



**CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY**

Name(s) Shona M. Brown	Project Number J1704
Project Title Shake It Up	
Abstract Objectives/Goals The project is to find if a speaker's performance is dependent on its size. Two speakers were built and a decibel meter was used to measure the sound level of various tones. The hypothesis is, "reducing the speaker enclosure size will cause the sound level of some frequencies to be louder." The Chladni Plate experiment is replicated to visualize the patterns generated by the signals applied. Methods/Materials Speaker Materials: 10" and 4" speakers, plywood, Decibel meter, tone generator. Procedures: A 10" speaker was built with enclosures ranging from 100-500mm. A decibel meter placed 1m in front of the speaker measured the magnitude of frequency tones from 500-15,000 Hz. This procedure was repeated for a 4" speaker with enclosures ranging from 40-200mm. A multi-output jack was used to apply the tones simultaneously to both speakers and the combined sound level recorded. Chladni Plate Experiment Materials: Metal plate, black sand, tone modified speaker Procedures: A metal plate was attached to a 10" speaker so that it would vibrate when tones were applied. The speaker was placed flat, and black sand was poured on the plate. Tones ranging from 10-573Hz were applied and the patterns recorded. Results This project partly supported the hypothesis. I found that reducing the speaker size does improve the response but once the enclosure reached a certain size the response got worse. I also found that each had a resonance frequency. The Chladni Plate experiment was replicated and patterns were clearly shown when signals were applied. Conclusions/Discussion The best enclosure is not the smallest or the largest. The best was 200mm for the 10", 80mm for the 4". Each also had a resonance frequency of 600Hz. The Chladni experiment showed that the patterns produced are more complex for higher frequencies.	
Summary Statement "Shake It Up" is an experiment to determine how the size of a speaker enclosure affects its loudness, and the Chladni Plate Experiment is to visualize patterns of complex sound waves.	
Help Received Mrs. Janet Herreweyers, my 8th grade Science teacher, and Mr. Stephen Brown, my father and an engineer at Qualcomm.	