



**CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY**

Name(s) Cori D. Holmes	Project Number S0209
Project Title Perilous Playgrounds: The Physics of Distinguishing Which Playground Surface Material Reduces Force on a Head on Impact	
Abstract Objectives/Goals The purpose of this experiment was to see which of five playground surfacing materials resulted in the lowest impact force put on a head-form. I wanted the material with the least acceleration because the acceleration varies directly with the force according to Newton's law; so if acceleration is reduced, force will also be reduced. Methods/Materials I had six different materials: coarse rubber mulch, fine rubber mulch, wood mulch, sand, gravel, and concrete. I made a head out of twelve layers of pine wood with an accelerometer installed in the middle. Inside the head were lead and steel weights to simulate real head mass. The accelerometer was attached to a computer oscilloscope. From the computer, I read off the acceleration and the time it took to stop. Results Impact with the six inches of fine rubber resulted in the lowest acceleration, with an average peak acceleration of about $56g \pm 4$ during testing. The second lowest was the wood mulch with the average peak acceleration of about $77g \pm 7$. Next was the sand at $85g \pm 15$. In fourth was the gravel with an average peak acceleration of about 93 ± 30 . The coarse rubber was the fifth lowest and had an average peak acceleration of $102g \pm 12$. The material with the highest average peak acceleration was the concrete with $400g \pm 50$. Conclusions/Discussion My conclusion is that the six inches of fine rubber would be the safest material to use as a playground safety surfacing. My hypothesis was right. The coarse rubber, sand, gravel, and wood would also be acceptable but concrete would not.	
Summary Statement The purpose of this project is to determine which of six different playground surface materials most reduces the force on a head upon impact.	
Help Received Father owns oscilloscope; Borrowed accelerometer from the Air Force Research Laboratory at Edwards Air Force Base.	