Please Pass the Carbon

Goal of Activity: This activity helps the group focus attention on the various components of the carbon cycle and illustrates the path carbon molecules take as they pass through the cycle.

Audience: Grade 4th – Adult, need at least 6+ participants

Difficulty Level: Intermediate

Materials Required
Clothespins (3 for each person)
Poster board
Markers
String or yarn
Carbon cycle poster

Estimated cost of materials: $10.00

Instructions

Estimated time required to complete activity: 15 minutes
Preparation time: 1 hour

This activity can be found in the Climate Change Backpack Presenter's Guide:
http://www.sciencecentercollaborative.org/nescc/backpack/backpack4.pdf

1. Read description of the global carbon cycle at:
   http://www.sciencecentercollaborative.org/nescc/backpack/backpack2.pdf
   http://www.sciencecentercollaborative.org/nescc/backpack/backpack3.pdf
2. Prepare signs that represent the following: atmosphere, biomass, soil, ocean, fossil fuel deposit, or underground rocks, and a few signs that represent fossil fuel users (examples include a bus, motorcycle, chain saw, and bulldozer).
3. Select six participants to act as carbon pools. Give each a sign that represent a carbon pool.
4. Select two or more additional participants to act as fossil fuel users or deforestation agents. Give them the appropriate sign.
5. Explain how the activity will illustrate the carbon cycle. Briefly show the group the carbon cycle poster so they understand what is happening.
6. Using the clothespins to represent carbon, give the 6 participants who represent carbon pools, three clothespins each. Each clothespin represents one unit of "carbon."
7. Students can act out the pool of carbon they represent. For instance, the atmosphere person can wave their hands.
8. Begin the cycle. Atmosphere, biomass, soil, and ocean begin by passing one piece of carbon at a time. All four pass and all four receive. Students can

explain what happened to the carbon as it was passed from one part of the cycle to the next.

9. Explain how a cycle works and how the cycle is stable and in equilibrium.
10. Perform several trades between the carbon pools but make sure the cycle remains in equilibrium.
11. Explain that over hundreds of millions of years, comparatively tiny amount of carbon go underground and eventually come back out. To show this, tell the fossil fuel and the rock representatives to pass one clothespin each to the other pools without trades. Rocks and fossil fuels stop passing clothespins while the rest continue. Again, point out that the cycle remains in equilibrium.
12. Explain to your audience that many things in the real world can throw the carbon cycle out of balance. The two greatest concerns today are deforestation and fossil fuel extraction and combustion.
13. Have the deforestation agent remove a clothespin from the participant representing biomass and pass it to the atmosphere.
14. Have the fossil fuel user come over to the fossil fuel person and grab a carbon piece and pass it to the atmosphere.
15. Do a couple of simple passes. After you have let this go on for a while, have everyone stop and count his or her carbon pieces.

What's Happening?

Carbon moves through the **atmosphere, oceans, plants, soil,** and the **Earth** in cycles over time. This activity illustrates both the natural **carbon cycle** and the changes that occur when large amounts of **carbon dioxide** are released into the **atmosphere** through the human activities like **fossil fuel burning** and **deforestation.**

Additional Resources:

http://www.sciencecentercollaborative.org/nescc/backpack/backpack1.pdf

Contributed to the IGLO Toolkit by The Northeast Science Center Collaborative, a program of Clean Air - Cool Planet.

Utah 9th Grade Science Core earth systems science **Standard:**3600-01
Objective: 3600-0103
ILO's: Develop and use categories to classify observations, make estimations and predictions based on observations and current knowledge, recognize personal relevance of science in daily life, construct a chart to describe and summarize data, know science terminology facts, use language and concepts of science as a means of thinking and communication, and realize and value peer review in assessing interpretations.

The Global Carbon Cycle

Summary: This activity could be used to introduce the carbon cycle. It is an inquiry designed to model the flow of a carbon atom as it travels through the carbon cycle. Students also make connections about how human activities affect the carbon cycle.

Duration: One class period.

Category: Inquiry

Materials, equipment and/or facilities:
butcher paper, colored markers, white 5 x 7 index cards (3 per group).

Background Information:
General, 'everyday' knowledge of carbon-based substances in the environment is assumed. Since students work in small groups, the collective, shared prior knowledge of group members is adequate to complete the activity.

This activity can be adjusted to meet the capabilities of students across a relatively wide range of abilities. To make the activity easier, you could print a copy of table 1 with the information deleted. This gives the students a starting point.

However, for all classes, it is encouraged that the student generate and develop their own unique carbon cycle, including major carbon reservoirs and fluxes.

Teaching and Learning Strategies:
Ensure inquiry: Students will develop independent group charts illustrating the global carbon cycle. Teachers should not feel the need to answer all their questions, let the students discover their own answers. When helping students, teachers can stimulate the thought process by answering student questions with questions.

Prerequisite Instruction:
Before this activity, introduce the concepts of flux and reservoir.
Reservoir- global location
Flux- a change

Invitation to Learn:
Problem: Speculate on the "fate" of carbon atoms contained in carbon dioxide molecules found in a breath of air. Trace possible pathways of the carbon atom over a short and long time and possible reservoirs of the carbon atom in the past.

- Divide students into groups of 3, and provide them with a set of the materials listed.
- After index cards are labeled and filled in, have students decide which of the reservoirs respresents the largest and smallest reservoir of carbon atoms on a global scale. Write the phrase 'most carbon', and 'least carbon' on that card.
- Attach your three cards to a large piece of butcher paper. Arrange the cards so they are roughly equally spaced from the sides of the paper. Students should realize that a carbon atom can move from one reservoir to another. A carbon flux can be indicated by drawing an arrow from one reservoir to another and writing down the process that moved the carbon atom.

Summary of Learning:
Assessment of Learning: Have students share their observations by taping their group chart on the board. Compare the different charts. Emphasize the similarities among the charts rather than just differences. Answers to include are as follows:

Table 1: Some carbon-containing substances and their global locations

Common carbon-containing substances	Major Global Locations
carbon dioxide	atmostphere
carbon dioxide (dissovled), hydrogencarbonate ions, carbonate ions, some biomolecules	ocean water
biomolecules	aquatic life
biomolecules, hydrogencarbonate ions, carbonate ions	land-based life
biomolecules, hydrogencarbonate ions	land (soil)
carbon, methane, other hydrocarbons	fossil fuels

a. If an oil spill occurs, hydrocarbons will also be present, particularly at the surface

b. 'Biomolecules' are any molecules of biological origin.

Next have the class identify different carbon fluxes and write those on them on the board. Some likely examples include:

fossil fuels- (burning)- atmosphere
atmosphere- (dissolving)- ocean
atmosphere - (photosynthesis)- land-based life
land-based life - (respiration)- atmosphere
aquatic life- (respiration)- atmosphere
land- (acid rain attack on carbonates)- atmosphere

Next have students identify the reservoir with the most and least amount of carbon. The actual ranking is:

1. oceans (including mid and deep waters)
2. land (soil)
3. atmosphere