CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Travis S. Adams

Project Number
J0801

Project Title
Watts Up with Fuel Cells? The Effect of Extreme Temperatures on the Power Output of Direct Methanol Fuel Cells

Abstract

Objectives/Goals
The objective of my project is to investigate the performance of a direct methanol fuel cell at three different temperatures. These three different temperatures have been chosen to stimulate the environment that applications such as an automobile and cell phones may be expected to operate in. These temperature extremes range from an icy snowstorm, to the heat of the desert. These fuel cells must be able to operate efficiently across this temperature range.

Methods/Materials
To calculate the power output of the fuel cell, I set up a circuit using a resistive load and a pair of multi-meters to simultaneously measure the voltage and the amps of the circuit. For safety the methanol was diluted down to three percent to power the fuel cell. The whole setup was run at the three different temperatures using an oven and a freezer for the extreme temperatures.

Results
The fuel cell showed dramatic changes over the temperature ranges. After thirty minutes, the power output at the cold temperature was 1.20 milliwatts, at the ambient temperature it was 2.61 milliwatts, and at the warm temperature it was 3.69 milliwatts. The power output was calculated by multiplying the volts by the milliamps. When the fuel cell was exposed to the ambient temperature (79° F), it stabilized almost immediately. At the hotter temperature, the power output rose surprisingly high. Although, at the colder temperature the power output dropped extremely low. After forty- five minutes of testing, the power output was still dropping.

Conclusions/Discussion
Although the results of the power output of the cold fuel cell dropping that low was very unexpected, it proved my hypothesis correct. The fuel cell did operate better at the hotter temperature. The experiment showed dramatic increases in power output across the temperature range. This experiment showed that this fuel cell would not effectively operate at extremely cold temperatures. Temperature has a surprisingly significant effect on the way a direct methanol fuel cell operates.

Summary Statement
The purpose of my project is to determine and compare the power output of a direct methanol fuel cell at three different temperatures.

Help Received
Dr. Novis Smith, Lithchem Energy Lab; Parents helped with the display

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Neil Deep Agarwal

Project Number
J0802

Project Title
Efficiency of a Photovoltaic Cell: High vs. Low Temperature

Abstract

Objectives/Goals
The objective of my project is to test how does the power output of a photo voltaic cell is effected by change in temperature. My hypothesis is that, higher the temperature lower the power output.

Methods/Materials
I used two photo voltaic cells of similar specifications. I connected both the cells to two different monitoring devices that record volt and ampere at various temperatures. I then placed two lamps at the same height from each cell. I heated the ambient temperature of one cell and cooled the ambient temperature of the other cell in the same volume of air by placing the cells in an enclosure. I then recorded the vols and ampere of each cell at different temperatures.

Results
The photo voltaic cell in the cooler ambient produced higher power output than the photo voltaic cell in the higher ambient temperature.

Conclusions/Discussion
The results proved my hypothesis correct. I believe it is a result of better conductivity produced through the silicon in the photo voltaic cell. The cooler temperature of the leads carrying the current from the cell also had a positive effect on the output of the cell.

To keep the photo voltaic cells cooler on the roof of a house, a rubber tubing system carrying water may be installed under the cells. The warm water can then be channeled to a water heater to reduce the cost of heating.

Summary Statement
My project is designed to test the efficiency of a Photo Voltaic Cell at various temperatures.

Help Received
Peter Agarwal, my dad helped buying the material and assembling the project. Ed Murdoch of Anaheim Public Utility provided suggestions to keep the integrity of the test results.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Mackenzie Anderson; Alicia Lovelace

Project Number
J0803

Project Title
CO(2) in da house! Greenhouse, That Is. Will CO(2) Affect How Much Electricity a Photovoltaic Cell Produces?

Abstract

Objectives/Goals
Our goal was to find out whether CO2 affected how much electricity a photovoltaic cell produced. We hypothesized that when surrounded by CO2, the cell would produce more electricity. Inspired by the greenhouse effect theory on global warming, we thought that light trapped between the layer of CO2 and the solar cell would make more frequent contact with the cell, knocking off more electrons, and producing more electricity.

Methods/Materials
We had a 5 gallon water container with screw top, a photovoltaic cell, a volt meter, a thermometer, a relative humidity meter, a stop watch, CO2 cartridges and injector, a light bulb/socket, and a bike pump. In the first line of tests, we placed the photovoltaic cell/volt meter into the container and took our first control readings. Then we injected CO2 from the cartridge in through the opening and sealed the container and took readings over a three minute period. For the next set of tests, we injected the CO2 through a hole we punctured in the lid of the container, turned on the light, and took our readings for three minutes. We also did similar tests where we turned the container upright and some where we tested purely for a pressure effect using a bike pump.

Results
The photovoltaic cell produced 0.5 volts more than the control readings when there was CO2 in the container. We heard the container depressurize when the lid was taken off after we had positive results. So then, we did another set of tests to isolate and measure the pressure factor. When tested without the lid, the volt meter showed only a 0.25 increase when the CO2 was added. When we used the bike pump without injecting any CO2, we got a reading of 0.25 increase of voltage as well. We did not have consistent results, but a pattern did seem to be obvious.

Conclusions/Discussion
The results did support our hypothesis. We learned as we went along that there were more variables that might be affecting the photovoltaic cell#s production of electricity than we originally thought. We concluded that CO2 does affect how much electricity a photovoltaic cell produces and so does pressure. We also observed that temperature and relative humidity did not seem to affect the production of electricity. If the light actually did get trapped between the photovoltaic cell and the CO2 as we had expected, this experiment would be following the model of the green house effect theory thus helping prove it true.

Summary Statement
In this project, we found that both CO2 and pressure cause a photovoltaic cell to produce more electricity.

Help Received
Both sets of parents helped financially for our materials. Rob Lovelace, my father, supervised the experiments for safety. Rick Sharp, our former 6th grade teacher, helped us think of additional ways to test our hypothesis after our first line of tests.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Amy T. Bellinghiere

Project Number
J0804

Project Title
Fire on the Electrical Neuron

Abstract

Objectives/Goals
To build an electrical circuit model of an integrate-and-fire neuron, and test its function: More specifically, to find out how integrate-and-fire neurons work, how to construct simple electrical circuits, measure voltage and current, and how to change the operations of the circuit. I also wanted to find out if this circuit could improve the processing speed of robots, computers, and other electronics.

Methods/Materials
First I researched and learned about integrate-and-fire neurons. Then I learned about electricity and basic circuit components. Then I constructed a circuit model of an integrate-and-fire neuron. I did some basic measurements on the model, like voltage across the integrating capacitors, and current through it.

The materials I used: 1 Maxitonix Electonics Lab with wires, 6 AA batteries, 1 4.7K, 1 10K, 1 47K, 1 100K, 1 220K,1 470K resistors,1 relay, 1 meter, 2 NPN Transistors, 2 100uF capacitors, 2 10uF Capacitors 1 switch,2 light emitting diodes, wires, a voltage regulator, a millisecond timer, and a voltage meter

Results
My results have been that I have a working electronic circuit model of an integrate-and-fire neuron. Through measurements I verified the proper operation of this model. I also managed to change the firing time of the neuron model. For example, when I decreased the value of the input resistor the firing time reduced, and when I increased the value of the input resistor the firing time became longer.

Conclusions/Discussion
My conclusion is yes, I have an electrical circuit model of an integrate-and-fire neuron. The firing rate and charging rate, of the model can be controlled, by adjusting the input resistor on the circuit. It can collect and release charges like a neuron can with chemicals. I can also slow down or speed up the input like a neuron. I would like to have more different amounts of input resistance next time. Also I would like to have a circuit board dedicated to just that circuit.

I would like to build a duplicate circuit and connect the two together to show basic processing. I would like to learn about the mathematical models of this type of circuits and develop some of my own. I would also like to figure out how this type of processor is applicable for robots, such as with their decision-making and sensing.

Summary Statement
I wanted to learn about artificial intelligence so I built an electrical circuit model of a integrate-and-fire neuron and tested its function.

Help Received
Dr. Peter Petre helped me explore the new world of electronics by suppling textbooks, mentoring and supervision; Dr. Brian Limkatkai designed the circuit that I built on the Electronics Lab; My 7th grade brother helped me with computer problems; My Parents helped with proofreading and typing.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Krikor Bornazyan

Project Number
J0805

Project Title
Modified Electrode Placement for 12-Lead Electrocardiogram

Abstract

Objectives/Goals
Is 12-lead modified-torso electrode ECG interchangeable with standard 12-lead ECG? Based on my research, I hypothesized that modified-torso method will result in diagnostic interpretations different from standard because electrical signals obtained from the body will vary depending on electrode placement on the body.

Methods/Materials
The study compares diagnostic outcome of two sequential 12-lead ECGs in 24 adult patients, one being taken with approved standard and the other with modified-torso methods.

Results
Modified-torso method produced important amplitude and waveform changes associated with shift of the P, T and QRS frontal plane axes, particularly in those with abnormal standard ECGs. Such changes generated important diagnostic interpretation differences in 46% of patients with abnormal standard ECGs, making abnormalities disappear in 4 patients resulting in normal ECGs, and in 2 patients changing diagnostic outcome of abnormalities. Torso method also caused clinically important frontal axes changes in one patient with normal standard ECG.

Conclusions/Discussion
Modified-torso method resulted in diagnostic interpretations different from standard because electrical signals obtained from the body varied depending on electrode placement on the body. It is vital that ECGs should be acquired in the standard way unless there are particular reasons for not doing so like reducing limb movement artifacts, increasing speed of application in emergency by minimizing undressing and any modification of electrode placement must be reported on the ECG itself. Data fully supported the hypothesis. Findings agree with the information found in the literature.

Summary Statement
By comparing 12-lead modified electrode ECGs with standard in 24 patients, it was shown that first method produced important waveform changes causing diagnostic interpretation differences, therefore these methods are not interchangeable.

Help Received
Consulting, transportation to obtain necessary materials and literature. Glendale Adventist Medical Center provided equipment and lab.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Shyamal Buch

Project Number
J0806

Project Title
Got Motor? Got Generator! Can a Motor Act Like a Generator, and How Efficiently?

Abstract

Objectives/Goals
My objective was to determine if a motor could act like a generator, and its efficiency. Also, I wanted to find out how the efficiency is affected by the rotation speed. My hypothesis was that if I turned the shaft of a DC motor, it would produce voltage, just like a generator. I could then use this voltage to drive another motor. I expected the efficiency to be in the 60-75% range.

Methods/Materials
I decided to use DC motors from my robotics kit, because they had built-in rotation sensors with 1 degree accuracy. Also, the microcomputer in the kit could be programmed to vary motor speed and rotations using LabView software.

I rotated the shaft of a DC motor so that it would generate voltage. This voltage was used to power a 2nd motor. The aim was to measure "rotations in" at the 1st motor (generator) and "rotations out" at the 2nd motor, to determine the efficiency. Two motors were then added: a 3rd motor to act as a rotation sensor, and a 4th motor to control generator speed. "Rotations in" were varied from 1 to 10, and speed was varied from 10% to 100%. "Rotations out" were measured for each step, and then efficiency was calculated. As a further study, the generator voltage was measured to see how it changed with rotation speed. I did research to see which wires in the motor cable powered the motor. Then I stripped the cable and soldered those wires so that I could measure generator voltage with a multimeter.

Results
My experiments showed that a motor could act like a generator. The measured average efficiency was 67.4%. For the initial rotation, however, efficiency was lower. Efficiency did increase with speed, but below 50% speed, the generator voltage was not enough to drive the motor. Voltage increased linearly with speed.

Conclusions/Discussion
My results supported my hypothesis, since average efficiency was in the 60-75% range as expected. Efficiency is less than 100% because of mechanical, electrical, and magnetic losses. Using a microcomputer helped me take measurements which were accurate and repeatable. I learned that it is very important to research ways to improve generator efficiency. My report describes many practical uses for "motor-acting-like-generator". I plan to do more experiments to identify other characteristics of my generator.

Summary Statement
This project investigates whether a motor can act like a generator, determines its efficiency, and evaluates how the efficiency and voltage depend on generator speed.

Help Received
Ms. Bruins, my teacher, motivated and guided me. Mr. Reinking introduced me to the robotics kit. Mr. Balasubramanian/Mr. Martin gave me a tour of Cal ISO to view the power grid. Dad clarified concepts and assisted with soldering. Mom proofread my report and helped with board layout.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
John R. Caldwell, Jr.

Project Number
J0807

Project Title
Marvelous Maglev

Abstract

Objectives/Goals
The Marvelous Maglev project found the optimum load for a maglev train in motion on a 100-centimeter track. To discover the optimum load, the magnetic field was assessed by carrying various loads

Methods/Materials
This experiment studied the strength and optimum load of the maglev train by transporting four different loads (17.5 oz, 35 oz, 52.5 oz, and 70 oz), while measuring the distance it traveled on the 100-centimeter track. The height between the car and the track magnets, or floating distance, was measured to determine the linear characteristic of the magnetic field. The independent variable was the weight (in ounces), or load, put on the model maglev car. The dependent variable was distance traveled along the 100-centimeter track while carrying the load. The other dependent variable measured floating distance. After much trial and error a suitable propulsion system, the car was propelled by a constant means, using a spring catapult system.

Results
After the data was collected, it was discovered that the model maglev supported weight in a non-linear fashion. It was very strange to observe, because the closer the magnetic poles came together, the more weight was required to lower the maglev any further distance. A non-linear function regarding the load on the maglev car means the car can support more weight as it gets closer to the track. It was also discovered that it takes a lot of power to get the maglev moving, but once it started, it did not take much energy to maintain the speed. The result details are presented in tables and graphs.

Conclusions/Discussion
A few conclusions were drawn from the experiment. One of the most important conclusions to be determined was that a maglev required external propulsion before it began to move, even though it was constantly floating and had no friction. In addition, the optimal load for the model maglev was 37 oz, which was the maximum amount of weight it could hold, and still move down the track satisfactorily.

Summary Statement
This project determined the optimum load for a maglev train I designed, developed, constructed, and tested for this experiment.

Help Received
Dad allowed me to use his tools, and mom helped edit paper.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Bradley Carlson; David Robinson

Project Number
J0808

Project Title
Mag Generator

Abstract

Objectives/Goals
The goal of this project was to take a tiny burst of energy to start our magnetic based generator that would be able to create a greater amount of energy than we began with. This generator would also produce enough energy to sustain itself and create enough power to be able to run other electronic items, such as engines (perhaps eventually an automobile) and/or motors. This will be an alternate and a zero emmision way to create electricity and power.

Summary Statement
What we are trying to create is an alternate power source with zero emmissions that can sustain itself and create extra power to run other objects as needed.

Help Received
Mr. Karsavar (our science coach), and the Robinson and Carlson family for funding and general help

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Jared M. Clark

Project Number
J0809

Project Title
Are Fuel Cells Our Future?

Abstract

Objectives/Goals
My objective was to test if a hydrogen oxygen proton exchange membrane (PEM) fuel cell is more energy efficient than a rechargeable chemical battery.

Methods/Materials
The mission of my project was to test various types of energy storage devices. I needed to build an experiment to measure the energy in and out. One requirement that was essential for my experiment was that all the energy storage devices had to be reversible, meaning that I could charge and discharge them. That was essential to my experiment because to calculate the energy efficiency, I had to measure both the input energy and output energy. To compute the amount of power out, I needed to measure the voltage and current. I recorded data at constant time intervals. The time intervals were 15, 30, and 60 seconds depending on the type of energy storage device that I was using. I used one hydrogen oxygen PEM fuel cell, one rechargeable chemical battery, and a 1-millifarad capacitor as energy storage devices. Serving as loads were several 1- and 10-ohm resistors. For charging, I used a power supply. For measuring the voltage and current, I used two multimeters. After constructing a circuit to charge the energy storage device, I measured the voltage across the energy storage device and the current around the circuit. I reversed the circuit so that it was discharging the cell into a resistor. I measured the discharging voltage and current. I took the data that I read off the multimeters and multiplied them together to get the power. I measured the area under the curve of power over time to obtain the total amount of energy. I used the ratio of energy out over energy in to get an efficiency percentage. I preformed three trials to get an average efficiency for each energy storage device. My project was a success and the results told an interesting tale.

Results
My results showed that the rechargeable chemical battery was more energy efficient than the PEM fuel cell, rendering my hypothesis incorrect.

Conclusions/Discussion
My conclusion is that the fuel cell may not be our preferred energy storage device today but maybe in the future the fuel cell will replace the battery in the quest to be the most efficient in the field of energy storage. Even though the fuel cell is less energy efficient than the battery, it is still more environmentally clean than the battery.

Summary Statement
My project is to compare the energy efficiency of a hydrogen oxygen proton exchange membrane fuel cell to a rechargable chemical battery.

Help Received
My dad taught me how to calculate efficiency, the trapezoid rule, and the basic laws of electricity.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Kevin Crispie; Nicholas Crispie

Project Number
J0810

Project Title
CESSIL: Cycling Equipment Signalling Stoplight Illuminesence LEDs

Abstract

Objectives/Goals
The objective of our project was to develop an indicator system to help bikers signal their turns and stops without having to take their hands off the handlebars.

Methods/Materials
All of the following were materials used to build the project: 15.7 meters of 30 gauge copper wire, one 10cm by 5cm printed circuit board, one 12.5cm by 5cm by 7.5cm foil cake tin, one roll of black electrical tape, 3 momentary pushbutton switches, 10cm of steel wire, a can of black spray paint, a strip of Velcro, one 10cm by 5cm piece of foam, eight 2mm regular red LEDs, two 5mm jumbo red LEDs, 2 AA batteries, 1 battery connecter, 1 AA battery holder, one 0.5m metal dowel and one bike. These tools were used in building the product: a wire wrap tool, a wire stripper, pliers, wire cutters, a tape measure, and scissors. We tested our invention as follows: one of us would stand behind the display of LEDs while the other was turning them on. The person standing behind the display would keep walking backward until he could not see the LEDs. Then we would measure the distance.

Results
All in all, our project was 75% successful. It worked beautifully at night, up to 50m. But at daytime, someone could only see the lights at 8m. It worked well in semidarkness, but it definitely worked better at nighttime.

Conclusions/Discussion
This product will help bikers signal, thus making cycling safer. This product would work best in bad weather, e.g. overcast and rainy days as well as at night. The implications are reasonably successful. This invention, with some help, could seriously cut down on the number of cyclists killed. Because it would make cycling safer, it might encourage more people to bike instead of drive and therefore cut down on carbon emissions. We learned many things while working on our invention. We learned that engineering projects take time, intelligent and critical thinking, and effort. All these things separate good engineers from bad engineers. In addition, it is great to plan out the project clearly and address the budget, criteria, and constraints.

Summary Statement
Our project was to develop an indicator system to help bikers signal their turns and stops to make biking safer.

Help Received
Mother helped with project board; Father showed us how to wire-wrap; Neighbor helped chose LEDs

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Conrad M. Esch

Project Number
J0811

Project Title
The Ability of Different Materials to Block Cell Phone Transmissions

Abstract

Objectives/Goals
The purpose of this experiment is to test whether materials of different types will block cell phone transmission. The hypothesis is that conductive materials will block transmission and non-conductive ones will not.

Methods/Materials
A cell phone will be placed inside enclosures constructed of various materials; several sizes of wire mesh, tin foil, plastic, wood, salt water, and tap water. The cell phone will be called from a separate phone. Each call will be noted for; if it was received and signal strength. The experiment will be conducted in two locations; high and medium signal reception areas.

Results
In both locations only the saltwater and tin foil enclosures completely blocked cell phone transmissions. The smallest mesh, window screen mesh, blocked cell phone signals in the medium signal reception area, but not at the location with high signal reception. Larger size mesh, plastic, wood and tap water enclosures did not block cell phone transmissions.

Conclusions/Discussion
Cell phone trasmissions are electromagnetic microwave radiation that can be blocked or diverted by conductive materials. Although several of the enclosures were conductive, only tin foil completely blocked signal transmission. A mesh size smaller than window screen is apparently needed to completely block cell phone transmissions. Salt water also effectively blocked transmissions. The salt dissolved in the water had some conductivity, therefore redirecting the transmissions back toward the cell phone.

Summary Statement
The purpose of this experiment is to test whether enclosures made of conductive and non-conductive materials will block cell phone transmissions.

Help Received
Parents helped build enclosures and edit report.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Nathan E. Galicia

Project Number
J0812

Project Title
Which Linear Motor Technology Is Most Effective at Propelling a Roller Coaster Ride: Synchronous or Induction?

Abstract

Objectives/Goals
To determine which of the two linear motor propulsion technologies is most effective at propelling a roller coaster vechicle down a track.

Methods/Materials
In order to prove my hypothesis, I constructed two roller coasters each launched by a separate electromagnetic propulsion system. Each of the roller coaster layouts is identical with a launch section, a vertical loop followed by a vertical section of track (where the car will go up and go back through the loop backwards). I measured the time it took for the car to travel sixteen inches (measured from the axel of the front wheel). Before each run, the car will be placed at the beginning of the straight track. Positioning is important#the car has to be placed so the fixed magnet below the car is just over the first coil in the LIM; for the LSM the hall-effect sensor has to be placed over the first fixed magnet which has the #N# pole up, and the coil has be lined up just before a fixed magnet with the S pole up. After making sure the capacitors are charged up, I press the red button on top of the power supply to launch the #LIM# car. The #LSM# car launches as soon as the car is placed on the track as described above (and the two 9-volt batteries are connected) Despite their differences, each of the motors use the same principle, using electromagnets to propel a projectile at a high speed.

Results
Because the LIM used the most energy, I hypothesized that I would launch the car the fastest and the results of my test appeared to prove that true. My design of the #cars# seemed to play a big role in the result. The weight of the two 9-volt batteries and the amount of current they produced #slowed# down the LSM car; the original circuit called for + and - 12-volt from a DC power supply.

Conclusions/Discussion
Because the LIM used the most energy, I hypothesized that I would launch the car the fastest and the results of my test appeared to prove that true. My design of the #cars# seemed to play a big role in the result. The weight of the two 9-volt batteries and the amount of current they produced #slowed# down the LSM car; the original circuit called for + and - 12-volt from a DC power supply.

Summary Statement
With my project I build working prototypes of a linear induction and synchronous electromagnetic motors and compare which is more efficient in terms of power usage and performance.

Help Received
Father purchased some of my material for me online; Father supervised me when I was soldering; Father helped me test my project with a multimeter to make sure it was safe.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Wyatt C. Gormley

Project Number
J0813

Project Title
Suspension via Electromagnetism

Abstract

Objectives/Goals
Like a metal snake entwining itself around its helpless victim, the coils of an electromagnet engulf its metal core. Suspension via Electromagnetism deals with a wide variety of electromagnetic variables; however, its main purpose is to illustrate the best way to build the strongest, most efficient electromagnet.

Methods/Materials
The research necessary for conducting and understanding the many experiments involved branched in several directions. From voltage, current, and wire gage, to the electromagnetic force, even to gravity, Suspension via Electromagnetism required much research. Testing an electromagnet#s strength when influenced by the independent variables, which include wire gauge, core size, core shape, battery type, and the amount of batteries, produced an ample amount of data that shows what materials are ideal to use while building a strong electromagnet.

Results
The results revealed several key factors that greatly affect the strength of an electromagnet. Essentially, an efficient wire gage should have an approximate 1:8 ratio to the diameter of the core; also, the amount of batteries used had a significantly greater affect as compared to the batteries# voltage on the electromagnet#s field strength. Also, a horseshoe shaped magnet had more lifting potential, likely because the poles were focused on a particular spot. To conclude, the larger the gage and core are, the greater the magnet#s field (obviously).

Conclusions/Discussion
T o conclude, an ideal electromagnet should have a few things. First, the core should be a horseshoe shaped, and roughly the same size as the item that is desired to be lifted. The wire used should be about one eighth as thick as the core, should have as thin coating as possible, and should be neatly rapped. Finally, a large amount of 9 volt batteries (or even car batteries if the magnet#s build desire#s so) should be connect to the wire that is coiled around the core.

Summary Statement
"Suspension Via Electromagnetism" focuses on testing several variables that affect an electromagnet's strength, and it also tests the degree of influence each particular variable holds.

Help Received
none whatsoever (with the exception of purchasing materials)

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Audrey M. Halstead

Project Number
J0814

Project Title
Birth of the Battery

Abstract

Objectives/Goals
My goal was to determine if common household items can be combined to produce and store enough energy to power small electronic devices. Also, to compare the results of the various combinations and determine the most effective mix.

Methods/Materials
1)Attach a wire to three of each type of coin with electrical tape
2)Place a penny and a different coin in the lemon juice
3)Attach the volt meter to the wires (one end to the penny and the other end to the other coin)
4)If the voltage reading is negative, switch the voltmeter ends.
5)Repeat steps 2-4 trying all coin combinations in the lemon juice. Don't use any single coin more than once.
6)Determine which two coins have the highest voltage.
7)Re-test these coins with each of the other substances. (salt water and phosphoric acid). Only use the two best coins and the best substance for the rest of the project
8)Cut the cork into pieces that fit in a plastic tube with holes on each end. Dip them into the liquid and put them aside.
8)Attach a piece of wire to one of each type of coin. Place one of the coins into the container, so the wire goes through the hole and sticks out of the end. Save the other coin with a wire attached to it for the top of the battery
9)Put a piece of cork on top of the coin. Stack one of the other type of coin on top of the cork. Continue this pattern until you've used up all of the materials(36 coins and 13 pieces of cork, so 39 layers total)
10)Put the lid on the tube. A wire from a coin should be protruding from each end of the container.
11)Attach the voltmeter to the battery and measure the voltage at 1 min. intervals for 30 min.

Results
To build the batteries, I followed an #a, c, b, c" pattern (a: penny, b: dime, c: cork w/lemon juice). It was able to produce enough current to be read on a voltmeter. Though I tried using each battery, then a combination of both, they didn't have enough current to light a small light bulb.

Conclusions/Discussion
My hypothesis was correct and I was able to create a battery that, when attached to a voltmeter, was able to show some form of electricity. The battery wasn#t strong enough, however, to power even a small light bulb. This told me that it was impractical to power any devices due to insufficient current. If the

Summary Statement
This project involves using common household chemicals and U.S. coins to produce a battery able to generate enough electical current to be read on a multimeter.

Help Received
Dad supplied materials and shed to do project in; Mom helped glue some pages to board.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Jake F. Hancock

Project Number
J0815

Project Title
Easy Access: Using a Parabolic Reflector Antenna to Improve Wireless Internet Signals

Abstract

Objectives/Goals
My objective is to improve a wireless internet signal and access the internet more easily by building a parabolic reflector antenna to extend the range of the signal.

Methods/Materials
Materials:(A)parabolic antenna: cardboard, foil, glue, tape, block to serve as model router for display.(B)For testing signal strength: wireless computer and program to monitor connection quality in detail.
Methods: Download computer program to record and monitor wireless signals on different computers located throughout the house. Measure and map distances of each station, 1 through 4, from the router. Measure and record the wireless signal at the four locations before building the antenna. Build the cylindrical parabolic reflector antenna and attach it to the router. Test and record the signal strength at each different station with the antenna installed. Compare the signal strength measured without the parabolic reflector antenna to the new measurements with the parabolic reflector antenna installed. Make and test other types of antennas (eg. flat reflector & upright antenna)for signal comparison. Take photographs of the different antennas and print out the graphs of the different measured signal strengths.

Results
The parabolic reflector antenna made a drastic impact on the wireless signal at each station. Gains in signal strength ranged from 5 to 11 points. Additional measurements taken with the other experimental antennas showed no change in signal strength. The flat antenna and tall upright antenna did not improve signal strength at all. Continued monitoring of these changes showed the increases in signals to remain constant at the exact same gains throughout the course of the experiment.

Conclusions/Discussion
My experiment worked! The increase in gains of signal strength with the parabolic reflector antenna were measurably significant. The parabolic antenna drastically improved the strength of the wireless signal at all stations and made it possible to connect to the internet at Station 2. Station 2, at over 50 feet, is the most distant station from the router and was not able to maintain a consistent connection to the internet before the installation of the parabolic antenna. Station 2's connection is now strong and consistent and adds greatly to our home wireless network making it possible to work from another room that was unavailable before the installation of the parabolic antenna.

Summary Statement
Building a parabolic reflector antenna is easy to do and can significantly increase the signal strength of the wireless internet signal, providing better connections and allowing longer distances for wireless networks.

Help Received
Dad helped hold tape measurer for calculating distances of computer stations.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Jacquie A. Hayes

Project Number
J0816

Project Title
Solar vs. Wind

Abstract

Objectives/Goals
The objective was to compare the differences between solar and wind energy, to see which one is more efficient.

Methods/Materials
A solar generator and a wind generator were made. The solar generator was easily produced. The first wind generator used a motor and did not work, so another one was made using wires and magnets. They were then each tested seperatly. How much energy they were producing was measured with a volt meter. How easy they were to work with was also considered.

Results
The solar generator produced enough energy to light a 3 watt light bulb. However the wind generator had some difficulties with the experiment. First the motor was found to not be able to spin freely with wind. When the new model was made it produced some energy; but still did not produce enough energy to light a light bulb.

Conclusions/Discussion
Due to the observations made of the solar generator and wind generator, it is thought that the solar generator is more efficient. This is due to the problems with the wind generator and how much torque it takes to produce energy. It was also difficult because the volt meter did not read anything and because the wind generator kept falling apart.

For a better and more accurate experiment the two generators could have been bigger, and needed to be able to produce the same amount of voltage so they could have been more accurately tested and compared.

Summary Statement
This experiment compared the efficiency of solar energy and wind energy.

Help Received
Dad help cut boards.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Matthew A. Jordan

Project Number
J0817

Project Title
Which Method of Maglev Train Works Best?

Abstract

Objectives/Goals
The objective of my project was to build a magnetic levitated train, a working EMS system, and a rail gun system.

Methods/Materials
I used 44 1in neodymium magnets, 46 ½ inch neodymium, 4 1in circular neodymium magnets, twelve feet of six inch wide wood, 12 feet of 1 inch high wood lengths, 4 1in wide 8 feet lengths of aluminum, 4 1in wide 3 feet lengths of aluminum, 2 half square 8 feet lengths of aluminum, 4 4in wide 2 feet long lengths of wood, 4 3in wide 2 feet lengths of wood, 6 - 9 volt batteries, 4 Resistors, 3 Transistors, 1 Hall Effect Sensor, 2 Diodes, 1 Solenoid, 1 piece of breadboard
Built the guide way and train, I put together the EMS drive circuit, then put that in the train, I took aluminum strips laid them out and electrified them and put my rail gun axle system on that, I tested all these out five times.

Results
My results were that the rail gun did the best; it accelerated the fastest, was stable and kept a quick speed. The 2 feet per second push was second best, the 1 foot per second push did third best, and the EMS system did the worst.

Conclusions/Discussion
My conclusions from my experiment are that the rail gun system worked better. The EMS system didn#t have the power to over come the friction on the sides of the guideway. But if I was able to scale up the rail gun it would need a lot of new rails and a lot of power, while the EMS system would take lower power. The pushes in large scale are out of the question, you would have to build a large pushing device, and what happens if the push isn#t strong enough? The train would stop in the middle of the track. I don#t think the sparks flying off the rails from the rail gun would be too safe either. So in a nut shell the rail gun and push do well in small scale, but not in large scale. My hypothesis is void, my data does not support it.

Summary Statement
My project is to build a working maglev train.

Help Received
My father helped cut wood and wire electronics

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Tohma A. Judge

Project Number
J0818

Project Title
Solar Cells: Can They Take the Heat?

Abstract

Objectives/Goals
My objective was to find how solar cell energy output was affected by temperature. I believed that all solar cells would produce less energy as the temperature went up and that the amorphous solar cell would be affected the least by the rise in temperature.

Methods/Materials
A wooden box was constructed. A solar cell was placed inside and hooked to a voltmeter and a thermometer, both of which were outside the box. A blow-dryer was placed into a hole in the wall to provide hot air. A halogen lamp was placed on the top of the lid as a source of heat. At the start of the experiment, all equipment was turned on, and as the heat rose from about 10°C to 70°C, photos were taken of the thermometer and the voltmeter. The numeric data was later recorded onto charts. This process was repeated six times for a monocrystalline solar cell, a polycrystalline solar cell, and an amorphous solar cell.

Results
I found that for all types of solar cells, the volts put out decreased as the temperature went up. I also found that the amorphous solar cell lost the least percentage of energy and that the monocrystalline solar cell lost the most percentage of energy, with the polycrystalline solar cell in between.

Conclusions/Discussion
The results support my hypothesis. My conclusion is that the hotter a solar cell is, the less energy it will put out, and that amorphous cells are the least affected by temperature changes.

Summary Statement
My project is about how solar cell energy output is affected by changes in temperature.

Help Received
My dad helped to construct the box and proofread the reports. I received information and tips from Mr. Robert Seton of DC Sonoma, a solar energy company, and Mr. Kelly Murray, who works with solar cells for Lockheed-Martin.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Arash Kardoust

Project Number
J0819

Project Title
Does Magnet Strength Affect the Rotation Speed of Electric Motors?

Abstract

Objectives/Goals
The purpose of this experiment was to determine if rare earth magnets would cause an electric motor to spin faster than conventional magnets.

Methods/Materials
To build the motors I attached unfolded paperclips to the battery leads. Next I bent the opposite ends of paperclips into hooks to hold the armature, which is the part that spins. Armatures are made of enameled copper wire. The wire was wound into a ring the same diameter as the battery. Extra wire on each side of the ring was left to wrap around the armature. These leads on either side of the armature support it, and act as a switch. One of the leads was completely sanded, so that electricity could flow to it. The other lead was only sanded on one side, so it is a switch. The armature was placed on the support hooks and the magnet was placed on the battery beneath the armature. This started the motor spinning.
I attached a small fan to one lead of each armature. The fan rotates as the armature spins, causing the fan to blow. A wind-meter was attached near each fan.

Results
The fan powered by the rare earth magnet spun faster because it blew the wind meter more. This proved my hypothesis.

Conclusions/Discussion
the results proved my hypothesis.

Summary Statement
This expirament was done to compare the neodymium and conventional magnets using them in the same type of motor.

Help Received
My science teacher, Mr. Dzmura helped me make the fans and he revised the abstract. My brother, Omid Kardoust, gave me the idea of suspending a piece of paper on the end of the string so that it catches more wind.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Muhammad A. Khan

Project Number
J0820

Project Title
Zap! Electricity Generation

Abstract

Objectives/Goals
An electric generator is a device that converts mechanical energy to electrical energy. Generators are now widely used in homes, vehicles, industries as they provide a highly reliable source of electric power. The basic principle in a generator is that a voltage is induced in the coil when a magnet is moved inside it. The objective of my project is to investigate the relationship between the number of turns in the coil and the voltage generated in the generator.

Methods/Materials
The materials I used for this project were 4 magnets, a metal rod, a frame, 4 cardboard boxes (the first box with 100 turns of magnetic wire, the 2nd box with 200 turns, the 3rd box with 300 turns and the 4th one with 400 turns), a hand drill (to rotate the magnets) and a voltmeter.
First, I attached 4 magnets to the metal rod, then built a wooden frame and anchored the hand drill to it. I prepared the generator boxes, set one box connected to the voltmeter and the magnet hanging inside the generator box. I spun the magnet at a constant rate by using the hand drill and measured the voltage generated for each generator box.

Results
The average volts generated by the coil containing 100 turns was 0.25 V, it doubled to 0.51 V with the 200-turns coil, trebled to 0.78 V with the 300-turns coil, and increased four-fold to 1.06 V with the 400-turns coil.

Conclusions/Discussion
The conclusion I reached was that greater the number of turns in the coil, the greater the induced voltage and therefore, the greater the current can be in the wire (if the resistance is kept constant). When the wire around the magnet contains more turns, there are more electrons available to move around and thus more current. Hence when designing a generator, scientists can use more coils around the magnet in order to maximise the voltage induced and the current.

Summary Statement
The purpose of my project was to investigate the relationship between the number of turns in the coil and the voltage generated in a generator.

Help Received
My dad helped me get the materials and make the set-up. My mom helped me with the board and my teacher (Dr. Lian Jeeawoody) gave me advice.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Christopher R. Kolar

Project Number
J0821

Project Title
Can You Hear Me? Which Antenna Has the Most Directional Radiation Pattern?

Abstract

Objectives/Goals
To detarmine which amateur radio antenna has the most directional radiation pattern, in terms of field strength. I believe that the yagi antenna will be the most directional.

Methods/Materials
Materials included a quarter wavelength ground plane antenna, 3-element yagi, a J-pole antenna, field strength meter, and amateur radio transciver. Built or purchased antennas and meters, Mounted on to level board, rotated to receive field strength to calculate radiation pattern, plotted data on to a radial graph to visually create outline of approximate directionality. Tested three separate antennas at 16 data points for three trials each. Recorded readings from meter in microvolts, industry standard field strength measurement

Results
Yagi resulted in a massive upswing in readings as it was rotated towards antenna, the quarter wavelength ground plane was at a average constant of 1-2 on the scale, the J-pole was also fairly constant at about 3 on the scale

Conclusions/Discussion
The hypothesis was proven correct, due to the structure and the placement of the elements, the signal of the yagi antenna was concentrated in one direction, thus having the most directional radiation pattern.

Summary Statement
This project will seek to determine which amateur radio antenna has the most directional radiation pattern.

Help Received
Father helped with experimentation (transmissions only), building test rig, and antenna assembly.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Riley H. Lavering

Project Number
J0822

Project Title
The Linear Accelerator

Abstract

Objectives/Goals

1. Problem Statement: Can magnets be used to increase the momentum of a steel ball?

2. Hypothesis: If magnets are introduced to a kinetic energy sequence with steel ball bearings hitting each other, then the momentum of the steel ball bearings on the magnetic track will be twice the speed of the last ball on the non-magnetic track.

Methods/Materials

3. Materials:
14 5/8 inch steel ball bearings 4 1/2 x 1/2 x 1/2 neodymium magnets
2 tracks with 1/2 inch routed groove 4 1/8 inch steel nuts
Epoxy glue 1 1/2 inch wodden dowel

4. Procedure:
1. Set up linear accelerator with magnets
2. Release 5/8 inch steel ball bearing down ramp of accelerator
3. Film last ball over a twelve inch track as it leaves the accelerator
4. Calculate speed of ball by converting inches traveled/frames of video @ 30 frames/second to inches per second
5. Perform ten trials of steps one through four
6. Repeat steps one through five for linear accelerator

Results

5. Results: The last ball of the linear accelerator reached speeds up to 90 inches per second, while the last ball on the non-magnetic track reached speeds up to 11 inches per second.

Conclusions/Discussion

Magnetic linear accelerators are a more efficient way to move mass than non-magnetic linear accelerators.

The large linear accelerator uses electromagnets instead of real magnets. They use these huge machines to then speed subatomic particles to incredible speeds and crash them into each other. (Wikipedia, 2007) Scientists do this to observe the effects of the subatomic collisions and to gain insight as to larger scale collisions in space. Scientists can then get an idea of how the universe was formed.

Summary Statement

This experiment tests the use of magnets to accerlerate steel balls.

Help Received

Dad helped with the use of power tools to construct the accelerator. mom helped edit the written report.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Bridget Lerman; Lisa Osepyan

Project Number

J0823

Project Title

Does the Angle and Color of Wavelength Affect the Amount of Electricity Produced by a Solar Panel?

Abstract

Objectives/Goals

The purpose of this experiment was to find out if the angle and the color of the wavelength affected the amount of electricity produced by a solar panel.

Methods/Materials

We tested the affect of the angle by placing the solar panel at 90, 100, 110, 120, 130, 140, 150, 160, 170, and 180 degrees at five minute intervals. Then we repeated the process using one minute intervals. To test the affect of color, we covered the solar panel in pink, blue, and clear cellophane.

Results

At five minute intervals (at average), the solar panel at a 900 angle created 35.60 mA, a 1000 angle created 46.50 mA, a 1100angle created 55.30 mA, a 1200 angle created56.00, a 1300 angle created 59.00 mA, a 1400angle created 51.30 mA, 1500 a angle created 49.00 mA, a 1600 angle created 25.8 mA, a 1700 angle created 35.4 mA, and a 1800 angle created 42.00 mA. At one minute intervals (at average), the solar panel at a 900 angle created 45.9 mA, a 1000 angle created 53.3 mA, a 1100angle created 58.80 mA, a 1200 angle created 62.5 mA, a 1300 angle created 59.10 mA, a 1400angle created 57.30 mA, 1500 a angle created 51.30 mA, a 1600 angle created, a angle created 25.3 mA, a 1700 angle created 24.5 mA, and a 1800 angle created 40.4 mA. The colored cellophane test gave the following results; at 1800 pink created 31.3 mA, blue created 25.8 mA, and clear created 34.1 mA.

Conclusions/Discussion

From our experiments, we learned that obtuse angles of around 1100- 1300 produced the most electricity. The clear cellophane produced the greatest energy, followed by the pink cellophane, and the blue cellophane.

Summary Statement

Our project is about how to improove the solar pannel output by testing the angle and color.

Help Received

Mr. Saramosing (teacher who guided us in the scientific process)

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Johnny L. Manzo

Project Number
J0824

Project Title
Wave Hello to Clean Energy

Abstract

Objectives/Goals
This project, Wave Hello to Clean Energy, concerns the recent developments at Oregon State University. Their Motor Systems Resource Facility has created a buoy system, which translates wave energy into electricity using Faraday's Law of Electromagnetic Induction. This is important because it is clean and efficient. The purpose of my project is to find out whether waves with large amplitude and wavelength or small amplitude and wavelength will allow the buoy to generate more electricity.

Methods/Materials
To test my hypothesis, that the smaller waves will produce more electricity, I built a 6.5 foot wave tank and working replica of OSU's buoy. I then exposed the buoy to both types of waves and then measured the energy produced in the capacitor of the buoy with a voltmeter.

Results
The results of my tests supported my hypothesis: that the small waves would help produce more elctricity. This is because of their more frequent occurences and the speed at which they induced the buoy to move.

Summary Statement
The purpose of this project is to find whether waves with large amplitudes and wavelengths or small amplitudes and wavelengths will allow an energy producing buoy to create more electricity.

Help Received
Father helped build tank and buoy, Mother helped cut and mount for board, graduate student Joe Prudell at OSU helped answer my questions via e-mail

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Jozefa S. McKiernan

Project Number
J0825

Project Title
So You Want to Build a Radio?

Abstract

Objectives/Goals
The goal of my project was to learn as much as possible about radio receivers and transmitters and the components that make them up.

Methods/Materials
I studied several different aspects of radios: I studied how changing the resistance and capacitance of an oscillator circuit affected its output frequency; I studied the amplification of a signal using a transistor-based amplifier circuit; I studied how antenna length affects the reception of a crystal radio using a microammeter; I built an AM transmitter by combining a variable frequency oscillator circuit with a coil-and-capacitor tank circuit; and I built an FM transmitter and broadcast a signal to a commercially available receiver. To accomplish the above, I learned about capacitors, resistors, inductors, and equipment like ammeters and oscilloscopes.

Results
I found that the lower the resistance of the oscillator circuit, the higher-pitched the sound was and the greater the capacitance, the lower the frequency. The amplifier circuit considerably magnified the input signal. I found that the longer the antenna, the greater the amount of current. It seemed that some antenna lengths were not compatible with the wavelength. A longer transmitter antenna allowed the signal to be received farther away. The FM transmitter could transmit sounds but not voices at about 89.6 MHz.

Conclusions/Discussion
Radios fundamentally operate on resonance of electronic circuits. The resonant frequencies can be tuned using different values of resistance, capacitance, and inductance. I was able to tune radio transmitters and receivers using these principles. Receiver antenna length appeared to show wavelength dependence. Weak receiver output was amplified enough to drive an audio speaker.

Summary Statement
My project studies how radios work and how their components affect them.

Help Received
Grandfather answered questions and provided information and equipment; father answered questions, provided equipment, and edited report and abstract; mother typed report; Mr. Hall provided advice and information.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Amir Mojarradi

Project Number
J0826

Project Title
Thousands of Volts from a Battery!

Abstract

Objectives/Goals
Create thousands of volts from a battery. I think that direct connection of a battery to a transformer will produce high voltage.

Methods/Materials
Use a transformer to increase voltage, from low to high. The transformer was salvaged from a friend#s television. Direct connection to battery did not work. I learned that a transformer#s input must be AC and not DC. My research suggested that I could create an AC driver circuit for the transformer and power it with a battery. I found the schematic of the circuit on the net and started to build it.

Results
After much testing and researching, I learned that the battery#s DC current can be fed into a 555 timer chip, which switched the current on and off, converting the battery#s direct current to alternating current. That was then fed into the transistor, which also switched the current, giving it a final AC current that was then fed into the transformer, which then produced thousands of volts. The experiment was proven, as the high voltage jumped a spark gap.

Conclusions/Discussion
My hypothesis was incorrect, as it is not possible to connect a battery to a transformer, because a battery produces a direct current. Faraday#s Law states so. Instead, we must convert the current to alternating current and then feed it into the transformer. A transformer works by making a magnetic field around one coil, using alternating current. Inducing magnetic filed into another coil with many more turns, increases the voltage.

Summary Statement
Create high voltage from a battery.

Help Received
My neighbor helped solder board. Friend gave me TV transformer.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Colin B. Ries

Project Number
J0827

Project Title
Does Color Matter for Solar Power?

Abstract

Objectives/Goals
My problem statement is, #How do different colors of light affect the electrical output of a photovoltaic cell?#. My hypothesis was if green light would shine on a photovoltaic cell then it will produce the most electrical current.

Methods/Materials
An acrylic prism was used to produce a spectrum of colors. A photovoltaic cell connected to a multitester measured the voltage produced of each color of the spectrum.

Results
I found the most electrical current produced was under yellow light of the spectrum, with 8.9% more voltage than outside the spectrum and red was similar. Green and blue produced less and indigo the least amount.

Conclusions/Discussion
My hypothesis was incorrect. Red and yellow produced more electrical current than green. Even though these color#s energy levels were lower than the other color#s, they produced the greater electrical output.

Summary Statement
Different colored light effects the output of a photovoltaic cell.

Help Received
My Dad helped type the report and helped make the graphs. My Mom assisted putting together the board.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Christopher Sauer; Jonathan Zdasiuk

Project Number
J0828

Project Title
Electromagnetic Propulsion System for Magnetic-Levitation Train

Abstract

Objectives/Goals
Our objective was to build a propulsion system using electromagnets to drive the magnetic-levitation train car that we built for last year's science fair.

Methods/Materials
We built last year's train car and track using static magnets on a wooden frame lined with Plexiglas for very low friction. This year we used a steel plate, static magnets, electromagnets from disassembled solenoids, wire, various switches, and power supplies to develop and test various propulsion prototypes.

Results
First, we tried to pull a piece of steel attached to the top of the train car with an electromagnet, but the attraction between them was too weak. Second, we lined the bottom of the track with five static magnets of alternating polarity, put an electromagnet in the train car, and switched the electromagnet's polarity as it moved over the magnets. However, when in the third prototype we added more static magnets along the track, the train car seesawed back and forth because it was being pulled in both directions by similar forces. In the fourth prototype, we put static magnets on the train car and electromagnets along the track and tried first pushing and then pulling the train car, but neither alone was strong enough to actually propel it. When we combined the two--pulling from the front and pushing from the back--our train car moved successfully. We then measured the magnetic field strength of the various parts of our system as a function of distance. The maximum magnetic fields from both the static magnets and electromagnets were roughly one kiloGauss.

Conclusions/Discussion
We succeeded in reliably propelling a train car with a static magnet attached to it, by using a line of electromagnets in the track that we wired to pull the train car from the front and push it from behind.

Summary Statement
We built a push-pull electromagnetic propulsion system for our continuously-levitated magnetic-levitation train.

Help Received
Our parents taught us how to solder and use power tools, helped us buy parts, and helped us with the troubleshooting, wiring diagrams, and typing. Varian Medical Systems lent us a Gauss meter. After our project, Sam Gurol's group at General Atomics gave Jonathan's family a tour of their mag-lev project.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Mohammed H. Siddiqui

Project Number
J0829

Project Title
Never Lose Track of Time

Abstract

Objectives/Goals
How does the construction of a magnetic clock affect its efficiency in comparison to a battery operated clock?

Methods/Materials
I used a mechanical pendulum clock, 2 bar magnets, 1 cylindrical antioc magnet, one battery-operated clock with used batteries, and a timer.

A. 1. First, I must construct a magnetic clock
2. I start by using a mechanical pendulum clock as a basic foundation of the magnetic clock
3. After this, I attached the antioc magnet to the pendulum, and I placed 2 bar magnets with equal force and same size on either side of the pendulum.
4. I then adjusted the positions of the magnets to provide the most efficient pendulum movements due to the repulsion
theory
B. 5. I now have my construction ready; therefore I proceed to the actual comparison part.
6. I begin with taking out the battery-operated clock and inserting old batteries (for the reason of testing faster)
7. I then synchronize both the pendulum clock and the battery- operated clock
8. I have 3 trials, all out of a time period of 5 minutes
9. I time how long it takes each clock to come to a complete halt
10. I write down my results, and compare both clocks# efficiencies

Results
From my experiment, out of a total 5 minutes, my magnetic clock worked approximately one minute every trial. Each consecutive oscillation of the pendulum took longer. I discovered that during the first, second, and third trial the pendulum#s first oscillation took approximately 1 second. Later the pendulum oscillations took longer.

Conclusions/Discussion
A battery- operated clock is more efficient than a magnetic clock. The results refute my hypothesis, because the battery- operated clock worked 5 minutes out of 5 minutes, in contrast the magnetic clock worked for approximately 1 minute. Some reasons for the ceasing of the clock's progression could be the force of gravity, insufficient power by the magnets, or wrong positioning of the magnets. Therefore, the

Summary Statement
My project is about creating a clock, designed to never stop working and revolutionize the world by using magnets for everyday purposes, including clocks.

Help Received
Aunt helped purchase necessary items for project. (presentation necessities)

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Jaime Silva, Jr.

Project Number
J0830

Project Title
Hydrogen Peroxide and Salt Water Battery

Abstract

Objectives/Goals
To measure the voltage/amperage generated by magnesium and iron electrodes immursed in a NaCl and H(2)0(2) solution; and to demonstrate that a small light bulb can be illuminated through this process.

Methods/Materials
First, I screwed the miniature light base to the wood. I used a large plastic container and clipped the red wire to one screw and the black wire to the other screw. I had to connect the red alligator clip to the iron electrode and secure it to the side of the container. Next, I connected the black alligator clip to the magnesium electrode and secured the side to the opposite end by using tape. In one pitcher, I prepared salt water. I made sure the electrodes were not touching and that the alligator clips were not touching the water. I poured the water with salt into the pitcher. No results. I added more salt. Nothing happened. I made the water warmer and still nothing happened. I read in the research I did that the oxygen in the air may not be enough to get light. In case this happened, I was supposed to add hydrogen peroxide to the salt water. I added the hydrogen peroxide. I stirred it and a little light was produced. I added more hydrogen peroxide and stirred and the bulb lit up for a longer duration and at a higher voltage. The voltage/amperage was measured throughout the process.

Results
The pitcher with water and salt produced no results. The addition of more salt to the water and the increase in temperature of the water also did not affect the water and salt solution.

Once hydrogen peroxide was added to the water and salt solution, light was produced. The more hydrogen peroxide that was added and the more the molecules were stirred, the more amperage/volts were produced, and therefore the light bulb was able to shine.

Conclusions/Discussion
Hydrogen peroxide when mixed with water and salt can illuminate a light bulb.

A few changes were made to the original design, but in the end it all worked out and the light bulb was able to glow.

Maybe one day, I will have a big tank with salt water and metal outside my house supplying me with electricity.

Summary Statement
H(2)0(2) mixed with NaCl and H(2)0 produces enough electricity to illuminate a bulb.

Help Received
My mother purchased the supplies and typed the report, and my father helped me physically contruct the project.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Gautam Soundararajan

Project Number
J0831

Project Title
Wake-O-Matic: User Alertness Monitoring Device

Abstract

Objectives/Goals
The purpose of my project is to prevent fatigue related accidents by designing a simple, portable and affordable device that would alert the user as soon as he closes his eyes.

Methods/Materials
Based on my research, when an infrared beam is aimed at the eye, the amount of infrared reflected back is different when the eye is closed vs. open. My procedure involved the design of an electrical circuit which used an IR emitter and an IR detector aimed at the eye and triggering circuitry which included a transistor switch and a piezo transducer buzzer to alert the user when he closes his eyes for more than a couple of seconds. The circuit is mounted on a pair of eye glasses to be worn when the user is susceptible to fatigue under dangerous conditions.

Results
The device was tested on 20 human subjects of different skin tones and eye colors as well as under different lighting conditions to make sure that it will function as expected. I was able to sound the buzzer in my circuit when the user closed his eyes for more than a couple of seconds.

Conclusions/Discussion
Infrared reflection is different from an open vs. closed eye and this difference was sufficient to design a circuit to trigger a buzzer when the eye is closed. Wake-o-Matic is a simple, portable, and affordable device. The purpose of Wake-O-Matic is to help people avoid getting hurt by alerting them when they close their eyes.

Summary Statement
To design a simple, portable and affordable device that would alert the user as soon as he closes his eyes.

Help Received
Mother provided guidance in designing the circuit. Father helped build the circuit. Dr. John Webster guided in choosing the correct parts.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Kevin M. Stanley

Project Number
J0832

Project Title
Head Up on the Highway: Solar Power vs. Hydrogen Power: The Final Showdown

Abstract

Objectives/Goals
The objective of the project is to determine what type of car goes faster: a solar powered car or a hydrogen powered car. My hypothesis is that that the solar powered car will go faster than the hydrogen powered car because the solar powered car will have a lot more current than the hydrogen powered car.

Methods/Materials
Materials: Stopwatch, Chalk, Water, Distilled Water, 500 Watt Light Bulb, Ruler, Protractor, Goggles, Hydrogen/Oxygen Stickers, Solar Panel, Hydrogen Fuel Cell, Gas Tank, Volt Meter, Red Wire, Black Wire, Gear Motor, Car Chassis, Gas Collector, Axle, 4 Wheels With Tires, Support for Solar Panel, Syringe, Piece of Hose, Test Tube, 2 Hose Clamps, 2 Hose Connectors, 2 Plugs, 8 Banana Plugs, Spool, String, Syringe Tip, Screw FZ, Bushing For Attachment
Method: A. Build hydrogen fuel cell car. B. Weigh hydrogen fuel cell car. C. Build solar cell car. Add water so that weight of solar cell car equals weight of hydrogen fuel cell car. D. Test time elapsed for hydrogen fuel cell car to travel distance of 5 feet. (20 trials) E. Test amperage with voltmeter every 5 trials. F. Test time elapsed for solar cell car to travel distance of 5 feet. (20 trials) G. Test amperage with voltmeter every 5 trials. H. Shine the 500 watt bulb from decreasing distances on the solar cell car and measure the amperage with voltmeter to find maximum current. I. Fill the fuel tanks for the hydrogen fuel cell car and measure the amperage with voltmeter every 30 seconds to find maximum current.

Results
The solar cell car went faster than the hydrogen powered car. The average speed of the solar powered car was 2.269 seconds with an average current of 186.4 milliamps. The average speed of the hydrogen powered car was 5.4475 seconds with an average current of 53.58 milliamps.

Conclusions/Discussion
This experiment proves that the solar powered car has more current than the hydrogen powered car, because the hydrogen fuel tank can only contain a certain amount of fuel. If the fuel was to be increased the hydrogen powered car might provide more current causing it to go faster. This might also happen with the solar powered car if the solar panel was larger as it might provide more current.

Summary Statement
This project compares solar power and hydrogen power to see which moves cars faster.

Help Received
My dad helped me with the project by him holding the car and letting it down to roll when the stop watch was ready to time the car. He also helped me by telling corrections I should make on my research. My mom helped me glue the documents onto my science fair board.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
William A. Strober

Project Number
J0833

Project Title
Acceleration by Magnetic Forces and a New Propulsion System

Abstract

Objectives/Goals
To determine what the direction of the lines of force would be if you could get inside an electromagnet with a north pole on the left end and a south pole on the right end. Are the forces in the same direction as the forces on the outside of the electromagnet? To determine if a new propulsion system could be designed based on my observations.

Methods/Materials
With a hollow electromagnet that I built, and a natural magnet, I performed several experiments. I placed the natural magnet in various positions in relation to the north and south poles of the electromagnet. These included putting the natural magnet in the center of the hollow tube of the electromagnet, and putting the natural magnet on the outside of the electromagnet with different poles of the natural magnet facing the different poles of the electromagnet.

Results
The south pole of the natural magnet was attracted to the north pole of the electromagnet and the magnet shot into the hollow tube of the electromagnet, and stopped in the center. The same happened when I placed the north pole of the magnet next to the south pole of the electromagnet. When in the center, the magnet resisted when I tried pushing it to either end. Thus, it was repelled by either end. When I tried putting the magnet's north pole into the electromagnet's north pole, it repelled. After I forcefully pushed it in, it would stay in the center, but shot out the south pole when pushed slightly further toward the south pole. However, when I pushed the magnet from the center in the opposite direction toward the north pole, it then shot out of the north pole. Thus, it was attracted by either end.

Conclusions/Discussion
To my surprise, the inside and outside of one end of the electromagnet behaved as north poles, and the inside and outside of the other end behaved as south poles. I also designed a new propulsion system for maglev trains or subways, since when the natural magnet shot into one end of the electromagnet, and I reversed the flow of electricity when it got to the center, it shot out the other end. Trains could be propelled this way through a series of hollow electromagnets.

Summary Statement
This project is about exploring the direction of magnetic fields inside and outside of electromagnets.

Help Received
Father provided information for switches, helped in handling during experiments, and helped in editing.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Lonnie R. Taylor

Project Number
J0834

Project Title
Focusing Signals for a Better Wireless Network

Abstract

Objectives/Goals
My objective is to see if home made antennas made out of everyday materials will effect the signal of a wireless router.

Methods/Materials
I conducted sixteen different tests using the homemade antennas on the wireless router antennas facing north, south, east, and west and took the different signals strengths in each room of my house. Then I used the same method by taking off the supports which were the toilet paper and the paper towel rolls. I used two Toilet Paper rolls, 2 Paper Towel rolls, a five by five inch piece of cardboard, a ten by ten inch piece of cardboard, scissors foil, a hot glue gun, and a wireless capable laptop.

Results
When I tested the toilet paper roll and compared it to my testing without the toilet paper roll, I found that without the roll and just the cardboard I got better results because with the roll the signal was not focused and it scattered the signal. When I tested the paper towel roll I got the same results that I did with the toilet paper roll and that the signal was scattered and not able to be focused. When all of my tests were compared to the original signals I found that with the rolls the signals came out higher than the original signals displaced by the router itself.

Conclusions/Discussion
In my conclusion I dicided that it was better just to have the piece of cardboard with foil and not the roll because the roll damaged the signal. I also had noticed that with some of my testings they did not come out the same and that they did not match up, i realized that when i had conducted the tests that something that interfears with the wireless signal such as cell phones, cars, metal filing cabnets, radios, or televisions could have been around or in use at the time which interacts with the radio waves displaced by the router.

Summary Statement
Using everyday things to enhance a wireless routers signal.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Melody Wu

Project Number
J0835

Project Title
ElectroMagneto

Abstract

Objectives/Goals

I wanted to know whether the size of the iron core (1 nail, 2 nails, and 3 nails), the thickness of the wire (20-gauge, 22-gauge, and 26-gauge), or the number of coils (10 coils, 20 coils, and 30 coils), would have the largest effect on the strength of the electromagnet.

Methods/Materials

Since batteries will lose their power during the tests, the results will not be accurate. So, I used an AC adapter with an output of 9V DC 500mA.

The materials I used are: three different gauges of wire, 20-gauge, 22-gauge, and 26-gauge, 12 large nails, a wire cutter, a ruler, a knife, about 200 small paper clips, electrical tape, alligator clips, a wrench, a wire stripper, pliers, and an AC adapter.

I wound the wire around the nail(s) to create the magnet. I divided the magnets into three groups that would test the thickness of the wire, the number of coils, and the size of the core (number of nails). I attached the magnet to the alligator clips and plugged the AC adaptor in. Then I put the magnet in the pile of paper clips and counted how many the electromagnet picked up. I did five tests for each magnet and then found the average.

Results

These results were the averages of the five tests.

In group 1, the magnet with 26-gauge wire picked up 16.4 paper clips. The 24-gauge magnet magnetized 22.2 paper clips, and the 20-gauge magnet attracted 27.8 paper clips.

In group 2, the magnet with 10 coils attracted 8.6 paper clips. The magnet with 20 coils attracted 21 paper clips. The third magnet had 30 coils and picked up 35 paper clips.

In group 3, the magnet with one nail picked up 21.8 paper clips. The second magnet had two nails as the core and it magnetized 25.6 paper clips. The third magnet with three nails picked up 34 paper clips.

Conclusions/Discussion

In group 1, the thickest wire was strongest. In group 2, the electromagnet with the most coils was strongest. In group 3, the magnet with the biggest core was strongest.

I compared the averages in each of the separate groups. I found the percentage that the power of the electromagnet had increased by. Then, I compared the differences between the percentages with all the groups. Since the difference in power was greatest in group 2; that proved that the number of coils affected the strength of the electromagnet the most.

Summary Statement

My project is about investigating which factors affects the power of an electromagnet the most.

Help Received

My dad helped me make the power supply and attach the alligator clips to the wire.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Christopher A. Zikry

Project Number
J0836

Project Title
How Can Super Fast Motion Be Captured with a Camera?

Abstract

Objectives/Goals
The purpose of this experiment is to test how super fast motion can be captured with a camera. Fast motion picture that couldn#t be seen with a naked eye can now be captured with a 35mm or Digital camera.

Methods/Materials
I designed, created and build from scratch an electronic device that can captured super fast motion action with a camera. The device consists of electronic components (transistors, resistors, capacitors, SCR, potentionmeter to adjust the sensitivity, flash, a camera with a bulb setting, a microphone to capture the sound, an electonic board, soldering gun, and a tester.

Results
Amazing pictures!!, incredible shots!!. The device performed flawlessly. more details about the results in the report.

Conclusions/Discussion
Through testing with various objects,the device is able to catch super fast motion most of the time.It is able to catch a balloon popping, but can't capture the bullet od a BB gun, which goes 250m/s.
The device could be improved by adding more sensor, not only to capture sound but to catch motion, light or very soft sound like dripping water, which would result in pictures never seen before.

Summary Statement
I created an electronic device, that can capture fast motion picture with a camera, that could not be seen with a naked eye.

Help Received
My Dad helped me with the display board, due to constraint of time.