CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Erik J. Aidukas

Project Number
J0201

Project Title
Does Drumstick Material Affect the Rebound of Drumsticks on the Snare Drum?

Abstract

Objectives/Goals
The purpose of this experiment was to see if there was a measurable difference between the rebound heights of drumsticks on a snare drum according to what material the drumstick was made of. The hypothesis was if man-made materials, such as fiberglass, had more consistent properties (such as optimal balance point and consistent density) than organic materials, such as wood, then the man-made materials would have consistently greater rebound. The independent variable, or cause, was the different types of materials out of which the drumsticks were made. The dependent variable, or the effect, was the height of the rebound off the head of the snare drum.

Methods/Materials
A catapult-type apparatus that mimicked the way a drummer holds the stick and hits the drum was designed and built. The torque was kept at a constant Newton # meter, which was 0.67 N-m for trials 1-5 and 11-15 and 1.00 N-m for trials 6-10, measured at the release point. A digital camcorder was used to record the rebound height against a backdrop of graph paper with a grid size of 2 mm per side of each square.

Results
The material type that produced the highest rebound at 0.67 N-m torque was the Titanium Alloy Fiberglass nylon tip sticks. The Hickory wood tip drumsticks had the highest rebound at 1.00 N-m and they also tied with the Oak nylon tip sticks in the experiment trials that had the collision point offset from the edge of the drum. It was demonstrated mathematically that the effects of gravity were not significant enough to change the conclusions.

Conclusions/Discussion
The varying of the results of the experiments demonstrates there isn#t a clear connecting relationship between material type and the rebound of the drumsticks, despite what various manufacturers state. There were two opportunities for human error in the experimental design, the point of release and the observed high point of the rebound. Removing these problems would remove the high and low extremes, making the data averages more consistent. However, it still may be that there is no constant correlation between drumstick material type and the height of its rebound off the snare drum.

Summary Statement
The purpose of this project was to see if there was a measurable difference between the rebound heights, which contributes to the speed of play, of drumsticks on a snare drum according to what material the drumstick is made of.

Help Received
My teacher supplied lab equipment. My neighbor used his drill press to make the hole in which the drumstick was held. My dad released the drumsticks at the angle I measured. My mom helped glue the elements on the display board.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Zachary S. Bobbitt

Project Number
J0202

Project Title
Massive Impact

Abstract

Objectives/Goals
To determine if the mass of an arrowhead affected the penetration depth of a fixed target.

I believed that as the mass of the arrowhead increased that the penetration would decrease due to the pull of gravity.

Methods/Materials
Using a fixed bow trigger mechanism, an arrow was launched at a fixed target. The mass of the arrow was varied by using 6 similarly shaped arrowheads with different masses. The penetration depth was measured and the experiment was repeated with each mass for accuracy.

Results
Data shows two things; first, I believe that some of my earliest tests were faulty because the 9.6 gr. mass penetrated the target deeper than the other masses. I corrected for this error with the other experiments. Secondly, the data shows that as mass of the arrowhead increases, the penetration increases.

Conclusions/Discussion
My hypothesis has been proven incorrect. According to my data when the mass of the arrow increased, the arrow penetrated further into the target. With 2 of my arrowheads, those with masses 5.8 and 6.5, the experiments did not produce data consistent with either my original hypothesis or the pattern that I observed with the other arrowheads. I have kept these experiments in my project because I want to research more to see what went wrong with these experiments. At this point, I believe that the inconsistent data produced in tests with these arrowheads was a result of human error during early testing that was taken care of during the later tests. I have learned an important law of physics that I did not understand when I started my project. That law is that the force of the arrow which causes it to penetrate the target more is increased when the mass is increased and the acceleration remains constant. F=ma.

Summary Statement
I learned that the penetration of the arrow increased as the mass of the arrowhead increased.

Help Received
Dad supervised building of the bow trigger mechanism.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Peter I.A. Bottlik

Project Number
J0203

Project Title
Boat Stability: What Shaped Boats Are Least Likely to Tip Over?

Abstract

Objectives/Goals
The objective of this project was to investigate the relative lateral stability of boats (or other floating objects) with different cross-sectional shapes. For feasibility, I restricted the cross-sectional shapes investigated to those with the same area and height, top and bottom parallel, and linear sides with angles of #45 (bottom longer than the top), 0, 45, and 60 degrees relative to an axis perpendicular to the top.

Methods/Materials
To determine stability I designed (and built with Legos) an apparatus that allows the application of a torque to a floating cross-sectional shape and measures the degree of tilt. This was difficult. The design consists of a wheel at the center of gravity of the cross-sectional shape with strings going left from the top and right from the bottom. These are then routed over many pulleys to bring them down, on one side of the apparatus, were they are connected together to a bar to which a varying weight (by the use of a container filled with varying volumes of water) is attached. The strings going from the wheel on the cross-sectional assembly to the next set of pulleys need to be level because if these strings are not level they will create a vertical force which would cause the results to be incorrect. The angle of tilt is measured by a protractor attached to the cross-sectional shape.

Results
The 60-degree shape required the most torque to flip. The greater the angle of the sides of the shape, the more stable the shape.

Conclusions/Discussion
The objective of this project to investigate the relative lateral stability of boats (or other floating objects) with different cross-sectional shapes was achieved for the restricted set of shapes considered. The 60 degree shape was the most stable in the sense that it took the most torque to cause it to flip over.
The investigation of other shapes (those with non-linear sides) and the investigation of stability at small angles of tilt would answer the general objective of lateral boat stability in more depth but was not possible within the time constraints of this project, but might well be the objective of another project.

Summary Statement
To determine lateral boat stability for a set of cross-sectional shapes an apparatus was designed and constructed to measure the degree of tilt as a function of torque.

Help Received
Help from Ivan P. Bottlik: Guidance in restricting the scope of the project. Fetching Lego parts to build the apparatus. Help in sawing and varnishing the shapes and procuring material and in threading the strings. Guidance in data reduction and documentation.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Erica P. Ceraos

Project Number
J0204

Project Title
Glass Fracture

Abstract

Objectives/Goals

I hoped to find similar ways in fracturing with glasses at room temperature, freezing temperature, and boiling temperature of water. Since the glass was the same size and thickness, and the same method was used to break the glass, I had high hopes in finding consistency within the same temperature. I hoped to discover some kind of relationship with the glass at different temperatures and with the way they fracture. I hoped to learn and understand glass more in general. For example, I wanted to find out more about what glass was made of and how it was made.

Methods/Materials

For my science fair project, I broke glass. I purchased sixty 4 x 4 squares with 1/16 inch thickness. I drew an X across each glass to show the center of the square. I set up my device made out of a ring stand and PVC pipe and placed the square glass on a designated spot on a piece of construction paper. Before dropping the 20g weight down the PVC pipe, I used a plumb-bob to make sure the pipe was lined up with the center of the glass. Then I would drop the weight. After it broke, I put the pieces of glass back together the best I could and recorded the way it fractured. I repeated this process with glass squares at room temperature (21 degrees Celsius), freezing temperature (-2 degrees Celsius), and boiling temperature of water (100 degrees Celsius). I kept 19 pieces of glass at room temperature, boiled 16, and froze 20. The other 5 were used beforehand to find a method on how to fracture the glass.

Conclusions/Discussion

I suppose I accomplished a lot in my project. I found out that glass doesn#t fracture the same way no matter how many things I controlled to be the same. Even if the glass was the same size, shape, and thickness, you would not find consistency in the way it fractures. I know a lot more about glass and understand it more, too.

Summary Statement

I broke the same type of glass with the same size, thickness, and at different temperatures (room temperature, freezing temperature, and boiling temperature of water) to see if it would fracture the same way.

Help Received

Father helped boil the glasses.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Sheena M. Cross

Project Number
J0205

Project Title
Need Ballistics

Abstract

Objectives/Goals
The object of this project was to determine whether or not the brand of 40 caliber ammunition affects the performance capabilities of the shot.

Methods/Materials
In this project the brands used were called Federal and Corbon. The ammunition was shot through three mediums 1.9 cm plywood which represents a wooden door, two pieces of twenty-guage steel which represent a car door, and saturated newspaper which is a tissue simulant. Each brand of ammunition was shot thirty times through each medium for a total of 180 shots. The performance of the shots was determined by the measurement of penetration, expansion, and weight retention.

Results
The average penetrations for federal were 26cm through plywood, 21cm through steel, and 15cm through newspaper.
The average penetrations for corbon were 23cm through plywood, 22cm through steel, and 16cm through newspaper.
The average expansions for federal were 1.5cm through plywood, 1.5cm through steel, 1.8cm through newspaper.
The average expansions for corbon were 1.8cm through plywood, 1.5cm through steel,and 1.9cm through newspaper.
The average weight retentions for federal were 9grams through plywood, 10 grams through steel, and 9 grams through newspaper.
The average weight retentions for corbon were 9 grams through plywood, 10 grams through steel, and 7 grams through newspaper.

Conclusions/Discussion
Out of all of the averages, corbon performed better on more occasiond than federal. The differences however, were extremely marginal. Therefore, both brands performe very well and one is not much better than the other.

Summary Statement
Does the brand of 40 caliber ammunition affect the perfomance capabilities of the shot?

Help Received
sgt. Van Duesen allowed me to use the sheriff's range to perform my tests;Trevor Bissonnnette gave me a gun handling and safety lesson

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Kiersten E. Dellinges

Project Number
J0206

Project Title
The Ice Cream Platform

Abstract

Objectives/Goals
The "Ice Cream Platform" is a platform that fits around the top rim of a wafar cone. "The Ice Cream Platform" was meant to do two things. To be strong enough to hold an ice cream scoop if it falls off the whole cone, and to hold drips without a leakage problem.

Methods/Materials
I did four different prototypes to complete my invention. For my first prototype, I used a thin piece of cardboard. For my second prototype, I used a larger, thicker, and more suitable piece of cardboard. My third prototype was edible, and baked in the oven. My forth prototype was also baked in the oven, but I curled up the sides of the platform.

Results
My first prototype didn't leak, but was not strong enough to hold the ice cream. My second prototype had no leakage problems and was strong enough to hold the ice cream. My third prototype worked a lot better, but when i drizzled water over the platform, it slid off. And my forth prototype worked the best because of the curled up edges.

Conclusions/Discussion
I am using my forth prototype as my model invention because it did everything I wanted it to do. It is strong, durable, easily used, and edible.

Summary Statement
An edible ice cream platform that prevents your ice cream from dripping and falling off the cone.

Help Received
My mother watched me while I secured the blade into the food processor.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Benjamin Desch; Kevin Woolley

Project Number

J0207

Project Title

Going the Distance: The Effect of Soccer Ball Construction Materials on Performance

Abstract

Objectives/Goals

The purpose of the project we did was to determine which type of bladder material -- latex or butyl-- used in making soccer balls, would make for the bounciest ball. By bounciest, we mean, the balls that would go farthest when kicked. We think that the balls with the latex bladders will travel farther when kicked than the balls with butyl bladders.

Methods/Materials

A total of 18 balls were used: 9 with latex rubber bladders and 9 with butyl rubber bladders. The balls were labeled LA through LI if they were made with a latex bladder and B1 through B9 if they were made with a butyl bladder. A machine was designed and constructed of 2" by 4" boards, metal rods and wood screws to simulate the kicking of a ball and to keep the strike on the balls consistent. We used an artificial turf playing field at Humboldt State University. The balls were placed one at a time in front of the machine. The distance of each ball was measured by the yard markers on the field. A total of 3 repetitions were made for each ball.

Results

The average of all trials of latex bladders is 33.56 yards. The average of all trials of butyl bladders is 31.09 yards. The latex bladder balls average higher than the butyl bladder balls. The latex balls traveled an average of 2.47 yards farther than the butyl balls. When all 54 kicks are ranked longest to shortest distance traveled, out of the top (longest distance) half, 21 are latex and six are butyl. At the bottom (shortest distance) half, 21 are butyl and six are latex.

Conclusions/Discussion

Looking at the average distance comparison, or a ball by ball comparison, the latex bladder balls travel farther than the butyl bladder balls when kicked by the machine. We think the latex balls would travel farther when kicked by people, just like they did with the kicking machine.

Summary Statement

Our project is about comparing materials (latex and butyl baldders) in soccer balls to see which will provide better bounce.

Help Received

Father helped build the machine and helped wiht the computer graphing. Soccer friends, coaches, and Sunnybrae Middle School helped provide balls. Used Redwood Bowl at Humboldt State University for the testing of the balls.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Carolyn A. Ewert

Project Number
J0208

Project Title
Does the Uniformity of a Golf Ball Affect How the Golf Ball Rolls?

Abstract

Objectives/Goals
To determine if the uniformity of a golf ball and straightness of ball's roll are related and can be predicted, so that a golfer can choose a specific brand of golf ball that will roll true when putted.

Methods/Materials
Five types of golf balls were evaluated. Each golf ball was first evaluated for uniformity by floating the ball in saturated salt water and noting if the balls floated randomly, or returned to the same place each time. The golf balls were then rolled on a flat surface and evaluated for straightness of roll. The ball was rolled "parallel" so that the heavy and light side would roll end over end. The ball was rolled "perpendicular" so that the heavy side rolled to one side. Three golf balls of each brand were tested, and each golf ball was rolled three times in each direction. All the information was put on the data sheet.

Results
The Titleist DT was moderately uniform and placed 5th in the rolling test.
The Title HVC had the worst uniformity and placed 4th in the rolling test.
The Wilson True was moderately uniform but rolled the straightest.
The Calloway had the best uniformity but placed 3rd in the rolling test.
The Pinnacle was moderately uniform and placed 2nd in the rolling test.
After evaluating the golf ball by brand, the data was sorted by order of perpendicular and parallel roll.
The initial conclusion, that the Wilson True ball rolled the straightest, was confirmed by each sort.

Conclusions/Discussion
Many golf balls do not have a center of gravity in the geometric center of the ball, i.e. they are not uniform.
None of the golf balls that were tested had a very low deviation in the roll(less than 10 inches). That is, none of the golf balls really rolled straight.
No relationship could be found between a golf ball's uniformity and its rolling performance.
The Wilson True appeared to roll truer than the others.
I believe the roll of the golf ball was influenced by the hard surface of the bowling alley. For future study, I would try to better represent a grass surface. Floating the balls in salt water was a very effective procedure to evaluate uniformity. However, only having three categories to measure the uniformity did not provide sufficient variation to rate the uniformity.

Summary Statement
My project tried to determine if there is a relationship between a golf ball's uniformity and its rolling performance.

Help Received
Parents helped me get materials, sort data, and prepare my board. AMF Westchester Lanes let me use their bowling alley for my rolling test.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Daniel P. Ferons

Project Number
J0209

Project Title
How Loud Is Too Loud?

Abstract

Objectives/Goals
My experiment compares the different volumes produced by playing music on five different stereos. For my project I learned about sound and sound waves. Other topics I studied are how stereo equipment works, sound levels, and decibel levels. This information helped me solve the question: are the volume control dials of compact disk players calibrated the same?

Methods/Materials
The materials and procedures used to test the noise produced by the stereos were:
1) Turn on the Noise Dosimeter and place microphone 2.5 centimeters away from the speaker.
2) Put Linkin Park Meteora, into the Sony compact disc player and play track eleven.
3) Turn volume up to level two and record the decibel levels.
4) Do trials three (3) times for verifying data.
5) Repeat steps three and four at the volumes of four, six, eight, and ten.
6) Repeat steps two through five with the portable Panasonic CD Player, Aiwa Digital Audio compact disc player, Psyc Sony CD player, and the Ford Car Stereo.
7) Record decibel amount, dosimeter lower limit is approximately 70 dB.

Results
The test results showed that the volume control dials of compact disk players are not calibrated the same. The hypothesis was correct and the larger the amplifier, the more noise it can produce. The results also show that playing loud music on the stereo for extended periods of time can cause ear damage.

Conclusions/Discussion
The volume control dials are not calibrated the same on the five stereos that were tested. Similar types of compact disc players and stereos have similar volume ranges. Both of the home stereos exceeded 120 decibels. The two personal CD players had an average decibel level of 68-99 decibels. The house stereo can be played at full volume for fifteen minutes or approximately three songs without causing ear damage. The permissible exposure for over 115 decibels is fifteen minutes. Personal CD players can be played for two to three hours at the highest setting. The permissible exposure is two hours at 100 decibels and three hours at 97 decibels.

Summary Statement
The project determines whether the volume control dial on different audio CD players are calibrated the same and the level of sound intensity produced by each CD player.

Help Received
Father and Mother assisted with typing; Father's work provided the dosimeter

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Shane M. Finley

Project Number
J0210

Project Title
Pellets Count

Abstract

Objectives/Goals
My project was to determine which size pellets in a shotgun shell would have the most concentration of pellets within a 30-inch diameter circle when shot at 40 yards away. I believe that the BB size pellets contained in a shotgun shell casing will have the highest concentration of pellets.

Methods/Materials
I collected two of each of twelve different types of shells to represent the common types of shells that I could choose for duck hunting with my dad. I cut open the casing to count and record the number of pellets in each type. I then drew a 30 inch diameter circle on 12 different pieces of 4ft 8in X 3ft 8in cardboard and labeled each with a different shell type. I put a target on the target stand at the 40-yard marker and cleared the shooting area of people and animals. I used a gun rest for accurate aim and fired at the center of the target with a Remington 1100 12 gauge with modified choke barrel. After each time the gun was fired, I replaced the target. I counted the number of pellet holes inside each target circle and compared the data using a bar graph. For safety I wore goggles and earplugs. Additionally, I calculated the percentage of pellets that hit inside the target area by dividing the number inside the circle by the total number of pellets in the original shell casing count to determine if efficiency was related to concentration.

Results
Some of the pellets cleared the cardboard completely. In each of the 12 experiments, the number of pellets inside the circle was different. The #4 Nitro steel 3 inch mag 1 3/8 oz. Remington shell had 159 pellets hit inside the target which was the highest number of pellet holes inside the 30-inch circle. At 43 pellets, The BB sized Fed steel 1 ¼ oz. 3 inch shell had the least number of pellets hit within the same circle.

Conclusions/Discussion
My hypothesis was wrong because the shell with the BB size pellets had the least number of pellets hit within the 30-inch circle. The #4 Nitro steel 3# mag 1 3/8 oz. Remington shell outperformed the other shells. I will probably use it when I duck hunt with my father. If I had unlimited funds, I would repeat this experiment to make sure the results are accurate. However, my results raise several questions about how pellet size effects scatter efficiency and expense of each type of shell as well as how the construction and material makeup of the shell casing may effect shell performance.

Summary Statement
My project was to find the shell that works in my gun and will kill a duck the best.

Help Received
Dyllan Forbes, John McBeth, Dick Baigi and my dad donated shells. Ronnie Beauchamp let me use his gun rest and his dad let me use his land. Brian Nunn gave me cardboard. My father helped me set up the targets and complete the actual shooting and my mother helped me with some typing and editing.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Daisuke A. Gatanaga

Project Number
J0211

Project Title
How Does the Distance between Dominoes Affect the Speed that Dominoes Fall?

Abstract

Objectives/Goals
My project was to determine how the distance between dominoes affects the speed that the dominoes fall.

Methods/Materials
The dominoes were lined up in the same direction with distances of 0.5, 1.0, 1.5, 2.0, 2.5 3.0, and 3.5cm between the dominoes until they measured 1.5m or 3.0m in a straight line. A stopwatch was used to measure from when the first domino was pushed over to when the last domino touched the ground. There were 10 trials in each condition.

Results
The results show that the speed of the falling of the dominoes is in inverse proportion to an increase of the distance between dominoes. The speed of falling dominoes that has the distance of 0.5cm between the dominoes was fastest in both the 1.5m and 3.0m lengths.

Conclusions/Discussion
The data did not support my hypothesis, which was that the distance of 2.8cm between the dominoes would give the fastest speed. The results showed that the 0.5cm distance between the dominoes was the fastest in both the 1.5m length and 3.0m length. This is because more dominoes fell, causing the dominoes to gradually speed up. Also, the graph shows that any distance shorter than or equal to 1.75cm between the dominoes had the speed of 3.0m faster than the speed of 1.5m, and any distance longer than or equal to 2.0cm had the speed of 1.5m faster than the speed of 3.0m. This is because the more dominoes there are, the faster the speed is because of the weight adding up as each domino falls. And, since more dominoes are needed for lining up a distance of 3.0m, the speed of 3.0m is faster than the speed of 1.5m for any distance between the dominoes shorter than 2.0cm. However, any distance between the dominoes longer than 1.75cm would have a less amount of dominoes, therefore having a less amount of weight added up and because of that, the speed of 1.5m was faster than the speed of 3.0m.

Summary Statement
My project is about how the distance between the dominoes affects the speed that dominoes fall.

Help Received
My parents helped me line up the dominoes and measure the time that the dominoes fell.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
John B. Glaser

Project Number
J0212

Project Title
The Physics of Cheating in Baseball

Abstract

Objectives/Goals
I tried to determine whether cork, sawdust, or rubber balls, when used as fillers in hallowed out wooden baseball bats, will cause a baseball to travel farther in distance upon contact compared to a solid wooden bat (the control bat).

Methods/Materials
My father helped me hallow out three standard bats. I filled each to capacity with one of three substances: cork, sawdust, and rubber balls. I also made a batting device, which held the bat stationary and was attached with a spring to cock the bat back 90 degrees and then release it to hit the ball at the same velocity and position each time. Measuring tape was placed on the ground to mark the spot each ball first hit the ground. There were 25 trials for each of the four bats.

Results
The solid wooden bat hit the ball the farthest with an average of 206 inches after 25 trials. The cork bat hit the ball an average of 205 inches with the rubber ball and sawdust bats hitting the ball the same average of 202 inches.

Conclusions/Discussion
I determined that, given all variables constant except the bat filler, a wooden bat hits a ball farther than the other fillers. I considered the weight of each bat, since the filler changed the weight, but the results did not indicate that weight was a factor. More importantly, the density of the bat was consistent with the results. The sawdust and the rubber ball bats are the least dense and therefore hit the ball shortest in distance. A wooden bat is more dense than a cork, but not by a significant amount.

Summary Statement
The density of the bat is related to the distance a ball will travel, but not to a significant level to allow cheating in baseball.

Help Received
My dad helped me hallow and fill each of the three experimental bats and supervised me making the device to hold the bat. He also helped to determine the distance each ball projected. My teacher helped me organize the board and made sure I properly submitted the paperwork.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Natalie C. Hartman

Project Number
J0213

Project Title
The Velcro-Support Stocking

Abstract

Objectives/Goals
Elastic support stockings are used to treat leg edema (swelling).Many people who need to wear them find it too difficult to apply the stockings.The goal of my invention was the design of a support stocking with a Velcro-closure, which would provide identical compression as traditional support stockings, with added ease of application.

Methods/Materials
Materials included Futuro brand knee-high support stockings (nominal compression 15mmHg at the ankle), a mannequin "right" leg, scissors, a pediatric blood pressure cuff, sew-on Velcro 3/4 inch strips, a sewing machine and cotton thread. The blood pressure cuff was wrapped around the mannequin leg above the ankle, and inflated to a reference pressure of 60mmHg. The stocking was cut 12 inches from the top and placed on the leg. The overlap of stocking edge required to meet the nominal compression were measured and a rise from the 60mmHg baseline, to 70-75mmHg was demonstrated. Velcro strips were then cut and sewn on to permit overlap and closure of the stocking. The Velcro-closure stocking was then retested against the blood pressure cuff to confirm nominal compression range.

Results
Three prototypes of Velcro-strip closures for the stocking were tested, including a single-strip Velcro medial closure, a medial closure with interrupted Velcro strips, and a single-strip lateral closure. The superior prototype was the single-strip medial closure, which provided the nominal pressure above the ankle.

Conclusions/Discussion
The single-strip medial closure was the superior prototype because it provided nominal pressure combined with ease of placement onto the leg. A disadvantage of the single-strip medial closure was the stiffness of the Velcro. Currently there is no flexible Velcro available. Use of a Velcro that mimics the flexibility and elasticity of the stocking's material could further improve upon this design.
Swelling of the legs in the elderly is a common problem, and compressive support stockings offer an inexpensive, safe, and effective treatment. A frequent complaint of the elderly patient is the difficulty of applying the stockings, and consequently they go unused. My velcro-closure stocking would improve the compliance of the elderly in the use of these stockings.

Summary Statement
My product is an improvement upon the standard knee-high support stocking, retaining its traditional therapeutic features while offering simplified application to the user.

Help Received
My mother proofread my reports, and assisted me in holding the leg during testing. My father was the photographer.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Patrick M. Hearst

Project Number
J0214

Project Title
Catapulting Our Way into Science

Abstract

Objectives/Goals
The objective of this experiment is to demonstrate the relationship between the distance traveled for similar shaped round projectiles of different weight, volume, and density.

Methods/Materials
A Scorpion II Catapult Kit was assembled and used to fire 20 identical wooden balls. Then, 9 different types of balls of varying weight, volume and density were fired 15 times each. Distances were measured with a metric rollout measuring wheel. Each of the ten types of projectiles was weighed. Then, the diameter of each of the ten types of projectiles was calculated using a micrometer caliper. This was used to establish the volume (diameter/2 x Pi squared). Next, density was established as weight/volume. The data collected was incorporated into Excel graphs to illustrate the correlation between distance traveled and the weight, volume and density of each of the 10 types of projectiles.

Results
The 20 identical wooden projectiles traveled nearly identical distances. Each of the other types of projectiles traveled a very consistently similar distance. Distances varied, however, between types of projectiles, with golf balls traveling the farthest and ping pong balls traveling the shortest distance.

Conclusions/Discussion
The highest degree of correlation between distances traveled was with density rather than weight or volume.

Summary Statement
This experiment used a catapult to demonstrate whether weight, volume, or density had the greatest affect on how far a projectile traveled.

Help Received
Grandfather helped assemble the catapult and provided digital micrometer. Father assisted with research at UCSD Library and marked landing points. Mother helped shop for display materials and photographed during the procedures.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Tom J. Hiel

Project Number
J0215

Project Title
Will Crash Barrels Decrease the Stopping Force When a Car Impacts?

Abstract

Objectives/Goals
On the roads, yellow barrels are often placed in front of guard rails. These barrels contain a substance that helps with the absorption of stopping forces when a car impacts. Usually, this substance is sand. In this project, I will compare different substances and determine which is the most effective.

Methods/Materials
To test my problem, I built a ramp on which a model car rolls down and bumps into a force plate. In front of the force plate, a small container is placed filled with a substance. I test one solid substance, one liquid substance, one thick gel like substance, and an empty container. When I release the car at the top of the ramp, it hits the container before crashing into the force plate. The container absorbs an amount of force and the force plate records the remaining impact. The data is collected and graphed. Using the results, I will determine which substance is the most effective in absorbing the stopping force.

Results
After finishing and graphing all my experiments, I concluded that air was the most effective substance. The results of all experiments with 1 or 3 barrels show that the impact force was nearly cut in half compared to having no barrels at all. Also the placement of the barriers invariably decreased the maximum impact force. This was true for the impact velocity range imparted by releasing the car from different positions of the ramp.

Conclusions/Discussion
All the data is recorded and graphed. An explanation of the observed results has been developed to explain what the most effective barrel is. My conclusion is that air in an enclosed barrel is most effective.

Summary Statement
In my project, I tested if crash barrels decrease the stopping force when a car impacts.

Help Received
Discussed results with my dad

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Alex J. Jacobs

Project Number
J0216

Project Title
The Physics and "Physiques" of Baseball

Abstract

Objectives/Goals
My objective was to determine if baseball bats, when illegally filled with cork in order to enhance the distance traveled by the ball, gives a baseball hitter an advantage over using approved baseball bat.

Methods/Materials
I researched the applicable physics, and how the corked bats were perviously made. After buying the materials, I assembled the batting machine using the materials listed below. Two altered baseball bats were prepared using the methods explained on the experiment display. Baseballs were placed on the tee, the bat was cocked to its maximum position and released. The ball was propelled into the air. The ground contact point was marked with a wood stake and the distance measured.

Materials (and tools) List: 1) 3 wooden baseball bats; 2) A vise; 3) A workbench with various hand and electric tools; 4) Electric drill motor; 5) Rolled sheets of cork; 6) Rubber bands; 7) Sandpaper; 8) Hand saw; 9) One large piece of plywood; 10) Drywall screws; 11) About 5 #2x4# planks of wood; 12) 2 springs; 13) One spring loaded hinge; 14) A baseball; 15) Batting tee (adjustable height); 16) Steel tape measure (to measure distance traveled by ball); 17) Metal spikes (to secure batting machine to ground).

Results
Using three different types of bats, I batted approximately 25 baseballs with each type bat. The bats used were 1) corked filled 2) rubber filled and 3) unaltered-standard. I was successful in collecting data and recording it to a spreadsheet.

Conclusions/Discussion
Although I observed a slight advantage to corking the bats, it appears that altering the bats does not make a substantial difference. My conclusion is that the reduction in the total mass of the bat (by removing wood and replacing it with a slightly lighter substance such as cork or rubber) undoubtedly increases the velocity of the bat at the point it strikes the ball. This increased velocity provides for a potential increase in energy to be transferred to ball. However, this benefit is offset by the fact that there is a reduction in weight in the section of the bat where it strikes the ball. The reduction of weight in this area tends to make the transfer of energy less efficient.

Summary Statement
My project was to determine if a consistent batting advantage could be substantiated by altering a standard baseball bat.

Help Received
Father assisted in cutting lumber through the use of power tools, and spotting the location of baseballs.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Sean P. Jenvay

Project Number
J0217

Project Title
Collisions: Mass and Inertia. What Comes Down. . . Might Go Up!

Abstract

Objectives/Goals
My objective is to demonstrate, by using a collision and lever system, a direct relationship between the loss of kinetic energy and the inertia of the lever. By altering the mass of the lever and each pair of balls (effort and load), I believe that the inertia of the lever is responsible for the loss and transformation of kinetic energy.

Methods/Materials
Materials include a large grid to measure movement of all projectiles, levers of various mass and length made of iron, aluminum, plastic, and wood, steel balls of 10 different masses (2 of each), an electromagnet to provide an accurate dropping point, and a video camera as a reliable witness. After set-up of the first lever, the first mass is placed on the load end. Electromagnet suspends the second (effort) mass. As the effort hits the lever, the load is projected upwards. Testing is completed when all levers have encountered all masses.

Results
Results are calculated using the formula: mgh (potential energy) = .5mv^2 (kinetic energy). If the amount of energy applied to the lever on the effort side is subtracted from the lever's load side, the loss of kinetic energy will be the difference of the two. My data confirms that a larger mass, unlike a smaller mass, achieves greater resistance (ie., the inertia of the lever) over a lesser mass.

Conclusions/Discussion
The inertia existing in the lever is directly responsible for the loss of kinetic energy between two colliding equal masses. I found that the longer levers provided greater transfer of energy, overall, than the shorter levers of equal mass. The acrylic plastic lever seems to be helped by a "springboard" effect that appears not to be present in any of the other levers. My project gives me a clearer view about the interaction of masses under force. Energy cannot be destroyed or created. It is simply transformed. But where has that unaccounted for energy gone? How can I quantify what seems lost? Perhaps, in my next project.

Summary Statement
My project attempts to demonstrate the transference of kinetic energy from one mass to another through a collision process with a movable intermediate mass, the lever.

Help Received
My father helped me with design, procedure, graphics and calculations of my project; my mother helped with organizing and typing my report.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Ting L. Kelly

Project Number
J0218

Project Title
Fractography: The Way Things Break

Abstract

Objectives/Goals
I wanted to know if brittle materials broke in a pattern, and if so, whether similar materials have similar patterns of breaking. My hypothesis was that each material would break in its own pattern (sizes, shapes and number) and that different thicknesses or sizes of the material would not affect the results as much as different types of material would.

Methods/Materials
My design used 6-10 pieces of each material: textured plastic, acrylic plastic, bathroom tile, regular glass, and textured glass. I would break each piece the same way, by dropping a 1.350 kg ball weight from 1 meter high onto the center of the object. Afterwards, I would measure the angle of each shard, and tally the quantity of pieces from each piece of material. Then I plot the data into a chart.

Results
My results were clear and interesting. The way a material breaks was not random, but had a pattern. More importantly, I also discovered that similar materials did break into similar patterns. For example, both types of tile, patio and bathroom, both broke into 4 or 5 square pieces. The patio tile was almost four times the size as the bathroom tile, but they still produced almost identical results.

Conclusions/Discussion
My final conclusion was that the type of material made a bigger difference for the pattern of breaking than the texture, size or thickness of that material. I learned that each kind of material had its own method of breaking because of the way it is constructed, so similar materials broke in similar ways.

Summary Statement
My project shows how different materials have their own distinct way of breaking and similar materials break in similar patterns.

Help Received
My father showed me how to cut the glass and took pictures of me working. My mother assisted me with using the graphing program.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Shannon N. McClintock

Project Number
J0219

Project Title
The Little Engine That Could: Enhancing Traction through Friction

Abstract

Objectives/Goals
The objective is to find a material which could enhance the traction for a train. Though fine silica (sand) is already employed in certain situations, a different substance might provide greater value.

Methods/Materials
An experimental device was constructed using two abutting fly-wheels to simulate a train and its track. A cycle computer with cable and sensor was used to measure how the application of different materials improved the ability of the wheels to reach a maximum acceleration.

Results
Garnet 100 grit performed most desirably with an average increase in acceleration of 44.87%. Garnet 36 grit also achieved a higher percent than sand (37.93%) with a 39.85% increase. Garnet 80 grit, Garnet 60 grit, Vitreous Smelter Slag 30-60 grit and Vitreous Smelter Slag 35 grit improved acceleration 33.74%, 37.64%, 31.81%, and 29.35% respectively. Vitreous Smelter Slag 16-30 grit and beeswax rendered no successful reads.

Conclusions/Discussion
Garnet 100 grit performed an average 6.94% better than silica due to its high density and fine consistency. It is able to penetrate and fill small crevices in a train's wheels while withstanding the weight of a locomotive.

Summary Statement
The Little Engine That Could (Enhancing Traction Through Friction) addresses the performance of different substances when employed in increasing a train's traction.

Help Received
Father assisted in obtaining materials and assemblance of mechanical device.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Kevin C. McGiffen

Project Number
J0220

Project Title
Investigations into the Art of Hurling: Effects of Trebuchet Arm Length and Counterweight Mass on Projectile Distance

Abstract

Objectives/Goals
My project was to determine how changing the length of the throwing arm and the mass of the counterweight would affect the distance a golf ball could be thrown by my trebuchet. I hypothesized that one of the mid length arms would throw the farthest, and that the 10 lb. counterweight would work better than the 7.5 lb. counterweight.

Methods/Materials
I used a trebuchet of my own design and construction, golf balls, two different counterweights, one 7.5 lbs. and one 10 lbs, and throwing arms that measured 6", 12", 18", 24", 30", 36", and 42" long. I fired ten shots with each arm length/counterweight combination, and measured the distance each golf ball traveled.

Results
On average, the 18" arm threw a golf ball the farthest with both weights. The 10 lb. counterweight shot farther than the 7.5 lb. counterweight with every arm except the 6". The 10 reps for each combination tended to be centered near a certain point.

Conclusions/Discussion
My conclusion is that a beam ratio (length of arm between axle and counterweight to length of arm between axle and long arm tip) of 1:3 can launch a golf ball the farthest. Also, heavier counterwieghts tend to throw farther than lighter counterweights.

Summary Statement
After experimenting with different arms and counterweights for a trebuchet of my design, I found that an 18" arm and a 10 lb. counterweight hurled golf balls further than shorter and longer arms tested and the lighter counterweight used.

Help Received
While building my trebuchet, dad suggested ways to make it sturdier. Mom machine-stitched the seams on the slings. During the experiment, mom marked where the golf balls first hit the ground with flags. Mom also helped with photocopying, some editing, some cutting, and spraying pictures with glue.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Taylor H. Moir

Project Number
J0221

Project Title
The Force Absorbed by the Knees and Hips in Ski Jumping

Abstract

Objectives/Goals
Previously I found that landing on the flats in a ski jump can create as much as 23 g's of force at the ankle. The objective in this project was to measure how much of the force of landing was absorbed by the knees and how much was absorbed by the hips.

Methods/Materials
Two accelerometers using a spring and weight sliding on a steel rod attached to a plexiglass plate were constructed. I then attached these accelerometers above and below each of the joints being studied. Wearing appropriate safety gear, I jumped off a variety of ski jumps and noted the force of landing recorded by each of the accelerometers. By subtracting the force recorded above a joint from the force recorded below that joint I calculated the force absorbed by the joint being studied.

Results
On average 75% of the force recorded at the ankle was absorbed by the knee joints, and 52% of the force recorded at the thigh was absorbed by the hips.

Conclusions/Discussion
The majority of the force of landing in ski jumping is absorbed by the knees. A smaller but significant amount of force is absorbed by the hips. Only a small fraction of the total force of landing is felt by the upper body. The knee is the most commonly injured joint in skiing, and this makes sense knowing how much force the knee must absorb.

Summary Statement
I calculated how much force was absorbed by the knees and hips in ski jumping.

Help Received
My mother helped type my report and helped me set up my project board. My father helped me find background information and helped me design and build my accelerometers.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Skylar D. Montierth

Project Number
J0222

Project Title
Trajectory of a Free Falling Object

Abstract

Objectives/Goals
How do you maximize the distance of an object shot from a trebuchet?

Methods/Materials
Procedure: 1. Measure counterweight, pin angle, and the string length; 2. Pull the counterweight up; 3. Put the arm in the arm holder; 4. Put the gate up; 5. Insert the safety; 6. Put the ring onto the pin; 7. Loosely load the golf ball into the net. Do not embed the golf ball within the netting; 8. Put on release; 9. Take off safety; 10. Stand as far as possible away from the trebuchet, at an angle in front of it and to the side (see Photo 1 for a picture of the trebuchet before shooting); 11. Take off release; 12. Watch and then record distance.
I used these things: 1) Building; i) Wood; ii) Wood Screws; iii) Mesh for Launcher; iv) Plastic Wheels (3); v) Drill Press/Drill Bits; vi) Portable Drill; vii) Power Sander; viii) Opened Wrenches; ix) Tape measures (100 ft and 15 ft); x) Wood Glue; xi) Hammer; xii) Wood Clamps 5
2) To shoot: i) Golf Balls; ii) String (holds launcher mesh); iii) Pennies (counter weight); iv) Protractor used to measure pin angle; v) Pencil; vi) Clip board.

Results
First, I found that if you increased the counterweight you usually get a further distance traveled. Then again you also have a bigger chance of going in some direction that you did not want it to go.For this reason the more weight the more likely it is to fall over and collapse under its own weight. If it is off the ground by 1 mm then the whole shot could be invalid. Second, I figured out that the optimum pin angle was around 80 degrees I know this because all the best shots were around the 80 degrees mark.Lastly, was the string length and I was successful.My hypothesis was supported by showing that the longer the string the further it went because the 8 in string didn#t go as far as the 12 in.

Conclusions/Discussion
My experiment had many twists and turns something that I could have done better on would have been to not put it off until the last month and get it all done with no time to spare. Next I should have gotten a longer string so I could have found the absolute best string length. The following things that went right are that there was barely any wind when I tested the distance. In addition to that my friends were willing to help me when I needed them to carry the trebuchet and materials needed for testing back and forth from the testing location.

Summary Statement
How do you maximize the distance of an object shot from a trebuchet?

Help Received
Father helped my use the power tools

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Courtney C. Moss

Project Number
J0223

Project Title
Can I Make Lead Float?

Abstract

Objectives/Goals
I wanted to see if I could apply Archimedes Principle to something as heavy as lead.

Methods/Materials
Procedures: 1. Collect materials for experiment. I looked for lead sheets, but they were too expensive and transportation was difficult. 2. Do research on Archimedes Principle of Buoyancy and Lead. 3. Calculate the amount of water the lead needs to displace. (For details see Calculations.) 4. Create the Lead Boat: a. I tried to form and pour the lead into a shell, but it would puddle up unsuccessful. b. Shaped into a rectangular container, waited for it to cool and drilled/carved out insides. I could not get sides thin enough, unsuccessful. c. I tried pouring it at several angles. So, it would thin or run out, unsuccessful. d. I tried pouring it into multiple containers including: cast iron, tin, spun aluminum, pressed aluminum, Teflon and steel, unsuccessful. e. Lastly, I tried melting the lead and let it drip from four or five inches above. I let it drip onto aluminum foil wrapped around an upside down eight-inch pie pan. I used aluminum foil because it dissipates the heat easily. Also, dropping the lead from four or five inches up helped the lead to not puddle-up. It made the lead thinner by the time it hit the foil. This was successful. 5. Measure the weight of the bowl. Apply to calculations and check. 6. Then, test to see if it floats.
Materials: 1 cubic inch of lead
 Water  5 by 9 by 3 inch pan  Mapp Torch Aluminum foil
 Screw Driver  Goggles and mask  8 inch pie pan.  Large bowl
 Scale measures in Ounces

Results
Results:I can make lead float. The easiest way to make lead float is to melt the lead and let it drip over the aluminum foil. Let it drip from 4 to 5 inches up. This gives the lead time to thin. The aluminum helps to dissipate the lead. Then, shape into a boat and see it float. This, seems to be the best and easiest way to make lead float. My other attempts were unsuccessful.

Conclusions/Discussion
Conclusion:My hypothesis was correct that I can make lead float. I can make lead float because of Archimedes Principle of Buoyancy. With Archimedes Principle I can make anything float. The Lead boat just had to displace enough water to keep it up. This means it had to displace or push away approximately 15 cubic inches of water, according to my calculations.

Summary Statement
My project is mainly about, applying Archimedes Principle of Buoyancy to lead.

Help Received
I recieved help from my father, He helped me melt and shape the lead. This was because of the dangerous materials we had to deal with.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Rajan R. Murgai

Project Number
J0224

Project Title
Effect of Surface on Speed

Abstract

Objectives/Goals
Do different surfaces affect how long it takes a model car to cross a certain distance?

Methods/Materials
Accelerate a model car down a ramp made of wood covered with styrofoam, and different grit sandpaper (120 grit, 50 grit, and 80 grit). I used sanding belt machine sandpaper because it was long enough that I did not have to make any joints along the length of the ramp. Measure the time it takes the car to go down the incline and compare. I did ten trials for each surface to allow for experimental variation.

Results
The model car went fastest down the surfaces with the least amount of friction and went slowest down the surfaces that had the most amount of friction.

Conclusions/Discussion
I found that the order of surfaces from shortest time to longest time was bare wood, Styrofoam, 120 grit sandpaper, 80 grit sandpaper, and 50 grit sandpaper. Basically the rougher the surface, the longer it took the model car to cover the distance. These results support my hypothesis and are similar to my expectations. I was able to hypothesize correctly based on my observations that when I am on a smoother surface I can ride my bike faster.

Summary Statement
My project is about how different surfaces affect how fast you can go on them.

Help Received
My parents helped obtain materials for the experiment and helped build the project. Mrs. Brooks, my science teacher, gave me overall direction.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Courtney Nash; Tyrone Thames

Project Number
J0225

Project Title
Maglev: Magnetic Levitation

Abstract

Objectives/Goals
The purpose of this science experiment is to demonstrate levitation by magnetic repulsion and the effectivenesss of the Maglev Train in reducing friction while in motion.

Methods/Materials
A simple model of the Maglev Train was created along with a 36-inch long track. The train was tested under various inclination angles, while velocity and acceleration were calculated using the time recorded and the distance.

Results
Magnetic Repulsion caused the train to glide smoothly down the track. The inclination angle was directly proportional to the acceleration of the model. The non-magnetically levitated model did not move until the track was inclined at 45 degrees.

Conclusions/Discussion
The results supported the hypothesis, the levitated model was directly affected by the angle of inclination, doubling for every 2.5 degrees the model was raised, while the other did not begin to move until 45 degrees.

Summary Statement
This project is about the demonstration of the effectiveness of magnetic levitation in reducing friction and the amount of energy needed to produce motion.

Help Received
Dad helped to cut the board and glass; brother helped hold the board while glue was drying; mom bought magnets to use for project

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Nicholas L. Okita

Project Number
J0226

Project Title
Effect of Friction on Objects in Motion

Abstract

Objectives/Goals
This study was conducted to determine whether objects of different materials (but equally weighted) would travel the same relative distance as the material of the sliding surface is changed. The objective was to study the frictional equation: Frictional Force =(Coefficient of Friction)*(Normal Force).

Methods/Materials
The effect of friction was investigated using four surfaces (pressed wood, felt, aluminum foil, and sandpaper). Four objects were used: wood Jenga block, plastic Lego block, eraser, sponge. The weight of each object was made identical using coins attached to the top of the object. Each object was shot across each surface five times for a total of 80 measurements. The starting point and force of the shooting mechanism were constant for each measurement.

Results
Each surface resulted in a different average distance traveled for each object. However, the distance traveled by the objects moving across the surfaces did not stay in the same relative order as the surfaces changed. The objects went the farthest on the smooth pressed wood surface (lowest frictional effect). The relative difference in distance traveled by each object was also the greatest. The sandpaper surface was observed to have the greatest amount of frictional effect based on the shortest distance traveled. Surprisingly, all objects traveled the same distance on this surface.

Conclusions/Discussion
The results indicate that the frictional coefficient is affected by the combination of the object and the sliding surface. Since the relative distance (or order of distance traveled) by the objects did not stay the same, different combinations of objects and sliding surfaces may result in higher than expected frictional conditions. Further, as observed of the rough sandpaper surface, the force to put the objects in motion may need to be increased to a certain minimum level to overcome static frictional effects.

Summary Statement
This project studies the effect of friction on bodies in motion.

Help Received
Minimal help was needed. My parents proofread my report and reviewed my work when it was complete.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Zachary L.T. Patterson

Project Number
J0227

Project Title
Bullets and Phonebooks

Abstract

Objectives/Goals
The goal of my project was to find out what affects bullet penetration the most: velocity, mass or bullet construction.

Methods/Materials
I used 12 variations of the .243 caliber cartridge. Those cartridges were fired at wet phonebooks set up 50 feet away. Each round's velocity was measured by a chronograph. The velocity was determined by the composition of the cartridge.

Results
The result of my project was that mass affected bullet penetration the most. The speed helped to determine this. When a 75 grain bullet went too fast it came apart. But when a heavier bullet such as a 95 grain bullet went at high speeds it could withstand the forces of impact. The construction of the bullet did not have much of an effect. In fact there was only 2.54 cm difference betwewen the two.

Conclusions/Discussion
In the conclusion of my project I have found that weight affects a bullets penetration the most. With more gunpowder I had a steady increase in speed but not a definte increase of penetration. Design did not have hardly any effect.

Summary Statement
I find out what cartridge combination is the most effective for bullet penetration.

Help Received
Father supervised all weapon control, Step helped give thoughts on board, Mom helped type report

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Prem N. Ramkumar

Project Number
J0228

Project Title
Mobility through Materials: Handicapped No More!

Abstract

Objectives/Goals
My objective was to understand how total hip replacement joints worked, and the design factors that improve patient mobility and quality of life. My scientific question was the following: What are the key factors that drive the design of knee and hip replacement joints, and artificial limbs? How do the materials in these designs improve a patient#s mobility and quality of life?

Methods/Materials
Three hip joint tests were conducted using the accelerated test setup in the Los Angeles Orthopedic Hospital (LAOH) test facility, and many ongoing tests were observed. Three UHMWPE acetabular cups and Co-Cr femur caps were used in these tests. Tests were conducted in accordance with the industry standard ASTM F-1714-96 method using the LAOH support fixture, Paul in-vivo loading profile, and cyclic loading equipment. Tests were conducted to be representative of fast jogging at 1.75 Hertz and a maximum load of 4500N. The LAOH bovine fluid was replaced by olive oil for my tests. Volumetric wear of the UHMWRE cup was measured using the LAOH Coordinate Measuring Machine (CMM). The CMM measured spatial coordinates at 300 points on the cup, before and after 500,000 load cycles, to compute the extent of wear. Gravimetric wear was measured using the LAOH test equipment. Testing was recorded using a digital camera. Test results were recorded in an Excel database. Results were analyzed and compared to other LAOH observations and data published in the open literature to draw conclusions.

Results
Test results revealed that UHMWPE (polyethylene) is a very durable acetabular cup material with a mean wear rate of ~ 300 mg/million cycles against a Co-Cr femur cap. These results and data in the open literature supported my hypothesis (the best designs use biocompatible materials that closely match the stiffness and strength of the natural body parts they replace, and improve the wear resistance at the joint location) and identified wear-resistant interfacial materials as the best solutions for hip and knee replacement joints and artificial limbs.

Conclusions/Discussion
Biocompatible materials enable robust design concepts for knee and hip replacement joints and artificial limbs that are impacted primarily by the wear performance of interfacial materials. The days of the wooden leg are long gone and advances in materials technology have mobilized patients to a higher quality of life!

Summary Statement
My project determines, specifically, which two materials in a total joint (the pelvis) replacement can mutually coexist at the interface to yield the least amount of wear, making it a more efficient joint replacement.

Help Received
My parents helped me with the background research, transportation to and from the test facility at the Los Angeles Orthopedic Hospital, and the documentation of my testing. Mr. Bill McGarry helped me set up and run the tests at the LAOH test facility and take wear measurements on the CMM and the gravimetric

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Keven D. Richardson

Project Number
J0229

Project Title
Can You Throw with a Counterweight?

Abstract

Objectives/Goals
My objective is to see if the mass of an object affects how far it travels out of a trebuchet.

Methods/Materials
1 Trebuchet; 1 25 Gram Projectile; 1 50 Gram Projectile; 1 75 Gram Projectile; 1 100 Gram Projectile; 1 900 Gram Counterweight; 1 1200 Gram Counterweight; 1 1500 Gram Counterweight; Measuring Tape; Notepad to Record Data

1. Make sure that the trebuchet works properly and is ready to use.
2. Put the 900 gram counterweight in the counterweight bucket.
3. Launch the 25, 50, 75, and 100 gram projectile 12 times each. Record the distance each time it is launched.
4. Put the 1200 gram counterweight in the counterweight bucket.
5. Repeat step 3.
6. Put the 1500 gram counterweight in the counterweight bucket.
7. Repeat step 3.
8. Find the average distance of all the launches.

Results
I learned that the lighter the projectile the greater distance it would go out of a trebuchet. My results were the 25 gram projectile averaged higher than the 50, 75, and 100 gram projectiles, the 50 gram projectile averaged higher than the 75 and 100 gram projectile and so on. I learned that the more weight the counterweight is the greater distance the projectile will travel. I observed that when I changed from the 900 gram counterweight to the 1200 gram counterweight each projectile went just a little bit farther than before. The same thing happened when I changed from the 1200 gram counterweight to the 1500 gram counterweight, the projectiles traveled just a little bit farther than before.

Conclusions/Discussion
My experiment turned out the way it did because, just like the results proved, the lighter the projectile the greater distance it will travel. My hypothesis was that the heavier the projectile the less distance it will travel, so my hypothesis was correct. The only other thing that I would like to do with this project is make a larger trebuchet and do the same thing I did with this project.

Summary Statement
My project is to see if the mass of an object affects how far it travels out of a trebuchet.

Help Received
Dad helped build trebuchet and measure the distances of the projectiles.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
David S. Rose

Project Number
J0230

Project Title
Pick-a-Pick: A New Tool for Playing the Guitar

Abstract

Objectives/Goals
Guitar players frequently use different thickness picks for different styles of music. During a song or performance, changing different picks or going from finger picking to using a pick takes too long. While playing songs that require faster strumming, picks are frequently dropped. The Pick-a-Pick was invented to allow a guitar player an on-hand choice of three different picks that can be quickly selected while playing, without being dropped.

Methods/Materials
The design was drawn on graph paper. A cardboard model was made. Each guitar pick was cut from various sheets of plastic, using a standard guitar pick shape with a 3 X .5cm long stem extending from the point of the pick. The edges were then smoothed using medium-grade sand paper. Next, a 3/32 inch drill bit was used to create a hole in each of the picks. A plastic washer, (.5cm X .5cm) was placed between the .4mm and .6mm picks. After that, the picks were assembled to a mirror rosette in order of thickness. A (3 X 2cm) piece of hook Velcro and a (11 X 2cm) piece of plush Velcro was attached to the mirror rosette. Finally, a piece of cloth (5 1/2 X 2 cm) was attached to the adhesive back of the Velcro. Materials: (11 X 2 cm) plush Velcro, (3 X 2 cm) hook Velcro, 3.25 inch mirror rosette with stem, cardboard, cloth (5.5 X 2 cm), 0.4 mm vinyl sheet, 0.6 mm polypropylene sheet, 0.9 mm acrylic sheet, 0.9 mm plastic sheet.

Results
The tool worked as designed. The acrylic guitar pick cracked easily while being manufactured and used. A softer plastic was easier to manufacture and more durable; however, the mounting hole stripped easily while in use. Field-testing indicated that buyers would purchase this product if priced correctly.

Conclusions/Discussion
The Pick-a-Pick is successful. It makes quick pick changes and relaxed playing much easier. The prototype was revised to eliminate experimental defects. The original faults were that the strap was uncomfortable, the picks did not stay in place, the 0.9 mm acrylic pick was too brittle, and the stem was too narrow, causing breakage. The revised model includes a wider strap, a plastic washer to keep the picks in place, a softer plastic used for the 0.9 mm pick, and wider pick stems. A future model may include an insert to reinforce the mounting holes on each stem. A nut for the mirror rosette will help to keep the picks in place. Further field testing will determine if additional design changes are necessary.

Summary Statement
The Pick-a-Pick was invented to allow a guitar player an on-hand choice of three different guitar picks.

Help Received
Father supervised safety while manufacturing.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Raymond A. Sarno

Project Number
J0231

Project Title
The Effectiveness of Industrial and Non-Industrial Lubricants on an Aluminum Bearing Surface

Abstract

Objectives/Goals
My question was "Which lubricant will be most effective when applied to an aluminum bearing surface under 25 pounds of force?"

Methods/Materials
To conduct this experiment, I constructed an apparatus to test lubricants on a bearing surface. In this apparatus I included a control unit, a servo motor, displays, and inputs. I built the frame out of aluminum strut. I also wrote the program for the apparatus. To test each lubricant, I removed the weight assembly and applied one of the lubricants to both bearing surfaces and the shaft. I then ran the machine once to spread the lubricant around evenly. I tested seven different lubricants ten times each in this manner. I recorded the "spin-down" time for each trial (spin-down time is the length of time indicated on the machine from the moment the weight is released from the drivewheel to the time when the weight assembly stops spinning). The entire experiment was repeated four times.

Results
On average the most effective lubricant was Vaseline. However, in the first test, this lubricant had entirely spread off the bearing surface after its sixth trial! In subsequent tests greater amounts of each lubricant were used. The next most effective lubricant was Dow Corning 44. The other five lubricants tested also performed relatively well, but were significantly less effective than Vaseline or Dow Corning 44. After the first test, all of the lubricants had higher spin-down times by approximately 1-2 seconds. This was because in subsequent tests I applied more of each lubricant to the bearing surface.

Conclusions/Discussion
Although Vaseline was the most effective lubricant in my experiment, it would not be effective in an industrial setting because it spreads off the bearing surface quickly and would need to be re-applied too often. Dow Corning 44 is an effective all-purpose lubricant which can withstand a wide range of temperatures and pressures. In practice, most industrial lubricants are manufactured for a specific range of applications and vary in their versatility.

Summary Statement
I constructed a computerized apparatues to test the effectiveness of various lubricants on an aluminum bearing surface.

Help Received
Crescent Design Inc. Allowed me to utilize their machining equipment and much of their scrap parts.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Robert C. Schult

Project Number
J0232

Project Title
Let the Sunshine In

Abstract

Objectives/Goals
Many Houses in San Diego have old windows that are very inefficient. There is now other window options. I examined four different configurations of windows to see which one was the most efficient.

Methods/Materials
I used four boxes made from plywood, each with a different window configuration to test their efficiency. By putting the four boxes corner to corner with the window facing in. This creates a center area where the heat source, a 100-watt light bulb, generates heat. The light source was turned on and left for 22 minutes to heat up the center area to a stabile temperature. The temperatures inside the boxes were measured and recorded. There were 10 trials done.

Results
The Low emistivity double paned window was the most efficient followed by the Triple Pane. Next was the double pane window and finally the single pane was the least efficient.

Conclusions/Discussion
My hypothesis was that the triple pane window would be the most efficient, but different results occurred. The Double Paned window with a Low Emistivity coating performed more efficiently than the Triple Pane. Though the Triple Pane had the most panes of glass the Low-E coating on the double pane reflected more of the light that would have other wise heated up the inside of the box.

Summary Statement
The efficiency of different window constructions was examined in my experiment.

Help Received
I thank my Mom for helping me with the backboard and typing the research paper. I thank my Dad for helping with the construction of the window frames and boxes and assisting with the testing. I also thank Milgard Windows for donating the Low-E glass. Last, but not least, I thank Mrs. Gillum for helping me

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Maddie Schwarz

Project Number
J0233

Project Title
A Tap Dancing Machine for the Hearing Impaired

Abstract

Objectives/Goals
I set out to invent a device that enables the hearing impaired and the deaf to appreciate the rhythm of a tap dance, while maintaining a great performance quality for the hearing. I predict that my invention will be successful and that it will be an effective performance tool for both the hearing and hearing impaired.

Methods/Materials
My invention is comprised of a portion for the hearing and a portion for the hearing impaired. The former is made of four plywood boards with drum triggers (a type of vibration sensor) underneath them, which makes a sound on a drum module. The portion for the hearing impaired uses a sensor called the "Light Dancer Interface" and a fluorescent blue lamp that flashes each time a tap is made. To test my invention, I performed on my invention for ten subjects who were unable to hear. I administered two tests: a test of correctly repeated rhythms and a written survey.

Results
I successfully created my "tap dancing machine" with little difficulties, excluding a change in my original diagram. 90% of my subjects were able to correctly repeat the rhythms I tapped on my invention after no more than three tries, so I can conclude that the deaf and hearing impaired could appreciate the rhythm of my tapping after a short period of time. All of my subjects enjoyed the performance, and 80% said they would enjoy my invention in a performance, so overall, my results were positive and were what I hoped for.

Conclusions/Discussion
The results of my invention were positive, overall, and I believe my hypothesis to be correct. I successfully built my invention with hardly any difficulties, and obtained truthful results from my survey. The people who took my survey enjoyed watching the invention in action, and on their surveys, gave me support and suggestions for the invention. I can conclude that this invention is definitely impressive and entertaining for the hearing, and is most likely a great tool for the hearing-impaired and deaf. Future experimentations could include adding separate lights for each board, possibly in different colors, separating the boards so that a different dancer could be on each board, and performing with my invention for a deaf audience.

Summary Statement
I created an invention that allows both the hearing and hearing impaired to appreciate tap dancing to its full value, by providing an electronic drum sound and a flashing light for each tap.

Help Received
Tap teacher helped with wiring and preliminary invention; electrician helped create diagram and find parts for invention.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Jesse D. Thomas

Project Number
J0234

Project Title
Paintball Accuracy Test

Abstract

Objectives/Goals
To find out what paintball brand is most accurate and by how much.

Methods/Materials
I used my F-4 Illustrator paintball gun with a four stage expansion chamber and stock barrel with a twenty oz. CO2 tank to shoot five rounds of different types of paintballs four times at 30 ft. and 60 ft. for a total of 40 shots for each brand. I mounted the gun on a stable stand so it would not move when I shot it. The target was white poster board with a ruler and a square.

Results
I found that the more expensive paintballs are more accurate at both 30 and 60 feet than the less expensive ones. This was my hypothesis so this experiment proves it correct.

Conclusions/Discussion
I have concluded that Chronic is the best brand of paint by my analysis above.The data collected suggests that circumference and correct fit in the barrel play a role in accuracy. Weight may also contribute to accuracy with heavier paintballs being more accurate, but it is hard to tell because weight differences are slight.

Summary Statement
What brand of paintball is the most accurate?

Help Received
My dad replaced the poster board after I shot the groups of paint at it.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Jeffrey T. Wilfong

Project Number
J0235

Project Title
Splatter Patter: Development of a Single Use Sunscreen Applicator

Abstract

Objectives/Goals
To develop a single use sunscreen applicator that prevents contamination of hands and eyes, yet still allows adequate sunscreen to be applied. The name Splatter Platter was picked based upon how the single use applicator is used. Original ideas for the design were tested and improved upon.

Methods/Materials
Several iterations of the applicator were developed using materials such as cotton, gauze pads, felt, tape, and foil. Sunscreen purchased at a store was also used.

Results
The Splatter Patter works great! Testing and improving upon several designs resulted in a single use applicator that makes it possible to apply sunscreen without getting it on your hands or in your eyes. Problems such as how to evenly distribute the sunscreen in the applicator and how to prevent drying or leaking of sunscreen were solved by experimenting with different materials and design approaches.

Conclusions/Discussion
Sunscreen should be used by anyone who is out in the sun for long periods to prevent sunburn and long-term problems such as skin cancer. Today many people do not like to use sunscreen because it can be messy to apply, getting on your hands and in your eyes. Large bottles of sunscreen are also inconvenient to carry around. I believe that a single use sunscreen applicator will encourage people to use sunscreen because having a single use applicator will make applying sunscreen quick, easy, and clean. A single use applicator can also be easily carried in a pocket or purse.

Summary Statement
Development and material selection of a single use sunscreen applicator.

Help Received
My Mother helped me type my report, and my Father helped me with the drawings and putting the display board together.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Erik W. Young

Project Number
J0236

Project Title
Flying Trains: Magnetically Levitated Transportation

Abstract

Objectives/Goals

Objective
Make a magnetically levitated model train move on it#s own using magnetic forces.
Hypothesis
If the electromagnets on the track are pulsed in a certain direction, then the train should move on it#s own in that direction.

Methods/Materials

In this project I went through several designs, all of which had certain design flaws such as tipping, not moving, etc. Only my fourth design actually moved the train down the track. It consisted of 48 hand wound electromagnets, 10 ft. of large copper wire, and two six-foot boards.

Results

Based on prior research I first tried making a car according to a procedure that had already been done by someone else, with the car sitting in a flat-bottomed trough. I then thought about how real maglev trains work, with the track shaped like an upside-down #T#. I then decided to expand on the ideas above and modified my track and train. I then saw that the foil was not giving very good contact to that brush on the train, so I tried flattening some copper wire, sticking it down through the board and winding the positive wire from the electromagnets around the bottom.

Conclusions/Discussion

In my first design I was able to levitate my car, but, if I gave it a push, it would immediately tip over. In my second design, the upside down #T#, I was able to levitate the car. In my third design, the automatic switching of the electromagnets by the car was partially successful; it only worked when everything was set up just perfectly and it got just the right starting velocity. In my fourth and final design, I think it worked very well because the electromagnets were closer together so that the train only had to boost itself half the distance than before.

Summary Statement

In this project I atempted to make a model Maglev train move by itself using magnetic forces.

Help Received

My Dad helped develop some of the designs. He also helped wind the electromagnets and he covered all expenses