Name _____ Class _____ Date _____

The Greenhouse Effect

According to theory, the Earth's atmosphere acts like a greenhouse, warming our planet in much the same way a greenhouse warms the air inside its glass walls. Like glass, the gases in the atmosphere (especially those known as the "greenhouse gases") let in light, yet prevent heat from escaping. This natural warming of the planet is called the Greenhouse Effect.

Solar radiation enters the Earth's atmosphere and reaches the surface where about 30 percent of the energy reflects back out of the atmosphere. A portion of the reflected radiation is trapped in the atmosphere by clouds and "greenhouse gases", the rest is absorbed by the oceans and land masses. The "greenhouse gases" trap the heat near the Earth's surface where it warms the lower atmosphere. It is this natural barrier of gases that keeps the temperature of the Earth from fluctuating to the extreme variables seen on our moon and planets without an atmosphere.

Now, however, our efforts to provide for the Earth's quickly growing population are releasing "greenhouse gases" at much greater rates. As more "greenhouse gases" are produced, more radiation is absorbed and, in theory, the mean annual temperature of the Earth continues to gradually increase. This change in the Earth's temperature may have some far reaching effects.

There are four major "greenhouse gases". These include carbon dioxide, methane, nitrous oxides and fluorocarbons. Carbon dioxide, methane and nitrous oxide are all naturally occurring gases. People and animals exhale carbon dioxide as they breathe, this carbon dioxide is then used by plants during photosynthesis. One way that humans have altered this delicate balance is through deforestation. With fewer plants available to utilize the carbon dioxide created during respiration, an excess of carbon dioxide occurs. Carbon dioxide is also created as a by product of factories burning fossil fuels such as coal and by fuels used to power combustion engines.

Methane is generated naturally by bacteria that decompose organic material in wetlands and rice fields. It also escapes from natural gas deposits as well as garbage landfills and dumps. As humans produce more garbage and create more landfills, the balance again can be altered. Fluorocarbons are man-made gases that are being phased out due to many concerns, including the Greenhouse Effect as well as depleting the ozone layer.

In the following experiment, you will explore the theory of the greenhouse effect. You will create two environments that are identical except for one factor. One environment will be open, simulating what might occur in an environment where few greenhouse gases are present and incoming heat energy can escape. The second environment will be closed, simulating an environment where greenhouse gases are present and incoming heat energy is trapped. You will expose both environments to the same light source and conditions, and investigate the difference in the rates of heating and cooling in the environments.

Materials

GLX	Soil	Funnel
Spatula	Rubber stopper (2)	Weighing dish
Temperature sensors (2)	Bottles (1 open, 1 closed)	Ring stand and light
	Beaker	

GLX Set-Up

Follow the instructions on the "Greenhouse Effect lab/Data Studio Graphing Directions" sheet.

Procedure

1. Measure out one level weighing dish of soil for each of your bottles. Use the funnel and pour the soil into the closed bottle. **Do not pack the soil; it should be loose.** Repeat the process for the open bottle.
2. Set each bottle on its side and push the rubber stoppers into the top of the bottles.
3. Slide a temperature sensor into the hole of each of the rubber stoppers. The end of the sensor should be midway to the base of the bottle. (**see the example at the front of the room**)
4. Place both bottle environments directly under a light source so that the edge of the metal light shade is _____ cm above the table.
5. Position the bottles so they will receive equal amounts of light energy.
6. Observe the temperature sensors to make sure they are still positioned correctly.
7. At the same time, turn on the light source and click on the "Start" button on Data Studio to begin collecting data.
8. You will collect the temperature change with the light on for 10 minutes (600sec.). At the end of 10minutes, turn off the light source. **DO NOT Turn Off the GLX/Data Studio.**
9. Continue collecting temperature readings with the light off for 10 minutes (600 sec.).
10. Push the "Stop" button on Data Studio after a total of 20minutes. (1200sec.)

Analysis

Follow instructions on the "Greenhouse Effect lab/Data Studio Graphing Directions" sheet to check your data and make your graph.

1. Which of the two bottles recorded the highest increase in temperature? Why?

2. What part of the atmosphere is represented by the closed bottle?

3. Relate the closed bottle to a greenhouse,

4. Explain how your closed bottle trapped heat; relate this to how our atmosphere works to trap heat.

5. Why is it usually warmer on a cloudy night than on a clear night?

6. Why is the amount of carbon dioxide important to the greenhouse effect?

7. If humans do not interfere, how does the amount of carbon dioxide in the atmosphere remain virtually unchanged?

8. Use the **smart tool** to determine the highest and lowest temperature readings of each bottle. Also determine the percent increase for each bottle.

Open Bottle – High temperature _____

Low temperature _____

Percent increase _____

Closed Bottle – High temperature _____

Low temperature _____

Percent increase _____