



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Emily T. Cox	Project Number J1504
Project Title Sound Absorption Characteristics	
Objectives/Goals I came up with this idea on the way to school when my sister was yelling at me. I wondered what material I could wrap her in that would block the most sound. I also have a relative that is legally hard-of-hearing because of his exposure to jet engine noise.	
Abstract Methods/Materials With the help of my grandpa, we attached an oscillator (frequency generator) and an alternating current volt meter to a speaker that was held in place by a cardboard box and styrofoam. We changed the frequency levels of the input from 50-15,000 cycles. For every material, the input signal was set at 2 volts. This made sure that all the frequencies we tested were tested at the same amplitude. We attached a microphone above the speaker in a second cardboard box. The microphone was attached to a pre-amplifier. We then placed the test material between the microphone and the speaker for each test frequency. We recorded the voltage with and without (always 2 volts) the test material. To convert the voltage readings to decibels we used the formula: $\text{dB} = 20 * \text{Log}10(\text{ volt with } / \text{ volt without })$	
Results All materials tested showed unique results. We tested seven different materials; acoustical tile, double pane glass, speaker cover, single pane glass, tapestry cloth, cardboard and printer paper. The double pane glass blocked sound the best overall. At different frequencies, some materials absorbed sound better than others. Surprisingly, at a few points, some of the materials like cardboard and printer paper resonated carrying the sound closer to the microphone resulting in a voltage measurement that surpassed that of the input voltage.	
Conclusions/Discussion All the materials tested reduced the sound level at most points. Because the double pane glass reduced the sound level more than any other material tested my hypothesis was proven correct. I was surprised that at some frequencies, the material resonated and made the voltage appear to be greater than the voltage without the material. I was also surprised that the speaker covering was not completely transparent. It blocked the sound a little bit at some points.	
Summary Statement Sound levels can be reduced more effectively by some materials than others at different frequencies.	
Help Received used equipment belonging to and under supervision of grandfather, George Taylor retired engineer	