

## The Carbon Cycle Game

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

Please credit the author, Jennifer Ceven, Grade 6 Science Teacher, 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.

ATOM of C w/ different molecules

### 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:

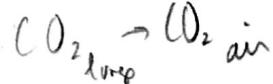
The movement of carbon through various aspects of the natural environment is the focus of much scientific research. Global warming and climate change can be attributed to the increased amount of heat-trapping gases, such as carbon dioxide. Students must develop an understanding of how carbon moves through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

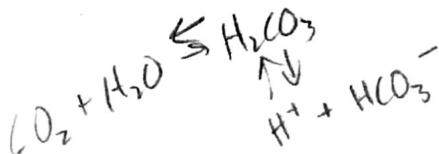
### Warm-Up:

- 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



weathering / erosion?





- 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.

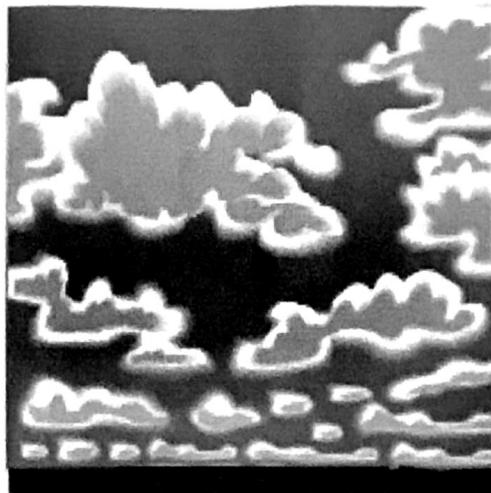
### Wrap-Up and Action Plan:

- 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:

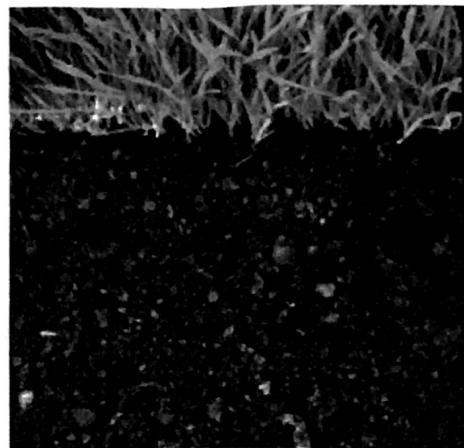
- Rate students' understanding on their responses from class or group discussions.
- Assign a follow-up activity:
  - Role-play the motion of carbon throughout the carbon cycle.
  - Write a story about your carbon atom as it moved through the carbon cycle.

# ATMOSPHERE



If you roll...	Then you...
1	Stay in the atmosphere as CO <sub>2</sub> .
2	Are taken up by a plant in photosynthesis and become glucose (C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> ). GO TO PLANT.
3	Stay in the atmosphere as CO <sub>2</sub> .
4	Stay in the atmosphere as CO <sub>2</sub> .
5	Are jostled by wind and wave action and dissolve in seawater. GO TO SURFACE OCEAN.
6	Are taken up by a plant in photosynthesis and become glucose (C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> ). GO TO PLANT.

# SOIL



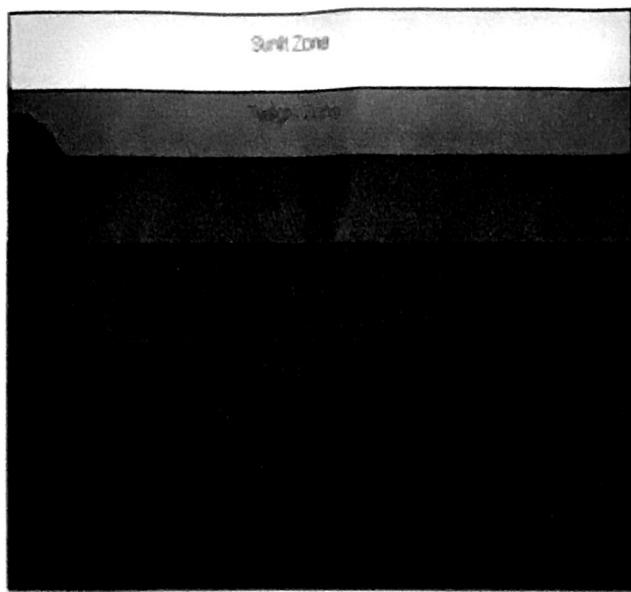
If you roll...	Then you...
1	Are CO <sub>2</sub> in soil air. STAY IN SOIL.
2	Are taken in by a plant doing photosynthesis. GO TO PLANT.
3	Are part of dead plant tissue, become trapped in anoxic soil, and with high temperature and pressure you become a fossil fuel. GO TO FOSSIL FUELS.
4	Diffuse into the sky on a warm breeze. GO TO ATMOSPHERE.
5	Are in a carbon compound within detritus. STAY IN SOIL.
6	Are part of dead animal tissue, become trapped in anoxic soil, and with high temperature and pressure you become a fossil fuel. GO TO FOSSIL FUELS.

# PLANT



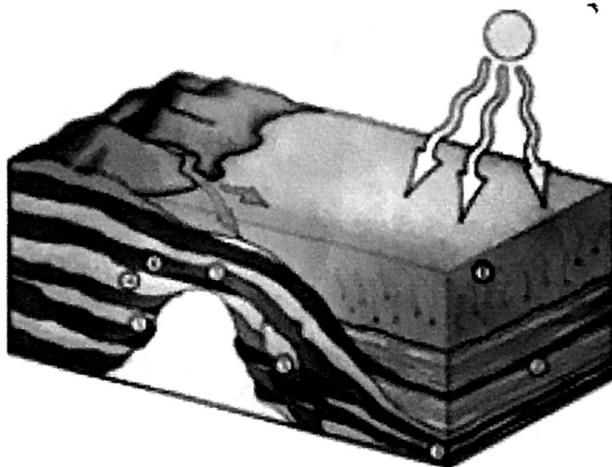
If you roll...	Then you...
1	Are in a leaf, but the tree sheds all its leaves. GO TO SOIL.
2	Are in the cellulose within the xylem in a tree trunk. STAY IN PLANT.
3	Are in glucose, $C_6H_{12}O_6$ , within a fruit and that fruit is eaten by an animal. GO TO ANIMAL.
4	Are in starch within the cytoplasm of a root cell in a tree. STAY IN PLANT.
5	Are in sucrose ( $C_{12}H_{22}O_{11}$ ) within the phloem in a tree branch. STAY IN PLANT.
6	You were glucose, $C_6H_{12}O_6$ , in the leaf but the leaf cell respired and now you're $CO_2$ . GO TO ATMOSPHERE.

# DEEP OCEAN



If you roll...	Then you...
1	STAY IN THE DEEP OCEAN.
2	STAY IN THE DEEP OCEAN.
3	Join an upwelling current. GO TO SURFACE OCEAN.
4	Join an upwelling current. GO TO SURFACE OCEAN.
5	Join an upwelling current. GO TO SURFACE OCEAN.
6	Are swallowed by a dolphin. GO TO ANIMAL.

# FOSSIL FUELS



If you roll...	Then you...
1	Are methane ( $\text{CH}_4$ ). STAY IN FOSSIL FUELS.
2	Are crude oil, a mixture of substances that is about 85% carbon. STAY IN FOSSIL FUELS.
3	Are coal (one type: $\text{C}_{137}\text{H}_{97}\text{O}_9\text{NS}$ ). STAY IN FOSSIL FUELS.
4	Are in peat, a mixture of substances that is 48-63% carbon. STAY IN FOSSIL FUELS.
5	Are pumped out of the ground by humans, burned in a car engine, and are now $\text{CO}_2$ . GO TO ATMOSPHERE.
6	Became rock, underwent subduction, melted, and after a volcanic eruption on Hawaii emerge as $\text{CO}_2$ . GO TO ATMOSPHERE.

# SURFACE OCEAN



If you roll...	Then you...
1	Join a downwelling current. GO TO DEEP OCEAN.
2	Are floating in a calm sea. STAY IN SURFACE OCEAN.
3	Were in a protein within an organism that died and sank to the bottom of the ocean. GO TO DEEP OCEAN.
4	Are floating in a calm sea. STAY IN SURFACE OCEAN.
5	Move up into the atmosphere with wind and wave action. GO TO ATMOSPHERE.
6	Move up into the atmosphere with wind and wave action. GO TO ATMOSPHERE.

# **ANIMAL**



<b>If you roll...</b>	<b>Then you...</b>
1	Are part of a lipid molecule in adipose tissue. <b>STAY IN ANIMAL.</b>
2	Are in a carcass in the ground, as the animal that ate you died. <b>GO TO SOIL.</b>
3	Are exhaled as CO <sub>2</sub> , because the animal that consumed you did cellular respiration. <b>GO TO ATMOSPHERE.</b>
4	Are part of a food chain, because a predator eats the animal you are in. <b>STAY IN ANIMAL.</b>
5	Are exhaled as CO <sub>2</sub> , because the animal that consumed you did cellular respiration. <b>GO TO ATMOSPHERE.</b>
6	Are exhaled as CO <sub>2</sub> , because the animal that consumed you did cellular respiration. <b>GO TO ATMOSPHERE.</b>