



NOAA INTERACTIVE ATMOSPHERIC DATA VISUALIZATION (IADV)

DIRECTIONS

Follow the instructions to create a graph, or use the information from your teacher. Then answer the analysis questions below.

- A. Open this website if it is not already open: <https://bit.ly/2q4t5Pw>
- B. Use the "+" symbol to zoom in on the area of the world where you live.
- C. Hover over and then click on the red dot that is closest to where you live. Red dots indicate active sites.
 - a. Ensure that the name of the sampling location that you would like to use (closest to where you live) is listed in the first drop down menu at the top of the page.
- D. In the drop down menus near the top of the page:
 - a. Find programs, and choose "Carbon Cycle Gases."
 - b. Leave the other two drop down menus on their default settings.
 - i. Popup detail: "Full"
 - ii. Active Sites: "All Sites"
- E. In the right side bar, click on the "Carbon Cycle Gases" button.
 - a. Two or more plot types will appear.
 - i. Click on "Time Series."
- F. You will be taken to another screen. Leave all options on their default settings.
 - a. Parameter: "Carbon Dioxide"
 - b. Data Type: "Flask Samples" or "Aircraft Data"
 - c. Data Frequency: "Discrete"
 - d. Time Span: "All - a graph of all available data"
 - e. Click the "Submit" button.
- G. Answer Analysis Questions below.
- H. If you'd like to choose another site and time allows, click the "Site Selection" button next to the small globe icon on the right side of the screen under the top banner.

NOAA IADV ANALYSIS QUESTIONS

1. Look at the graph, and circle the long-term trend for the years displayed. Over time, carbon dioxide (CO₂) in the atmosphere at the monitoring site:
 - a. Increased
 - b. Decreased
 - c. Stayed the same
2. Make a claim. Given what you know, what are the effects of increasing concentrations of atmospheric CO₂ on Earth's temperature?

GREENHOUSE EFFECT

SETTING UP THE EXPERIMENT

1. Please work with your instructor to assemble into teams of 4.
2. Each team member will choose a role from the list of team member roles in the box to the right.
3. As quickly as possible, the team member who is the test subject will use a binder clip to attach the thermometer to the clothing on their lap. Attach the binder clip approximately halfway down the length of the thigh, and ensure that as much of the thermometer as possible is contacting the leg (Fig. 1).

MATERIALS

- Thermometer
- Small binder clip
- Stopwatch
- Hand towel
- Rectangle of space blanket
- Calculator

TEAM MEMBER ROLES

- Test subject
- Materials manager
- Timer
- Data recorder

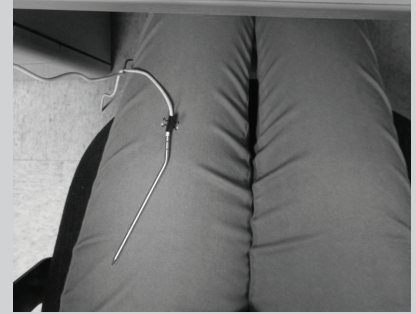
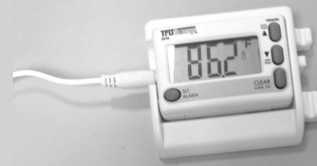


Figure 1. Example thermometer set up

TRIAL ASSIGNMENT

Your instructor will assign your group to conduct either the Towel Trial or the Towel + Space Blanket Trial. **Circle** the trial that your group has been assigned.

Towel Trial

Towel + Space Blanket Trial

PROCEDURES FOR TOWEL TRIAL

- Data recorder**, once the temperature reading of the test subject's lap has stabilized, record the temperature in the "Your Group" table on page 3. It can take several minutes for the temperature to stabilize. Enter the temperature under the "Temperature" column in the "Lap" row.
- Materials manager**, give the towel to the test subject. **Test subject**, lay the towel over the thermometer and across your lap so that its long side is perpendicular to your thighs, and tuck the ends of the towel under your legs if possible. **Timer**, press the start button on the stopwatch.
- Timer**, every time a minute passes on the stopwatch, call out the time to the data recorder. **Data recorder**, when the timer calls out the time, read the temperature on the thermometer and record it in the correct row of the table. Stop recording after 5 minutes. **Timer**, stop and reset the stopwatch.
- Test subject**, remove the towel and thermometer from your lap and give them to the materials manager.
- Everyone in the group will transfer these measurements onto their own data table. Using these data, answer question 3.

PROCEDURES FOR TOWEL + SPACE BLANKET TRIAL

- Data recorder**, once the temperature reading of the test subject's lap has stabilized, record the temperature in the "Your Group" table on page 3. It can take several minutes for the temperature to stabilize. Enter the temperature under the "Temperature" column in the "Lap" row.
- Materials manager**, first give the towel and then the space blanket rectangle to the test subject. **Test subject**, lay the towel over the thermometer and across your lap, and then place the space blanket rectangle on top. Both should be oriented so that the long side is perpendicular to your thighs. Tuck both the towel and the space blanket under your legs together if possible. **Timer**, press the start button on the stopwatch.
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- D. **Test subject**, remove the towel, space blanket, and thermometer from your lap and give them to the materials manager.
- E. Everyone in the group will transfer these measurements onto their own data table. Using these data, answer question 3.

Report the temperature difference from your trial to the class. Record every group's differences, including your own, in the "whole class" table. Calculate the mean towel difference and the mean towel + space blanket difference. Answer the results and conclusions questions.

DATA COLLECTION AND ANALYSIS

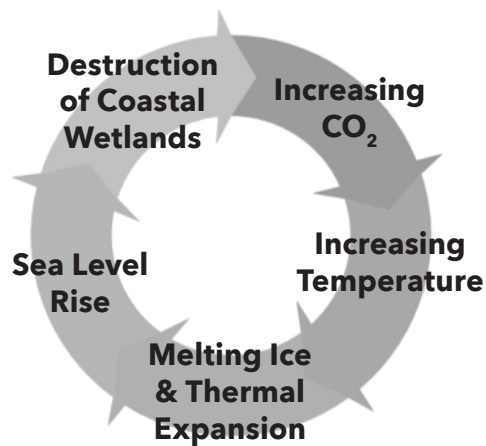
Your Group	
Time	Temperature
Lap	°F
1 minute	°F
2 minutes	°F
3 minutes	°F
4 minutes	°F
5 minutes	°F

3. In your group, what was the difference between the ending temperature (5 minutes) and beginning temperature (lap)? Show your work.

Whole Class		
	Towel Difference	Towel + Space Blanket Difference
	°F	°F
	°F	°F
	°F	°F
	°F	°F
	°F	°F
	°F	°F
Mean		

GREENHOUSE EFFECT RESULTS AND CONCLUSION QUESTIONS

4. In the **whole class table**, which trial had the greater mean difference? Circle one.
- a. Towel b. Towel + space blanket c. Same in both trials
5. Make a claim. Do the data from this model help support the scientific explanation for the greenhouse effect? Why or why not?

POSITIVE FEEDBACK LOOP

6. How is this positive feedback loop destabilizing?
7. In the diagram above, circle the point at which humans can have the most influence on the positive feedback loop.
8. What are some ways that humans can reduce the amount of atmospheric carbon dioxide that we emit?

ANSWER KEY



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 - a. Increased
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 - c. Stayed the same
2. Make a claim. Given what you know, what are the effects of increasing concentrations of atmospheric CO₂ on Earth's temperature?

Student answers will vary, depending on prior knowledge, but may include the following explanation. As atmospheric carbon dioxide increases, global temperature will increase because of the greenhouse effect.

GREENHOUSE EFFECT

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Student answers will vary

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Student answers will vary

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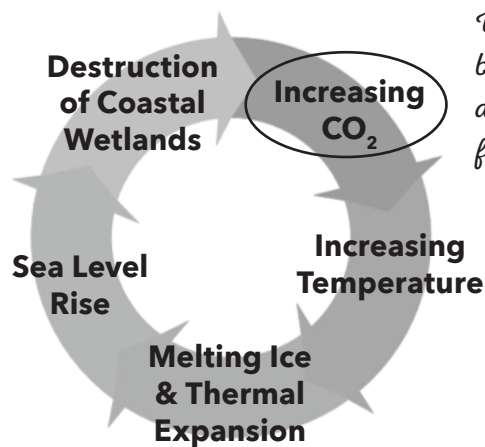
c. Same in both trials

This is usually the case

5. Make a claim. Do the data from this model help support the scientific explanation for the greenhouse effect? Why or why not?

Student answers will vary but should include at least some of the following explanations. Yes, these data support the explanation that adding greenhouse gases, modeled by the space blanket, will result in more of the heat that is radiated from Earth being re-radiated back toward Earth instead of escaping to space. The towel + space blanket trial had a greater mean difference. In other words, the temperature increase was greater in the trials with a space blanket, and adding greenhouse gases to the atmosphere is like adding a space blanket and is resulting in global temperature increases.

POSITIVE FEEDBACK LOOP



We could have the largest impact by reducing the amount of carbon dioxide that we release by burning fossil fuels.

6. How is this positive feedback loop destabilizing?

The feedback loop is destabilizing because it leads to more warming and moves the system away from the original state, lower global temperature.

7. In the diagram above, circle the point at which humans can have the most influence on the positive feedback loop.

8. What are some ways that humans can reduce the amount of atmospheric carbon dioxide that we emit?

There could be a number of answers, including reducing electricity use, improving building efficiency, switching to renewable energy sources, such as solar and wind, carbon capture and storage from fossil fuel powered electricity plants, using more electric vehicles, improving vehicle fuel efficiency, carpooling, using public transportation, walking, riding a bicycle, recycling, reusing, and reducing the amount of consumption of factory-produced materials and other goods.