

## Investigating Climate Change at the Micro- and Macroscopic Level

### Objectives

- Discover some causes and effects of increasing global temperature.
- Determine the environmental factors that affect the motion and size of glaciers.
- Explain how greenhouse gases influence the temperature of the Earth.

### PART A: Glaciers

1. Open up the PhET Glaciers simulation (<http://phet.colorado.edu/en/simulation/glaciers>) and play with the sim for five minutes. **What do you find? Discuss your ideas with your partner.**

2. Observe what happens to the glacier as you adjust different parameters in the simulation. Record your observations in the table.

Action	Glacier Movement	Maximum Thickness
Decrease the average annual snowfall	<input type="checkbox"/> Advances <input type="checkbox"/> Retreats <input type="checkbox"/> None	<input type="checkbox"/> Increases <input type="checkbox"/> Decreases <input type="checkbox"/> No Change
	<input type="checkbox"/> Advances <input type="checkbox"/> Retreats <input type="checkbox"/> None	<input type="checkbox"/> Increases <input type="checkbox"/> Decreases <input type="checkbox"/> No Change
	<input type="checkbox"/> Advances <input type="checkbox"/> Retreats <input type="checkbox"/> None	<input type="checkbox"/> Increases <input type="checkbox"/> Decreases <input type="checkbox"/> No Change
	<input type="checkbox"/> Advances <input type="checkbox"/> Retreats <input type="checkbox"/> None	<input type="checkbox"/> Increases <input type="checkbox"/> Decreases <input type="checkbox"/> No Change

3. What claims can you make about the relationship between the amount of snowfall and the movement and thickness of glaciers? Provide evidence for your claims.

4. What claims can you make about the relationship between the average temperature and the movement and thickness of glaciers? Provide evidence for your claims.

### PART B: The Greenhouse Effect

1. Open up the PhET Greenhouse Effect simulation (<http://phet.colorado.edu/en/simulation/greenhouse>) and play with the sim for five minutes. **What do you find? Discuss your ideas with your partner.**

#### Greenhouse Effect Tab

1. Adjust the concentration of greenhouse gases in the atmosphere and observe what happens. Record your observations in the table below.

Greenhouse Gas Concentration	What happens to sunlight?	What happens to infrared photons?	What happens to the temperature?
Today			
Ice Age			
None			

Photon Absorption Tab

2. Explore how the different molecules interact with visible and infrared light. Do you find any patterns?

3. Which gases are considered *greenhouse gases*? Provide evidence to support your answer.

4. Build an atmosphere with different compositions. Use the table below to record your observations.

Composition of Atmosphere	What happens to infrared photons?	What happens to visible photons?
Lots of greenhouse gases		
No greenhouse gases		

5. Compare your observations for infrared photons in #1 and #4. Use this data to explain how greenhouse gases can affect global temperature. Use microscopic evidence to explain the difference in global temperatures during the ice age and present day.

**PART C: Reflection**

Use your observations on the *microscopic* level in The Greenhouse Effect simulation to explain your *macroscopic* observations in the Glaciers simulation. What connections can you make?