



Carbon Reservoirs and Global Carbon Cycling Introduction

Overview

Students begin to explore the carbon cycle, including the main processes or flows that move carbon between reservoirs on Earth. They first do a Quick Write and share ideas with a partner to access their prior knowledge and then the terms carbon reservoirs, flows (processes) and carbon cycle are introduced and defined. Students use this information and make a sketch from an image of the local estuarine/harbor ecosystem, labeling all the carbon reservoirs and flows they are familiar with from prior knowledge and a turn and talk discussion. A reflection provides the opportunity to compare their ideas before and after the activity and to consider what questions still remain.

Materials Needed

For the class

- PowerPoint presentation
- Digital/data projector
- Whiteboard or flip chart paper and pens
- (Optional) Access to video:
 - It's All About Carbon video <https://www.youtube.com/watch?v=yobb9Zi5Tao>

For every student

- Blank sheet of 8.5 x 11" paper
- Pen/pencil

For each small group

- (Optional) 1 copy of Carbon Cards in an envelope

Preparation of Materials

1. (Optional) For small groups

Duplicate Carbon Cards (or use cards from Ocean Sciences Sequence curriculum). Make one set of 2-sided copies for each small group of 4 participants.

2. (Optional) Set up projection system/review multimedia.

Set up and test the projection system to be sure all students will be able to see the video at

<https://www.youtube.com/watch?v=yobb9Zi5Tao>



Session at a Glance

Task	Description	Time (minutes)
A. Activity: <i>Sketching Local Carbon Reservoirs and Flows</i>	Students do a Quick Write to access their prior knowledge about carbon. The terms carbon reservoirs, flows (processes) and carbon cycle are introduced and defined. They then make a sketch from an image of the local estuarine/harbor ecosystem, labeling all the carbon reservoirs and flows they are familiar with from prior knowledge and a turn and talk discussion.	20
B. Reflection: <i>Quick Write–Line of Learning</i>	Students return to the Quick Write prompt from the beginning of the session and add additional ideas they want to remember about carbon and the carbon cycle and what it has to do with climate change.	5

Session Details

A. Activity: *Sketching Local Carbon Reservoirs and Flows*

1. **Introduce content focus – carbon and the carbon cycle.** Tell students that we will focus on carbon and the carbon cycle, following carbon as it cycles around the ocean, land and atmosphere. Define the carbon cycle as: **The whole system of flows of carbon (in all its forms) between different parts of Earth.**
2. **Quick Write.** Have students think about and then spend a few minutes writing to the following prompts:
 - a. What are some of the different places that carbon (in any form) can be found or stored on Earth?
 - b. What are some processes involved in moving atmospheric CO₂ around Earth?

Do not collect the Quick Writes; participants will add to the prompt at the end of the session.

3. **Turn & Talk - the Carbon Cycle.** Have students do a turn and talk and discuss their responses to the Quick Write prompts, as well as one additional prompt:



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- a. What does carbon and the carbon cycle have to do with climate change?
4. **Introduce reservoir.** Explain that a place where something is collected and stored is a reservoir. One familiar type of reservoir stores water, but a reservoir does not have to be pure and contain only one thing. For example, the ocean can be considered to be a reservoir of salt, which is dissolved in seawater with a lot of other things.
5. **Expand definition to carbon.** Point out that anything which is made completely or partially of carbon describes a carbon reservoir, a place where carbon is stored. Ask, “**What’s an example of a small carbon reservoir?**” [*The graphite in pencils.*] “**What’s an example of a huge carbon reservoir?**” [*All animals and plants on Earth.*] Explain that all living (or once living) organisms are carbon reservoirs.
6. **(Optional) Distribute carbon cards.** Pass out a set of Carbon Cards to each small group. Explain that these cards provide examples of a diverse array of carbon reservoirs. Encourage students to explore the back of the cards and talk to the person next to them about what kind of information is provided. Give students about 5 minutes to explore the cards. [Note to instructor: don’t collect the cards yet because they will be used again later in the session.]
7. **(Optional) Watch video, It’s All about Carbon, and Turn & Talk.** Ask students to jot down questions or ideas as they watch the video – It’s All About Carbon (3 minutes, 20 seconds) and then after the video, have them do a Turn & Talk to share their questions and ideas.
8. **Display image and diagram carbon in Sydney Harbor (or equivalent local ecosystem).** Tell students that this next activity will give them the opportunity to think about and grapple with how carbon might flow in a relatively familiar environment of a coastal city with both natural and human activities taking place. Distribute a blank sheet of paper and tell them that they will have about five minutes to:
 - a. make a diagram and label carbon reservoirs they see on the image of Sydney Harbor (or use an approximately equivalent, or locally-relevant image),
 - b. show with lines and arrows how carbon might flow (or move) from one carbon reservoir to another, and
 - c. generate a list of questions they have about carbon, carbon flows and reservoirs.Explain that this diagram is a model of how they are thinking about reservoirs, flows and interactions in the carbon cycle and represents their prior knowledge.



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- 9. Students share diagrams and questions with a partner.** After students have spent about five minutes drawing and writing down questions, give them another couple of minutes to share their drawings, questions and ideas with one another to get additional ideas that may cause them to question their assumptions. **IMPORTANT:** have participants keep their diagrams to refer and add to later.
- 10. Provide more complex definition of carbon cycle.** Display the following definition of the carbon cycle: Living things take in carbon as CO_2 through the process of photosynthesis and return carbon to the environment through the processes of (a) respiration, (b) absorption in the ocean, (c) decomposition, (d) combustion, and (e) fossil fuels and limestone. This is the carbon cycle.

Share that subsequent activities will delve into several of these processes in more detail, including photosynthesis, respiration, and absorption into the ocean.

B. Reflection

- 1. Introduce Reflection Quick Write.** Have students refer back to what they wrote to the initial Quick Write and Turn & Talk prompts:
 - What are some of the different places that carbon (in any form) can be found or stored on Earth?
 - What are some processes involved in moving atmospheric CO_2 (and other forms of carbon) around Earth?
 - What does carbon and the carbon cycle have to do with climate change?
- 2. Line of Learning.** Have students draw a line under their original response and add new information and details under the line that they want to remember. Also include which of their questions they were able to answer about carbon, carbon flows and reservoirs, and what questions they still have.