

Climate Change

Objectives

You will be able to

- Explain how the amount of greenhouse gases in the atmosphere affects global temperature.
- Plan and carry out an investigation to determine the effect of CO₂ levels on temperature.
- Construct an explanation about CO₂ and temperature using experimental evidence.
- Discuss your findings as a group.
- Write a clear and logical explanation using evidence.



How do we know human activity is influencing climate, and what can we do about it?

Evaluation and Feedback

To evaluate your work, you will

- Use the "Planning Investigations,"
 "Carrying Out Investigations,"
 "Analyzing and Interpreting Data," and
 "Constructing Explanations and
 Designing Solutions" rows of the Science and Engineering Practices Rubric.
- Use other criteria determined by your teacher.

Task 1: The Effects of Carbon Dioxide on Climate

As a group:

- Plan your experimental design based on class discussion.
- Conduct the experiment.
- Record and graph your results.
- Discuss and share results.
- Read, view slides, or watch a video about how our Earth systems stay "just right."
- Complete the individual questions about the research.
- Write a conclusion for your experiment.

Vocabulary

- atmosphere
- carbon dioxide (CO₂)
- Goldilocks principle
- greenhouse effect
- greenhouse gases
- methane
- nitrous oxide
- temperature

Connect to the Culminating Project

Organize your thoughts about the problem you are addressing for the school board by considering these questions:

- Explain why the climate in your area has been "just right."
- Describe the evidence that CO₂ is a greenhouse gas.



Introduction

For thousands of years, we have been lucky enough to have a global climate that is generally not too hot and not too cold. As Goldilocks would say in the story of the three bears, the temperature was "just right"—at least for survival of the plants and animals on Earth. However, you saw in the Lift-Off Task that global temperatures have been rising over the past century. But why? Let's return to the list of questions you made in the last task.

- 1. Which question could best help you figure out the answer why?
- 2. Today you will plan and carry out an experiment to help you answer this question. First, make a prediction about the question.

Part I • Student Lab—Plan and Conduct an Experiment to Model the Effect of Greenhouse Gases on Temperature

LAB		
1.	 EXPERIMENTAL QUESTION We want to find out what the effect of CO₂ is on This is the question you will answer with experimental evidence: <i>How do increased levels of CO₂ affect the temperature inside a bottle when heated?</i> 	
2.	MATERIALS 2 clear 2 L soda bottles with labels removed Aluminum foil 2 thermometers 250 mL beaker + water	2 Alka-Seltzer® tablets (break both in half) 150 W light fixture (heat lamp) Ruler Stopwatch



LAB

3. PROCEDURE: Discuss

- Examine the materials (listed above).
- Discuss the **PROCEDURES** with your small group and the class. Take notes during the discussions about the decisions that you make about the procedures.

Questions to Think about When Deciding on a Procedure	Notes about Procedures from the Class and Small Group Discussions
How much water will you add to each bottle?	
Where should you hang the thermometer in the control bottle?	
How will you make sure gas doesn't escape?	
Why do you keep the amount of energy transferred to each bottle the same?	
How far will each bottle be from the light source?	
How will you measure the temperature of the gas?	
How often will you record the data?	

4. PROCEDURE: Draw and Label

• Draw and label your experimental setup. Label all the parts. Note amounts of anything added to the systems.

Safety

- Set up the lamp on the table so that it faces away from the rest of the class.
- Be careful as you work with the lamp. The lamp can get very hot.



The Effects of Carbon Dioxide on Climate

LAB

5. DATA TABLE

• Conduct the experiment and record your results.

Time	Setup 1: Control (water only) °C	Setup 2: Experimental (water + CO ₂) °C
0 minutes		

6. CLEAN UP

When you have finished collecting data, clean up your lab station.

7. DISCUSS and SHARE

Discuss and share the results within your small group and then with the class.

- What was the difference between the two bottles?
- What does the light represent?
- What does the gas in the bottle that you added Alka-Seltzer® to represent?
- **Cause and effect**: Use the boxes below to describe what happened in both bottles. Write a connecting statement next to the arrow.



LAB

Bottle 1 (without Alka-Seltzer®)	Bottle 2 (with Alka-Seltzer®)
Cause	Cause
¢	¢
Effect	Effect

Part II • Greenhouse Gases and the Goldilocks Principle

- 1. You will either watch a video, read an article, or view a slide presentation.
- 2. As you read or observe, do the following:



- Record or underline definitions.
- Note connections with prior knowledge or experiences.
- Write questions about anything that is confusing or that you are curious about.
- 3. Each person in your group should share a connection or a question.



- 4. Discuss the following questions and record your answers in your science notebook.
 - How was the lab that you conducted an example of the greenhouse effect?
 - How do energy-absorbing gases keep the Earth's temperature "just right"? **Draw** and **explain** your answer in the boxes below.

Illustration	Explanation

• Why is the Earth's temperature not "just right" any more?



5. For the **Conclusion** to your experiment, make a Claim, Evidence, Reasoning (CER) report using the table below.

Parts of the Scientific Explanation	Your Scientific Explanation
Claim: Cause and effect: Describe the effect that increased CO ₂ has on the temperature inside a bottle.	
Evidence: Support your claim using data (numbers) that your group collected in the experiment.	
Reasoning: How/why does your evidence support your claim? Use the science knowledge you learned in the reading, video, or slide presentation to justify how your data represents reasonable evidence for your claim.	





Reflect

1. At the beginning of this task, you made a prediction about why global temperatures are rising. Look back at your prediction. After learning from your lab and your research today, how can you add to your prediction? Use your CER report to help you.

2. In this task, you focused on the crosscutting concept of cause and effect, or how one event can lead to another. Give one example of how this crosscutting concept came up in today's task.

Part III • Connect to the Culminating Project and Assessment

Complete the Individual Project Organizer for this task.

