Name _____

Global Warming Experiment

Question: How does the earth maintain a temperature range that can support life? What provides heat to the earth? What keeps the earth from getting too hot?

Materials:

One large clear glass jar (large enough to hold a plastic or paper cup)

Two paper cups

Soil (such as potting or topsoil)

Outdoor thermometer (small enough for the base to fit in the cup)

Spray bottle with water.

Procedure:

1. Place the soil in each of the cups so the cups are almost full. Label one cup "A" and the other cup "B".

2. Place the thermometer in cup "B" so that the base (the bulb of the thermometer) is slightly buried by the soil.

3. Place both cups in direct sunlight (such as on a table outside). Wait about 10 minutes and record the temperature in cup "B".

4. Move the thermometer to cup "A" and repeat the temperature measurement. Both cups of soil should be at the same temperature, if not, wait a few more minutes before taking the temperature.

5. Place the large glass jar (upside down) over cup "A" keeping the thermometer in the soil.

6. Wait several minutes and remove the jar and record the temperature.

7. Move thermometer to cup "B" that was not covered, wait several minutes, and record the temperature again.

Observe:

What did the temperature do when the soil was covered by the glass jar?

Temperature Observations:

Cup A:
At the Beginning: _____

After Covered by Glass Jar: _____

Cup B:
At the Beginning: _____

At the End: _____

Evaluate:

Why do you think the temperature changed when the earth (soil) was enclosed by the glass jar? What is the source of the heat? Why did it not affect cup "B" that wasn't covered?

Enrichment:

Repeat the entire experiment with one addition. After you have recorded the temperature in the soil covered by the jar, spray water mist into the jar before turning it over and covering the cup. Wait and record the temperature again. What happens? Is the temperature higher or lower when the water mist is sprayed in the "atmosphere" of the earth (the cup). Why do you think the water mist makes a difference?

Extension:

Water vapor is invisible. Can you think of other gases in the earth's atmosphere that can have the same effect that water vapor did in this experiment? Why did you use two cups instead of only one? What happened to the temperature of cup "B" that was not covered by the jar? Most experiments have what you might think is an "extra" object or subject that is studied or measured. Why do you think this is important and what do you think it might be called?

Personal Experience:

Have you ever walked into a greenhouse? What was it like? Can you think of other situations where the heat from sunlight is trapped in a small space and it gets hot? Why might this greenhouse effect be bad for the earth?

Teacher's Guide:

Global Warming Experiment Goal:

To give students an understanding into the complexities involved in the global warming phenomenon. The earth's temperature is the result of sunlight penetrating the earth's atmosphere and warming the planet. Some of the light energy is reflected; however, certain gases in the atmosphere "trap" the heat energy after it is reflected off the surface of the earth. This trapping of sunlight energy creates the greenhouse effect. Gases, such as carbon monoxide and chlorofluorocarbons (formerly found in spray products until they were banned), are gases that trap light energy. Water vapor also has this capacity.

Observe:

The cup of soil covered by the inverted glass jar will be warmer than the uncovered cup. The glass jar acts like a greenhouse trapping reflected heat energy.

Evaluate:

Sunlight is the source of the earth's heat. There is a natural balance of sunlight that enters the atmosphere and energy that is reflected and not converted to heat. Anything in the atmosphere that "traps" sunlight energy will add heat to the atmosphere and can result in an increase in temperature.

Enrichment:

Water vapor is a gas and can "trap" heat that enters the inverted jar, as can other gases. The primary concern with the greenhouse effect is that artificial gases added to the air as pollutants are increasing this effect and slowly causing the earth's temperature to increase. This is not only a very slow process (estimates are about 1 degree F this century), but it is also unevenly distributed across regions of the earth.

Environmental consequences are thought to include melting of the polar ice, sea level rise, and an increase in extreme weather patterns, such as droughts and floods.

Extension:

This experiment used two cups, one was a "treatment" (cup "A") and one was a "control" (cup "B"). The control gives the students an introduction to the concept of comparisons of measurements. The experiment could be expanded to have several control and treatment cups if it is desired to teach the concept of the mean, variability (variance), or basic statistical approaches. Students should understand that an important method used in science involves treating or manipulating the subject of study and then observing or measuring the outcome. Without a proper reference, it is impossible to determine what effect the treatment is having, either negative or positive.

Personal Experience:

The students should understand that what we add to our air may not be visible but may have profound effects on human health or the environment. The concept of long-term change is also important. Cumulative effects over decades or centuries can have an irreversible effect on the planet. Most children are familiar with the sun's effect in a closed car. They can discuss what this means if the entire earth is subjected to this type of effect. Will more farmland be converted to desert by droughts? Will sea level rise due to the melting of polar ice and coastal areas and islands disappear? Scientists disagree on the future impacts of global warming; however, it is important that we consider all the consequences of our actions.