



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Nathaniel P. Warfield	Project Number J1023
Project Title IR Drop: Testing Resistance on Wire Metals	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of this project is to find the sum of voltage drop in multiple different wires made up of different metals. Then concluding which wire is the most effective based on performance and price. There are different types of metal that can be used to conduct electricity. All wires have a flaw and that is voltage drop, otherwise known as IR drop. Voltage drop is, due to Ohm's law, where it states that voltage leads to current, but resistance impedes it causing IR drop.</p> <p>Methods/Materials The experimenter laid out two wires (one for positive, outgoing current and one for the negative incoming current) about an inch off the ground using PVC risers. Then the experimenter would take the voltage of the 1.5-volt watch battery to have a baseline for that wire. Then attach the battery to the wire and an assistant takes the voltage at the other end. Wide range of wire metals like copper, Kanthal A1 alloy, brass, and silver were tested. In addition, the variables of this project were: independent, the measurement of the end voltage of the wires; dependent, the amount of drop based on the end voltage compared to the start voltage; controlled, wire length, voltage tester, battery, testing conditions, and gauge of the wire.</p> <p>Results It was found that brass held its charge with less voltage loss over 25 feet better than the other metals. The resistance of the wires in ohms were, copper: 4,000 ohms, brass: 1,000 ohms, Kanthal A1: 3,000 ohms, & Silver at : 2,000 ohms.</p> <p>Conclusions/Discussion The experimenter found that brass wire had the lowest amount of resistance. However it appeared to the coating on it acting as insulator. The silver wire had the next lowest amount of resistance, but due to its price, it wouldn't be suitable to run long distances. Silver wire could have a more effective role in small electronics. The next best replacement would be the Kanthal A1 alloy, with least amount of resistance under silver. It is very inexpensive and suitable for everything from short to great distances and cost efficiency. By measuring the voltage through the four metals, I found that there was a difference in the IR drop and resistance between all them.</p>	
Summary Statement By measuring the voltage through the four metals, I found that there was a difference in the IR drop and resistance between all them.	
Help Received I built and design the experiment by myself. I receive assistance from Tim Meehan, PhD (electrical engineer) in understanding principals of Ohms Law.	