

GREENHOUSE EFFECT

Objective: To describe how the “greenhouse effect” affects temperature on the earth and to use evidence to support whether the “greenhouse effect” is good or bad for the earth.

Introduction: Global warming is perhaps the “hottest” topic in today’s headlines. The cause of warming is usually blamed on the “greenhouse effect” or “greenhouse gases.” The following simulation will allow you to first examine how the “greenhouse effect” works in a greenhouse. You will then experiment with a simulation of the earth’s atmosphere where the concentration of greenhouse gases can be varied. Finally, you will use the results of the two simulations to describe how the “greenhouse effect” affects temperature on the earth and discuss whether the “greenhouse effect” is good or bad for the earth.

Directions: *Steps in bold font require a written response. A double asterisk is placed in front of questions requiring a complete response.*

Before diving into the whole issue of global warming, try to picture sitting in an enclosed car on a cold but sunny day ... pretty comfortable, isn’t it. Now imagine sitting in that same car on a hot, sunny day. Don’t hold that image too long. You’ll fry just thinking about it.

- 1) ****Hypothesize why the inside of a car feels so much warmer than its surroundings on sunny days.**
- 2) Go to <http://phet.colorado.edu/new/simulations>
- 3) Select the “Earth Science” tab.
- 4) Select the “Greenhouse Effect” simulation.

Or go to http://phet.colorado.edu/new/simulations/sims.php?sim=The_Greenhouse_Effect

Part I: A Greenhouse Simulation

- 5) Select the “Glass Layers” tab.
- 6) Uncheck the “View all photons” box.
- 7) **What do the yellow stars represent?**
- 8) **What do the red stars represent?**
- 9) Both the yellow and red stars represent forms of energy in the form of photons: the yellow are visible light, the red are heat.
- 10) **Record the approximate temperature “inside the greenhouse” before adding glass panes.**
- 11) Add one glass pane.
- 12) ****What do the sunlight photons do when they hit the glass from the top?**
- 13) ****What do the infrared photons do when they hit the glass from the bottom? Be specific.**
- 14) **What is the new temperature “inside the greenhouse?”**
- 15) ****Based on the observations of the photons, why does the temperature go up so much?**

- 16) What happens to the temperature as additional glass panes are added?
- 17) ****Explain why this happens by observing the photons.**
- 18) ****Before proceeding to the earth, predict how what you have discovered regarding greenhouses might apply to the earth and its atmosphere.**

Part II: The Earth Simulation

- 19) Select the “Greenhouse Effect” tab.
- 20) Uncheck the “View all photons” box.
- 21) **Which greenhouse gases are considered by the simulation?**
- 22) **Which time period do the default conditions represent?**
- 23) The thermometer represents the average global temperature.
- 24) **What is the average global temperature for the “today” simulation?**
- 25) **Is the behavior of the photons more similar to the greenhouse simulation with or without glass panes?**
- 26) Reduce the greenhouse gas concentration to “None”.
- 27) **Is the behavior of the photons more similar to the greenhouse simulation with or without glass panes?**
- 28) **What is the average global temperature?**
- 29) ****Considering the behavior of the photons, why does the temperature drop so much?**
- 30) Increase the greenhouse gas concentrations to “Lots.”
- 31) **What is the average global temperature?**
- 32) ****Considering the behavior of the photons, why does the temperature increase?**
- 33) Experiment with other periods in earth’s history or add clouds and record interesting observations.

Part III: THIS IS THE MOST IMPORTANT PART OF THE LAB!!

Write a response the following questions:

1. How does the “greenhouse effect” affect temperature on the earth?
2. How is the “greenhouse effect” similar to blankets on a bed?
3. Is the “greenhouse effect” good or bad for the earth?

YOU MUST USE EVIDENCE FROM YOUR OBSERVATIONS OF THE SIMULATION TO SUPPORT YOUR ANSWERS. Your grade will be based on the amount of evidence you use and how effectively you use it.