

Introduction to the Carbon Cycle

Levels V-VI



Grades 9-12

Overview:

Students will learn about the carbon cycle and how carbon dioxide enters the atmosphere. (NOTE: In this lesson students are introduced to the carbon cycle, and how energy from the sun drives this cycle. The lesson assumes a basic understanding of photosynthesis.)

Objectives:

The student will draw a diagram of the carbon cycle based on their local environment.

Materials:

- Bunsen burner
- Tongs
- 1/4 slice of bread
- 1/4 slice of lunchmeat
- Crackers
- STUDENT WORKSHEET: "Diagramming the Carbon Cycle"
- OVERHEAD: "Photosynthesis and the Carbon Cycle"

GLEs Addressed:

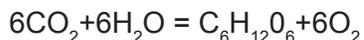
Science

- [9] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.
- [10-11] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring, and communicating.
- [10] SD1.2 The student demonstrates an understanding of geochemical cycles by describing their interrelationships (i.e., water cycle, carbon cycle, oxygen cycle).
- [10] SC3.1 The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy by exploring ecological relationships (e.g., competition, niche, feeding relationships, symbiosis).

Activity Procedure:

1. Explain that carbon is essential to life on Earth; all organisms depend on carbon for physical structure (wood, bones, shell) or energy (gained from food, burned for heat). Carbon moves from one system to another in a continuous cycle. It travels from the oceans to the atmosphere, is taken up by vegetation, consumed by animals, and is eliminated or exhaled in a constant rotation called the carbon cycle.
2. Ask students to imagine a carbon atom as it travels through time. Start by exhaling the carbon atom, joined by two oxygen atoms. This breath floats through the air and outside, drifting around until it comes in contact with a blueberry bush. The blueberry bush draws in the carbon dioxide (CO₂) through its leaves. By using energy from the sun and water from the soil, it recombines the atoms to form a sugar. The plant then releases oxygen, through respiration, back out through its leaves. The oxygen floats along until it enters the classroom. Breathe in and the oxygen from the plant enters the lungs. Eat the blueberries and the body will extract nutrients and release CO₂ into the bloodstream. Exhale and the CO₂ leaves the lungs again, free to begin the process over.

3. The formula below shows how plants use six carbon dioxide molecules (CO_2) and six water molecules (H_2O) to make one sugar molecule ($\text{C}_6\text{H}_{12}\text{O}_6$) and release six oxygen molecules (O_2):



Display the TRANSPARENCY: "Photosynthesis and the Carbon Cycle" on the projector and indicate how carbon atoms travel through the cycle.

This simple example of the carbon cycle demonstrates how carbon is recycled over and over. The same carbon atom may have passed through the lungs of a caribou last spring, and it may have been part of a tree growing in the forest the year before until a forest fire burned up the tree and released the carbon into the air.

4. Perform the following lab demonstration in front of the classroom:

Materials:

- Bunsen burner
- Tongs
- 1/4 slice of bread
- 1/4 slice of lunch meat
- Crackers

STEP 1. Ask students to explain what plants need to live. (*CO_2 in the air, sunlight and water*)

STEP 2. What do plants produce with CO_2 , sunlight and water? (*sugar and oxygen*)

STEP 3. Using a Bunsen burner and tongs, burn the 1/4 slice of bread until it is charred. Ask students what remains of the bread (*an example of a plant*) when it's consumed by fire or by digestion? (*carbon*)

STEP 4. What do animals need in order to live? (*plants or animals that eat plants*) Explain that carbon makes up about 50 percent (*dry weight*) of what plants and animals are made of.

STEP 5. Hand out crackers for students to eat and ask them if they can explain what happens to the carbon in the cracker when they eat it. (*The CO_2 is given off in respiration as a by product of metabolism, as well as stored in the tissue of the consumer.*)

STEP 6. Using the Bunsen burner and tongs, carbonize a small piece of lunchmeat. What remains? (*carbon*)

5. Explain to students that some carbon is released into the air during the burning process. A forest fire releases CO_2 when it burns a tree, and leaves behind the remaining carbon in the form of burned trees. The dead trees gradually decompose, releasing still more carbon into the air. When forests re-grow, they drink in this carbon from the air and start the process over.
6. Carbon also exists in the world's oceans. Just like plants on land, phytoplankton in the ocean convert carbon from the air and water into sugars and release oxygen as a byproduct. Phytoplankton are a food source for many marine species, such as baleen whales and shellfish. Carbon atoms travel from phytoplankton to clams to the otters that eat them and so on. When sea animals die, they often sink to the ocean floor, taking carbon with them where it slowly decomposes and re-enters the atmosphere as carbon dioxide. Colder oceans, like the Bering Sea, hold carbon dioxide longer than warmer oceans because decomposition takes longer in colder temperatures.

Critical Thinking Concept: The One-Minute Paper Method. Check student progress and understanding by asking students to describe the carbon cycle. Give them one minute to write down any ideas or knowledge they have on the topic.

7. During Earth's history there have been long periods of time when the climate remained cold and the northern oceans were covered in ice. During these periods organic matter built up to form coal and oil

deposits. When these deposits are released through drilling or mining, and used to heat homes and power cars, the carbon is once again released into the air.

Answers:

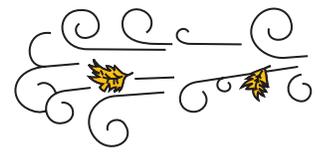
Students should draw a diagram of the carbon cycle that includes local and marine animals, plants, soil, man-made structures and cars. The following should be labeled: Atmosphere, sunlight, carbon dioxide, animal respiration, photosynthesis, plant respiration, oxygen, decomposition, and fossil fuel.

Name: _____

Diagramming the Carbon Cycle

Student Worksheet

Levels V-VI



Directions: Use the page below to draw a diagram of the carbon cycle as it relates to the village, ocean and landscape around the village. Include local marine and land animals, plants, the sun, soil, man-made structures, and cars that use fossil fuels for heat and release CO₂. Include and label the following features:

- | | | | |
|-------------------|----------------|--------------------|----------------|
| atmosphere | carbon dioxide | animal respiration | photosynthesis |
| plant respiration | oxygen | decomposition | fossil fuel |

Photosynthesis and the Carbon Cycle Overhead

