



CALIFORNIA STATE SCIENCE FAIR 2012 PROJECT SUMMARY

Name(s) Delfin A. Acosta	Project Number S1801
Project Title The Effects of Gases on Solar Water Heaters	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This experiment is designed to test whether changing the gases inside of the heating box will affect the amount of the time needed to heat the water to a given temperature. My hypothesis was that the gas with the lowest thermal conductivity would result in the most efficient operation of the solar heater. This is because it would prevent heat from escaping from the hot metal plate, through the gas and outside via the walls or conductive, metal valves.</p> <p>Methods/Materials The experimental water heater is designed like most solar water heaters; a plastic or glass top, a box that is air-tight, with copper pipes and a heat plate below to receive the energy let into the box and transfer it to the water. I tested to see the time taken by the water circulating in the heater to reach the temperature of 110 degrees Fahrenheit. In this experiment, regular air in the box was my control, then I filled it with various gases, and repeated the experiment. During each trial; I conducted three trials for each test group (Air, Argon, Helium); I measured out exactly the same volume of water at 70 degrees Fahrenheit. The room temperature outside the heater was kept at a constant 75 degrees Fahrenheit. In order to place the other gases, such as helium, inside the chamber, I installed two gas valves on either end of the container. The energy entering the heater was kept constant by utilizing two 250 Watt heating lamps kept at a distance of 1.5 feet.</p> <p>Results The results of my experiment were such that the air group was the most efficient, with an average time of 73 minutes. This was followed by Argon with a time of 74 minutes average, though there was an extraneous result, excluding this extraneous, the average is 76 minutes. Helium was the least efficient with an average time taken to reach 110F of 84.6 minutes.</p> <p>Conclusions/Discussion In evaluating my results and comparing them to my hypothesis, I found that my predictions were only correct with the Helium group, with it being the least efficient. The most efficient group, contrary to its thermal conductivity, was air, closely followed by argon. Yet, the difference between the times for the argon group and that of air, lie well within a reasonable margin of error. Thus, only another experiment, with more precise measurement, more sheltered from outside variables, can prove or disprove my hypothesis.</p>	
Summary Statement To determine whether placing different gases with differing thermal conductivities inside the chamber of a solar water heater would affect its efficiency.	
Help Received Help from my father in welding together pipes.	