



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

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Project Title How Things Break: Failure Analysis	
Objectives/Goals To determine whether a material breaks randomly or in patterns due to their molecular structures and components, and furthermore, to decide whether differences in surface or velocity will affect the breakage patterns and tendencies.	
Abstract Methods/Materials Glass sheets, Ceramic tiles, Cardboard Box, PVC Pipe, Steel Rod, Carpet, Wood Flooring, Concrete Flooring, Spray Paint, Safety Goggles, Gloves We utilized a homemade apparatus consisting of PVC pipe and the aluminum plated steel rod to break ceramic tiles and glass squares on three surfaces: wood, carpet, and concrete an at two heights: 1m and 2m. Before each trial we had to mark the center of the specimen to be broken and align the PVC pipe at exactly a right angle to the center in order to minimize the loss of force due to friction and to increase the level of reproducibility and normalcy within our results.	
Results Overall, the ceramic tiles were very predictable with the most consistent results at one meter. The glass however had significantly more randomized results that were evident on all three surfaces and from both heights. This can probably be attributed to the crystalline structure of the glass compared to the combination crystalline-glassy structure of the ceramic tiles.	
Conclusions/Discussion Our hypothesis was proven to be only partially correct. Both the ceramic tiles and the glass sheets broke in specific patterns due to their molecular structures but were less predictable then we had hoped. Factors that may have altered our data include spray-painting the glass (could have altered the original structure of the material by strengthening its resistance to the breaking force), human errors (such as not aligning the PVC pipe and specimen correctly), variations in the concrete surfaces, and unpredictable flaws in the materials we used.	
Summary Statement We wanted to determine if things broke according to their molecuar structures and componets, or if breakage patterns were completely randomized.	
Help Received Lowe's personnel cut glas squares	