

Grade Level: 6-8

Overview	Students will research the greenhouse effect using provided material on the Zotero. Then the students will make their own greenhouse and once they are done completing their greenhouse they will summarize their data.
Objectives	Students will understand the following:
1.	Infrared rays from the sun enter Earth's atmosphere. The gas carbon dioxide (CO ₂), which is given off by oxygen-breathing organisms and produced by the burning of fossil fuels, traps the sun's warmth within Earth's atmosphere. This phenomenon is known as the <i>greenhouse effect</i> .
2.	The greenhouse effect is important to life on Earth because it provides our planet with the warmth it needs for animal and plant life to thrive.
3.	The burning of certain fuels creates excess CO ₂ , which traps even more heat within Earth's atmosphere, possibly creating a phenomenon known as <i>global warming</i> , which may be harmful to life on Earth.
Standards	Benchmark 6-8: Knows the composition and structure of the Earth's atmosphere (e.g., temperature and pressure in different layers of the atmosphere, circulation of air masses). Benchmark 6-8: Knows ways in which clouds affect weather and climate (e.g., precipitation, reflection of light from the sun, retention of heat energy emitted from the Earth's surface). Benchmark 6-8: Knows factors that can have an impact on the Earth's climate (e.g., changes in the composition of the atmosphere; changes in ocean temperature; geological shifts such as meteor impacts, the advance or retreat of glaciers, or a series of volcanic eruptions). Benchmark 6-8: Knows that the sun is the principal energy source for phenomena on the Earth's surface (e.g., winds, ocean currents, the water cycle, plant growth).

Materials	For this lesson, you will need:	
•	Research materials on the greenhouse effect	
•	Computer with Internet access	
•	Materials students will require to create the greenhouse models they design (examples: clear plastic wrap, craft sticks, cardboard, scissors, tape)	
•	Several lamps with strong incandescent light bulbs	
•	Several indoor/outdoor thermometers	
•	Graph paper	
Procedure		<ol style="list-style-type: none"> 1. To assess what your students already know about the greenhouse effect, ask them to explain to you how Earth stays warm enough for animal and plant life to survive and thrive. If they say that the sun provides Earth with warmth, go on to ask them what keeps the sun's warmth within Earth's atmosphere.
2.	If students' answers do not include the greenhouse effect, introduce the term to them now.	
3.	<p>Even if students have heard of the greenhouse effect, they may not fully understand how the process works. Have them use materials you have provided and already found internet pages stored on Zotero to research the greenhouse effect. They should come away understanding the following:</p> <ol style="list-style-type: none"> 1. Infrared rays from the sun enter Earth's atmosphere. 2. The warmth given off by the sun's infrared rays is trapped within Earth's atmosphere by the gas carbon dioxide (CO₂) in the atmosphere. 	

	<ol style="list-style-type: none"> 3. O₂ is given off by green plants. 4. The burning of certain fuels, such as the gas used by cars, creates excess CO₂. 5. Some scientists and environmentalists believe that excess CO₂ may be trapping too much of the sun's heat and causing global warming---a rise in temperature that could prove harmful to life on Earth.
4.	<p>Explain to your students that the phenomenon they have been researching is called "the greenhouse effect" because Earth can be compared, in certain ways, to a greenhouse in which plants are grown. Tell them that they are going to create their own model greenhouses to observe the greenhouse effect firsthand.</p>
5.	<p>With your class, brainstorm a list of structures in their everyday lives that act as greenhouses---that is, that take in the sun's warmth and trap it. Examples are cars with nontinted windows or rooms with large window areas.</p>
6.	<p>Divide your class into groups, assigning each group the following tasks:</p> <ol style="list-style-type: none"> 1. Design a structure that will act as a greenhouse. 2. Create the structure. 3. Measure and record the changing temperatures within the structure over a 24-hour period.
7.	<p>Allow time for groups to plan and design their greenhouses, cautioning students to plan structures that will require only materials that can be easily obtained at home or in school. Group members should collect the materials they will need that afternoon and bring them to school the following day, when they will build their structures.</p>
8.	<p>When each group has built its greenhouse, have students take and record the temperature inside the greenhouse.</p>
9.	<p>Leave each greenhouse on a windowsill where it will receive a sufficient amount of</p>

	warmth from the sun to raise the temperature, or leave each greenhouse under a lamp with a strong incandescent bulb.
10.	Have group members observe and record temperatures at regular intervals for several hours.
11.	The changes in temperature within each group's greenhouse should be recorded by each student on a graph that shows times of day on one axis and temperature readings on the other.
12.	Have each student write a summary of his or her data and an explanation of his or her observations.
Evaluation	<p>You can evaluate your students on their graphs and explanations using the following three-point rubric:</p> <p>*Three points:*graph carefully prepared and accurately reflects the required information; explanation clearly and accurately summarizes information recorded on graph and observations made by student; written work free of errors in grammar, usage, and mechanics</p> <p>*Two points:*graph satisfactorily prepared and accurately reflects the required information; explanation adequately summarizes information recorded on graph and observations made by student; written work has several errors in grammar, usage, and mechanics</p> <p>*One point:*graph carelessly prepared and fails to accurately reflect the required information; explanation unclear, incomplete, and contains inaccuracies; written work contains numerous errors in grammar, usage, and mechanics</p>

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