure that we have enough fresh water for future generations.
- Water **pollution** limits the amount of usable water.
 - Water is constantly being polluted from agriculture runoff, sewage, oil spills, and industrial waste.
 - Contaminated or polluted water is **dangerous** for organisms.

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The Carbon Cycle

All organisms contain **carbon** and require it to survive.

- The **atmosphere** contains carbon dioxide.
- Producers use carbon dioxide to make glucose through **photosynthesis**.

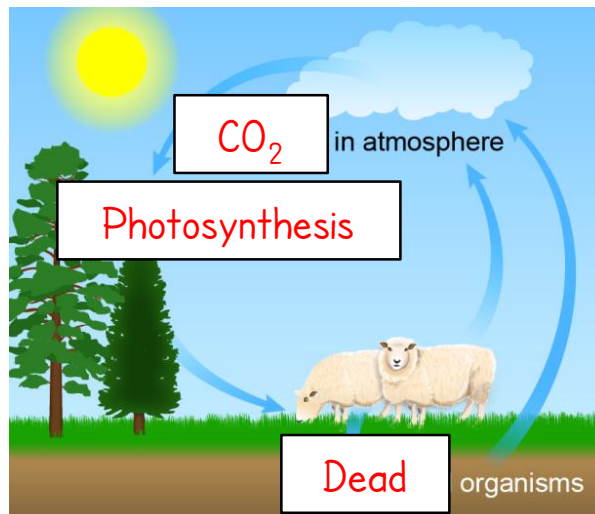
Producers and consumers break down **glucose** molecules to obtain **energy** through cellular respiration.

- Releases **carbon dioxide** as waste

When producers and consumers die, their remains are broken down by **decomposers**.

- Returns **carbon** compounds to the **soil**
- Releases carbon dioxide into the **atmosphere**

Complete the diagram.



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Human Impact on the Carbon Cycle

REAL-WORLD CONNECTION

Human activity can also have an impact on the amount of **carbon** in the atmosphere.

- Burning of **fossil fuels** releases carbon dioxide as waste.
- **Deforestation** decreases removal of carbon dioxide through photosynthesis. Burning releases even more **carbon dioxide** into Earth's atmosphere.

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The Nitrogen Cycle-Part 1

All organisms require **nitrogen** to make proteins.

- "Free" nitrogen **cannot** be used by most organisms.
- Bacteria convert nitrogen gas into a usable form through **nitrogen fixation**.

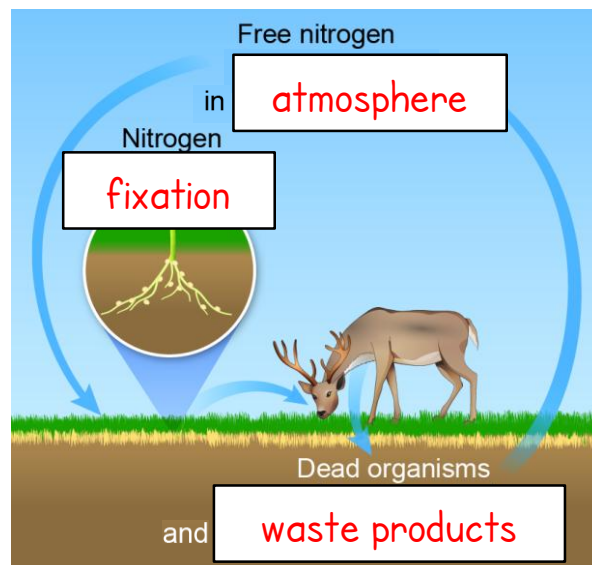
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The Nitrogen Cycle-Part 2

- Plants absorb **nitrogen** compounds through their roots.
- Animals get nitrogen by **eating** plants and other animals.
- Decomposers** return nitrogen to the soil.
- Nitrogen eventually **breaks** down completely.
- Free nitrogen is returned to the **air**.

Complete the diagram.



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Human Impact on the Nitrogen Cycle

REAL-WORLD CONNECTION

- When crops are **harvested**, little nitrogen is returned to the soil.
- Fertilizers** and **nitrogen-fixing crops** can be used to replace nitrogen in the soil.

Summary

Biogeochemical Cycles in Ecosystems

**Lesson Question**

How does matter cycle through an ecosystem?

**Answer**

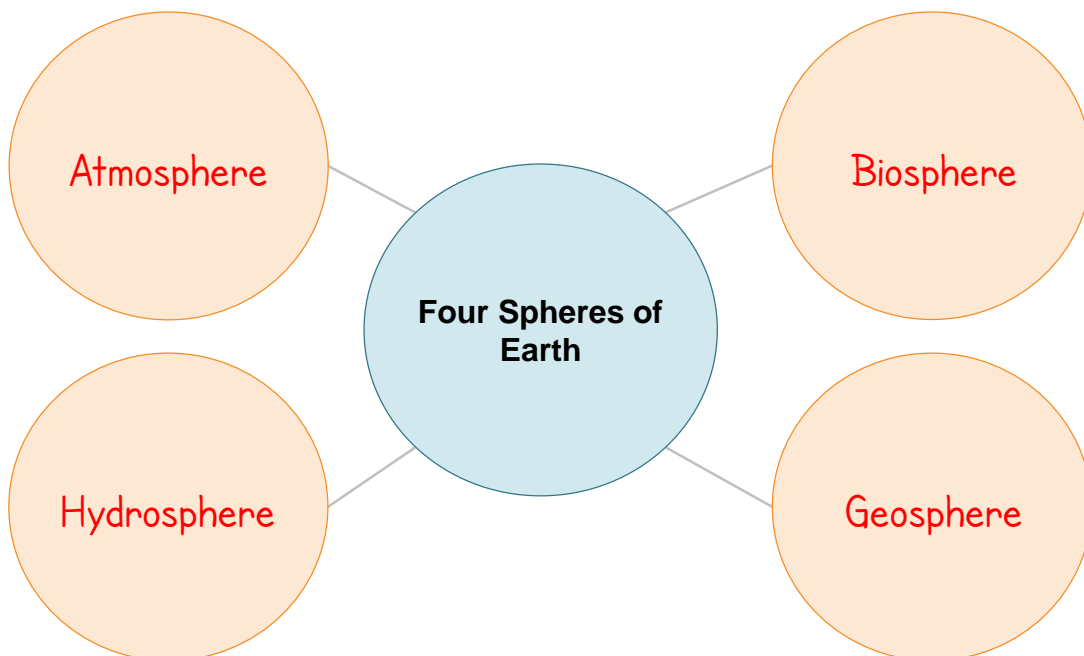
(Sample answer) Matter cycles through Earth's ecosystems by way of the water cycle, the carbon cycle, and the nitrogen cycle so it can be used and reused.

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Review: Key Concepts**FOUR SPHERES OF EARTH**

Fill in the blanks in the graphic organizer.



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Review: Key Concepts**CYCLES OF MATTER****The Water Cycle**

- Water **evaporates** from bodies of water to form water vapor in the atmosphere.
- Water vapor in the air **condenses** to form clouds.
- Water falls back to Earth as **precipitation**, which may infiltrate the ground or become runoff.

The Carbon Cycle

- CO₂ is removed from the atmosphere during **photosynthesis**.
- Organisms release CO₂ as waste during **cellular respiration**.
- Carbon compounds and CO₂ are returned to the soil and atmosphere during **decomposition**.

The Nitrogen Cycle

- Free nitrogen is changed to a **usable** form.
- Plants **absorb** nitrogen compounds through roots.
- **Consumers** get nitrogen by eating organisms.
- **Decomposers** return nitrogen to the soil.
- Free nitrogen is returned to the **atmosphere**.



Summary

Biogeochemical Cycles in Ecosystems

Use this space to write any questions or thoughts about this lesson.