

Details

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The Carbon Connection – A Carbon Cycle Game

Overview

By rolling a die, students will simulate a molecule of carbon's movement with in the carbon cycle.

This is a fun, active way to introduce students to the carbon cycle and/or to review the cycle and identify carbon sinks and sources.

Students experience the carbon cycle as CO₂ molecules or as stored carbon and travel the path of various carbon sources (plants, animals, ocean, soil, atmosphere, fossil fuels) in a journey over time. The process helps them to make connections about carbon, CO₂, and climate change.

Objective

1. Students will describe the various components of the carbon cycle and understand that carbon cycles naturally through living and non-living parts of the Earth system in a complex way.
2. Students will describe a possible path of stored carbon or a CO₂ molecule might take on it's way through this cycle.
3. Students will describe the role of plants in this cycle.
4. Students will classify processes, organisms and environments in the cycle as carbon SOURCES or carbon SINKS.

Lesson Preparation

Background

Proteins, Carbohydrates, Nucleic Acids and other molecules essential to life on earth contain carbon. Carbon is present in the atmosphere as a gas. (CO₂)

Materials

- Student page with Station "cards" cut for each station.
- 1 copy of the Student "score card" and follow up questions for each student
- 6 dice (one die per station)

Carbon is also present in the ocean and fresh water as dissolved CO₂. Carbon is in rocks, animal shells and plants. Without carbon, there would be no life on earth! Carbon does not stay in one place. It is constantly moving. This movement is referred to as the carbon cycle.

The movement of carbon through various aspects of the natural environment is the focus of much scientific research. Global warming and climate change can be attributed to the increased amount of heat-trapping gases, such as carbon dioxide.

Students must know about CO₂ and understand how carbon moves through earth's environment in order to appreciate the complexity of climate change. In addition, since anthropogenic influences impact how much carbon is reintroduced to the active carbon cycle, students should recognize that human activities, such as the burning of fossil fuels, contributes to climate change.

Warm up:

Prepare students by showing them one of the interactive charts, power points or videos from the internet resources listed/linked below.

Steps:

1. Make copies of Carbon Cycle Score Cards (one per student) and Post -activity question page (one per student)
2. Prepare station cards by making a large written label (and/or draw or cut out magazine pictures) for each of the six stations: Atmosphere, Plants, Ocean, Soil/Rock, Fossil Fuels, Animals.
3. Use these labels to set up 6 stations around the room.
4. At each station, put a die and the station section cards designated for that station .

Procedure

1. Tell students that they are going to be carbon molecules moving through the carbon cycle. Categorize the places carbon can be found into these stations: Atmosphere, Plants, Animals, Soil, Ocean and Fossil Fuels. Point out the areas of the room that are labeled with each station
2. Divide the class into six groups. Give each student a score card on which to record his/her movements around the cycle. Have each group begin at a different station.
3. Explain how to move around the room. (You will need to decide if you want them to work in pairs, individually or as a team) At each station, students roll the die and read the statement corresponding to the number on the die. On the Score Card, record the station/ stop, what happens to them (as a carbon molecule) and their next destination.
4. Students stay at the station /stop until you call out "CYCLE". They then move to the next station as directed on that paper.
5. When a student, team or group has completed 10 -12 stations and recorded the information

on the carbon cycle score card, they may begin to complete the work page of follow-up questions. Encourage or facilitate discussion and team work for steps #2 and #3.

6. Ask students to share stories of their “journeys” and experiences. Discuss the storage and movement of carbon through the cycle and roles of each aspect of the cycle. Define and identify the sinks and sources.
7. Allow more time for students to complete their own diagram, carbon cycle description, identify sinks and sources in their journey and answer questions in step #3. (This written work may need to be done as homework or in another class session.)

Extensions

- Write a brief story from a carbon molecule's point of view that describes it's journey through the carbon cycle.
- Create a bar graph using the data collected. The bar graph should represent the number of times the carbon molecule (student) was at each station.
- Ask each group to discuss, research and prepare a brief presentation that answers one of the questions in step #3.

Resources

https://www.windows2universe.org/earth/inteclimate/carbon_cycle.html
https://www.bigelow.org/foodweb/carbon_cycle.jpg
<http://www.slideshare.net/reginejade/carbon-cycle-14710964>
<http://www.slideshare.net/MMoiraWhitehouse/carbon-cycle-teach?related=>
<http://www.neok12.com/Carbon-Cycle.htm>

Assessment

1. Individual participation in game, group work and discussions
2. Careful completion of score card
3. Carbon cycle diagram and answers to follow-up questions
4. Possible written reflection in science notebook answering prompt such as: What do you know now about carbon/carbon cycle that you didn't know before? What do you wonder or want to find out more about?

Author / Credits

This activity is an adaptation of “Water Wonders” from Project Learning Tree; Pre K-8 Environmental Education Activity Guide, page 188. Thanks to Lilly Goodman, Project Wild/ Project Learning Tree instructor, for sharing her version with me.

Cami Dalton <camimark@gci.net> created this lesson plan as a capstone project for the 2015 teacher training course entitled: Climate Change: Seeing, Understanding, and Teaching, held



in Denali National Park. The course is facilitated by the Arctic Research Consortium of the U.S. (ARCUS) in partnership with Alaska Geographic and the National Park Service.

File Attachments

- Student Score Card worksheet
- Student Follow-up questions worksheet
- Station Sections- Description page

Standards

National Science Standards:

Strand 2.1—The Earth as a Physical System

A) Processes that shape the Earth

B) Changes in matter

C) Energy

Alaska State Standards/GLE:

SC3.1

GLE (10) Relating the global carbon cycle to global climate change.

The Carbon Cycle Score Card

Student Name _____ Date _____

Record the places you travel as a carbon molecule.

Station/ Stop	What Happens	Destination
Example: <i>animals</i>	Example: <i>Exhaled by a bear</i>	Example: <i>Atmosphere</i>
1. _____		
2. _____		
3. _____		
4. _____		
5. _____		
6. _____		
7. _____		
8. _____		
9. _____		
10. _____		
11. _____		
12. _____		

After you have traveled through the carbon cycle once, please complete this page.....

1. Using *another piece of paper*, draw a diagram showing your journey. Use a diagram similar to the food web with arrows showing your movement. Or, describe your journey with words. Use complete sentences.

2. **Carbon Sources:** substances or places that produce or release carbon dioxide or other carbon products.
Carbon Sinks: areas or organisms that absorb, dissolve or store carbon for later use by other things.

➤ **Identify the sinks and sources in your journey.**

My Carbon sinks:

My Carbon sources:

3. Reflect on what you have learned about the carbon cycle. Choose 3 questions and answer thoughtfully and thoroughly.
 - What role do plants fill in this cycle?
 - How could deforestation, loss of permafrost or removal of plants affect the carbon cycle?
 - What are fossil fuels and how are they formed?
 - What are greenhouse gases?
 - What could be done to reduce the amount of carbon dioxide in the atmosphere?

Station #1 Atmosphere

You are currently a molecule of carbon dioxide in the **atmosphere**.

If you roll Then you.....

1	STAY in the atmosphere to circulate and trap the sun's heat.
2	Are used by a plant for photosynthesis Go to PLANT
3	Are used by phytoplankton in the ocean. Go to OCEAN
4	STAY in the atmosphere to circulate and trap the sun's heat.
5	Are dissolved in the Carribbean Sea. Go to OCEAN.
6	Are used by a Spruce Tree for photosynthesis. Go to PLANT.

Station #2 Plants

You are currently a carbon molecule in the structure of the **plant**.

If you roll Then you.....

1	Are stored as cellulose in the cambium of a tree used to build a campfire, and are released during combustion. Go to ATMOSPHERE.
2	Are in the leaf of a tree that shed it's leaves in the Fall. Go to SOIL .
3	Are in the heart wood of living tree's trunk. STAY in Plant.
4	Are a carbon molecule in a yummy blueberry that was eaten by a hungry bear. Go to ANIMALS.
5	Are stored as cellulose in the new needles of a pine tree. STAY in Plant.
6	Are stored as cellulose in a fern that died and become buried deep in sediments before it could decompose. You are turning into part of a rock. Go to SOIL/ROCK.

Station #3

Animals

You are currently a molecule of carbon in an **animal**.

If you roll

Then you.....

1	Are part of a bear, which burps and exhales you into the air as CO ₂ . Go to ATMOSPHERE.
2	Were exhaled from an animal's lungs into the air as CO ₂ . Go to ATMOSPHERE.
3	Were part of a forest animal that died and is slowly decomposing. Go to SOIL/ROCK .
4	Are stored in the fat of an animal. STAY in animal.
5	Were part of an insect that died and fell to the ground where it will decompose. Go to SOIL/ROCK.
6	Are part of a cow that releases excess gas and releases you as methane gas. Go to ATMOSPHERE.

Station #4

Soil/Rock

You are currently a molecule of carbon dioxide in the **soil or in a rock**.

If you roll

Then you.....

1	Are charred in a ground forest fire and are now almost impossible to decompose. STAY in Soil.
2	Are trapped in bog sediments and eventually become natural gas. Go to FOSSIL FUELS.
3	Are buried in rock, changing into natural gas. Go to FOSSIL FUELS.
4	Are spewed out in a volcanic eruption. Go to ATMOSPHERE.
5	Are part of a limestone rock that gets mined for cement and then are released as a gas. (CO ₂) Go to ATMOSPHERE.
6	Are part of permafrost that is melting. You are released as a methane gas. Go to ATMOSPHERE.

Station #5

Fossil Fuels

Fossil fuels are a rich source of energy that has been created from carbon that has been stored for many millions of years.

If you roll... Then you.....

1	Are converted into gasoline for an automobile and released as CO ₂ during the combustion process. Go to ATMOSPHERE.
2	Are being burned in a coal power plant and are released as CO ₂ . Go to ATMOSPHERE
3	Are mined for coal and breathed in by a coal miner. Go to ANIMAL.
4	Are burned in a coal plant and combine with water vapor to make acid rain. You run off into the OCEAN. Go to OCEAN.
5	Are natural gas that has not yet been tapped and pumped above the ground. STAY in Fossil Fuels.
6	Are converted to petroleum and shipped through a long pipeline to a refinery, where you are released as carbon dioxide. (CO ₂) Go to ATMOSPHERE.

Station #6

OCEAN

You are currently a molecule of carbon in the **ocean**.

If you roll..... Then you.....

1	Are dissolved in seawater and could be here a while. STAY.
2	Have just reacted with other chemicals in water. STAY
3	Are part of a phytoplankton that was just eaten by a shrimp. Go to ANIMALS .
4	A whale just exhaled and released you into the air as carbon dioxide (CO ₂) Go to ATMOSPHERE
5	Are a plankton who just died and fell to the bottom of the ocean, becoming part of the sediments on the ocean floor. Go to SOIL/ROCK.
6	A fish just exhaled and released you into the water. STAY