



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2018 PROJECT SUMMARY

<b>Name(s)</b> <b>Michael P. Karvelas</b>	<b>Project Number</b>  38673
<b>Project Title</b> <b>How Can the Insulation of a Window Be Improved?</b>	
<b>Objectives/Goals</b> I was curious to find out if I could improve the insulation of a double pane window by adjusting the spacing between the sheets of glass. I also wanted to know if traditional glass performed better as an insulator than the modern plexiglass. A better insulated window saves a homeowner money on heating and cooling the home. Improving energy efficiency in a home can help reduce fossil fuel consumption and carbon emissions. <b>Abstract</b> <b>Methods/Materials</b> I constructed a window frame out of wood and placed it on top of a 15in x 15in x 12in plywood box that I also constructed to simulate a room. In the window frame, I added struts with different spacing between them for inserting the double pane glass or plexiglass. I placed the box and window frame underneath a light source, positioned the two panes of glass on the first level of struts with the least amount of space and used a thermometer to measure temperature in 5 minute intervals for a 45 minute period. I then moved the two panes of glass to the next level of struts and performed the same steps. I then performed the same tests with the two panes of plexiglass. I also conducted a control trail with a traditional window, a window with only one pane of glass, to demonstrate the difference in insulation between traditional windows and double-paned windows. Each type of window was tested three times to ensure accurate measurements. <b>Results</b> The results of my experiment demonstrated that the average temperature of the room with a glass window and with a 10 cm gap (10 cm was the largest gap used between two panes) was 84 degrees Fahrenheit which was 2 degrees lower than a glass window with a 5 cm gap, 3 degrees lower than a plexiglass window with a 10 cm gap, 4 degrees lower than a plexiglass window with a 5 cm gap, and 8 degrees lower than the traditional window. <b>Conclusions/Discussion</b> The results of my experiment verified my hypothesis. My experiment demonstrated that windows made of glass and with the greater distance between two panes are better insulators.	
<b>Summary Statement</b> My project is about using simple mechanics to improve the insulation of a window and testing whether traditional glass is a better insulator than modern plastic alternatives.	
<b>Help Received</b> Ray Fernnett, our family contractor, helped me build the window frame and box for this project. Dr. Jain helped proof read my report and gave me valuable suggestions to make it better.	