



CALIFORNIA STATE SCIENCE FAIR

2002 PROJECT SUMMARY

Name(s) John T. Grasel	Project Number J0214
Project Title Characteristics of Winning Pinewood Derby Cars	
Objectives/Goals I want to see which characteristics (variables) have a significant effect on the race time of Pinewood Derby cars. I think that weight will have the greatest effect. Also, I think that a streamlined car with polished axles and the maximum amount of weight, placed in the rear, will be the fastest car.	Abstract In Part I, I made eight Pinewood Derby cars that each weighed 137 grams. The eight cars were constructed to have every combination of the independent variables of axle polishing (polished vs. as-received), aerodynamics (block vs. wedge), and weight placement (front vs. rear). I raced the cars on a Pinewood Derby track and recorded their times using an electronic timer. Next, I adjusted the weight of the eight cars to 143 grams. I then raced the new cars and recorded their times. In Part II, I constructed another car and raced it over a wide weight range (45 to 190 grams) without applying graphite to the axles. I then repeated that experiment using the same weight range and also graphite on the axles.
Results For Part I, the average race time was 2.886 ± 0.007 seconds. The best car (a wedge with polished axles and 137 grams in the rear) ran 0.04 seconds faster than the average car time. The slowest car (a block with unpolished axles and 137 grams in the rear) was 0.04 seconds slower than the average car. By using the experimental design in the range initially studied, I was able to find out that aerodynamics took off 0.008 seconds from the average time, axle polishing took off 0.025 seconds, a higher weight took off 0.008 seconds, and having back weight placement took off 0.008 seconds. From Part II, weight greatly affected the car's time up to 120 grams, but weight didn't make a significant difference afterwards. Graphite subtracted 0.8 seconds on the 45 gram car, and 0.2 seconds on the 145 gram car.	
Conclusions/Discussion With these results, I now have the information needed to create the ultimate Pinewood Derby car. I recommend building a car that is as close to 143 grams as possible, and certainly with polished axles. All else being equal, it can't hurt to make it wedge-shaped and put the weight in the rear although my results don't show that these variables are very significant. Finally, always apply a generous amount of graphite and spin it into the axles to get a speedy car.	
Summary Statement I systematically studied which variables affect a Pinewood Derby car's race time.	
Help Received My mother taught me the basic concepts of Statistical Experimental Design. My father helped me set up the Pinewood Derby track and electronic timer.	