



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b>  <b>Christian Felts</b>	<b>Project Number</b>  <b>J0308</b>
<b>Project Title</b>  <b>Determining Factors that Increase Speed in Pinewood Derby Cars</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The objective of this project is to determine the efficacy of specific mechanical changes made to pinewood derby cars resulting in greater Kinetic Energy in order to increase speed.</p> <p><b>Methods</b> Materials: Pinewood Derby Kits, graphite, scale that reads ounces, lead and tungsten weights and tungsten putty, aluminum track for testing, stopwatch. Tools included axle bending tool, mill, lathe and drill press. Methods: Built a baseline car to establish baseline speed. Using baseline car, made three incremental changes to car and tested changes to speed. Built two additional cars that started with the baseline car's parameters to test the impact of additional mechanical changes.</p> <p><b>Results</b> Three pinewood derby cars were built and tested. A baseline car was built and tested on an electronic track. A second car with a different wheel base was tested, and a third car with an aerodynamic shape was tested on tracks that did not record speed. Results were obtained by estimating car length advantage. (The second car was tested against the baseline car to test the different wheel base, and the second car was tested against the third with the same wheel base.) With each car, modifications were made incrementally and tested (three times) to isolate and verify the impact of changes. The following parameters made pinewood derby cars faster: using graphite on the axles and wheels, using lightweight wheels and polished axles, lifting the left front wheel and bending rear axles also raised speed. A longer wheel base and aerodynamic shape improved speed. Using the maximum weight and weight placement towards the back of the car also increased speed.</p> <p><b>Conclusions</b> Through testing, each mechanical change tested such as: weight placement, lighter parts, aerodynamic shape, and other changes to reduce friction resulted in making the pinewood derby cars faster. The results prove the scientific principle that reducing friction results in increasing Kinetic Energy and thus the speed of the car.</p>	
<b>Summary Statement</b>  I built three pinewood derby cars and tested various mechanical changes to the cars that resulted in increasing the speed of the cars.	
<b>Help Received</b>  I researched articles on the internet and YouTube that directed me in putting together my test plan and validating the test results. I built the pinewood derby cars with my father overseeing the work on a mill, lathe and drill press.	