

Climate Change and Its Effects Laboratory Activity – Student Edition

Climate Change Inquiry Lab

Background Information:



The Earth's climate has changed throughout history. Just in the last 650,000 years, there have been seven cycles of glacial advance and retreat, with the abrupt end of the last ice age about 7,000 years ago marking the beginning of the modern climate era – and of human civilization.

Most of these climate changes are attributed to very small variations in Earth's orbit that change the amount of solar energy our planet receives. The current warming trend is of particular significance because most of it is very likely human-induced and proceeding at a rate that is unprecedented in the past 1,300 years. Earth-orbiting satellites and other technological advances have enabled scientists to see the big picture, collecting many different types of information about our planet and its climate on a global scale. Studying these climate data collected over many years reveal the signals of a changing climate.

In this laboratory activity, you will investigate aspects of climate change drivers by conducting a series of experiments. Through this activity, you will gain a deeper understanding of the different factors that influence climate change which will also allow you to determine ways on how to mitigate the risks of climate change.

Learning Objectives:

At the end of this laboratory activity, students are expected to:

- investigate which type of ice—land ice or sea ice—poses a threat to sea level rise if large-scale melting due to climate change occurs.
- investigate the effect of simulating the addition of carbon dioxide (and other greenhouse gases) on temperature.
- investigate the effect of the simulated reduction of arctic sea ice on ocean temperatures

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Materials:

Each group needs the following materials:

Melting Ice and Sea Level Rise Activity	Carbon Dioxide and Air Temperature Activity	Sea Ice and Ocean Temperature Activity
<ul style="list-style-type: none"> • 2 large graduated cylinders • water • ice cubes • funnel 	<ul style="list-style-type: none"> • 2 beakers or clear plastic containers • plastic wrap • rubber band or string • 2 thermometers • adhesive tape 	<ul style="list-style-type: none"> • 2 flat containers (i.e. plastic bins, cut open cardboard cartons or something similar) • 2 thermometers • adhesive tape • towels for insulation • heat lamp and bulb • graduated cylinder or measuring cup • water • aluminum foil (to represent sea ice)

Procedure:

Part 1: Melting Ice and Sea Level Rise

1. Place about 10 ice cubes in one of the graduated cylinders, then fill it about three-quarters of the way full with water. This simulates the sea ice.
2. Fill up the other graduated cylinder to the exact same level as the first graduated cylinder.
3. Place the funnel in the top of the second graduated cylinder and put the same number of ice cubes in it as you did in the first cylinder. This simulates the land ice.
4. Wait for 15-30 minutes for the ice to melt and observe how much the water level has increased both graduated cylinders. Record the rise in water level for each graduated cylinder.
 - a. Rise in water level in sea ice graduated cylinder: _____
 - b. Rise in water level in land ice graduated cylinder: _____

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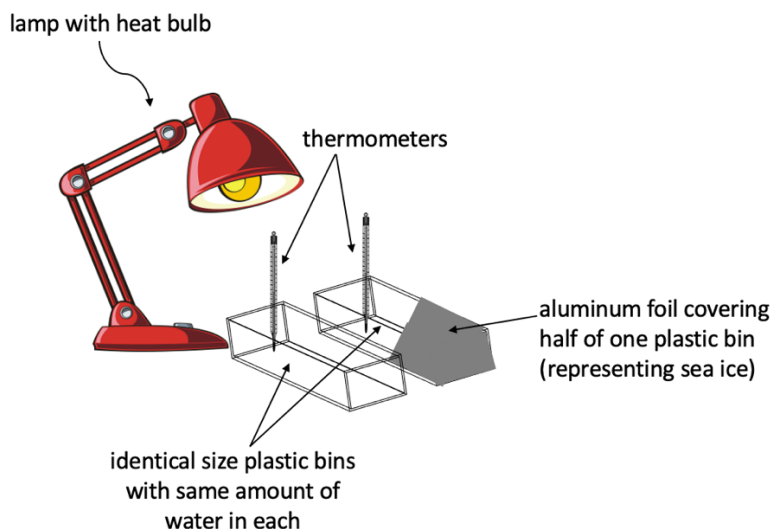
Part 2: Carbon Dioxide and Air Temperature

5. Tape the thermometers into the beakers or other containers, making sure you can read the temperature easily. If you are using lightweight plastic cups, it may help to tape them down the table for stability.
6. Label the first beaker as “regular air” and leave it open. Breathe out onto the second beaker with some of your air then quickly cover it with a plastic wrap. Label it as “air with simulated CO₂.”
7. Record the starting temperature of air in each beaker.
8. Put containers into sunshine. Make sure they receive the same amount of sun. **NOTE:** A heat lamp may be substituted for the sun, but you must be careful to place the containers the same distance from the lamp, and beware that the bulb and shade may get quite hot.
9. Record the temperature of each beaker after about 30 minutes.

	Starting temperature	Temperature after 30 minutes	Change in temperature
Regular air			
Air with simulated CO ₂			

Part 3: Sea Ice and Ocean Temperature

10. Set up the experiment as shown in the diagram below. Make sure you use the same amount of water in each container, and that you place the lamp equally between the two containers.



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- 11. Record the starting temperatures for the two containers.
- 12. Turn on the heat lamp. **Safety alert! The bulb and lampshade may get quite hot, so use caution.**
- 13. Record the temperatures of the water in each container after about 30 minutes.

	Starting temperature	Temperature after 30 minutes	Change in temperature
No sea ice			
Half sea ice (simulated by aluminum foil)			

Post-lab Questions:

1. Which type of ice (land or sea) has greater effect on sea level rise when large melting event occurs due to global warming? Why do you think so?

2. How does carbon dioxide increase the temperature of the atmosphere?

3. How does sea ice affect the global temperature?

4. How does this series of experiment help you better understand what climate change is?
