

Cloudy with a Chance of Science!

Week 3: Grades 6-8

Day 4: Dinosaur Breath

Teacher/Parent Background:

Of the more than 100 known elements, carbon is one of the most important and widely used in living systems. Individual carbon atoms cycle between the atmosphere and the biosphere through a series of steps. The main form of carbon in the atmosphere is carbon dioxide gas. In living systems, carbon exists mostly as carbohydrates and lipids. The law of conservation of matter states that matter can be neither created nor destroyed, but may only change in form. Therefore, matter and energy will cycle throughout the biosphere from one sphere to another accordingly. Different organisms play different roles in the carbon cycle. If one of the steps in the cycle were to fail, then the flow of molecules would cease, and the entire biosphere would collapse.

Most of the earth's carbon is sequestered in the oceans and the lithosphere. The atmosphere, biosphere, and ocean surface waters cycle carbon much more rapidly than the deep ocean and the lithosphere. There is a balance among the autotrophs, heterotrophs, and abiotic components of the carbon cycle. The excessive use of fossil fuels puts the balance at risk by accelerating the release of sequestered carbon from the lithosphere. Carbon dioxide (CO_2) is considered a greenhouse gas because it has the ability to absorb infrared radiation. At pre-industrial levels (around 280 ppm), this compound's ability to hold heat was critical to supporting life on earth, as this effect helped trap the sun's energy in the form of heat. However, at elevated levels (around 400 ppm as of 2012), carbon dioxide's ability to absorb heat contributes to elevated temperatures on earth's surface, which is causing global climate changes. Sources of CO_2 emissions may be natural, such as volcanoes, forest fires, the decay of organic matter, or animal respiration. At normal CO_2 atmospheric concentrations, the oceans are able to absorb and remove carbon from the atmosphere. Sources that remove carbon are known as carbon sinks. Plants are another carbon sink. Since the industrial revolution, the burning of fossil fuels has added CO_2 to the atmosphere at a rate faster than the sinks can keep up with. Deforestation, caused by industry or forest fires, has also removed a large part of the earth's carbon sink system, making the problem of above normal CO_2 levels in the atmosphere worse.

Overview: In this activity, adapted from Teachengineering.com, students will learn about the geological carbon cycle. They investigate the role of dinosaurs and other ancient biomass in the carbon cycle and the eventual storage of carbon. Students discover how the carbon cycle has been occurring for millions of years and is necessary for life on Earth.

Related Standards:

Construct and support an argument about how human consumption of limited resources impacts the biosphere.

Key Terms:

Climate- The set of weather conditions that prevail in a region year after year.

Data- Pieces of information.

Carbon Cycle- The continuous movement of carbon among the abiotic environment and living things.

Fossil Fuels- Fossil fuels such as coal, petroleum products and natural gas are the results of ancient biomass.

Materials List:

- 3-4 pieces of chalk (NOT dustless chalk)
- 1 tsp of baking soda
- rolling pin and hard surface to crush chalk
- 1 small sandwich bag in which to crush chalk
- ¼ cup vinegar (either red or white)
- 2 disposable water bottles
- 1 small balloon

Activity Description:

1. Ask students to read through the background reading, [Life of a Carbon Atom](#) and discuss the investigating questions through google classroom or some other online platform, if possible.
2. Make sure students understand the answer to the final two questions:
 - a. . How did the carbon atom become natural chalk? *The carbon atom became natural chalk after it was captured by the tiny marine creature, who used the carbon to build its shell. When the sea creature died, its remnants (including its shell) sank to the*

bottom of the ocean floor and formed sediments of limestone and chalk. These sediments were raised above sea level by tectonic activity to create large rock formations, like the White Cliffs of Dover, where a lot of natural chalk is mined today.

- b. *How can we release the carbon contained in the natural chalk, which could be from the exhaled breath of a dinosaur? We can release the carbon contained in the natural chalk, which could be from the exhaled breath of a dinosaur, through a simple chemical reaction with vinegar. The carbon atoms combine with oxygen in the atmosphere to form carbon dioxide.*
3. Have students follow the activity instructions on the student handout. You can [watch this video](#) to see the setup in order to better help students troubleshoot or if you want to do this as a demo on a zoom call.

Closure:

Discuss the Following with your students:

What are some carbon-containing objects? Seashells, plants, and coal. Anything that is or was once living and the atmosphere as it contains CO₂ and other carbon based gases.

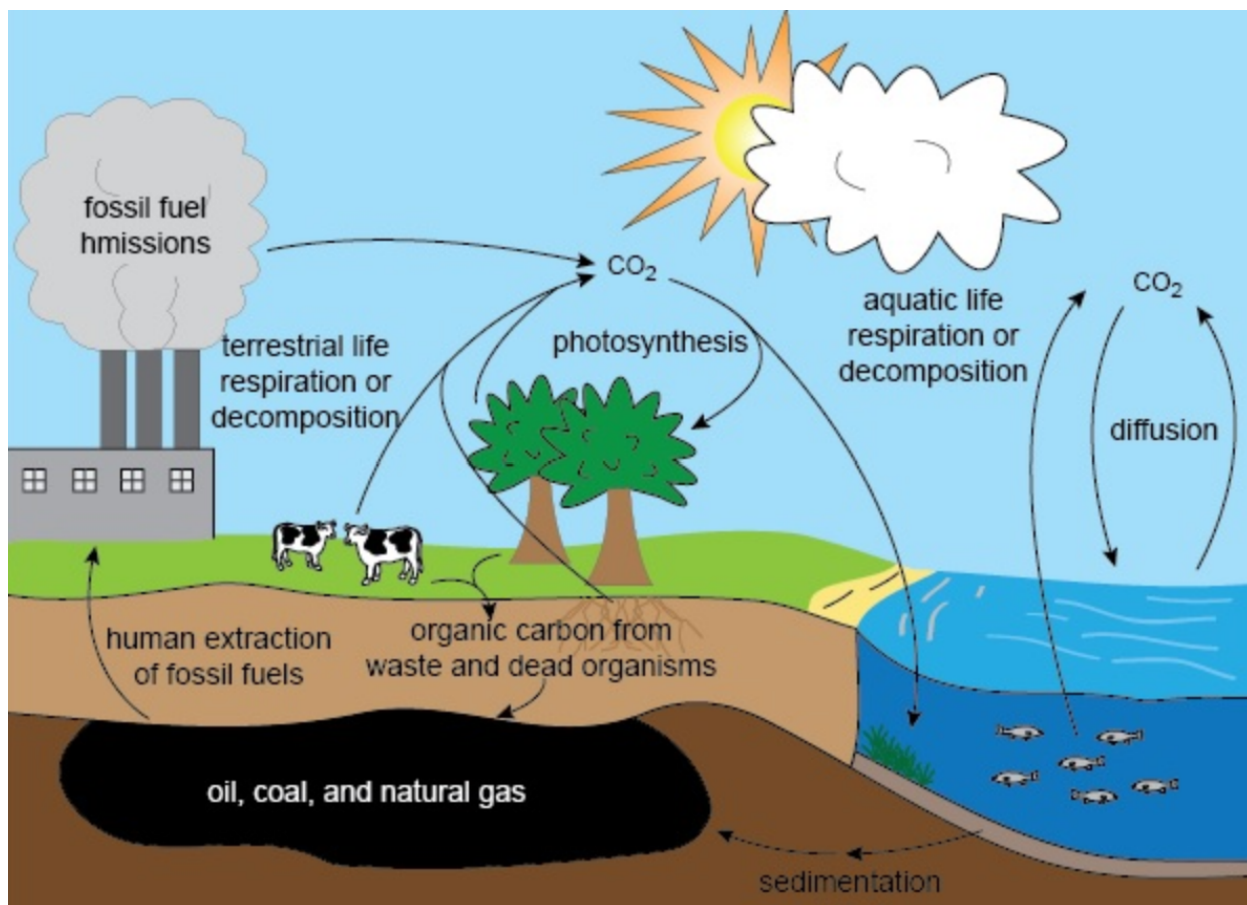
-Carbon is exchanged between the atmosphere, biosphere, hydrosphere and geosphere. What are some ways in which carbon is released into the atmosphere? Respiration, burning of biomass, deforestation and combustion of fossil fuels.

Extension:

-Explore and Learn:

- [A Student's Guide to Global Climate Change](#)
- [The Carbon Cycle](#)

Student Handouts



1. Gather the following materials:
 - o 3-4 pieces of chalk (NOT dustless chalk)
 - o 1 tsp of baking soda
 - o rolling pin and hard surface to crush chalk
 - o 1 small sandwich bag in which to crush chalk
 - o $\frac{1}{4}$ cup vinegar (either red or white)
 - o 2 disposable water bottles
 - o 1 small balloon
2. Seal sticks of chalk into plastic bags. Using the rolling pin and a hard surface, crush the chalk into as fine a powder as possible.

3. Fill one water bottle with about four tablespoons of the crushed chalk and the baking soda.
4. Fill the second water bottle with the vinegar.
5. Pour the vinegar into the bottle with the chalk and baking soda and then very quickly place the balloon securely on the mouth of the container containing chalk, baking soda and the vinegar.
6. Explain the reaction resulting from the addition of vinegar to chalk. In other words, what happened when you added the vinegar? What resulted from this reaction? What did you see, hear and smell?

7. Explain the carbon cycle and how it is possible that dinosaur breath was released when vinegar was added to chalk. It might be helpful to refer to the background reading to answer this question.
