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Global Warming and the Greenhouse Effect

Summary:

The Earth is naturally warmed through a process called the greenhouse effect. Greenhouse gases absorb thermal radiation in the atmosphere to produce a natural warming of the Earth. Scientists have found that the addition of anthropogenic sources of greenhouse gases is resulting in the warming of the Earth, the transitioning of climates, the deglaciation of continents, and rising sea levels. This laboratory demonstrates how greenhouse gases, such as carbon dioxide, can contribute to Global Warming and Climate Change.

Objectives:

- To understand the effects of greenhouse gases on the environment

Materials:

- 2 Tupperware containers with clear top (recommended container: Rubbermaid Lock-Its, 9 cup size, 8.5 x 8.5 x 3 inches)
- 2 digital thermometers with temperature probes (recommended: Pyrex Digital Probe Thermometer, or Taylor 1470 Digital Cooking Thermometer/Timer)
- 2 heat light bulbs with clamp or lamp stand
- 2 ring stands to secure the light fixtures
- small beaker (50 – 150 mL)
- small amount of dry ice and gloves/tongs to pick it up with
- black construction paper
- scissors
- ruler
- timer or stopwatch (or use cellphone)

Procedure:

1. Record the temperature every 2 minutes following turning on the lights for 15 – 20 minutes.
2. Cut out two equal size pieces of black construction paper to fit the bottom of the Tupperware containers
3. Place about 5g of dry ice (a small cube) in 30 mL of warm water in the small beaker
4. Place the beaker in one of the Tupperware containers so that it fills with CO2
5. Allow the Tupperware container to fill up with dry ice (about 60-90 seconds)
6. Insert a temperature probe into the Tupperware container containing CO2
7. Remove the beaker from the container and seal the cover onto the container to seal in the CO2 (do this quickly)
8. Place the second temperature probe into the Tupperware container containing atmospheric air and then seal the cover on to the container (this will be your control).
9. Place the containers side by side beneath the heat lamps
10. Measure the distance from the tops of each of the containers to their respective heat lamps and be sure that the distance is the same

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11. Wait until the temperatures within the containers have equilibrated to the same temperature. Once the temperatures have equilibrated, simultaneously turn on lights and record start time

Time (minutes)	Atmospheric Air Temperature (°C)	Carbon Dioxide Temperature (°C)
0		
2		
4		
6		
8		
10		
12		
14		
16		
18		
20		

Graph your data below. Use two different lines – one for Atmosphere Conditions and one for Carbon Dioxide conditions. Make sure to label the axis correctly!

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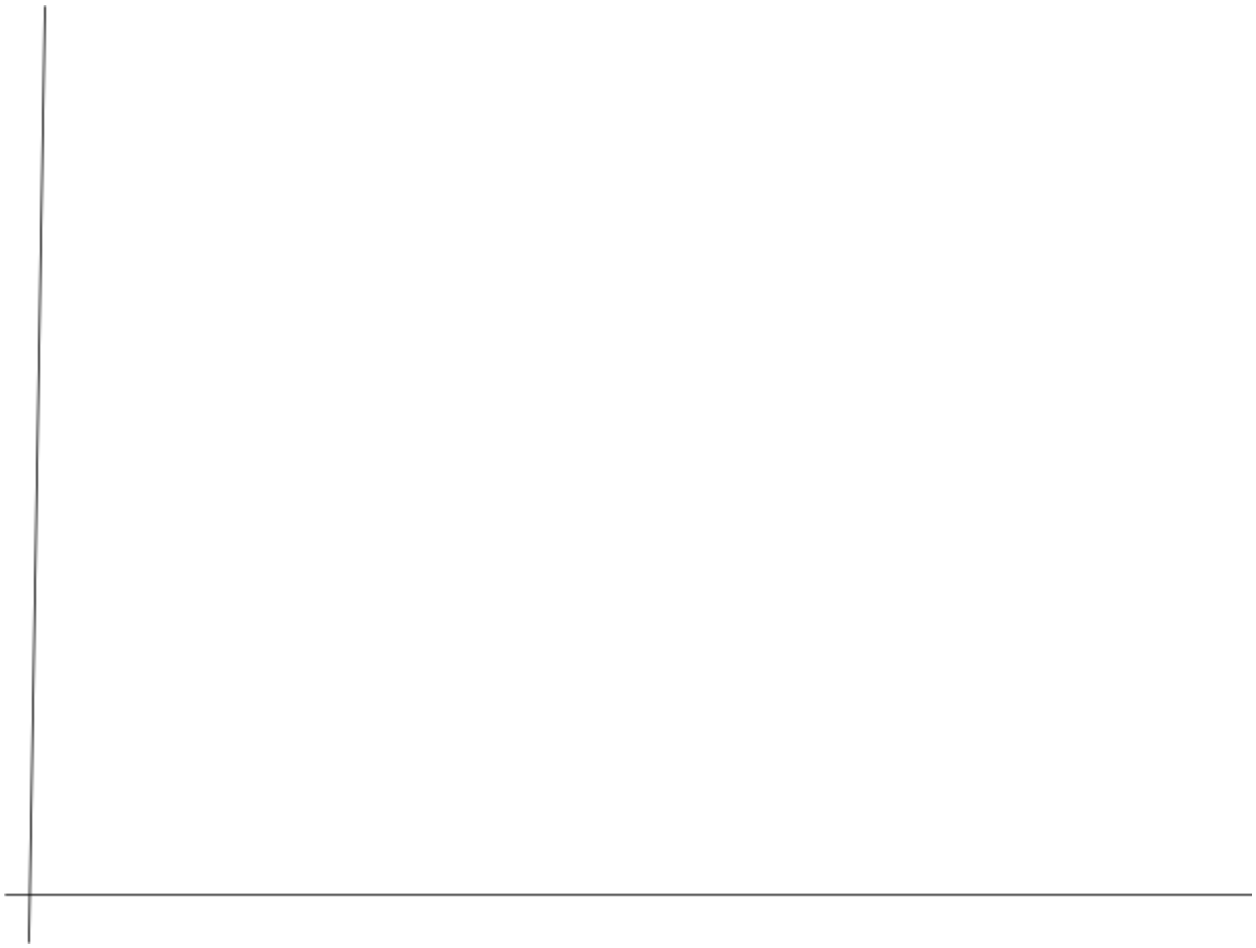

Analysis Questions:

1. How does Carbon Dioxide trap heat in the atmosphere – explain it in words or draw it

2. What were your observations of the atmospheric composition temperature?

3. What were your observation of the container that only contained carbon dioxide?

4. How would you explain the difference in temperature between the two?

5. What would happen to planet Earth if our atmosphere had less CO2?

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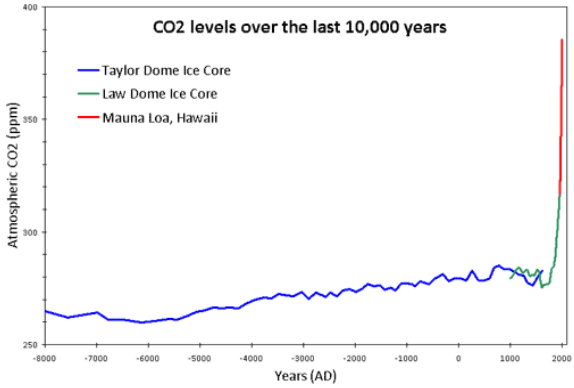
6. What would happen to planet Earth if our atmosphere had more CO2?

7. The graph to the right shows the amount of Carbon Dioxide in the atmosphere over the last 10,000 years. What trends do you notice?



8. What do you think has caused the large increase in CO2 in the last 100 years?

9. What effects is this going to have on the planet? Be specific.