Greenhouse Gas Lab

Background: Carbon dioxide is identified as a "greenhouse gas" because of its ability to "trap" heat within earth's environment. This investigation is designed to investigate the ability of a sample of carbon dioxide gas to absorb thermal energy compared to that of a sample of air.

Prelab Discussion:

1. What is the greenhouse effect?
2. Is this effect bad for the planet?
3. CO_2 is not the only greenhouse gas. What other gases contribute to this effect?

Problem: Does carbon dioxide trap heat more effectively than normal air?

Hypothesis: _____

Safety: Goggles and closed toed shoes are required at all times. Students should not eat, drink or taste anything in the lab. Students are required to wash hands when finished.

Materials

- 2 1000ml flasks
- 1 250ml flask
- 1 Shallow pan
- 1 Stopper apparatus (#6 stopper, 6cm glass tube, 30cm of flexible tubing)
- Parafilm
- Water
- 4 effervescent tablets
- Matches
- 2 lab thermometers or probes
- Stopwatch
- 1 Lamp with 150watt bulb
- 1 Ring stand

Procedures:

1. *Preparing the CO_2 sample.*
    a. Fill a shallow pan with approximately 4cm of water. Fill a 1000ml flask to the rim with water. Cover the top with Parafilm so that it will not leak when you turn it over.
    b. Invert the flask putting the opening of the bottle under the water in the pan. Remove the Parafilm. The flask should remain full.
    c. Put 100ml of water into a 250ml flask. Cap the flask with the stopper apparatus. Put the tubing end of the apparatus under the 1000ml flask that is inverted in the water.
    d. Carefully remove the stopper and drop 2 effervescent tablets into the 250ml flask. Replace the stopper immediately. The gas should bubble into the 1000ml flask and begin to displace the water. When the reaction begins to slow, remove the stopper and drop 2 additional tablets into the 250ml flask. This should create enough gas to completely displace the water in the 1000ml flask.
    e. Remove the tubing from under the inverted flask. Without tipping the flask, carefully bring it to the surface. When you have cleared the water, cover it with Parafilm and then turn it back over. Keep the Parafilm on the flask until you are ready to start taking temperature measurements.

f. You will need another 1000ml beaker that requires no other preparation. This is your sample of normal air.

2. *Setup*
   a. Place both flasks in front of a lamp containing a 150-watt light bulb. Do not turn on the lamp until you are ready to start taking measurements. The flasks should share the lamp equally.
   b. Once you remove the Parafilm from the CO_2 sample, it is very important that you do not create unnecessary air currents. You should move slowly and avoid breathing on the apparatus. Normal talking creates air currents so avoid talking when it is not necessary.
   c. Make sure that your thermometers or temperature probes are ready to be inserted into the flasks. Carefully remove the Parafilm from the CO_2 sample. Insert the thermometers or probes carefully. Adjust them so that they are in the same place in each flask. One thermometer should not be closer to the heat source than the other.
   d. Take your first temperature reading. Now turn on the light. Once the light is on, if you need to make any minor adjustments to ensure even heating of both flasks, you may do it now. Then do not touch the setup for the rest of the experiment.
   e. Record the temperature of each flask every 30 seconds until they level off.
   f. After the temperatures level off, remove the thermometers. Light two matches (strike away from your face and other people) and drop one in each flask. Observe the results.
3. *Cleanup*
   a. Turn off the lamp. Remove the thermometers and allow them to cool on the counter. Rinse the beakers out and move them so they are not sitting in the same spot on the counter. This will allow the beakers and the counter to cool for the next class.
   b. Rinse out your 250ml effervescent flask. Throw away any trash.
   c. Be sure that the lab station looks as it did when you arrived.

Data Collection: Your lab requires a data table and a line graph. (Please be sure to place the table and graph next to each other in this part of the lab write-up)

Analysis: (These should be in complete sentences in numbered format)

1. Which flask represented the experimental group?
2. Which flask represented the control group?
3. What was the dependent variable?
4. In this model, what did the lamp represent? What did the flasks represent?
5. Carbon dioxide is not the only greenhouse gas. Why do scientists focus on it so much?
6. Was there a difference in the behavior of the lit matches when they were dropped into the flasks?

Conclusion: (This should be in paragraph form)

1. Restate your hypothesis
2. Does the data support or reject your hypothesis?
3. Use data from the lab to support this statement.
4. What are some sources of error for this lab? What were some things that were difficult to control and may have had an effect on your data?
5. What further questions do you have after performing this experiment? Think about this. Please do not state that you have no further questions.

This lab was adapted from the following pdf file created by Northwestern University, IL
http://www.letus.northwestern.edu/projects/gw/pdf/C09.pdf