

# Climate Change Stations

## TEACHER PAGE

After setting up the six climate change stations around the classroom, these cards can be used to direct students as they begin lab work at each station.

### Teacher Instructions

Print out the following cards and place them with their corresponding lab station. You might consider laminating them to make them more durable and reusable.

Give each student (or team of students) a copy of the Changes in Earth's Climate student page, which provides additional prompts and guidelines for recording student observations and conclusions. These pages can later be added to students' lab journals, if appropriate.

Students investigate the tilt of Earth's axis at Station 3.



# Climate Change Stations

## STATION 1: Earth's Wobble

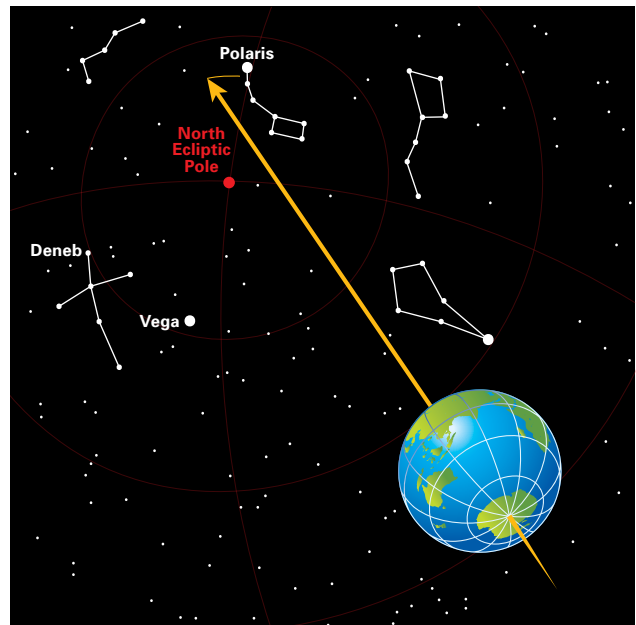
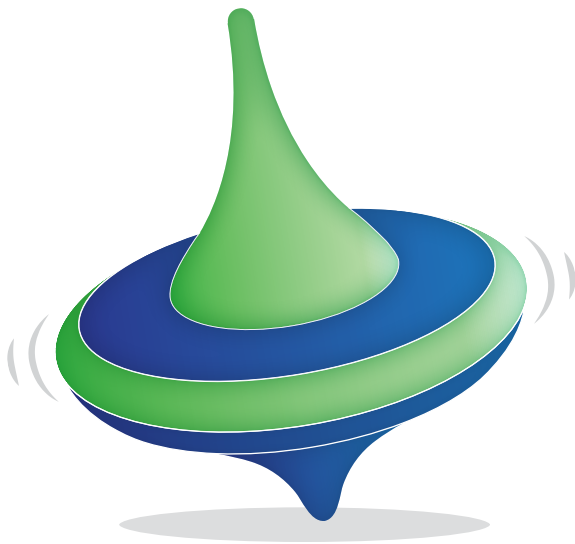
### What to Do

- 1 Get a top and spin it. Watch it as it moves around on the table top. What happens after it spins for a while? Does the top's handle point in the same direction at all times?
- 2 Record your observations.

### What It Models

Like a top, the Earth also spins on its axis. And, like the top, it wobbles a little as it spins. That means that the North Pole changes the direction it is pointing. Currently it is pointing toward Polaris (the North Star). In about 12,900 years it will be pointing towards Vega. In 12,900 years more, it will be pointing back to Polaris.

Unlike the top, the Earth's wobble happens very slowly. One wobble takes an average of 25,800 years.



### Climate Effects

What effect might this wobble have on Earth's climates? Record your ideas, using facts to support them.

# Climate Change Stations

## STATION 2: Earth's Orbit



### What to Do

- 1 For each illustration, use a centimeter ruler to measure (Orbit A and Orbit B) the distance between the sun and the Earth at each of the four dates.
- 2 Record your results.

### What It Models

The Earth's orbit around the sun is nearly circular. Over hundreds of thousands of years, the shape of the Earth's orbit changes slightly due to changes in the gravitational pull of Venus, Jupiter, and other planets. Orbit A shows the Earth's orbit today. Orbit B models what the Earth's orbit was like 95,000 years ago.

### Climate Effects

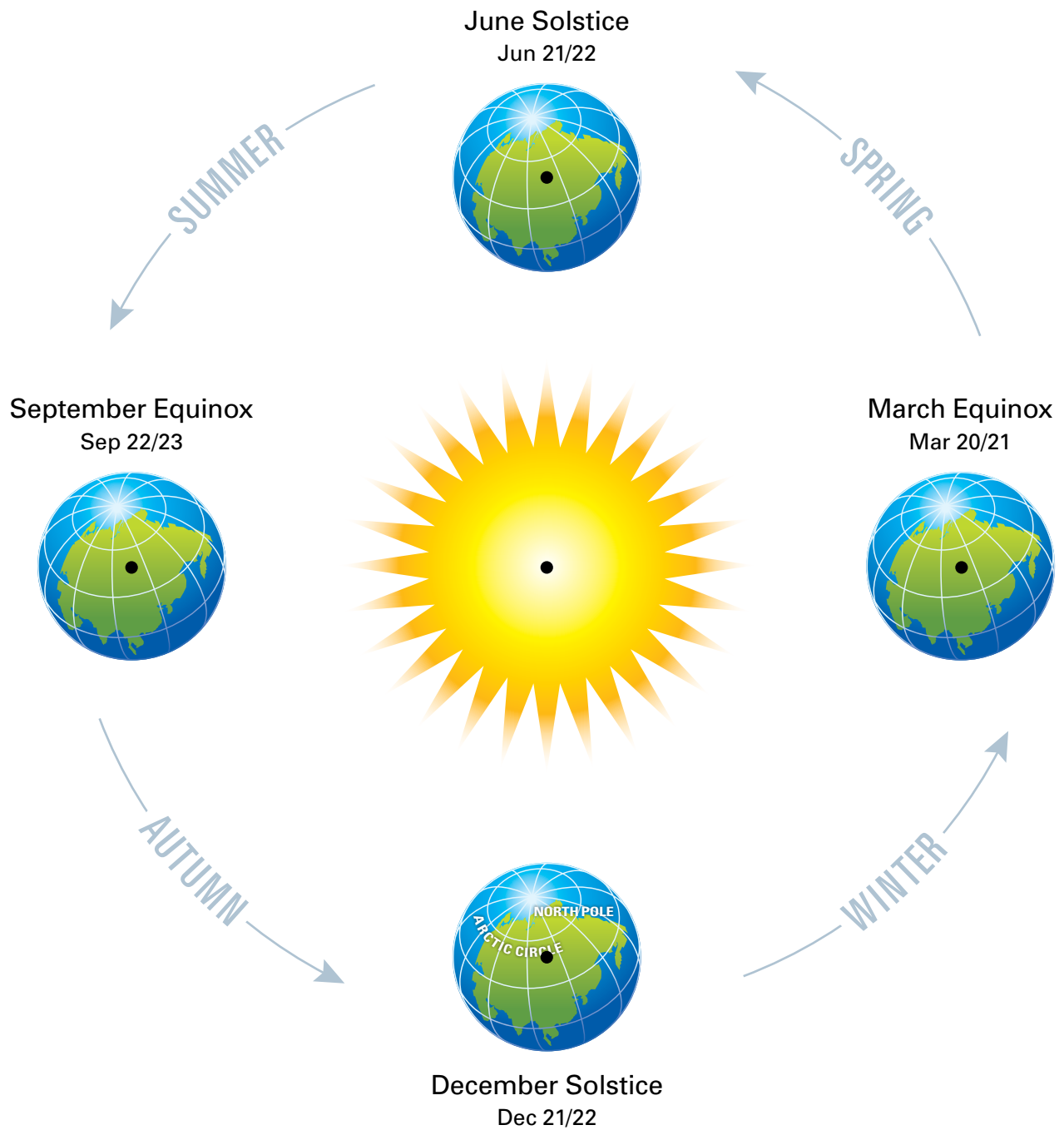
What effect might this change in Earth's orbit have on Earth's climates? Record your ideas, using facts to support them.

Did you know Earth orbits fastest when it's closest to the Sun and slowest when it's farthest?



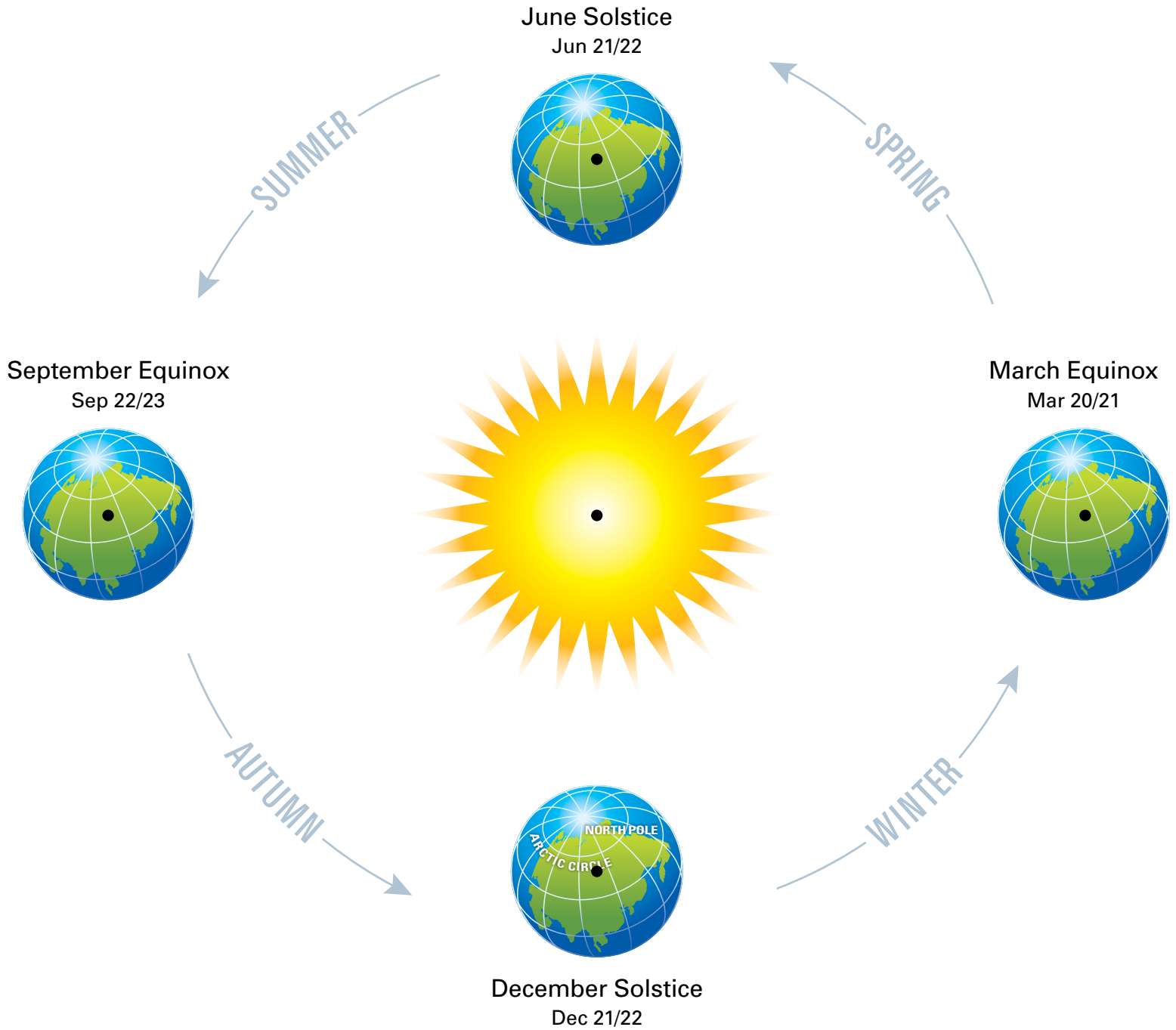
# Climate Change Stations

## STATION 2: Orbit A – Today



# Climate Change Stations

## STATION 2: Orbit A – 95,000 Years Ago



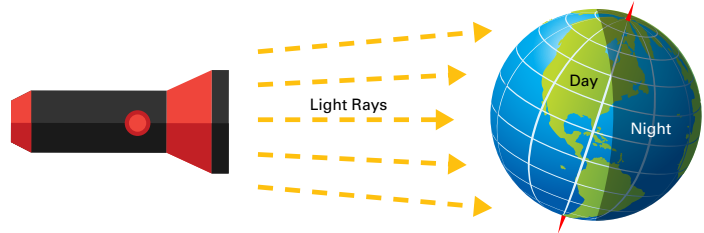
# Climate Change Stations

## STATION 3: The Tilt of Earth's Axis

### What to Do

Use a globe and a flashlight:

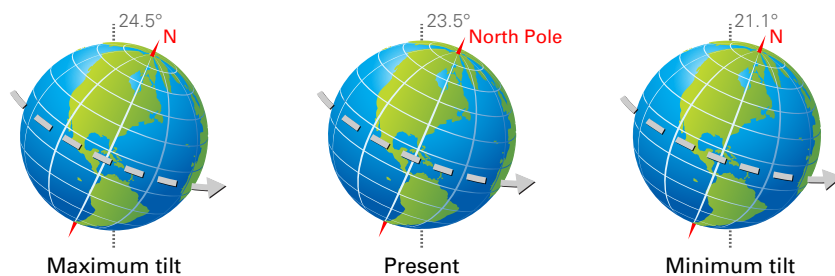
- 1 Find the 30° north line in the middle of the Pacific Ocean. Spin the globe until that point is facing as far up (toward the ceiling) as possible.
- 2 Turn on the flashlight and hold it above this point of the globe, roughly 12 in or 30 cm away from the globe. Record (sketch) which land masses are lit by the flashlight.
- 3 Tilt the globe towards you by placing a 1 cm or ½ in wedge under the base on the side of the globe away from you. Hold the flashlight in the same place as before. Record which land masses are now lit by the flashlight.
- 4 Finally, tilt the globe away from you by placing a 1 cm or ½ in wedge under the base on the near side of the globe. Hold the flashlight in the same place as before. Record which land masses are now lit by the flashlight.



### What It Models

The Earth does not sit straight up and down as it orbits around the Sun: it sits at a slight tilt. Throughout Earth's history, the angle of the tilt has varied from 21.1 degrees to 24.5 degrees (see illustration below). The change in tilt, called obliquity, is due to the moon's gravity and the fact that the moon's path varies a bit as it travels around the Earth. The tilt changes over time in a cycle that is approximately 41,000 years long.

#### Obliquity: Earth's Changing Tilt



### Climate Effects

What effect might this change in orbit have on Earth's climates? Record your ideas, using facts to support them.

# Climate Change Stations

## STATION 4: Volcanic Activity

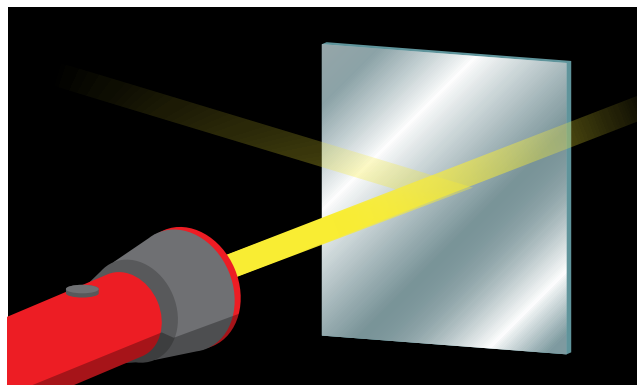


### What to Do

- 1 Hold the piece of plastic straight up and down on the table. Shine the flashlight on the plastic at a slight angle, holding it about 12 inches away from the plastic.
- 2 Observe the reflection of light from the plastic and how much light gets through the plastic. Record your observations.
- 3 Repeat steps 2 and 3 with the mirror instead of the plastic.

### What It Models

When sunlight reaches the Earth's atmosphere, some of it is absorbed into the atmosphere and some of it is reflected back into space. The plastic represents what happens normally and the mirror represents what happens after a volcanic eruption that puts volcanic ash or gases in the atmosphere. At those times, more sunlight is reflected back into space and less reaches the Earth's surface.



### Climate Effects

What effect might volcanic activity have on Earth's climates? Record your ideas, using facts to support them.

# Climate Change Stations

## STATION 5: Changes in Sun's Output

### What to Do

- 1 Turn on the battery-operated candle and place it inside the box. (This will allow you to observe the flame more easily.)
- 2 Observe the flame for 1 minute.
- 3 Record any changes you observe.

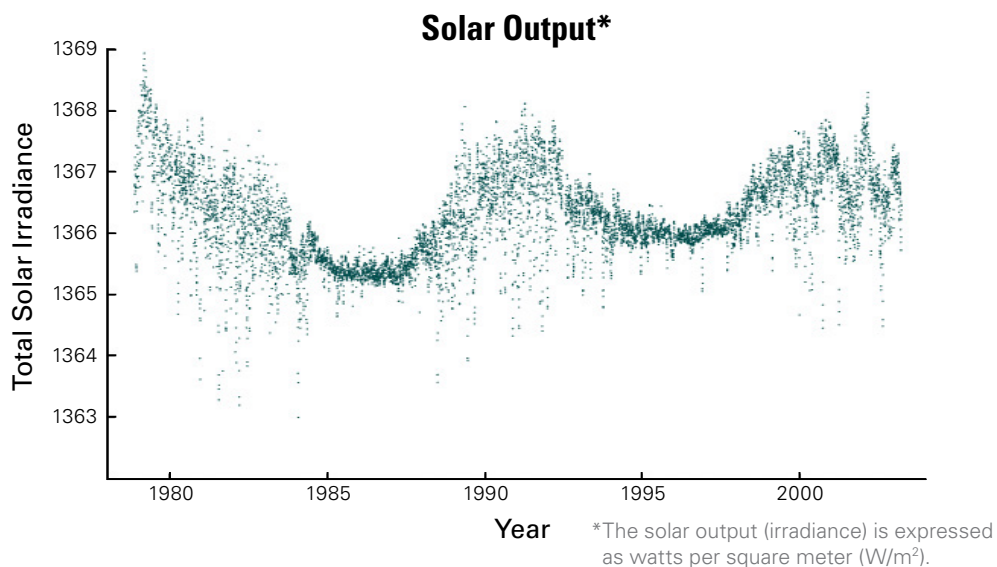
Solar flares are a brief eruption of intense high-energy radiation from the sun's surface.



### What It Models

The sun warms our planet, heating the surface, the oceans, and the atmosphere. This solar energy is one of the primary drivers of wind and weather. It also greatly affects Earth's climate.

The sun's energy output is not always the same. It changes with solar activity like solar flares or sunspots. When the sun has fewer sunspots, it gives off less energy. About every 11 years, the number of sunspots peaks and then decreases again.



### Climate Effects

What effect might a change in the sun's energy output have on Earth's climates? Record your ideas, using facts to support them.



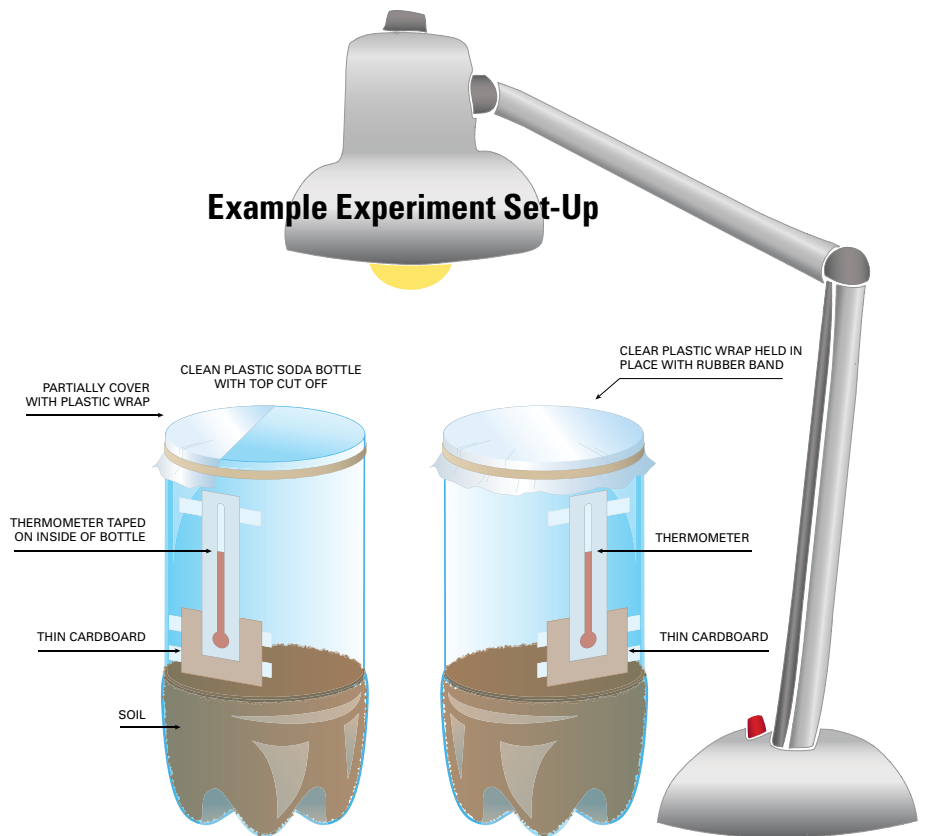
# Climate Change Stations

## STATION 6: The Greenhouse Effect

### What to Do

Do not put the light bulb too close to the plastic bottles or they will melt.  
Do not touch the light bulbs as they may burn you.

- 1 Read the temperature in the sealed container. Record the temperature.
- 2 Read the temperature in the partially sealed container. Record the temperature.
- 3 Compare the two temperatures. Which set-up represents increased solar radiation in the Earth's atmosphere and which one represents less?



### What It Models

Earth's atmosphere works like a blanket or greenhouse, holding in the sun's radiant energy. Without this "greenhouse effect," the sun's energy would escape into space, causing the Earth to become cold. Certain gases in the atmosphere—called greenhouse gases—increase the atmosphere's ability to absorb the sun's energy.

There is a higher level of greenhouse gases in the atmosphere now than in the past due to human activities. Burning gasoline, coal, oil, and other fossil fuels puts excess carbon dioxide or CO<sub>2</sub>, a greenhouse gas, into the atmosphere. Cutting down forests (deforestation) also leads to higher levels of CO<sub>2</sub> because the cut trees can no longer absorb it.

This station represents the Earth's atmosphere with and without an increased level of greenhouse gases.

### Climate Effects

What effect might an increase in greenhouse gases have on Earth's climates? Record your ideas, using facts to support them.