Too Many Blankets: Carbon Dioxide and Air Temperature

Scientists measure the amounts of certain gasses and solids in the Earthôs atmosphere as part of climate and climate change studies. Whatôs in the air affects the airôs temperature. Changes in whatôs in the air changes how quickly the Sun heats the atmosphere during the day and how quickly it cools down at night. What's in the air, the atmosphere? Not just the oxygen living things need, that's for sure. The air is a mixture of gasses and tiny pieces of solids. It has oxygen, nitrogen, carbon dioxide and water vapor gasses, to name just a few. It has tiny particles of dust and ice crystals and pollen, too. The Earthôs atmosphere, acts like a blanket and helps keep the Earth warm. In this investigation you explore how increasing the amount of carbon dioxide, a greenhouse gas, in the air affects the temperature of the air.

What you need: You need to build a neighborhood in a fish tank. You will use the tank twice, one time without adding carbon dioxide and one time with added carbon dioxide. Using a tank with a cover keeps the gasses in the tank from escaping. The amount of carbon dioxide you are going to add to the tank will increase the carbon dioxide to toxic levels. Yep, all the people in your tank neighborhood would not be able to get enough oxygen to stay alive. Not even the worst global warming predictions use carbon dioxide levels this high.

It will take 5 hours to complete this investigation using one tank. Do Part I one day and Part II the next day of you want.

For a basic tank:

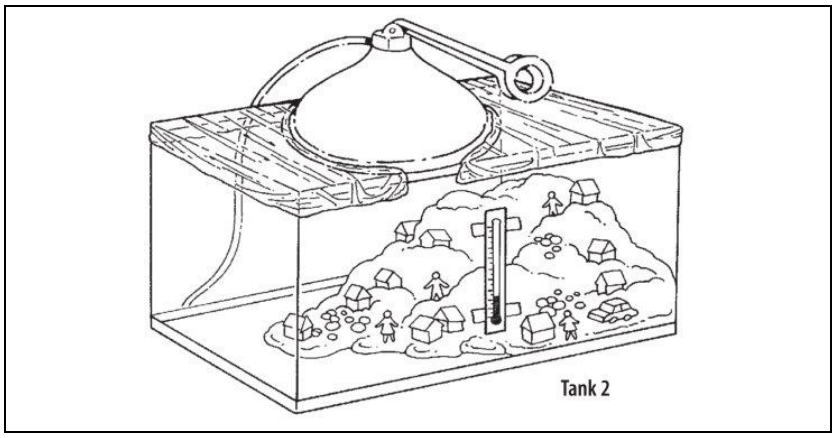
- Small fish tank with a cover. Plastic covers are a fire hazard and not recommended. Plastic wrap is not recommended for the same reason. Use heavy aluminum foil wrapped around the lamp (see Tank 2 diagram on page 2), but be careful, the foil and the lamp will get hot.
- Lamp with a 60w bulb. A clamp lamp or a desk lamp will work.
- Thermometer
- A few small chunks of dry ice (frozen carbon dioxide).
- Clock
- Student worksheet (see below)

For a tank like the one in the diagram*, you will also need:

- Water resistant modeling clay (florist clay)
- Plastic houses, people, cars, etc.

*Not adding all of the people, cars, house, etc. will not affect your results.

Tank Set-Up:



What you do:

- Build your neighborhood tank.
- Tape the thermometer to the inside of the tank with the numbers facing out.
- Complete Part I & II of the investigation.

Part I: No Added Carbon Dioxide

- Cover and seal your tank.
- Record the temperature of the air in the tank in the Tank 1: Lamp On table of your worksheet.
- Turn on the lamp.
- Wait 5 minutes and record the air temperature in the Tank 1: Lamp On table of your worksheet.
- Record the air temperature in the tank after 10, 30 and 60 minutes in the Tank 1: Lamp On table of your worksheet.
- Turn off the lamp.
- Record the air temperature in the tank after 0, 5, 10, 30 and 60 minutes with the lamp off in the Tank 1: Lamp Off table of your worksheet.
- Make graphs of the temperatures changes Part I.

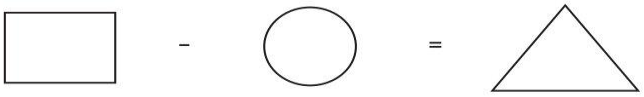
Part II: Carbon Dioxide Added

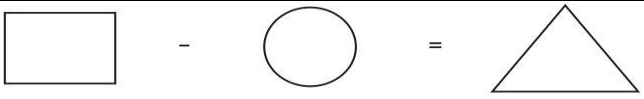
- Add a few pieces of dry ice to the tank and put the cover back on. Donôt seal it completely so the carbon dioxide gas can force out the ñnormalò air in the tank. Carbon dioxide gas is heavier than regular air and will sink to the bottom of the tank. As more of the dry ice evaporates, carbon dioxide gas will eventually fill the tank as the ñnormalò air is forced out of the top.
- Let the tank sit until all of the dry ice has evaporated, the fog has cleared in the tank (60 minutes should do it) and the tank comes back to room temperature.
- Now seal the tank as completely as you can.
- Record the temperature of the air in the tank in the Tank 2: Lamp On table of your worksheet.
- Turn on the lamp.
- Wait 5 minutes and record the air temperature in the Tank 2: Lamp On table of your worksheet.
- Record the air temperature in the tank after 10, 30 and 60 minutes in the Tank 2: Lamp On table of your worksheet.
- Turn off the lamp.
- Record the air temperature in the tank after 0, 5, 10, 30 and 60 minutes with the lamp off in the Tank 2: Lamp Off table of your worksheet.
- Make graphs of the temperature changes from Part II.

Use your observations and graphs to answer the questions on your worksheet.

Too Many Blankets: Carbon Dioxide and Air Temperature Worksheet

Name _____

Tank 1	**Lamp On**	**Temperature Change (ºF)** **Reading ºF – Starting ºF = Change ºF**
Time (minutes)	**Temperature (ºF)**	
0 		**0 ºF**
5 		
10 		
30 		
6o 		

Tank 1	**Lamp Off**	**Temperature Change (ºF)** **Reading ºF – Starting ºF = Change ºF**
Time (minutes)	**Temperature (ºF)**	
0 		**0 ºF**
5 		
10 		
30 		
6o 		

Tank 2	Lamp On	Temperature Change (ºF) Reading ºF – Starting ºF = Change ºF
Time (minutes)	Temperature (ºF)	□ – ○ = △
0 ○		0 ºF
5 □		
10 □		
30 □		
6o □		

Tank 2	Lamp Off	Temperature Change (ºF) Reading ºF – Starting ºF = Change ºF
Time (minutes)	Temperature (ºF)	□ – ○ = △
0 ○		0 ºF
5 □		
10 □		
30 □		
6o □		

Carbon Dioxide and Air Temperature Questions:

1. What was the total temperature change (ºF after 60 minutes - ºF at 0 minutes) for Tank 1: Lamp On? _____

2. What was the total temperature change (ºF after 60 minutes - ºF at 0 minutes) for Tank 1: Lamp Off? _____

3. What was the total temperature change (ºF after 60 minutes - ºF at 0 minutes) for Tank 2: Lamp On?

4. What was the total temperature change (ºF after 60 minutes - ºF at 0 minutes) for Tank 2: Lamp On?

5. Which tank reached the highest temperature with the lamp on, Tank 1 or Tank 2? _____

6. Which tank heated up the fastest, Tank 1 or Tank 2? _____

7. Which tank cooled down the fastest, Tank 1 or Tank 2? _____

8. Why are gasses in our atmosphere like carbon dioxide important to life on Earth?

9. Explain why the two tanks heated and cooled differently.

10. What does what you observed have to do with global warming and climate change?

11. What questions do you have about greenhouse gasses and climate change?