Module 11: Meteorology

Topic 7 Application: Greenhouse Gases Scientific Investigation

Before you begin this assignment, make sure to download the *Greenhouse Gases Scientific Investigation Report*. As you complete this scientific investigation, fill in any needed information on the report template. If you need more information about each section of the report, please visit the Developmental Module.

Introduction

The Greenhouse Effect is a process that is vital for all living things on Earth. This natural process traps heat in the atmosphere. Certain gases, called greenhouse gases, are responsible for the Greenhouse Effect. Greenhouse gases include water vapor, carbon dioxide, and methane. As radiation from the Sun reaches Earth, it can either be absorbed or reflected. Greenhouse gases absorb the reflected radiation and warm the lower atmosphere. If the level of greenhouse gases in the atmosphere is increased, too much reflected radiation will be absorbed. This causes the atmosphere of the planet to warm considerably. Recent data suggests that the addition of greenhouse gases into the lower atmosphere has increased significantly in the past 200 years. Much of the additional greenhouse gases are added by burning fossils fuels.

Objectives

In this scientific investigation, you will:

- analyze how greenhouse gases affect Earth's temperature; and
- identify processes that might increase or decrease Earth's temperature.

Hypothesis

Using the **Procedure and Data Collection** section below, read through the procedural information for this scientific investigation. Based on your understanding of the procedure, develop your own hypotheses which describe your expected results. How do greenhouse gases impact the temperature of Earth? What processes increase or decrease Earth's temperature? Record these hypotheses in the **Hypothesis** section of your *Greenhouse Gases Scientific Investigation Report*.

Required Simulation

Greenhouse Gases
Provided by:
PhET Interactive Simulations
http://www.phet.colorado.edu

Procedure and Data Collection

1. Click on the tab labeled *Greenhouse Effect* tab.
2. Using the menu in the right corner, click on *Ice Age*. Record the minimum temperature in the data table.
3. Record the carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).
4. Observe the photons as they strike the ground. Record any observations in the data table.
5. Add clouds and make observations about the change in temperature. Record any observations in the data table.

6. Repeat steps 1-4 for both *1750* and *Today*. Record the minimum temperatures and any observations in the data table.

Data

Using the **Data** section of the *Greenhouse Gases Scientific Investigation Report*, make sure to complete all requested data on the report itself.

Data Analysis

In the **Data Analysis** section of your *Greenhouse Gases Scientific Investigation Report*, provide responses to the following questions:

1. How did the greenhouse gases affect Earth's atmosphere during the Ice Age, the year 1750, and today?
2. What would happen if there were no greenhouse gases?
3. What would happen if greenhouse gases increase?
4. What could contribute to an increase or decrease in the amount of greenhouse gases?

Conclusion

Using the **Conclusion** section of your *Greenhouse Gases Scientific Investigation Report*, compose three to four sentences describing an overall conclusion about the relationships you examined in this scientific investigation. Were your hypotheses true or false, and how do you know? Use the data and notes that you collected from your simulation experience to form your conclusion. Make sure that you include information that you gained from data analysis to support your conclusion.

Experimental Sources of Error

On your *Greenhouse Gases Scientific Investigation Report*, provide responses to the following questions: Are there any sources of error? If so, what are they, and what could be done to minimize error?