

The Carbon Cycle Game

(Adapted by Jennifer Ceven from "The Incredible Journey," *Project Wet*)

Please credit the author, Jennifer Ceven, when using this lesson

Summary:

By rolling a die, students will simulate a molecule of carbon's movement throughout various locations within the carbon cycle.

Objective:

- Students will describe the movement of carbon within the carbon cycle.
- Students will evaluate the relative timing of movement through various locations in the carbon cycle.

Materials:

- 7 Dice
- 7 Station Signs
- 7 Station Movement Directions
- Data record sheets for each student

Background:

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 develop an understanding of how carbon moves through the environment in order to appreciate the complexity of developing solutions to address problems associated with climate change. In addition, since anthropogenic influences impact how much carbon is reintroduced to the active carbon cycle, students should recognize that human actions negatively affect the environment.

Warm-Up:

- Review what carbon is (an element, the stuff of life)
- Discuss where carbon can be found on Earth.
- Discuss the role of carbon in each of the places identified.
- Review the processes that move carbon around in the carbon cycle
 1. Physical processes
 - Water currents
 - Settling to the ocean floor or to the ground
 2. Chemical and Biological processes
 - Respiration – Exchange of gases through breathing
 - Photosynthesis - The synthesis of complex organic materials, esp. carbohydrates, from carbon dioxide, water, and inorganic salts, using sunlight as the source of energy and with the aid of chlorophyll and associated pigments.
 - Combustion – The act or process of burning

- Dissolving gaseous carbon dioxide into water, where it takes the form of carbonic acid
- Coming out of solution of carbonic acid to become carbon dioxide in the air (same process that occurs when you open a soda)
- Death and Decomposition - breakdown or decay of organic matter

The Activity:

1. Tell students that they are going to be carbon atoms moving through the carbon cycle.
2. Categorize the places carbon can be found into these stations: Atmosphere, Plants, Animals, Soil, Ocean, Deep Ocean, and Fossil Fuels. Point out the areas of the room that are labeled with each station and contain the directions for movement from that station.
3. Assign students to each station randomly and evenly. Have students identify the different places carbon could go from that given station. Discuss the processes that allow for the transfer of carbon between stations. Students should make a line and roll the die individually to follow the directions for movement from (or retention at) each station. Remind them that they are representing atoms of carbon moving through the carbon cycle and that they should record their movements on the data sheet.
4. Students will realize the routine movements (or non-movements) in the carbon cycle.
5. Once the carbon atoms (students) have had a chance to roll the die ten times, have each student create a bar graph using the data they collected. The bar graph should represent the number of times the carbon atom (student) was at each station.
6. Using graph paper, create a large bar graph recording the number of carbon atoms (students) at each station.

Wrap-Up and Action Plan:

- Ask a few students to tell the story of how their carbon atom moved through the cycle.
- Discuss the results – using the bar graph have the students explain where the most/least amount of carbon was in the cycle?

Assessment:

- Rate students' understanding on their responses from class or group discussions.
- Assign a follow-up activity:
 - Role-play the motion of carbon throughout the carbon cycle.
 - Write a story about your carbon atom as it moved through the carbon cycle.

The Carbon Cycle

REFERENCE PAGE

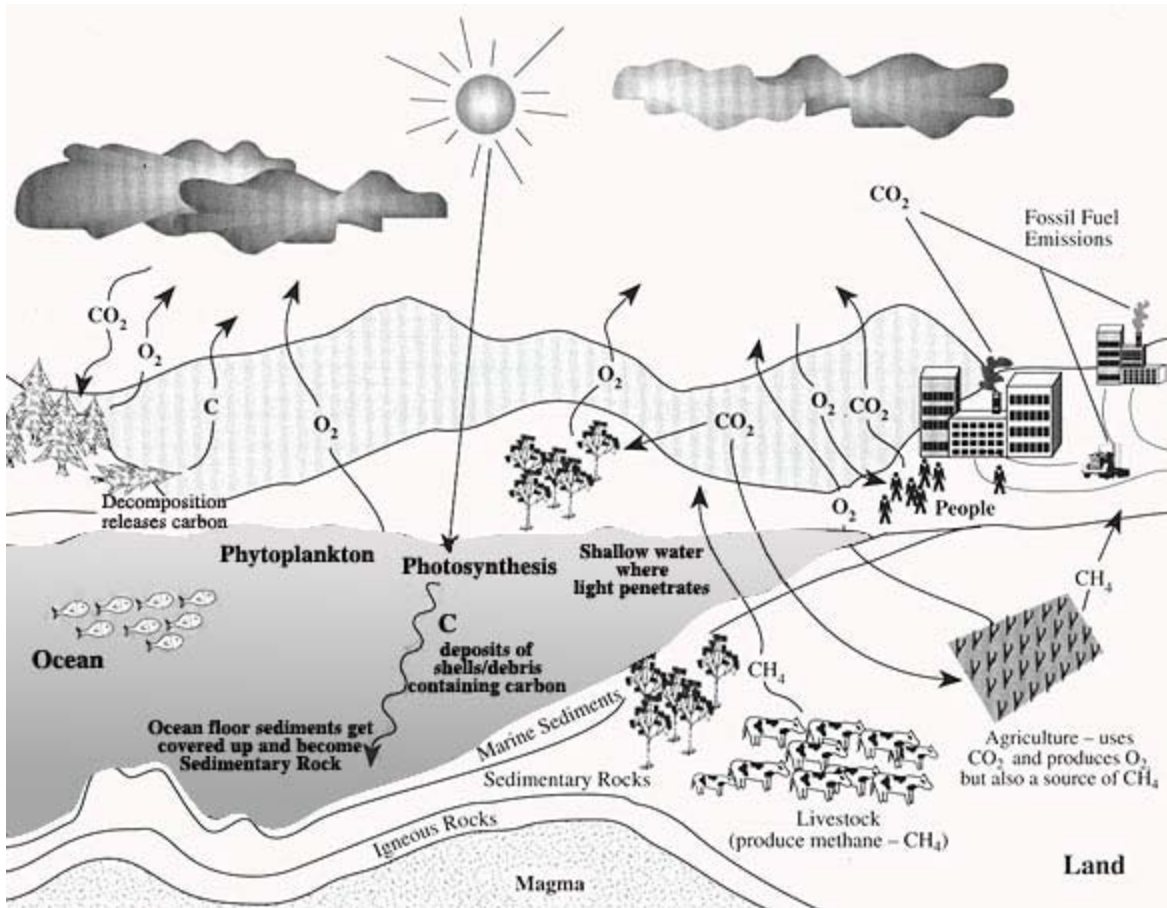


Image Source: http://www.bigelow.org/foodweb/carbon_cycle.jpg

The Carbon Cycle

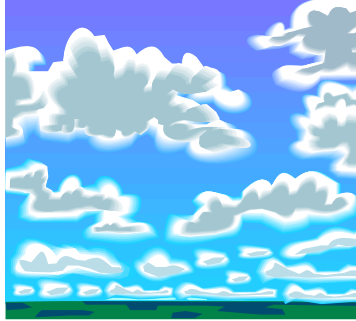
DATA RECORD SHEET

Record the places you have traveled as a carbon molecule.

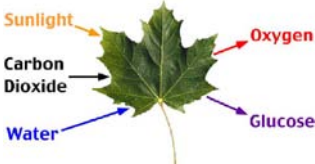
Student's Name: _____

	Station Stop	What Happens	Destination
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____
5.	_____	_____	_____
6.	_____	_____	_____
7.	_____	_____	_____
8.	_____	_____	_____
9.	_____	_____	_____
10.	_____	_____	_____

The Carbon Cycle
THE ATMOSPHERE





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

If you roll...	Then you ...
1	Stay in the atmosphere. Much of the carbon dioxide in the atmosphere moves through the atmosphere.
2	Go to plant. You are used by a plant in photosynthesis. 
3	Stay in the atmosphere. Much of the carbon dioxide in the atmosphere moves through the atmosphere.
4	Stay in the atmosphere. Much of the carbon dioxide in the atmosphere circulates through the atmosphere.
5	Go to surface ocean.
6	Go to plant. You are used by a plant in photosynthesis.

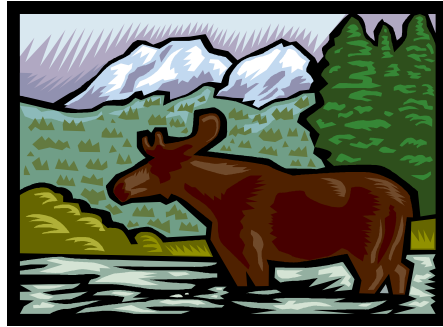
The Carbon Cycle **PLANTS**





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

If you roll...	Then you ...
1	Go to soil. The tree shed its leaves. <div style="text-align: center;">  </div>
2	Stay in plant. You are a carbon molecule in the tree's trunk.
3	Go to animal. The leaves and berries that the plant produced contain your carbon molecule and were eaten. <div style="text-align: right;">  </div>
4	Stay in plant. You are a carbon molecule in the tree's roots.
5	Stay in plant. You are a carbon molecule in the tree's branches.
6	Stay in plant. You are a carbon molecule in the tree's trunk.

The Carbon Cycle ANIMALS

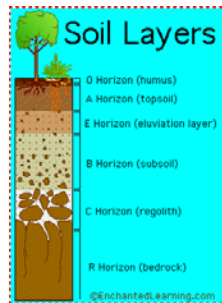


You are currently a molecule of carbon in an animal.



If you roll...	Then you ...
1	Stay in animal. The carbon molecule is stored as fat in the animal.
2	Go to soil. The animal that consumed you died and your carbon molecule is returned to the soil. 
3	Go to atmosphere. The animal that consumed you respired (breathed) you out as carbon dioxide.
4	Stay in animal. You are eaten by a predator. 
5	Go to atmosphere. The animal that consumed you respired (breathed) you out as carbon dioxide.
6	Go to atmosphere. The animal that consumed you respired (breathed) you out as carbon dioxide.

The Carbon Cycle

SOIL

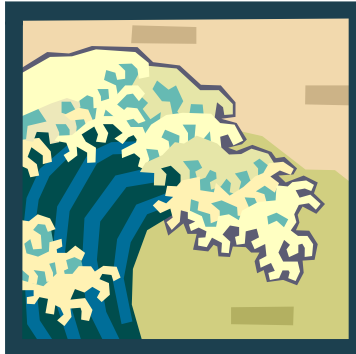


You are currently a molecule of carbon dioxide in the soil.


If you roll...	Then you ...
1	Stay in the soil. Much of the carbon in the soil is stored there.
2	Go to plant. You are used by a plant in photosynthesis.
3	Go to fossil fuels. Your carbon molecule has been in the soil so long it turns into fossil fuels. 
4	Go to the atmosphere.
5	Stay in the soil.
6	Go to fossil fuels. Your carbon molecule has been in the soil so long that it turns into fossil fuels. 

The Carbon Cycle

SURFACE OCEAN

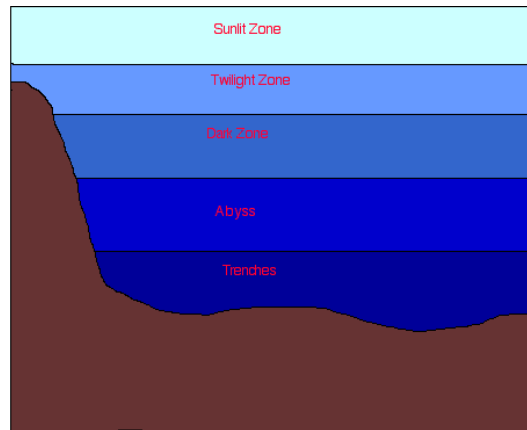


You are currently a molecule of carbon dioxide in the surface ocean.

If you roll...	Then you ...
1	Go to deep ocean.
2	Stay in the surface ocean.
3	Go to deep ocean. Your carbon atom was part of an ocean organism that has died and has sunk to the bottom of the ocean. 
4	Stay in the surface ocean.
5	Go to the atmosphere.
6	Go to the atmosphere.

The Carbon Cycle

DEEP OCEAN

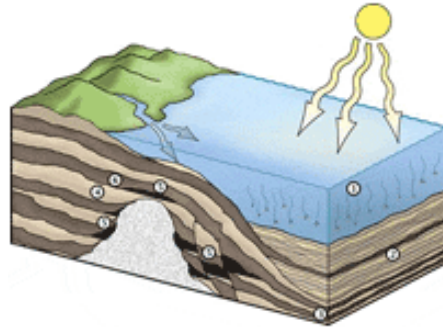


You are currently a molecule of carbon in the deep ocean.

If you roll...	Then you ...
1	Stay in the deep ocean.
2	Stay in the deep ocean.
3	Go to surface ocean.
4	Go to surface ocean.
5	Go to surface ocean.
6	Go to animal. An organism in the water has taken you up as food in the deep ocean.

The Carbon Cycle

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	Stay in the fossil fuels.
2	Stay in the fossil fuels.
3	Stay in the fossil fuels.
4	Stay in the fossil fuels.
5	Go to the atmosphere. Humans have pumped the fuel that you are part of out of the ground and have used it to power their cars.
6	Go to the atmosphere.