



<b>Title:</b> Investigating the Carbon Cycle			
<b>Author:</b> Kathy Rusert Acorn High School Mena			
<b>Course:</b> Environmental Science, Earth Science, Biology		<b>Duration:</b> 1—2 Class Periods	
<b>Grade:</b> 9-12			
<b>Objective:</b> Students will learn the various ways that CO <sub>2</sub> is put into our atmosphere.			
<b>Summary of Lesson:</b> Students will analyze a Carbon Cycle Model			
<b>Arkansas State Standards:</b>			
<b>SUBJECTS:</b>	<b>GRADE LEVELS:</b>	<b>CODE:</b>	<b>STANDARD:</b>
Environmental Science	9-12	EVS-ESS2-6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
Earth Science	9-12	ES-ESS2-6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
Biology	9-12	BI-LS1-7	Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
		BI-LS2-5	Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
Language Arts	9-12	RI.9-10.2 RI.11-12.2	Examine a grade-appropriate informational text. <ul style="list-style-type: none"> <li>● Provide an objective summary of the text.</li> <li>● Determine a central idea of a text and analyze its development over the course of the text, including how it emerges and is shaped and refined by specific details.</li> </ul>
		W.9-10.2 W.11-12.2	Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.



		<b>W.9-10.4</b> <b>W.11-12.4</b>	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
		<b>SL.9-10.1</b> <b>SL.11-12.1</b>	Initiate and participate effectively in a range of collaborative discussions <ul style="list-style-type: none"> <li>● one-on-one</li> <li>● in groups</li> <li>● teacher-led</li> </ul> with diverse partners on Grades 9-10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
<b>Teacher Excellence Support System (TESS):</b> 3b: Using questioning/prompts and discussion 3d: Using assessment in instruction			
<b>Instructional Strategies and Practices:</b> Advance Organizer, Brainstorming and Discussion, Problem-Based Instruction, Cooperative Learning, Writing			
<b>Bloom's Level:</b> Highest Level Only Analyzing			
<b>Materials and Resources:</b> Student Handout 1 Investigating the Carbon Cycle Sources of CO <sub>2</sub> in the Atmosphere Student Handout 2 Investigating the Carbon Cycle Essay Assessment  <a href="http://eo.ucar.edu/kids/green/cycles6.htm">http://eo.ucar.edu/kids/green/cycles6.htm</a> <a href="http://earthobservatory.nasa.gov/Features/CarbonCycle/">http://earthobservatory.nasa.gov/Features/CarbonCycle/</a> <a href="http://beyondweather.ehe.osu.edu/files/2011/03/620px-Carboncycle.jpg">http://beyondweather.ehe.osu.edu/files/2011/03/620px-Carboncycle.jpg</a>  (These web sites may change over time. If a web site is no longer available, search key words or phrases such as carbon cycle.)			
<b>Formative Assessment:</b> Students complete a self-assessment for essay.			
<b>Notes to Teacher:</b> Students may need to work in small groups to discuss the model before organizing their essays. Also, students may question that plants give off CO <sub>2</sub> . During their lifetime, plants actually give off about half the CO <sub>2</sub> they absorb, much of it during night when the sun is not powering photosynthesis. ( <a href="http://www.scienceline.ucsb.edu/getkey.php?key=826">www.scienceline.ucsb.edu/getkey.php?key=826</a> )			
<b>Student Activity:</b> Carbon dioxide (CO <sub>2</sub> ) is a greenhouse gas that absorbs thermal energy and radiates it back to earth, warming earth's atmosphere. This process is called the greenhouse effect because			



CO<sub>2</sub> acts like the walls of a greenhouse that allow the heat from the sun into the greenhouse but prevent the thermal energy from escaping.

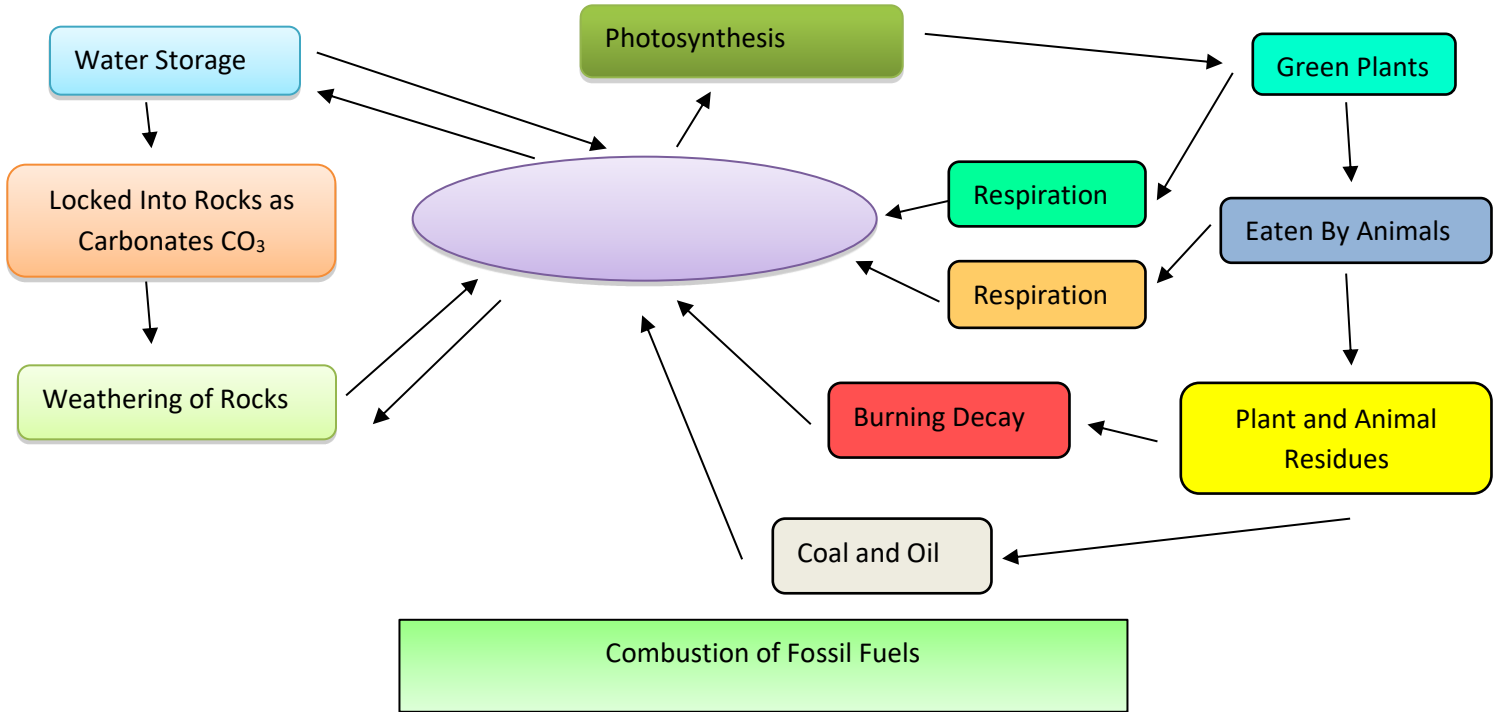
1. Distribute **Student Handout 1 Investigating the Carbon Cycle-- Sources of CO<sub>2</sub> in the Atmosphere** or create a visual to be projected in the classroom. Lead a discussion to analyze the chart. (A printable copy of the handout is available at <https://arkansasenergyrocks.com/educators/lesson-plans-9-12>)
2. Based on the handout/visual, students will write an essay explaining the various ways CO<sub>2</sub> can enter the atmosphere.
3. Students will complete **Student Handout 2 Investigating the Carbon Cycle Essay Assessment** before submitting their essay. A printable copy of the handout is available at <https://arkansasenergyrocks.com/educators/lesson-plans-9-12>
4. Evaluate the essay with a teacher-made rubric.

### Student Handouts

Printable copies of the handouts are available at <https://arkansasenergyrocks.com/educators/lesson-plans-9-12>



**Student Handout 1**  
**Investigating the Carbon Cycle | Sources of CO<sub>2</sub> in the Atmosphere**



**Student Handout 2**  
**Investigating the Carbon Cycle | Essay Assessment**

In my essay I have addressed:

- \_\_\_\_\_ Water Storage
- \_\_\_\_\_ Locked into rocks as carbonates
- \_\_\_\_\_ Weathering of rocks
- \_\_\_\_\_ Photosynthesis
- \_\_\_\_\_ Respiration from animals
- \_\_\_\_\_ Respiration from plants
- \_\_\_\_\_ Burning and decay
- \_\_\_\_\_ Combustion of fossil fuels (coal and oil)