

Carbon – The World Traveler!

Educator Lesson Plan

Original activity created by E.V. Bell 2009, COSEE-SE; updated 2020

About This Activity

Target Grade Levels: 2, 4, 6, 9 - 12

South Carolina State Science Standards: 2.E.2; 4.E.2; 6.E.2; H.B.6; H.E.4; H.E.5

Ocean Literacy Essential Principles

#2: The ocean and life in the ocean shape the features of Earth.

#3: The ocean is a major influence on weather and climate.

Focus Question

In what ways does carbon cycle through the hydrosphere, lithosphere, biosphere, and atmosphere and how does it impact climate?

Student Objectives

- 1) Understand components of hydrosphere, lithosphere, biosphere, and atmosphere.
- 2) Demonstrate how natural processes release and absorb carbon.
- 3) Describe ways in which carbon influences and impacts climate.

Activity Details

Suggested Pre-Activity: Carbon Cycle Poster, California Academy of Sciences (www.calacademy.org/educators/lesson-plans/carbon-cycle-poster)

Class Size: Class size of 24 or 30 students

Time: 20 – 30 min. (including prep. time)

Materials

- Plastic headbands (one per student)
- Large paper clips (one per student)
- Small Styrofoam balls (>1 inch in diameter) – one per student
- Plastic tokens or tickets (one per student; colors should be evenly divided)
- Magazines (optional) or access to the outdoors
- Poster board (if access to the outdoors is not possible)
- Glue or tape (if access to the outdoors is not possible)
- Markers (4 colors)
- Black marker
- Printed cards (enough for each student to play) – see Carbon Cycle Cards below
- Master flow chart of carbon cycle OR carbon cycle poster from suggested pre-activity

Preparation

- 1) Divide students evenly into 4 groups. Give each group the category of lithosphere, atmosphere, hydrosphere, or biosphere.
- 2) As a group, have students define characteristics about their sphere.
- 3) Select 2 or 3 students to represent the physical nature of that sphere. The rest of the group represents carbon atoms.
- 4) If possible, have those students representing the sphere go outside and pick out items that are found in their sphere. Example: the lithosphere group could pick up rocks and the biosphere group could pick up leaves or a flower. If access to the outdoors is not possible, have these students cut out pictures from a magazine and tape or glue the images to a piece of poster board.

- 5) For the students representing the carbon atoms:
 - a) Give each student one plastic headband, one paper clip, and one foam ball.
 - b) Pass out one marker to each group and have that group color each of their foam balls with that color.
 - c) Pass out the black marker and have the student write "C" on the foam ball to designate "carbon".
 - d) Carefully unwind the paper clip and wrap one end around the top of the headband. Have the other end stick straight up. Affix the foam ball to the other end so that the "C" is facing forward.
 - e) Have the students put on their headbands and stand with their sphere.
6. Have the spheres and carbon atoms stand in groups in a circle approximately 10 feet apart.

Part I

- 1) Pass out the cards to those students **representing the sphere**. Make sure that enough cards are given out so that each student **representing carbon** gets a turn.
- 2) Beginning with any sphere, have that student read the card aloud. It will specify the process by which carbon is released. After reading the card, that student will then gently tap one of the carbon atoms in their group "releasing" him or her. That carbon atom will then choose one of the spheres to be absorbed. That student will go and stand by the sphere they think they are absorbed by and the group will discuss if this is correct or incorrect. If incorrect, that student goes back to their original sphere and tries again. *Teachers, ask guiding questions to help students figure out the appropriate sphere to go to.*
- 3) When a carbon atom is correctly absorbed by a new sphere, that group then reads one of their cards and "releases" one of their atoms.
- 4) The game keeps going until all carbon atoms have left their original sphere and have ended up in a new sphere. The color-coded headbands will help you keep track.

Part II

- 1) Have the carbon atoms return to their original sphere.
- 2) Take the cards up and pass out tokens – each sphere should get at least 10-20 tokens all of the same color.

- 3) Give one student representing the sphere a master flow chart for how carbon is absorbed and released in that particular sphere. *Or have the students refer to posters made during the Suggested Pre-Activity: Carbon Cycle Poster.*
- 4) The job of the carbon atom is to rotate through all of the spheres collecting tokens from each and then return back to their original sphere.
- 5) This part does not need to be done one at a time. Have the carbon atoms, simultaneously, leave their sphere and travel. This is more indicative of how carbon cycles through the Earth's systems.
- 6) Carbon atoms can only receive a token by:
 - a) Telling their sphere of origin what process they are released by and then,
 - b) Traveling to another sphere and telling those students the process by which they are used/absorbed and then,
 - c) Telling that same sphere a process by which they are released. *Only after this last step will that sphere hand them a token.*
7. Carbon atoms must all get at least one token from all 4 spheres and arrive back at their original sphere.

Hint: It might take a carbon atom several visits to the same sphere before finding a way to arrive back at their original point of origin. That's ok! Carbon doesn't necessarily cycle in a perfect circle.

Example: A carbon atom located in the biosphere would tell those students that he or she is released through the process of burial and sedimentation. He/She would then travel to the lithosphere and state that they are absorbed in this sphere through the process of burial and sedimentation. Those students representing the lithosphere would check their master sheet to verify and "absorb" that carbon atom. The carbon atom would then tell them that through the process of eruption, he or she is released. Once released from the lithosphere, the student takes a token from the lithosphere group and walks to the atmosphere group and repeats the process.

Extensions

- Using the human adaptation cards from the Carbon Cycle Poster, describe how carbon impacts climate. These cards can be read aloud by the sphere groups as in Part I.
- Add indication of what state the carbon moves from and to. For example, cut circles of CaCO_3 , CO_2 , etc. and have students add them at the beginning of arrows and end of arrows.

Carbon Cycle Cards

Sheet 1 of 3

Through the process of **respiration**, fish use gills to get the oxygen they need and to release carbon dioxide.

(Bio to Hydro)

Through the process of respiration, humans use lungs to extract the oxygen needed and to release carbon dioxide.

(Bio to Atmo)

Fossil fuels are the result of the process of sedimentation.

(Bio to Litho)

Carbon Cycle Cards

Sheet 2 of 3

Don't Stand Too Close! When the pressure gets too much, volcanoes will erupt releasing ash and gases—sometimes several miles up!

(Litho to Atmo)

Worn out and worn down! Over millions of years, the process of erosion can wear away rocky or sandy areas. The Colorado River continues to erode the Grand Canyon.

(Litho to Hydro)

It's simple chemistry! The process of diffusion allows carbon dioxide to move from the atmosphere to the _____ as long as the concentration is lower here.

(Atmo to Hydro)

Carbon Cycle Cards

Sheet 3 of 3

Through the process of photosynthesis
carbon dioxide is used by trees.

(Atmo to Bio)

Through the process of photosynthesis carbon dioxide
is used by phytoplankton.

(Hydro to Bio)

It's simple chemistry! The process of diffusion allows
carbon dioxide to move from the hydrosphere to the
_____ as long as the concentration is lower here.

(Hydro to Atmo)