Uneven Heating

There are many reasons why cities at the same latitude might have different average monthly temperatures. Some cities are near large bodies of water, such as oceans, which influence temperature patterns over the course of the year. Other cities are located at higher elevations and experience different temperatures than cities at lower elevations. The following reading and investigations will help us find out how elevation and being close to large bodies of water impact regional temperatures.

Investigation Overview

Part 1: Investigating soil and water temperatures. This investigation will help us think about how being near large bodies of water affects temperature patterns. During the demonstration, you'll record temperature readings as soil and water samples are heated and then are allowed to cool. Afterward, you'll graph and discuss the results.

Part 2: Investigating elevation. This investigation will help us think about how elevation affects temperature patterns. After reading the story "Climb to Cold" and recording elevation and temperature readings on a data table, you'll plot this data on an elevation profile and discuss the patterns you noticed.

Supplies

- 1 heat lamp
- 1 cup, filled about 2/3 with soil
- 1 cup, filled about 2/3 with water
- 2 cooking thermometers
- 2 pieces of masking tape
- 1 watch or clock with a second hand
- Colored pencils (2 different colors for each student)
- Reading: "Climb to Cold" *(only for part 2 of the investigation)*

Part 1: Investigating soil and water temperatures. This investigation will help us think about how being near large bodies of water affects temperature patterns.

Before we begin the demonstration, answer these questions:

1. How will we make sure the water and soil samples are heating and cooling evenly?

2. How will we track our measurements and make sure they're accurate?

Collecting Data: Soil and Water Temperatures

What are the **starting (baseline) temperatures** of the soil and the water samples? Record these measurements on the data table below.

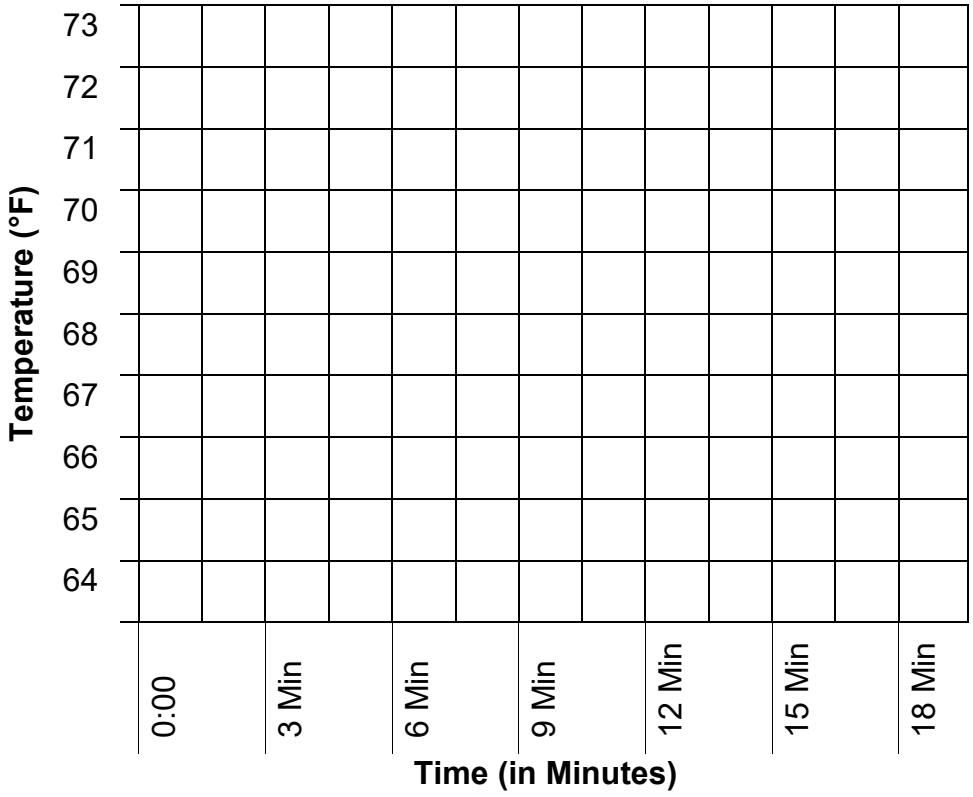
Now we'll turn on the heat lamp. The class timers will watch the time closely, and every 3 minutes, a pair of temperature readers will measure the soil and water temperatures and check each other's readings. Then everyone will record these temperature readings on their data tables. At 9 minutes, the heat lamp will be turned off so the soil and water will begin to cool. Different pairs of temperature readers will measure soil and water temperatures every 3 minutes during the cooling phase, and everyone will record the data on their data tables.

Data Table: Soil and Water Temperatures

Temperature (in Minutes)							
	Baseline	**Heating Phase**			**Cooling Phase**		
Material	0:00	3 Min	6 Min	9 Min	12 Min	15 Min	18 Min
Soil							
Water							

Graphing Data: Soil and Water Temperatures

Plot each data point on the graph below. Then use one colored pencil to draw a line connecting the data points for soil temperatures, and another colored pencil to connect the data points for water temperatures. Once your graph is complete, compare your data with your classmates' data and answer the questions in the next section.



Interpreting Data: Soil and Water Temperatures

1. What patterns do you observe when you compare the soil and water temperatures during the heating phase? What about during the cooling phase?

2. Water and land heat and cool the air above them. In the summer, they heat up, and so does the air. In the winter, the land and water cool down, and so does the air. But water and land don't heat and cool at the same rate.

   How do the data you collected support this statement?

Part 2: Investigating elevation. This investigation will help us think about how elevation affects temperature patterns.

Collecting Data

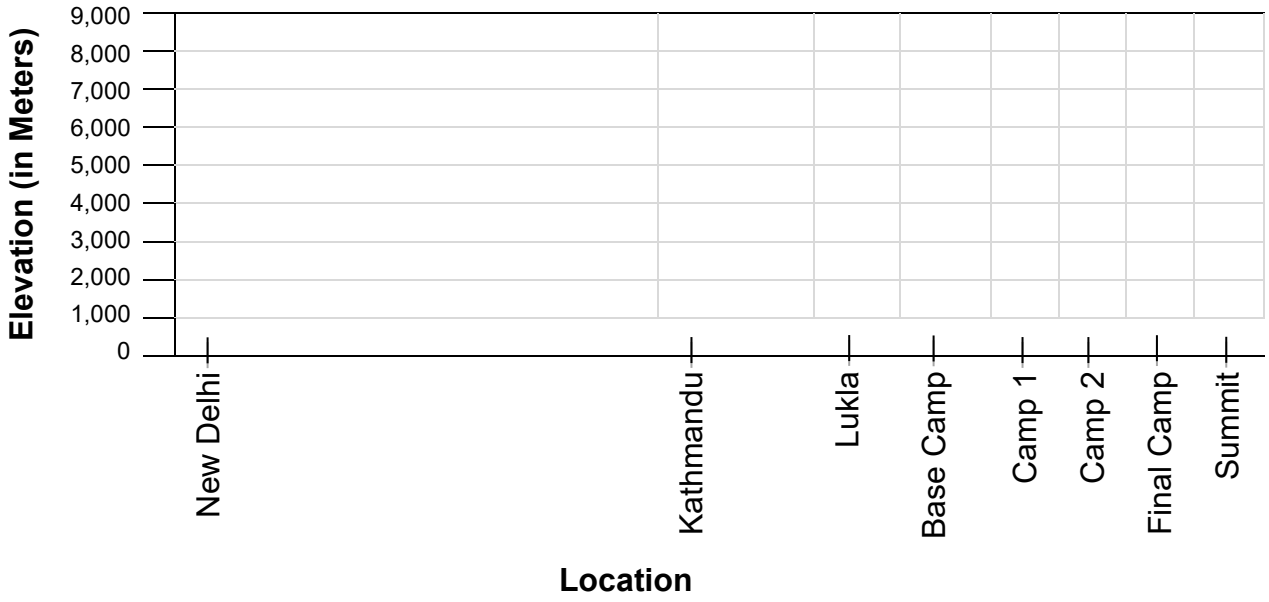
Read the story "Climb to Cold" independently. Each time you encounter a stop sign (STOP) where the team in the story stops to record elevation and temperature, write this information on the data table below. *(Note: Not all locations will have temperature data.)* When you've finished the story, follow the instructions in the next section for graphing your data.

Data Table: Elevation and Temperature

Location	Elevation (in Meters)	Temperature (°F)
New Delhi, India		
Kathmandu, Nepal		
Lukla, Nepal		
Everest Base Camp		
Everest Camp 1		
Everest Camp 2		
Final Camp		
Summit of Everest		

Graphing Data: Elevation Profile

Now you'll create an elevation profile using the data on your data table. An elevation profile is a cross-sectional view of the land as it changes elevation. First, plot on the graph below the elevation data points for each location from your data table. Place a dot on the graph at the correct elevation for each location and then write the temperature next to the data point (if a location has temperature data). Once you plot all the data points for these locations, draw a line with a colored pencil to connect the dots. Then shade in the area below the line. This shaded area represents what a slice of Earth would look like if you could see it from the side.



Interpreting Data: Elevation

Discuss the following questions with a partner.

1. What temperature patterns did you observe as the climbers traveled to the summit of Mount Everest?

2. Why might the climbers have had to wear oxygen masks as they approached the summit?

3. How do you think air density relates to air temperature?

4. Based on the elevation and temperature data you collected, how would you explain why the air temperature gets colder at higher elevations?