2 Climate Change

Objectives

You will be able to

- Compare levels of carbon dioxide and temperature in the past to those of today.
- Analyze data to identify evidence to support a claim or counterclaim.
- Construct an argument about the cause of climate change.
- Build on other group members' ideas.
- Construct an argument based on 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 "Analyzing and Interpreting Data" and "Engaging in Arguments from Evidence" rows of the Science and Engineering Practices Rubric.
- Use other criteria determined by your teacher.

Task 2: What Is Causing Climate Change, and How Do We Know?

As a group:

- Choose one of two claims about the cause of rising global temperatures.
- Analyze and identify how data from six graphs and a video provide evidence for the two claims.
- Write an argument supporting the claim you chose.
- Construct a flowchart that shows the chain of cause-and-effect events related to climate change.

Vocabulary

- claim and counterclaim
- climate
- emissions
- evidence
- fossil fuels
- global
- ice cores
- methane
- reasoning

Connect to the Culminating Project

Complete your Individual Project Organizer:

- Explain to the school board what is causing climate change.
- Provide evidence and reasoning to support your claim.

TASK 2 What Is Causing Climate Change, and How Do We Know?

Introduction

In the previous task, you learned about energy-absorbing gases (greenhouse gases) and how they affect temperature. Today you will look at the current amounts of these gases in our atmosphere compared to historical amounts. You will analyze and interpret data collected by scientists. Based on the data, you will construct an argument about the changes in greenhouse gases over time, and why those changes are contributing to climate change.

Part I • The Claim

Two students are discussing what has caused the increase in temperature in the last century (100 years).

1. Write down below who you agree with more: Emilio or Destiny.

2. Using prior knowledge, briefly defend your choice.

Which claim do you agree with?
Defend your choice.

What Is Causing Climate Change, and How Do We Know?

Part II • What Do You Still Need to Know?

1. You learned a lot about climate change in Task 1, but there are still things you need to know in order to help you decide whether Destiny or Emilio is correct. Fill in the first row of the table below to show what you know.
2. Then fill in the second row to show what you still need to know in order to decide which (if either) claim is valid.

	Destiny	Emilio
Know from Task 1		
Need to Know	*Has this happened in the past?* *Are we just in a warm period?*	*Is more carbon dioxide being made now than in the past?* *Are humans responsible?*

Part III • Collect Evidence

1. Watch the video about ice cores and take notes about important ideas.
2. Discuss the following questions:
   - What data do scientists get from the ice cores?
   - How do scientists get the data from the ice cores?
   - What questions do you have about the ice cores or about the data from the ice cores?
3. Examine the **first three** graphs on the Evidence from Graphs handout.
4. For each of these graphs, work with your group to fill in the Climate Change Evidence Chart below. This chart relates only to Destiny's claim.
   - Answer the analysis questions in the second column.
   - Check either "Supports," "Refutes," or "Neither" to say how the evidence in the graph relates to the claim.
   - In the last column, provide your reasoning (based on the evidence from the graph) about your decision in the previous step.

What Is Causing Climate Change, and How Do We Know?

Climate Change Evidence Analysis Chart

Destiny's Claim: I think Earth has natural warm and cool periods, and the increase in temperature in the last 100 years is just a warm period.

Evidence	Analysis Question Answers	What Does This Evidence Say about Destiny's Claim?			Reason That the Evidence Supports Your Choice
		Supports	**Refutes**	**Neither**	
Graph 1: CO_2 and Temperature Ice Core Data	1. What are the units on each axis of the graph? 2. When did scientists start gathering this data? 3. When was the last sample recorded on this graph? 4. What pattern(s) do you notice in the graph? 5. What can you learn about greenhouse gases from this graph?				

What Is Causing Climate Change, and How Do We Know?

Evidence	Analysis Question Answers	What Does This Evidence Say about Destiny's Claim?			Reason That the Evidence Supports Your Choice
		Supports	Refutes	Neither	
Graph 2: Global Temperature Changes	1. What are the units on each axis of the graph? 2. When did scientists start gathering this data? 3. When was the last sample recorded on this graph? 4. What pattern(s) do you notice in the graph? 5. What can you learn about greenhouse gases from this graph?				

What Is Causing Climate Change, and How Do We Know?

Evidence	Analysis Question Answers	What Does This Evidence Say about Destiny's Claim?			Reason That the Evidence Supports Your Choice
		Supports	Refutes	Neither	
Graph 3: Global Temperature and Carbon Dioxide	1. What are the units on each axis of the graph? 2. When did scientists start gathering this data? 3. When was the last sample recorded on this graph? 4. What pattern(s) do you notice in the graph? 5. What can you learn about greenhouse gases from this graph?				

5. Examine **graphs 4–6** on the Evidence from Graphs handout and fill them out for Emilio's claim, following steps 1–2 above.

Climate Change Evidence Analysis Chart

Emilio's Claim: I think human activities, like driving cars, release carbon dioxide and cause the increase in temperature we have seen in the last 100 years.

Evidence	Analysis Question Answers	What Does This Evidence Say about Emilio's Claim?			Reason That the Evidence Supports Your Choice
		Supports	Refutes	Neither	
Graph 4: Global Carbon Emissions from Burning Fossil Fuels	1. What are the units on each axis of the graph? 2. When did scientists start gathering this data? 3. When was the last sample recorded on this graph? 4. What pattern(s) do you notice in the graph? 5. What can you learn about greenhouse gases from this graph?				

What Is Causing Climate Change, and How Do We Know?

Evidence	Analysis Question Answers	What Does This Evidence Say about Emilio's Claim?			Reason That the Evidence Supports Your Choice
		Supports	**Refutes**	**Neither**	
Graph 5: Methane Emissions	1. What are the units on each axis of the graph? 2. When did scientists start gathering this data? 3. When was the last sample recorded on this graph? 4. What pattern(s) do you notice in the graph? 5. What can you learn about greenhouse gases from this graph?				

What Is Causing Climate Change, and How Do We Know?

Evidence	Analysis Question Answers	What Does This Evidence Say about Emilio's Claim?			Reason That the Evidence Supports Your Choice
		Supports	Refutes	Neither	
Graph 6: CO_2 Levels versus Volcanic Eruptions	1. What are the units on each axis of the graph? 2. When did scientists start gathering this data? 3. When was the last sample recorded on this graph? 4. What pattern(s) do you notice in the graph? 5. What can you learn about greenhouse gases from this graph?				

Climate Change Evidence Analysis Chart

Burning Fossil Fuels

Evidence	Analysis Question Answers	What Does This Evidence Say about Emilio's Claim?			Reason That the Evidence Supports Your Choice
		Supports	Refutes	Neither	
Evidence 7: Video: Products of Burning Fuel	1. What fuel is being burned in the video? 2. What product of burning fuel is shown in the very last tube? (Hint: cloudy bubbles) 3. What product of burning fuel is shown in the middle tube? (Hint: like breathing on a window) 4. What is the connection between burning fossil fuels and carbon dioxide?				

Part III • Addendum (Optional)

In order to support a scientific claim, you first need evidence. We need something that can tell us **whether or not earth's climate is much different from long ago. But where does that evidence come from?**

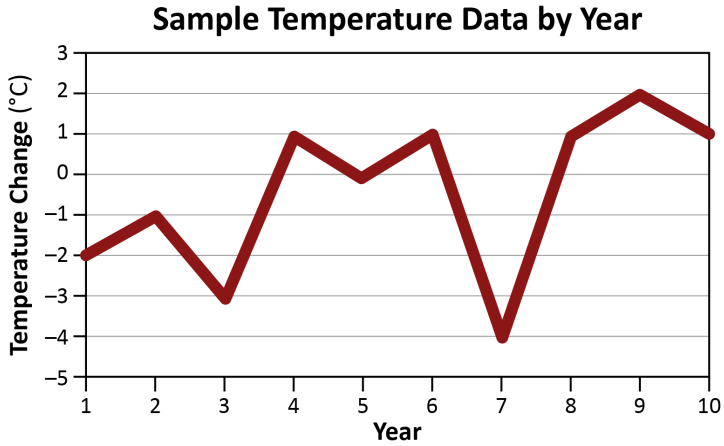
There are actually many sources of data that scientists are studying. One important source comes from examining ancient ice in the polar regions.

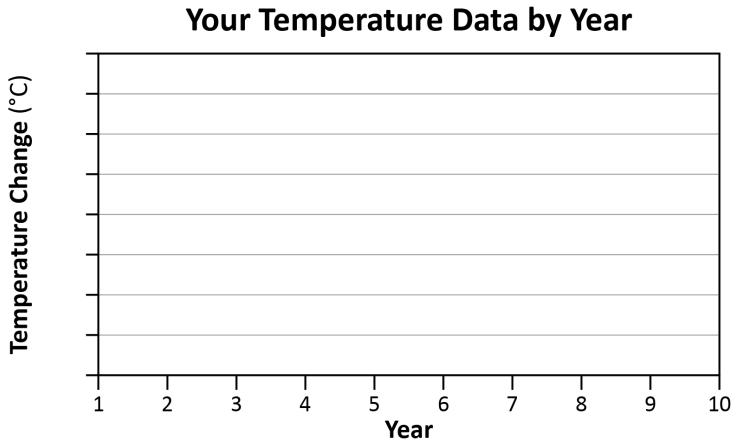
A. Watch the ice core video as a class. Think about the following questions as you watch the video.
   1. What data do scientists get from the ice cores?
   2. How do scientists get the data from the ice cores?
   3. What questions do you have about the ice cores or about the data from the ice cores?

B. Discuss what you learned from watching the ice core video with the class.

As a group you will create a temperature graph and a related ice core diagram that show a possible real-life situation. Your ice core diagram will be analyzed by another group of students.

1. First create a graph showing 10 years of temperature data. An example is shown here. Your group will create its own below.





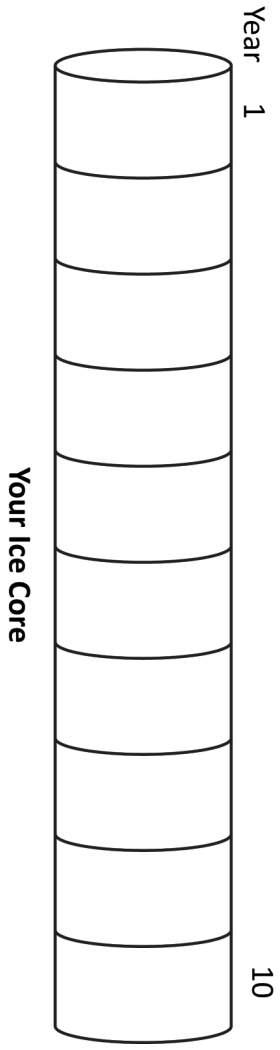
What Is Causing Climate Change, and How Do We Know?

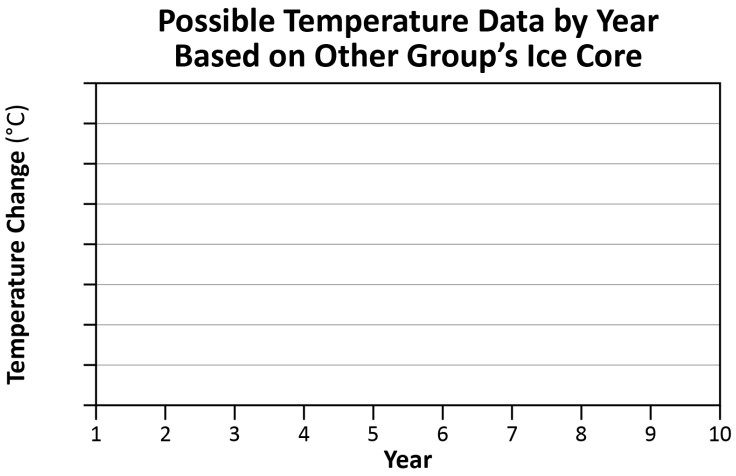
2. As a group, discuss how changes in your graph would be reflected in an ice core.

3. Make a diagram of the ice core on a separate sheet of paper based on your group's discussion.
   - Start by drawing the template to the right on your paper.
   - Use different colors and/or patterns to show what the ice core might look like for each year based on the data in your graph.
   - Create a key so that others can interpret the information in your ice core diagram.

4. Share your ice core diagram with another group for them to analyze.

5. Analyze another group's ice core diagram and create a possible graph to match the evidence in the ice core diagram.





Part IV • The Argument

1. Now that you have looked at the data, do you agree more with Emilio's or Destiny's claim?
2. Use the table below to write an argument that explains why you think one claim is better and the other is not as strong.
   - Use evidence from the graphs you analyzed and reasoning to support your claims.

Emilio says: I think human activities, like driving cars, release carbon dioxide and cause the increase in temperature we have seen in the last 100 years.

Destiny says: I think Earth has natural warm and cool periods, and the increase in temperature in the last 100 years is just a warm period.

Claim	I agree more with _____'s claim.
Evidence	I agree more with _____'s claim because I saw in Graph #___ that… I also saw in Graph #___ that… _____'s claim aligns with what I saw in Graph #___ when… In support of _____'s claim, I also noticed that Graph #___ included…
Reasoning	Because Graph #___ shows _____, I believe…
Counterclaim	In contrast, _____'s claim is not as strong.
Refute the Counterclaim	I conclude _____'s claim is not as strong because I saw in Graph #_____ that … Therefore, …

What Is Causing Climate Change, and How Do We Know?

Part V • Chain of Cause and Effect

1. Fill in the empty boxes of the cause and effect chain. Use what you have learned in this unit to help you.

Human Activity (Driving Cars, Raising Livestock, Burning Fuel for Industry, Etc.)	⇨		⇨	Increased Greenhouse Effect	⇨	

2. In your group, brainstorm new words or connections that you want to add to the class concept map.

Reflect

1. At the beginning of this task, you agreed with Destiny's or Emilio's claim and defended your choice. Look back at your decision and justification. After considering all the evidence today, how would you change your decision or add to your justification? Use your Climate Change Evidence Analysis Chart 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 VI • Connect to the Culminating Project and Assessment

Complete the Individual Project Organizer for this task.