



# CALIFORNIA STATE SCIENCE FAIR 2004 PROJECT SUMMARY

<b>Name(s)</b> <b>Maliha S. Ahmed</b>	<b>Project Number</b> <b>J0702</b>
<b>Project Title</b> <b>The Effect of Wire Looping and Layering on the Strength of Electromagnets</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> To determine the effect of wire looping and layering on the strength of an electromagnet. By varying the number of coils in an electromagnet, one can measure its strength by testing its ability to pick up different masses. In addition, to determine if layering the number of coils has an effect on the electromagnet's strength.</p> <p><b>Methods/Materials</b> The following materials were used in performing one trial of the experiment: a 20.3 cm long iron nail, one 6-Volt battery, flat steel-washers, thin insulated copper wire, triple balance beam, and a wire cutter. To create an electromagnet, copper wire was looped around the nail a number (x) of times. The wire was coiled tightly over the central portion of the nail. The ends of the wire were exposed by using a wire cutter to remove the insulating covering. One end of the wire was connected to the positive terminal of the battery and the other end was connected to the negative terminal. The electromagnet was then placed in a pile of washers for 20 seconds. After this time, the electromagnet was disconnected, and the attached washers were massed on the ! balance beam. This measurement gave the mass picked up at 'x' number of loops. This procedure was repeated for all the single layer tests (x = 25, 50, 75, 100, 150, and 200 loops). To investigate the layering effect, the same procedure for looping the wire was used except two layers of loops were wound over the nail. After the first layer was coiled over the nail, the second layer was coiled on top of the first layer. The two-layer combinations were the following: 25 loops per layer, 50 loops per layer, 75 loops per layer, and 100 loops per layer.</p> <p><b>Results</b> From all three trials involving 50 loops, the electromagnet picked up precisely 8.2 grams. From all three trials of 75 loops, the electromagnet picked up an average of 14.9 grams. From all three trials of 100 loops, the electromagnet picked up an average of 27.1 grams. The results for the layering effect involves conducting more trials to determine the results.</p> <p><b>Conclusions/Discussion</b> The hypothesis was proved correct because increasing the number of loops increased the strength of the electromagnet. This increase in strength was shown by an increase in the total mass picked up by the electromagnet. After graphing the data, the relationship between electromagnetic strength and the number of wire loops was shown to be linear. These results agree with the background research that stated that increasing the number of coils concentrates and increases the magnetic field. This additive effect of each turn around the nail makes the iron nail highly magnetized. The conclusion for the layering effect has not</p>	
<b>Summary Statement</b> The effect wire looping and wire layering has on the strength of electromagnets	
<b>Help Received</b> My brother for teaching me about the basics of electricity. My mother for getting my materials. My science teacher for encouraging me and explaining the rules.	