



**CALIFORNIA STATE SCIENCE FAIR  
2016 PROJECT SUMMARY**

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<b>Project Title</b> Heat Absorption and Retention of Carbon Dioxide and Other Atmospheric Gases	
<b>Abstract</b> <b>Objectives/Goals</b> Measure the absorption and retention of light heat by various atmospheric gases. I hypothesized that carbon dioxide would have the most absorption and heat retention of the four gases tested. <b>Methods/Materials</b> I placed four identical thermometers into four 1-gallon mason jars filled with either carbon dioxide, nitrogen, water vapor, or room air. I put each jar in front of its own identical heat lamp, and checked and recorded the temperature every half an hour. After an hour I turned off the heat lamps and observed the temperature every fifteen minutes for an hour and a half. <b>Results</b> Nitrogen and carbon dioxide had the highest rate of heat absorption with slopes of $0.47^{\circ}\text{C}$ per minute and $0.48^{\circ}\text{C}$ per minute respectively, while air and water vapor had the lowest rate of absorption with slopes of $0.42^{\circ}\text{C}$ per minute and $0.43^{\circ}\text{C}$ per minute respectively. However, carbon dioxide and water vapor had the highest rates of retention with slopes of $-0.077^{\circ}\text{C}$ per minute and $-0.084^{\circ}\text{C}$ per minute respectively, while nitrogen and air had the lowest rate of retention with slopes of $-0.074^{\circ}\text{C}$ per minute and $-0.075^{\circ}\text{C}$ per minute respectively. <b>Conclusions/Discussion</b> Out of the gases tested, carbon dioxide was the only gas that absorbed and retained heat well. Nitrogen was able to absorb heat well, but it did not retain it. Water vapor retained heat the best out of all the gases tested, but it did not absorb the heat very well. Air did not absorb or retain heat well. One factor as to why water vapor and carbon dioxide retained heat the best is because both are greenhouse gases. However, this experiment did not test for the greenhouse effect. Future climate modeling to include both the direct effect and greenhouse effects may yield more accurate climate models. Future investigation using various wavelengths of light should also be conducted, but were outside of the funding budget of this project.	
<b>Summary Statement</b> I measured that atmospheric gases have different direct absorption and retention of heat; carbon dioxide absorbed heat the best, and was second only to water vapor in retention of heat.	
<b>Help Received</b> I designed and built the experimental apparatus, and performed the experiments myself. My parents funded and advised on technical setup of project.	