



CALIFORNIA STATE SCIENCE FAIR 2009 PROJECT SUMMARY

Name(s) Douglas G. Johnston	Project Number J0912
Project Title Diodes: I Prefer Mine Over-Easy, Not "Fried"	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of this experiment was to determine a relationship between the voltage drop across a diode as temperature increases. My hypothesis was that as temperature increases, the voltage would increase. Ohm's Law states that voltage is directly related to current and resistance. I found that resistance increases as temperature increases. Voltage should then increase.</p> <p>Methods/Materials I built a circuit using a 9-volt battery, 1 Mega-Ohm resistor, and a diode. The diode and its connecting wires were placed in an oven. Positive and negative leads from a digital voltmeter were connected to the respective leads of the diode to monitor voltage drop. A digital thermometer probe was used to monitor the oven temperature. The oven was heated to a temperature of 170 degF (wire lead limit). As temperature increased, the diode voltage drop was noted until 170 degF was reached. The experiment was repeated 3 times for 3 diodes. To see higher temperatures a soldering iron was used. The same electrical circuit was used except that the diode was placed on the counter. The soldering iron and digital thermometer probe were placed at one lead of the diode and allowed to heat up. Temperature and voltage changes were noted until the diode failed. The soldering iron was unplugged and allowed to cool down. The experiment was tested 3 separate times for each diode. Voltage vs. temperature plots were created for each experiment.</p> <p>Results Excel plots show that voltage drops as temperature increases which is opposite of my initial hypothesis. In all three diodes there was small voltage drop to a certain temperature followed by a sharp voltage drop. In all cases though, a second order polynomial best fit line was able to be produced for each diode with a regression greater than 90% in all cases.</p> <p>Conclusions/Discussion Diodes have different resistances at each lead allowing current to flow. What I conclude is that as the temperature increased, the differences in resistances between the two leads became less. This smaller difference and a constant current source from the battery and resistor, accounts for the decrease in voltage drop across the diode. The small voltage decreases to a certain temperature can probably be described as the diode's operating range and the sharp voltage drop is where you might expect the diode to become unstable and fail.</p>	
Summary Statement This projects explores whether or not I could determine a relationship between the voltage drop across a diode as temperature increases.	
Help Received My father helped me connect the circuit and hold the soldering iron and temperature probe during the second phase of testing. My father showed me how to use Excel and produce the X-Y plots shown. My mother helped me assemble the board.	