Greenhouse Gas Lab

Prelab Discussion:

1. What is the greenhouse effect?

2. Is this effect only bad for the planet?

Question: Does carbon dioxide trap heat more effectively than normal air? (copy this in to your engineering notebook)

Hypothesis: write in engineering notebook. (remember, prediction + reason)

Background: write in engineering notebook. (what do you already know about CO2 and the greenhouse effect?)

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

• 3 250ml flasks

• 1 Shallow pan

• 1 Stopper apparatus (stopper + flexible tubing)

• 3 notecards

• Water

• 2 effervescent tablets

• Matches

• 2 thermometers that read the same room temperature

• Stopwatch

• 1 Lamp with 60 watt bulb

• 1 Ring stand

Procedure:

1. Preparing the CO2 sample.
   1. Fill a shallow pan with approximately 2 cm of water.
   2. Fill a 250 ml flask to the rim with water.
   3. Cover the top with a note card so that it will not leak when you turn it over.
   4. Invert the flask putting the opening of the bottle under the water in the pan.
   5. Remove the note card. The flask should remain full.
   6. Put 100 ml of water into another 250ml flask. Cap the flask with the stopper apparatus. Put the tubing end of the apparatus under the 250 ml flask that is inverted in the water.
   7. Carefully remove the stopper and drop 2 effervescent tablets into the upright 250 ml flask.
   8. Replace the stopper immediately. The CO2 gas should bubble into the inverted 250 ml flask and begin to displace the water. When the reaction begins to slow, remove the stopper and drop 1 additional tablet into the upright 250 ml flask. This should create enough gas to completely displace the water in the inverted 250 ml flask.
   9. 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 the note card and then turn it back over. Keep the note card on the flask until you are ready to start taking temperature measurements.
   10. You will need another 250 ml beaker that requires no other preparation. This is your sample of normal air.
2. Setup
3. Place both flasks in front of a lamp containing a 60-watt light bulb. Do not turn on the lamp until you are ready to start taking measurements. The flasks should share the lamp equally.
4. Label separate note cards with “CO2” and “normal air” and place them flat in front of the correct flasks.
5. Once you remove the note card from the top of the CO2 sample, it is very important that you do not create unnecessary air currents. You should move slowly and avoid breathing on the apparatus.
6. Make sure that your thermometers or temperature probes are ready to be inserted into the flasks.
7. Carefully remove the note card from the CO2 sample.
8. Insert the thermometers. 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.
9. Take your first temperature reading.
10. 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.
11. Then do not touch the setup for the rest of the experiment.
12. Record the temperature of each flask every 30 seconds until they level off.
13. After the temperatures level off, remove the thermometers.
14. Light two matches (strike away from your face and other people) and drop one in each flask at the same time. Observe the results.
15. Cleanup
16. Turn off the lamp. Remove the thermometers and allow them to cool on the counter.
17. Rinse the beakers out making sure to save the matches from going down the drain. Wet the matches before throwing them away.
18. Rinse out your 250ml effervescent flask. Throw away any trash.
19. Be sure that the lab station looks as it did when you arrived.

Results:

Your lab requires a data table and a line graph. (Please be sure to place the data table and graph next to each other in your engineering notebook, so you may need to skip a page for the graph)

Conclusion:

Analysis questions: (These should be in complete sentences in numbered format in your engineering notebook)

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 each flask represent?

5. Carbon dioxide is not the only greenhouse gas. Why do scientists focus on it so much?

6. What was the difference in the behavior of the lit matches when they were dropped into the flasks?

Conclusion: (This should be in paragraph form in your engineering notebook)

1. Answer the experimental question.
2. Restate your hypothesis – was it correct or incorrect?
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 improvements do you have after performing this experiment? Think about this. Please do not state that you have no improvements.

This lab was adapted from the following pdf file created by Northwestern University, IL

http://www.letus.northwestern.edu/projects/gw/pdf/C09.pdf