



**CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY**

Name(s) Nathan G. Behrens	Project Number J1602
Project Title Attenuation of Eight Different Sound Frequencies over Distance through Four Different Materials	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals I wanted to know whether (1) a low frequency was harder to attenuate than a high frequency sound, (2) a soft material like fiberglass would attenuate sound better than a hard material like wood, and (3) if sound attenuates linearly with distance.</p> <p>Methods/Materials To measure attenuation I constructed a sound insulated testing cube which was open on one side containing speakers connected to an electric piano used to generate different frequencies of constant volume. A sound meter was placed on a tripod at various distances to read decibels for each combination of sound attenuating material, distance, and frequency.</p> <p>Results As hypothesized, (1) high frequencies attenuated more than low frequencies and (2) fiberglass, a soft material, was one of the best sound attenuators. However contrary to hypothesis, the hard materials of wood and cardboard were equally good attenuators and Styrofoam, a moderately hard material was the worst attenuator. Contrary to hypothesis, sound does not attenuate linearly with distance as in circular spreading; instead it attenuates with the square of distance as in spherical spreading.</p> <p>Conclusions/Discussion The attenuation of all the hard materials was very similar in spite of differing thicknesses. Perhaps they are acting more as a reflector than an absorber. I'd like to test this further by adding thickness as a variable and by measuring the sound inside the chamber rather than just outside.</p> <p>At my larger distances, sound seemed to switch from spherical to circular spreading likely because the sound waves were bouncing off the ceiling and floor. To better test for spherical spreading at large distances, I would test in a larger open area.</p> <p>My experiment was also limited by the lower range of the sound meter at large distances especially for high frequencies and good attenuating materials; future work should include a more sensitive meter for quieter sounds.</p>	
Summary Statement Sound attenuation was measured and analyzed for four materials at eight different frequencies over distance.	
Help Received Dad helped design & build the equipment. Mom & dad helped run the experiment. Dad helped in the data analysis and presentation.	