CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Christopher S. Avery

Project Number
J0201

Project Title
A Quality Control Study of Little League Baseballs

Abstract

Objectives/Goals
The two largest manufacturers of baseballs certified for use in Little League Baseball competition are the Rawlings Sporting Goods Company and Diamond Sports Company, Inc. Since Rawlings is the sole supplier to Major League Baseball, and the MLB balls had quality control issues noted in recent reports, it was proposed to see if they also existed at the Little League level, and to compare the consistency of the Rawlings and Diamond balls, with the hypothesis of: Little League baseballs made by Rawlings are not as consistent in their performance, size and weight as those made by Diamond.

Methods/Materials
Materials: 1 dozen each of Rawlings and Diamond brand Little League Competition Grade Baseballs.

Testing performed included:
1) Measurements, using a digital scale and a flexible measuring tape, of uniformity in weight and circumference against the specifications of 5.0 to 5.25 oz. and 9.0 to 9.25 inches, respectively. (English units of measure were used, as that is what is used in the baseball specifications).
2) Bounce tests for liveliness, where a dozen samples of each brand of ball were dropped from a height of 72inches, recording the maximum rebound height of the balls on the 1st bounce, giving a rebound percentage comparable to that done in the Major League ball testing. Two rounds of bounce tests were performed and recorded with both digital video and still cameras.
3) Visual inspections of both the exterior of all the samples and a cross section of a randomly chosen ball from each brand to check how each is constructed.

Results
Findings showed that while the Rawlings balls did have some quality control issues in the areas of weight and size, their performance was consistent within the brand. The Rawlings balls' rebound percentage was less than the Diamond balls', but it was noted that different, softer materials were used in the Rawlings ball construction when compared to the Diamond ball construction.

Conclusions/Discussion
Rawlings' quality control IS lacking somewhat as evidenced by the larger size and weight differences when compared to the Diamond balls.
>>But it is the difference in ball construction between the Diamond and Rawlings Competition-Grade balls that most likely explains the difference in the performance test results, NOT quality control. Thus, the results both partially prove and disprove the hypothesis.

Summary Statement
An examination of how quality control and material construction affects the performance of Little League baseballs.

Help Received
Thanks to my neighbor, Mr. Mark Mooney, who lent the power saw used to get cross-section cuts of the sample baseballs; and my father, David Avery, for helping me to type the report, showing how to use a spreadsheet for data analysis, and for buying and/or helping to find the resources used for the project.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Reed B. Benoit

Project Number
J0202

Project Title
The Trebuchet: A Study of Mechanics and Motion

Abstract

Objectives/Goals
My project was to evaluate how different sling lengths and counterweight masses affect the distance a trebuchet throws a ball. My hypothesis was that a trebuchet would shoot farther with a medium sling length and a medium counterweight.

Methods/Materials
Initially, I built a 6' trebuchet. My manipulated variables were the length of the sling and the mass of the counterweight. I used 4 different sling lengths: 36", 33", 30" and 27". I used three counterweights: a 4"x12" PVC pipe filled to the top with sand, filled half-way and empty. I tested each counterweight with each sling length 5 times. I then averaged the 5 trials to obtain a distance measure.

Results
I discovered that with a full counterweight and a 27" sling length the trebuchet shot the farthest. In other words, the heaviest counterweight with the shortest sling worked the best.

Conclusions/Discussion
My results did not support my hypothesis. After I did my testing, I learned that the counterweight was the principle energy for firing the projectile. The heavier the weight the more force it had, the farther the ball flew. I also learned that the distance between the fulcrum and the counterweight and also the sling length were important. The shorter the distance, the faster and farther the ball flew as well.

Summary Statement
I built a trebuchet to evaluate how different sling lengths and counterweight masses affect the distance a trebuchet throws a tennis ball.

Help Received
Help with background research: Professor Monty Mola at Humboldt State University, librarian at HSU. Help with trebuchet construction: my dad and uncle. Help with backboard and writing: my mother

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Daniel E. Brown

Project Number
J0203

Project Title
Pumped Up! Determining the Optimum Air Pressure for a Soccer Ball

Abstract

Objectives/Goals
I wanted to determine how the amount of air pressure in a soccer ball affects the distance the soccer ball travels in the air when kicked and what is the optimum pressure for best performance.

Methods/Materials
Assemble slingshot. Launch the soccer ball with 2 pounds of pressure and measure the distance it travels. Repeat twice more at this air pressure. Next repeat 3 times each with the ball at 4, 6, 8, 10 and 12 pounds of pressure.
To get the coefficient of restitution, inflate the soccer ball to 2 psi. Someone stands on a chair and drops the ball from an 80 inch height. Measure the height of the bounce. This was repeated 3 times at each air pressure (2,4,6,8,10 and 12 psi). Calculate the coefficient of restitution by dividing the height of the bounce by the height of the drop.

Materials: Size 3 soccer ball, air pump, low-pressure air pressure gauge, 25 foot measuring tape, air inflation needle.
For Soccer Ball Launching Slingshot:
One of the following:4ft. X 4in. plywood ½ in. thick, 4in. X 4in. wood 18in. long, 4in.X4in. wood 20in. long, 1 ½in. O hook, 1in. wood drill bit, ½in. X 4in. wood 36in. long, pad of heavy duty felt, gate latch, 1in. dowel 13in. long, box of wood screws 1 3/4 in. long, round door stop 2in. diameter. Two of the following:4in. X 4in. wood 9 ½in. long, 2in. X 4in. wood 41 ½ in. long, 1in. I hook, 1 ¼in. I hook. Three: Bungie cords 24in. long.

Results
The distance increased from 2 to 8 psi then began to decrease. My data showed that the manufacturer recommendation, 6-8 psi is actually the air pressure that will give you the best performance of the ball.

Conclusions/Discussion
The optimum pressure is 6-8 psi. If you put more air, the ball becomes harder but doesn't perform better.

Summary Statement
My experiment was designed to determine the optimum air pressure of a soccer ball using the scientific method and launching the ball at incrementally higher pressures.

Help Received
My older brother came up with design for ball launcher; Dad took me to buy lumber, helped me build launcher and took pictures; Mom helped cut all the paper for backboard.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Anthony R. Coy

Project Number
J0204

Project Title
How Does Temperature Affect a Rubber Band's Elasticity?

Abstract

Objectives/Goals
The objective of the project was to see how temperature affects a rubber band's elasticity. The hypothesis was the heated (130 degree Fahrenheit) rubber bands would be most elastic, meaning they would stretch farthest, and be able to sustain the least amount of force before breaking.

Methods/Materials
Three different temperatures were tested on the rubber bands, 10 tests for each. The temperatures tested were 0, 66, and 130 degrees Fahrenheit. The setup of the project consisted of a meter stick measuring the rubber band's length in centimeters, and a spring scale measured the force required to break that rubber band in Newtons. Two video cameras were recording the footage at 30 FPS (Frames per Second). One recorded force, while the other recorded length. This footage was uploaded to a computer to accurately analyze the recorded data. Using Adobe Premier Pro, a video editing program, the footage was slowed down to the individual frames. When these frames or pictures are played at 30 FPS, it creates the illusion of motion.

Results
The frozen rubber bands (0 degrees Fahrenheit) broke at the average force of 33.6 Newtons, and stretched to 52cm. The room temperature rubber bands (66 degrees Fahrenheit) broke at an average force of 30.2N. The heated rubber bands (130 degrees Fahrenheit) sustained an average force of only 25.5N and stretched to an average 69.35cm.

Conclusions/Discussion
The results proved the hypothesis correct. The heated rubber bands were most elastic, stretching to the farthest distance of 69.35cm and breaking with the least amount of force with 25.5N. The frozen rubber bands were just the opposite with the shortest length of 52cm, and were able to sustain the greatest amount of force of 33.6N. The results were pretty consistent, providing a reliable conclusion to the project. Thermal expansion caused the rubber bands to react as they did. When the rubber bands were heated, the particles stretched out, making them more elastic and able to withstand greater force. When frozen, the particles contracted, adding strength and decreasing resistance to force.

Summary Statement
Temperature's affect on the length a rubber band can stretch, and the force it can withstand before breaking.

Help Received
Dad provided video camera; Mom got board cut, and let me burn rubber in the kitchen; Neighbor provided a video camera

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Carolyn P. Coyle

Project Number
J0205

Project Title
Some Variables Affecting the Torque Required to Turn a Screw

Abstract

Objectives/Goals
The objective of my project was to measure how much torque in newton-centimeters was required to turn a lag screw in a block of wood as the diameter of the screw, the depth of the screw, or the size of a pilot hole was changed.

Methods/Materials
Torque was measured by pulling perpendicularly on the handle of a socket wrench with a spring scale and measuring the force required to begin turning the screw in a large block of wood. Each trial was performed three times. The first experiment measured the differences in torque needed to turn screws with different diameters at a fixed depth in the wood. The second experiment measured the differences in torque needed to turn the same screw at different depths. The third experiment measured the differences in torque needed to turn identical screws at a fixed depth in the wood as the sizes of pilot holes were varied.

Results
Progressively more torque was needed to turn the screws as the diameter of the screw increased, as the depth in the wood increased, and as the size of the pilot hole decreased.

Conclusions/Discussion
My experiment showed that there was a significant difference in the amount of torque required to turn a screw as each of the three variables was changed. These findings have a practical use in the design of tools and the use of building materials.

Summary Statement
My project quantifies the amount of torque required to turn a screw under different conditions.

Help Received
Father helped design project and gather materials; Father drilled holes in wood.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Bryce W. Cronkite-Ratcliff

Project Number
J0206

Project Title
The Burning Mirror of Archimedes: A Weapon of Mast Destruction?

Abstract

Objectives/Goals
Several accounts of the Roman siege of Syracuse in 213 BC, including those of Zonaras and Tzetzes, describe a weapon of immense power, one capable of setting entire fleets of quinqueremes aflame almost instantaneously. This "Burning Mirror of Archimedes" is presumably a system of mirrors used to concentrate the sun's energy into a single point. This experiment is an attempt to consider the scientific and practical aspects of inventing and using a "Burning Mirror" to determine, first, whether Archimedes could have constructed such a device and, second, whether he could conceivably have used such an contraption as an effective defensive weapon during the siege of Syracuse.

Methods/Materials
The basic project outline is as follows: 1) conduct a series of experiments relating to geometric optics in order to develop a scale model of a possible "Burning Mirror" with proportionate properties to one Archimedes might have used, 2) construct a mirror system based on the developed plan capable of igniting a model ship on fire, and 3) analyze the data and consider the possibility of Archimedes actually constructing and using such a system of mirrors in defending Syracuse.

Results
Results include 1) the geometrical optics properties of each mirror and the entire system 2) temperature profiles comparing temperature attained in the focal spot vs. number of mirrors 3) an estimate for the number of mirrors Archimedes would need to build an effective weapon 4) qualitative demonstrations of my system in action (setting objects, such as model Roman ships, on fire).

Conclusions/Discussion
My results address two basic questions: could Archimedes have constructed and used a mirror array to burn enemy ships and did he actually do so. In experimenting with an accurately scaled replica of a Burning Mirror design, I have observed that it is possible to construct a mirror array capable of burning enemy ships. However, it is improbable that the Burning Mirror of Archimedes was actually constructed and used due to the practical complications involved. That is, in order for the Burning Mirror to be effective, Archimedes would require sunny weather, the means by which to construct, adjust, and man an array of many hundreds of mirrors, and would have to consider a host of other logistical issues. While Archimedes' Burning Mirror could have been used, it is unlikely that such a device was used to defend Syracuse.

Summary Statement
I constructed and tested a large (almost 700-mirror) solar "Burning Mirror" array to explore whether the classical story of Archimedes using such a weapon to defend Syracuse is plausible.

Help Received
My dad helped construct the modules (mainly using saws to cut the plywood and taking me to the hardware store to purchase materials) and conduct the experiments (sometimes it's a two person job). He also helped me understand some of the science involved in the project. My mom proofread my write-up.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Chris J. Davis

Project Number
J0207

Project Title
SPLAT! The Effect of Barrel Lengths on Paintball Accuracy

Abstract

Objectives/Goals
My objective was to find out how different barrel lengths will effect the accuracy of different types of paintballs.

Methods/Materials
Materials:
1 paintball marker
3 barrels(8,12,16-inch)
filled CO2 or compressed air tank
40 each of most expensive (Marbilizer), medium priced (All-Stars) and cheap (Stingers)paintballs
9 paper targets (disposable)
paper and writing utensil to record data
60 feet of flat, clear, open area to test
tripod
measuring tape
witness

Results
When I tested the 8-inch barrel for accuracy, the Stingers paintballs came in first, by far, with an average of 4.425 inches from the center of the target. The Stingers paintballs were also the only ones that had a bulls eye. When I tested the 12-inch barrel for accuracy, I found that the Stingers came in first again with an average of 4.725 inches from the bulls eye. The 16-inch barrel test was a whole different story. The All-Stars paintballs were first with an average of 2.7 inches away from the bulls eye. After calculating the averages of the three barrel lengths, I found that the 12-inch barrel had the best overall accuracy with an average of 5.45 inches from the bulls eye. I found that the All-Stars paintballs were the most accurate overall with an average distance of 4.92 inches away from the bulls eye.

Conclusions/Discussion
Although my hypothesis was incorrect, I was still able to reach my objective. I have learned that the All-star paintballs were the most accurate. They were the most accurate with the 12-inch barrel installed onto the paintball gun. I also learned that the Marbilizer paintballs were the least accurate. This tells us that if you are going to go play paintball, that you should buy the medium priced paintballs which are the All-Stars.

Summary Statement
Testing the accuracy of different types of paintballs shot from various lengths of gun barrels.

Help Received
Mom helped with the layout of the project board; Dad helped test the project.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
M. Zack Guerra

Project Number
J0208

Project Title
The Longer the Arm, the Farther the Throw?

Abstract

Objectives/Goals
I like playing golf and often wondered why the length of a club affects the distance the ball travels. It feels like the longer clubs just have more power when I swing them! I wanted to find out what it is that makes a longer club hit the ball farther.

Methods/Materials
My first thought was to use different length golf clubs to test their effect on a balls travel, but I realized it would be difficult to regulate the swing. Then I remembered a PBS special on the Trebuchet. A Trebuchet is a gravity powered Medieval battle weapon. It was the successor to the Catapult because of its superior range and accuracy. A heavy weight is attached to one side of a throwing arm, while a rope and sling are attached to the other. The sling cradles the projectile. When the weight is released, it swings downward, and raises the other side of the arm. The length of the rope extends beyond the arm and the sling releases the projectile at great velocity. Since building a full scale Trebuchet was out of the question, I decided to make a miniature one of my own design. I based it off several pictures on the internet. I kept it down to a foot high to limit the projectile's distance.
My plan was to use different pivot points in the throwing arm to test the different lengths. When I tried this, I realized that it also changed the relation of the weight to the axle. This changed the force that was applied to the throwing arm. In order to eliminate this, I had to make different arms for each length. I performed tests with a ten-pound weight initially, but settled on seven-pounds to better control the distance traveled.
I tested throwing arm lengths at 4, 6, 8, 10, 12, 14, 16, and 18 inches. I performed five throws for each arm, recorded the tests, and averaged them out.

Conclusions/Discussion
My tests proved my hypothesis correct! The longer the throwing arm, the farther the throw! Each time I increased the length of the arm, the distance the projectile traveled increased. I started with a four-inch arm, roughly the same distance as that between the weight and axle, and the projectile consistently went straight up in the air or backwards. Once I moved to a six-inch arm, the projectile went in a forward motion, but not very far.
What I realized was that as the arm grew in length, the force at the end of the arm also grew. This force is referred to as centrifugal force, and it increases as the length of the arm increases.

Summary Statement
I believe that the longer the striking arm (club) or throwing arm, the farther the object being struck or thrown will travel.

Help Received
Father helped construct trebuchet.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Sean W. Hammett

Project Number
J0209

Project Title
Project Canon Cannon: A Study of Projectile Range

Abstract

Objectives/Goals
This project is an endeavor to discover the relationship between the amount of pressure put in the tank of an air cannon and the distance that the projectile flies. In my experiment, I fired a small rubber ball (approximately two and a half inches in diameter) at 45, 50, 55, 60, 65, and 70 PSI. The air cannon that I built and used had a three-inch styrene barrel, a solenoid irrigation valve (powered by three 9v batteries), and a two-inch, schedule 40 PVC tank that was shaped so that it doubled as a stand (see Fig. 2). I hypothesized that the relationship would be an exponentional curve leveling off when higher pressures were reached.

Methods/Materials
Materials
- 1 air cannon (1 solenoid irrigation valve, 30" of 3" styrene pipe, 55" of 2" schedule 40 PVC, a 3" styrene end cap, a 2" T-bend, PVC, two 2" end caps, PVC, a 2" elbow bend, PVC, a 2" 45 degree bend, PVC, two 1" threaded to 1" non-threaded adapter, PVC, a 1" to 1.5" non-threaded adapter, PVC, a 1.5" to 2" non-threaded adapter, PVC, a tubeless tire input valve, a pressure gauge (reads to 70 PSI at least), a electrical box, three 9v batteries, 1 momentary push button, 1 on/off toggle switch, Approx. 10 ft. of wire, PVC glue and primer, Teflon tape)
- Drill 11/32"; - drill bit; - 1/8" tap drill; - soldering iron; - solder; - 1 spherical projectile (sized to the styrene pipe); - 1 bicycle pump/air compressor; - 1 tape measure, at least 300 ft.

Methods
- Assemble the air cannon as per Fig. 1 and Fig. 2. - Fire the air cannon several times at 45, 50, 55, 60, 65, and 70 PSI. - Record the distance of each shot.

Results
Distance (feet)

	Trial 1	Trial 2	Trial 3	Trial 4	Average
45 psi	122	124	136	121	125.8
50 psi	152	147	145	151	148.8
55 psi	175	176	165	164	170.0
60 psi	199	195	184	188	191.5
65 psi	208	209	196		204.3
70 psi	241	231	224		232.0

Conclusions/Discussion

Summary Statement
This project examines the relationship between the distance a projectile travels and the pressure applied as the motive force.

Help Received
Father helped assemble the cannon.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Stephen J. Harmer

Project Number
J0210

Project Title
The Spinning Edge

Abstract

Objectives/Goals
My project is based on discovering which golf ball spins the most after being hit from a 50-60 yd chip shot.I took 5,round,dimpled golf balls with different cores.I chose The Titleist Pro V1,Wilson Staff True Tour,Strata Tour Ultimate Plus,Titleist HVC Distance & Titleist Tour Balata 100. I hit 10 shots with each ball & took the 5 most consistent shots.The conditions werent exact as I wanted. I changed the way I measured the spin. When a ball is hit, spin is produced due to the degree of the clubface & the swiftness of the downswing. It will "check-up" or bounce up a bit,reversing the spin, pushing the ball in a forward motion. Thus,I measured how far the ball rolled forward after it hit the green.

Methods/Materials
Materials: 5 dimpled golf balls, all w/ different cores.A 56 degree sand wedge, Ball markers, Measuring tape, pen, paper.
Procdr:Gather required materials.Select flat,nicely cut driving range. Stand 50-60 yards from green to get good height & velocity on the ball.Hit 10 wedge shots for each ball. Record distances. Compute average results for each ball, Compare which ball had most spin.

Results
Due to weather & course conditions, I had to alter my procedure.There was a slight wind approx. 6-7 mph.When the ball is chipped it wont spin backwards as much due to the greens being punched & lightly sanded. Instead of measuring the distance the ball spins backwards, I measured the length it took the ball to stop rolling when it hit the green.Although the ball doesn't spin backwards, there is still a great amount of spin rotation on the ball.The ball will checkup & roll a shorter distance due to the backspin generated. Thus it slows the front spin down after it hits the green. The Titleist HVC Distance came in last place with an average of 11.7 ft. The Wilson Staff True Tour came in 4th place having an average distance of 8.5 ft. The Titleist Pro V1 came in 3rd place with an average of 7.8 ft. The runner up was the Titleist Tour Balata 100, averaging 5.8 ft. The winner was the Strata Tour Ultimate averaging 4.4 ft.

Conclusions/Discussion
I concluded multi-layer & wound core balls produce more spin & less travel than a solid core ball. The solid core balls are best used on large greens. A Multi-layer wound core ball are best on a small green.Solid core ball do best on wet greens.Wound or multi-layer ball are best when greens are hard. If a green is hot & dry its best to use a wound or multi-layer ball.

Summary Statement
My project is about the effect the core of a golf ball will have on the spin generated and the distance the ball travels.

Help Received
I received help from my parents gathering the materials, taking pictures, proof reading my research paper. I also got professional help in chosing the golf balls by Colin Meyers and Ric Moore at Bakersfield Country Club.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Brisk Kannel; Max Simmons

Project Number
J0211

Project Title
Dog-E-Diner

Abstract

Objectives/Goals
Some pet owners choose to feed their pets outdoors rather than inside. This exposes a pet#s food to dirt and most importantly to other animals such as raccoons or pets owned by neighbors who get into the food and eat it before the pet has a chance to eat it. The purpose of the Dog-E-Diner is to keep a dog#s food safe and clean while he isn#t actually eating it. The Dog-E-Diner can also keep wild animals and other dogs out of a dog#s food.

Methods/Materials
We took on the challenge of inventing a way to allow only an authorized animal access to the food in its bowl. We researched other pet feeders, drew preliminary sketches and spent several hours discussing what features would make our Dog-E-Diner functional. We selected components that would provide the functionality we designed. We began to layout all of the components to determine how big our enclosure would have to be to allow the internal components to work and move within the enclosure. We then drew the full scale version of the enclosure with the exact dimensions that house all of parts needed. We built the enclosure, and using a proximity device and many other off the shelf mechanical and electrical devices, we built the feeder.

Results
We invented and built a functional feeder that keeps pet food safe, clean and makes the food available only to a specific pet.

Conclusions/Discussion
The Dog-E-Diner is a great idea that we came up with really easily, but it took a lot more work than we ever imagined. We had a lot of fun inventing and building this project, and hope someday we can patent it make it available to other pet owners.

Summary Statement
We invented a feeder that keeps pet food safe, clean and makes the food available only to a specific pet.

Help Received
Stepmom helped type report; Dad helped with sizing of the actuator; Although we already knew a lot about wiring, a family friend taught us about power supplies.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Caroline H. Kim

Project Number
J0212

Project Title
Safe Scratches on CD

Abstract

Objectives/Goals
The objective of this project is to examine how CDs are protected against scratches and markings. The error correction mechanism is pre-studied before this project.

Methods/Materials
Use 30 CDs which are fully recorded with the same data. Then, continue to make scratches on the surface of a CD and test the readability until the data is no more readable. The tests are performed for several types of scratches such as radial scratch, circular scratch, and optical markings.

The materials needed are:
PC with CD-ROM drive
30 Blank CDs
Exacto knife (making scratches)
Permanent black marker (marking)
Acetone (erasing markings)

Results
Experimental results show that a CD's protection against scratches depends on the pattern of scratches. When the scratches are thin and lie in the radial directions, the CD is well protected and the files opened in regular speed. However, with many scratches, reading operation finally stalled. When the scratches are thick or they lie in the circular direction, the files opened slowly, and tended to stall occasionally. Experimental results also show that a CD is very sensitive to markings. However, it returns to its normal condition once the marking is removed.

Conclusions/Discussion
A CD has different levels of protection against different patterns of scratches. It is very sensitive to circular scratches but radial scratches are relatively safe. This agrees with the error correction mechanism of a CD called the interleaving.

Summary Statement
This project examines how sensitive a CD is to different patterns of scratches and markings and discusses the protection mechanism of a CD against scratches.

Help Received
My father explained the protection mechanism of a CD. My school science teacher, Mrs. Miller, helped me with the clarification of hypothesis and also my English mentoring.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Preston D. Neal

Project Number
J0213

Project Title
Which Lubricants Have the Least Friction?

Abstract

Objectives/Goals
To determine which lubricant has the least friction.

Methods/Materials
First, I bought a long strip of sheet metal then cut it into a rectangle. Another metal sheet was cut into five discs, so for each test a new disc was placed on a sanding disc. Then they were screwed onto the sanding disc and that was mounted to a drill press. Four different oils were placed on the sheet metal one at a time, first the motor oil, vegetable oil, baby oil, the synthetic oil, and then no oil. Then I put 0.3cc of oil on the sheet of metal, and then spun it at 3,200 rpm. Once it was spinning I applied about two pounds of pressure. Then once the oil smoked and the drill press stopped that is when I knew it was a stopping time.

Results
The results of my project are that the motor oil got 2 minutes and 1 second, the baby oil got 1 minute and 48 seconds, The synthetic oil got 1 minute an 46 seconds, the vegetable oil got 30 seconds, and the non-oil got 4 seconds.

Conclusions/Discussion
Out of the motor oil, baby oil, synthetic oil, vegetable oil, and no oil, the motor oil was the best. The baby oil was second, the synthetic oil came third, and vegetable got forth and then the non-oil came last. The project worked as planned, but the synthetic oil worked poorer than expected and the baby oil worked better than expected. This could be because the discs were cut with jagged edges so it increased the friction. Or because the end was used and the heat only had one way to go, so the heat had to stay in that spot and while it was heated there, it heated the oil too.

Summary Statement
My project was to compare different oils in a high friction enviorment, to test if synthetic is better.

Help Received
Mother helped type report; father helped set up test; science teacher advised.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Onur S. Olmez

Project Number
J0214

Project Title
The More Pulleys, The More Pull

Abstract

Objectives/Goals
My project was to find out if there were any disadvantages to using pulleys to lift weight. I think when you use more pulleys it gets easier to lift a certain amount of weight, but you pull more string to lift it.

Methods/Materials
Three pulley setups with identical weights but different number of pulleys were constructed. Setup 1 has only one pulley; Setup 2 has two pulleys, and Setup 3 has four pulleys. When the weights were lifted to the exact height, the string pulled on each setup were measured and the each distance were color marked on each setup's string.

Results
The amount of string pulled increased as the number of pulleys in each setup increased. On Setup 1 (one pulley), the distance pulled was the same as the lift height. On Setup 2 (two pulleys), the distance pulled was twice the lift height. On Setup 3 (four pulleys), the distance pulled was four times the lift height.

Conclusions/Discussion
My conclusion is that number of pulleys determine the number of string segments going around them. The number of string segments determine how long the string will be pulled to lift the weight to a certain height.

Summary Statement
My project is about the price you pay when you increase the number of pulleys to lift weights easier.

Help Received
My mother helped to type and to make the tables for my display.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Bryce R. Persichetti

Project Number
J0215

Project Title
Heads Up: A Study on Soccer Head Protection

Abstract

Objectives/Goals
This project is testing how useful head protection is and which type is the most effective. If the head protection is Full90 then the force will be reduced by 50% compared to the unprotected head.

Methods/Materials
One model used for testing made out of plywood which has a 20 oz. hammer attached from it's handle at the top. When hammer is dropped it hits a cylinder block of wood (representing a head) that is nailed to the bottom. A cardboard box partially filled with sand was used to measure the flight of the marble after impact. 1 Full90 headband, 1 Addidas headband, and 1 Addidas beanie cap were items used for testing.

Results
The Full90 headband reduced the force by 52%, the Addidas headband reduced the force by 40%, and the Addidas beanie reduced the force by 43%. 10 trials were counted.

Conclusions/Discussion
The Full90 headband is the best because it is made out of an absorbant material. Thickness is irrelevant because the Addidas beanie is twice as thick as the Addidas headband, yet it only reduced the force by 3% more.

Summary Statement
I tested soccer head protection products to see if they effectively reduced the force compared to the unprotected head.

Help Received
Grandpa helped me build the test model; Mom helped me buy some products and drove me around the city; Dad helped with the testing and his knowledge of Physics; My Computer teacher, Mrs. Utschig taught be how to use Microsoft Excel; My Science teacher, Mrs. McKinney helped throughout the whole

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Logan M. Pike

Project Number
J0216

Project Title
The Workings of an Ancient Trebuchet

Abstract

Objectives/Goals
The purpose of my experiment was to determine the impact on the distance a projectile is thrown from a trebuchet by changing the length of the throwing arm and the mass of the counterweight.

Methods/Materials
I built a 1/7 scale model trebuchet out of popular wood, PVC pipe and metal "L" brackets. I tested the my trebuchet by varying the thowing arm length and counter weight mass to determine what effected the distance the projectile was thrown.

Results
Data from multiple tests indicated that the longer the distance between the axle and the projectile holder (throwing arm length) the greater distance the projectile is thrown. Also in second test, the weight of the counter balance was varried to test the impact on the disance the projectile was thrown. In this second test greater the weight of the counter balance the greater the distance the projectile was thown.

Conclusions/Discussion
The results supported my hypotheses. The further out along the arm you place the release point, further the projectile will be launched. The more weight placed in the counter balance the further the projectile will be propelled. It is possible that there may be a point at which this is no longer is true, and the distance declines, but I didn#t test with enough weight and/or long enough arm to reach that point.

Summary Statement
The purpose of my experiment was to determine the impact on the distance a projectile is thrown from a trebuchet by changing two things, first the length of the throwing arm and second the weight of the counterweight.

Help Received
Mom purchased materials and tools, Dad helped with a small tinker toy model. The staff at Roberts Hardware in Woodside help on material selection.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Mary S. Poletti

Project Number
J0217

Project Title
Wimshurst Influence Machine

Abstract

Objectives/Goals
To first build a reproduction of an 1883 Wimshurst Influence Machine that would produce static electricity without the use of friction. Secondly, to improve on the design of the machine through experimentation.

Methods/Materials
I had a desire to build a copy of a machine that produced static electricity not using friction. I found an article in an encyclopedia dated 1912 that said this machine could easily be built.(It wasn't). I thought the Wimshurst Influence Machine, a machine developed by James Wimshurst in 1883, would be fun and interesting to build.
My machine was built according to the original plans with unvarnished natural wood and exposed brass and metal parts. This machine did produce a faint spark between the discharge terminals. However, I believed that through experimentation and research I could make improvements to my original Wimshurst machine. I wanted the machine to produce a spark that would jump a wider distance between the discharge terminals and one that would be bigger,and louder.
Over a three month time period I made modifications to the sectors, replaced the brass collector combs with brushes, used smaller diameter brass rods, and made and experimented with a variety of sizes of discharge terminals. I also varnished all wooden parts and used shrink tubing on every other part possible to eliminate leakage into the atmosphere, especially on humid days. The first Leyden Jars I made did not work very well due to the aluminum foil being too close together. I double insulated the Leyden jars to prevent shorting between the two layers of aluminum foil.

Results
Because of these modifications, when this machine is operating a person can see an intense white and blue static spark that jumps 1 1/2" between discharge terminals. He or she can even hear the loud snapping sound of that static spark. If the spark or some parts of the machine are touched, a person can feel a static shock and even smell the spark's discharge or the chemical transformation of the oxygen of the air into ozone.

Conclusions/Discussion
In conclusion, insulating the wood and metal parts allowed me to greatly improve the spark produced by my Wimshurst Influence Machine. Changing the surface area of parts and double insulating the Leyden Jars also allowed the original machine to work even better.
This machine is a very good aide for showing static electricity which will amaze and astound.

Summary Statement
To build a reproduction of an 1883 Wimshurst Influence Machine that would produce static electricity and to improve upon the design of that machine through experimentation.

Help Received
Dad provided supervision and built the most difficult parts; I drew up plans and had other parts made by a machine shop, many parts were bought off the shelf; Dad supervised me while I cut and drilled wood frame, routered corners, varnished wood, and used the torch to heat parts.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Cody D. Preis

Project Number
J0218

Project Title
Comparing the Effects of Vaporized Gasoline to Liquid Gasoline in an Engine

Abstract

Objectives/Goals
The objective of my project is to determine if a four-stroke engine will run longer on vaporized gasoline than it would on liquid gasoline. I believe the engine will run longer on the vaporized gasoline.

Methods/Materials
One half a cup of gasoline was vaporized in a pressurized pot and flowed to the carburetion system of the engine through an air line. The engine was started and set to an idle. The engine ran until it stopped, and the time was recorded, the process was repeated several times. Then, a half a cup of gasoline was poured in the gasoline tank of the engine and the engine was set to an idle and the time it ran for was recorded, and the two were compared.

Results
The engine ran off of vaporized gasoline averaged a time of 39.61 and .7 seconds longer than the liquid gasoline engine which averaged a time of 25.14 and 31.7 seconds.

Conclusions/Discussion
My results tell me that my hypothesis was correct and I now know how I can make an engine run longer on vaporized gas. Doing this project also helped me to understand how I can expand on this project by using a car engine and looking for the best mileage.

Summary Statement
Showing how an engine can run longer with vaporized gasoline and be more cost effecient.

Help Received
My father helped me get the materials to conduct the experiments.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Philemon Salib; Ben Schmidt

Project Number
J0219

Project Title
The Effect of Applied Temperature on the Accuracy of a 0.68 Paintball Projectile

Abstract

Objectives/Goals
"How will changing the temperature of a 0.68 paintball projectile (or in the case of the control, leaving it unaltered) affect its accuracy?" was the essential question that we attempted to solve.

Methods/Materials
Materials:
1)CO2-Powered Paintball Marker w/ insulated temperature-controlled hopper (i.e. used to keep temperatures of paintballs from fluctuating due to surrounding environment)2)Insulated Thermal Containers 3)Oven 4)Freezer 5)Zap Deviant 50 Count Paintballs 6)Project vise
Method:
We placed a Tippmann #98 custom paintball marker, adjusted to a muzzle velocity of 280 feet per second, attached a 16-ounce CO2 tank attached, on a stationary project vise. Next we placed a 24# x 24# target, with a black dot placed in the center, exactly 50' from the barrel of the marker. An Aimpoint 1000 sight is placed on top of the gun so that the red dot is positioned directly on the center of the target. Next we prepared the paintballs by placing ten Zap Deviant paintballs in a freezer at 23 degrees Fahrenheit for thirty minutes, an additional ten in a refrigerator at 37 degrees Fahrenheit for thirty minutes, ten in an oven set at 85 degrees for thirty minutes, ten in the oven set at 100 degrees, for thirty minutes, and unaffected room temperature paintballs at 72 degrees that have been sitting at that temperature for 24+ hours. * Once prepared, we loaded the hopper of the paintball marker with ten prepared paintballs. Once this was accomplished, we fired ten shots at the target, with a 30-second rest in between each shot. We measured the distance of each shot from the black dot located at the center of the target. We cleaned the target and retrieved another prepared group of paintballs. We repeated the steps from the * to the previous sentence until all levels were completed.

Results
Our results indicated that the paintballs that reached the highest temperature applied to them landed the closest to the black dot, hence having greater accuracy. We also found out that the unaltered room temperature paintballs performed with the least accuracy.

Conclusions/Discussion
We believe our results to be so based on the particular statement cited in our research regarding a paintball's ability to conform better to the mold of the barrel when heated due to enhanced malleability. This allowed for a more aerodynamic, accurate, expulsion from the barrel. The precautions we took ensured that these results were reliable.

Summary Statement
Our project delved into the depths of accuracy and ballistic applications to the paintball marker and its relative ammunition, the paintball projectile. with the use of temperature as our dependent variable.

Help Received
Timothy McFadden, a local armorer,"watched over" us during testing procedure to ensure that project stayed within legitimate limitations

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Benjamin P. Sheppard

Project Number
J0220

Project Title
The Limit of a Bounce

Abstract

Objectives/Goals
Objective: Find out what effect pressure (PSI) has on the bounce height of a ball.
Hypothesis: I predict that as you add more air pressure into a ball, the ball will bounce higher. At some high air pressure level, I predict that additional air pressure inside the ball will no longer increase the bounce height of the ball.

Methods/Materials
To conduct this experiment, I built a ball drop device that allowed me to consistently control the drop of each ball for my testing. Three different types of balls were tested: a men#s basketball, a women#s basketball and a soccer ball. Each ball was tested at twelve different air pressures, beginning at 5 psi and adding 1 psi of pressure each time to a total of 17 psi. The materials used for this experiment were: plywood, bolts and washers; compass; jig saw; screw driver, wrenches and drill; video camera and tripod; two ladders; balls, ball pump and needle; digital pressure gauge; measuring tape; weight scale.

Results
Each ball bounced higher as I increased the air pressure. I discovered that an air pressure of about 11.5 psi was where the balls began to level off in bounce height. After charting the results of my tests, I noticed that the larger the ball, the higher the bounce. I then investigated the relationship between the ball weight and circumference and the bounce height by charting the results into line graphs to view the relationships. The weight and the circumference of the ball had a consistent effect on the bounce height; therefore these factors didn#t affect the goal of my experiment.

Conclusions/Discussion
My results showed that the men#s basketball bounced the highest, then the women#s basketball, then the soccer ball. Up to the 12-15 psi level, all the balls did increase in bounce height. Above 15 psi, increasing the air pressure didn#t make the balls bounce higher. I discovered that a ball#s bounce height is related to all the factors of air pressure, weight, circumference and drop height.

Summary Statement
I tested three different balls by adding air pressure to them to see what effect the additional air pressure would have on the bounce height of ball.

Help Received
Dad helped me with the design and construction of the ball drop, ran the video camera as I dropped the balls, and taught me how to create charts and graphs in Excel.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Matthew T. Sinsky

Project Number
J0221

Project Title
The Effect of Lubricants on Airsoft Gun Accuracy

Abstract

Objectives/Goals
The goal of this project was fo find out whether or not different lubricants had an effect on the accuracy of an airsoft rifle. An airsoft gun is a realistic, non-lethal, shootinig replica of an actual firearm, which shoots small, plastic BB's. My hypothesis is that the silicon lubrication spray, designed for airsoft guns, will make the gun more accurate than a dry barrel or using simple WD-40 lubricant.

Methods/Materials
I tested this by firing 100 shots for each of the three groups, which were the dry barrel, the barrel with WD-40 sprayed in it, and the barrel with silicon lubrication sprayed in it. Accuracy was determined by measuring the BBs'distance from the center of the target after shooting them from the securely mounted gun.

Results
The results showed that the dry barrel, or control group, had a medium accuracy level, the WD-40 had the highest accuracy, and the silicone had the least accuracy distance because more than half of the shots completely missed the target. I then ran a friction test using a foil-covered book and a plastic box to help explain my results. The friction test showed that the WD-40 had the least friction.

Conclusions/Discussion
Surprisingly, the data I gathered proved that the silicone lubrication was the least accurate of the three groups, and the WD-40 was the most accurate. I figured out that because of Bernoulli's Principle (which states that the greater the speed of a fluid [which in this case the air traveling across the BB], the less its pressure), the BB with less spin would not curve as much, and the WD-40 could make that work. Although my hypothesis was proven to be incorrect, I still learned a lot and it had a very interesting outcome, which may turn out to help others in the future.

Summary Statement
This project tested the effect of lubricants on Airsoft Gun accuracy.

Help Received
Jerome L. Sinsky, M.D. helped with testing and Mr. William Fox helped with statistical analysis.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Cambria L. Ullrich

Project Number
J0222

Project Title
Impact of Change: The Effects a 10 Degree Titanium Driver Has on a Titleist Pro V1 Golf Ball at Impact

Abstract

Objectives/Goals
My project was to see if the repetitive impact of a 10 degree Titanium Driver on a Titleist Pro V1 golf ball would knock the ball out of balance.

Methods/Materials
I took twenty golf balls that were identical in mass and diameter and all rolled straight and true when rolled down a ramp onto an artificial putting green. I numbered the balls 1-20. I then hit ball number one 10 times, I hit ball number two 20 times and each successive ball 10 more times than the preceding ball until I hit ball number twenty 200 times. I then reweighed and remeasured each ball to see if there was a change in mass or diameter. I then rolled each ball ten times down a ramp onto an artificial putting green onto a chalk line to see if they would roll straight.

Results
I found that after the repetitive striking of a Titleist Pro V1 golf ball with a 10 degree Titanium Driver, the ball appeared to be out of balance and did not roll straight.

Conclusions/Discussion
I discovered that the repetitive deformation and reforming of a golf ball caused by the impact of a golf club can move the Center of Gravity from the Geometric Center, thus causing the ball to go out of balance. Golfers may be wise to change their golf ball more often than they think.

Summary Statement
The repetitive striking of a golf ball appeared to knock the golf ball out of balance, so it will not roll straight.

Help Received
Uncle helped build golf ball hitting machine and Father helped build artificial putting green

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Ryan J. Vig

Project Number
J0223

Project Title
What Material Makes a More Resonant Acoustic Instrument Soundboard?

Abstract

Objectives/Goals
The objective is to determine what materials make a more resonant acoustic soundboard for a musical instrument.

Methods/Materials
A test stringed instrument was built with the ability to interchange different soundboard samples to be tested. Eight different materials were mounted on wooden hoop frames, including thick birch plywood, thin birch plywood, galvanized steel, acrylic plastic, tempered masonite, illustration board, rawhide, and untempered masonite. A microphone was mounted to the test instrument to capture the sound. An automatic strumming device was used to strum the strings. A computer was used to record and measure the sound for analysis.

Results
The tested materials produced an initial sound volume in a range of 13 to 48 decibels. The sustained volume at 2 seconds was between 1 to 9 decibels. Thin birch plywood produced the highest initial and sustained volume.

Conclusions/Discussion
My conclusion was that my hypothesis was correct and that the thin birch plywood outperformed the other materials in both initial and sustained volume, thereby producing a more resonant sound overall.

Summary Statement
My project demonstrates and compares the ability of different materials to produce and amplify sound vibrations in an acoustical stringed instrument.

Help Received
My father gave me advice on my design and construction of the test instrument. He also supervised my use of the power tools I needed to build it. My mother helped me with some of the typing and editing.