

# CARBON ADVENTURE STORY

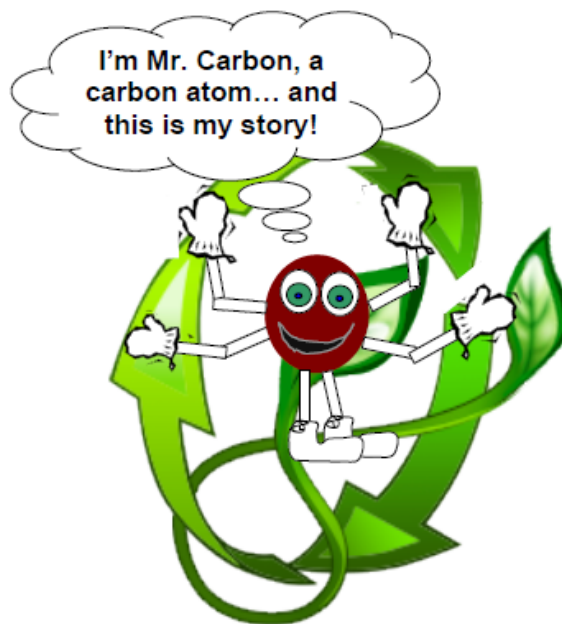
## EXPLORE 2 LESSON 10



*Can you...*

Follow the Carbon Atom?

A self-guided adventure  
through the Carbon Cycle



GLOBE® 2017

**THE GLOBE PROGRAM**

Carbon Cycle

Biosphere



## Glossary of Terms

**Atom** – The smallest particle of an element.

**Cellulose** – A carbohydrate made up of glucose molecules forming the main part of the cell wall in most plants.

**Decomposition** – The process of decay, breaking down into basic elements.

**Exoskeleton** – An external skeleton that supports/protects an animal's body.

**Hydrocarbons** – Molecules made up of long chains of carbon atoms with hydrogen atoms attached on both sides.

**Microorganism** – An organism too small to see without magnification, sometimes called a **microbe**.

**Organic matter** – One living material composed of compounds built around a structure of carbon atoms.

**Photosynthesis** – The process through which green plants and some other organisms make their own food from carbon dioxide and water using sunlight. Oxygen is released.

**Phytoplankton** – Tiny aquatic plants. Many are too small to see without magnification. These organisms get their energy from photosynthesis.

**Plant senescence** – The study of aging in plants. As part of the plant (leaves) ages plants try to save valuable resources (glucose, water, etc.) by cutting off nutrients to dying parts (one reason why leaves turn colors).

**Respiration** – The release of carbon dioxide as organic (carbon-based) compounds are broken down and used for energy by organisms. It can be thought of as the reverse of photosynthesis. Oxygen is taken in to use with stored carbohydrates as energy. Carbon dioxide and water are produced.

**Sediment** – Material that settles to the bottom of a liquid (e.g. soil particles and dead plankton falling to the bottom of the sea).

**Terrestrial** – Living or growing on land.

**Thermohaline circulation** – The movement of deep water in the oceans driven by differences in density, caused by salinity and temperature.

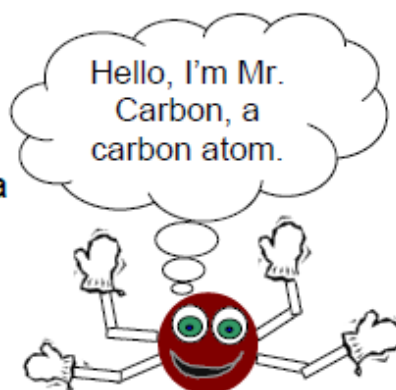
**Upwelling** – The wind-driven movement of colder, denser nutrient rich water from the deep to the surface of the ocean.

**Weathering** – The physical and chemical processes that break solid rock into tiny particles that can be moved to other places as sediment.

Can you ...  
...follow the Carbon Atom?

What is carbon?

Carbon (C) is an **atom** – a chemical element – and it's almost everywhere! But you can't actually see carbon atoms – they are too small for us to see with our eyes.



Scientists use strong microscopes to see very small things but even strong microscopes can't see single atoms.

Many scientists call carbon the building block of life. Most of you have probably used building blocks, like Lego's®, when you were younger. Almost like how building blocks can connect together to build things, carbon and other elements connect together to build things too. Chemical elements connect together into "molecules" or "compounds" – groups of atoms stuck together. These molecules then help to build things like trees or animals – even you and me!



Carbon is one of the most abundant elements in all living things and the 4<sup>th</sup> most abundant element in the universe.

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Carbon can also be found in the Earth's atmosphere (the air we breathe), the soil that we walk on, in the oceans and other water bodies, and in the Earth's surface (like rocks). So what kind of molecules does carbon make? Here are some examples of how carbon connects with other very common atoms like hydrogen (H), oxygen (O), and nitrogen (N). If **one** carbon atom joined up with **two** oxygen atoms it would become carbon dioxide ( $\text{CO}_2$ ); if **six** carbon atoms joined up with **six** water molecules ( $\text{H}_2\text{O}$ ) it would become a simple sugar called glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ ); and if **eight** carbon atoms joined up with **ten** hydrogen, **four** nitrogen and **two** oxygen atoms it would become caffeine ( $\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2$ ). Caffeine is found in chocolate, sodas, coffee, and many teas (I wonder if your



parents know that carbon

is in caffeine?). We

could go on forever

describing many more

compounds that contain carbon. But maybe we should get back to our story.



When carbon joins with these other elements the resulting molecules can be in the form of a solid, a liquid or a gas. Over time, a single carbon atom can be joined with, and released from, many different substances. Movement from carbon in trees to carbon in the air to carbon in the oceans and on and on is part of the carbon cycle.

You are about to take a journey through the global carbon cycle following our friend, Mr. Carbon, the carbon atom. Each time you travel to a new place you will learn about how carbon plays a role there. You will then have options about where Mr. Carbon should travel next. As you travel, record where you have visited (carbon pools) and then how you left (carbon fluxes) in the *Carbon Story Journey Table*. Some of the more difficult, or new, words are ***bold and italic*** and defined in the glossary at the back of the book.

Have fun!



GLOBE (Global Learning and Observations to Benefit the Environment) is a worldwide hands-on, primary and secondary school-based science and education program. GLOBE's vision promotes and supports students, teachers and scientists to collaborate on inquiry-based investigations of the environment and the Earth system working in close partnership with NASA, NOAA and NSF Earth System Science Projects (ESSPs) in study and research about the dynamics of Earth's environment. From its inception in 1994, the international GLOBE network has grown to include representatives from over 100 participating countries and approximately 150 U.S. partners coordinating GLOBE activities that are integrated into their local and regional communities.



The GLOBE Carbon Cycle ESSP joins NASA-funded carbon cycle scientists with the GLOBE Program to bring cutting-edge research and research techniques in the field of terrestrial ecosystem carbon cycling into secondary classrooms. As part of this project students collect data about their school field site to determine carbon storage and participate in classroom activities to understand carbon cycling. Students also have the opportunity to integrate their data with emerging and expanding technologies, including global and local carbon cycle computer models and online map resources. This program design allows students to explore research questions from local to global scales under both present and future environmental conditions.

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