



**CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY**

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Project Title Electric Motors and How They Work	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of this experiment was to build an electric motor and to change different parts of the motor to see how it effects motor speed.</p> <p>Methods/Materials Electric motors are made of a power source, an armature, a magnet and a switch. In my project, I experimented with different armatures and power sources to see how this could effect the motor's speed. The motors were constructed using a C-battery, two paperclips, a rubber band, a ceramic magnet, insulated magnet wire and Lego#s. Two electric motors were built to test different armature windings and shapes. I built one armature with 7 windings (loops) and one with 15 windings. Each armature was then placed in the motor and the speed of the motor was observed and recorded. Two D-cell batteries were then connected to the paper clips and motor speed was compared to a single C battery.</p> <p>Results The motor speed was fastest when one of three things happened: 1. The armature had more windings 2. The armature was near the center of the ceramic magnet 3. The armature was round vs. square More windings (loops) made a bigger magnet and bigger magnetic field. The round armature makes a stronger magnetic field than a square shape making more magnetic force. Increasing battery power did not seem to increase the motor's speed.</p> <p>Conclusions/Discussion The experimental results supported my first hypothesis that more windings (loops) on the armature would increase motor speed. The second hypothesis that a square shaped armature would run faster than a round shape was not supported. Round shapes may make stronger magnetic fields and more powerful motors. The third hypothesis that increasing power from one to two batteries would increase motor speed was not supported. Electric motors are used by almost everyone on a daily basis but few people understand how they really work. This experiment demonstrated the concept of how an electric motor operates by converting electrical energy into mechanical energy through the use of electromagnetic force. This experiment helped me understand these important relationships.</p>	
Summary Statement This project was to build electric motors and experiment with different designs to see which runs the fastest.	
Help Received My Grandfather helped type my report.	