CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Armen S. Arslanian

Project Number
J0201

Project Title
Is Plywood Stronger than Solid Wood?

Abstract

Objectives/Goals
The purpose of this experiment was to prove that solid wood is stronger than plywood.

Methods/Materials
An experiment was designed, consisting of two tests, Torsional Resistance and Cantilever Deflection , with ten trials for solid wood and ten trials for plywood. In the Torsional Test, the angle and weight at which the wood was broken were measured, while in the Cantilever Deflection, the amount of deflection and the amount of the weight which caused the wood to be broken were measured. Both tests relied on an experimental setup consisting of test bars and a clamp that held wood samples to the test rig. The wood samples broke according to the amount of weight applied, measured by the spring balance.

Results
The data for both tests indicated the same result, that solid wood is stronger, requiring more weight to break.

Conclusions/Discussion
Anything using solid wood would be stronger than plywood and less likely to break. Solid wood is more homogeneous and therefore has higher resistance to torsion and deflection. Some factors could have affected my results such as the irregularities in the formation of the plywood. If I were to modify this project, I would use shorter samples so that they fail at a smaller angle of torsion and smaller deflection. I would also use multiple kinds of composite wood.

Summary Statement
Solid wood is stronger than plywood.

Help Received
Dad helped with the setup.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)

Beau Bayless; Trevor Foss

Project Number

J0202

Project Title

How Does Changing the Air Pressure of an Air Gun Affect the Average Speed of the Pellet?

Abstract

Objectives/Goals

Objective- Our objective was to find how changing the air pressure of an air gun affects the average speed of the pellet. We thought that if you double the air pressure, the average speed will double, if you triple the air pressure, the average speed with triple, and so on.

Methods/Materials

Materials and Methods- We constructed an air gun that would shoot pellets at variable pressures through a barrel with a sensor at the beginning and the end. Then we set the pressure to 100 psi and fired the air gun. Then we recorded the time that the pellet took to pass through the first and second sensor and used the formula Speed=Distance/Time, to get the speed. Then we repeated those steps four more times and we averaged the five speeds. After that we repeated that procedure, increasing the air pressure by 100 psi each time until we reached 500 psi.

Results

Results- Our graph shows the average speed for each of the gas pressures. For 100 psi the average speed was 58 meters per second, 200 psi produced 77 mps, 300 psi produced 95 mps, 400 psi produced 105 mps, and 500 psi produced 109 mps.

Conclusions/Discussion

Discussion- We concluded that our hypothesis was wrong in the saying that doubling the psi would double the average speed. However, we discovered that although increasing the pressure increased the speed, as the psi increased, the increase in the average speed decreased. Between 100 psi and 200 psi the average speed increased by 18.6 mps, but between 200 psi and 300 psi the average speed only increased by 17.9 mps, between 300 psi and 400 psi the average speed increased by 10.8 mps, and between 400 psi and 500 psi the average speed increased by 3.4 mps. We think we got these results because the greatest change in pressure is between 100 psi and 200 psi. 200 psi is twice the pressure of 100 psi. 300 psi is only 1.5 times as great as 200 psi. 400 psi is 1.3 times as great as 300 psi and 500 psi is 1.25 times great as 400 psi. So the increases in pressure were also proportionally less. Our experiment is important because it tells people how fast their airsoft guns shoot. People can use this because most airsoft gun's speed is a guess based on distance and impact. This experiment can tell people how fast their airsoft guns really shoot and if airsoft manufacturers are lying about speed to increase sales.

Summary Statement

Our project is about how changing the air pressure of an air gun affects the average speed of the pellet.

Help Received

Trevor's dad helped sauter the wire board.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Danielle M. Behrens

Project Number
J0203

Project Title
Distances a Catapult Can Propel Spheres of Differing Mass and Density

Abstract

Objectives/Goals
To determine the farthest distance a catapult can propel a sphere.

Methods/Materials
Eleven spheres of differing mass and density were tested in a custom built catapult. Spheres were loaded into the catapult one at a time and propelled out along a tape measure where a spotter identified and called out the distance. Before testing all the spheres, the median weight sphere was chosen to test and improve catapult repeatability. Design modifications were made that reduced the variability in shot distance by ten times. This repeatability improvement turned out to be critical in determining the distance ordering of the spheres. The other ten spheres were then also tested with 25 shots each and the distances recorded.

Results
The 5 g marble went farthest for a single shot, but on average the 18 g marble went the farthest.

Conclusions/Discussion
I hypothesized that the golf ball would go the farthest, but at 46 g it was too heavy and only went 67% of the distance of the 18 g marble. The 5 g marble with a diameter of 1.6 cm was too small for the 3.1 cm throwing cup so it had poor repeatability. To deal with this problem I would make a series of several smaller nested cups so smaller spheres would not roll around in the cup while being fired. I would also like to find the ideal mass for this catapult by testing with 10 and 15 g spheres to refine my conclusion that the ideal mass is between 5 and 20 g.

Summary Statement
A catapult was custom built and improved for repeatability before shooting spheres of different mass and density to determine which would go the farthest.

Help Received
Dad helped design & build the equipment. Mom helped run the experiment. Dad helped in the data analysis & presentation.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Alex R. Bennett

Project Number
J0204

Project Title
Need for Speed: Optimization of a 1:18 Scale Radio Controlled Car for Speed

Abstract

Objectives/Goals
The objective of this project was to determine the effect motor design, gearing, tire design and car weight on maximum speed achieved with 1 1:18th scale model car.

Methods/Materials
A standard electric motor containing brushes was compared to a brushless electric motor in a Team Losi Mini T Pro- 1:18th scale electric car. Weights were attached to the car body using velcro strips. Different size pinon gears and tire designs were also tested. Maximum speed of the car with the different variables was determined in a flat parking lot using a radar gun. Multiple replicates were performed for each variable and a Student's t test was used to determine statistical significance.

Results
The car was significantly faster with the brushless electric motor compared to a motor with brushes. Adding weight to the car did not have a major effect on maximum speed of the brush containing motor but did have an effect on the maximum speed of the car with the brushless motor. Tire design also had a major effect on the maximum speed of the car, with soft rubber tire achieving a higher speed than a hard foam tire. Finally the size of hte pinion gear also had an effect on maximum speed, with larger gear producing the higher speed.

Conclusions/Discussion
The variable which had the biggest impact on the speed of the car was type of electric motor, followed by tire size and design, followed by gear size and then weight.

Summary Statement
The purpose of this project was to explore which of the many variables that go into designing cars had the biggest impact on maximum speed of the car.

Help Received
Father helped make measurements and proofed report.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Chris D. Botts

Project Number
J0205

Project Title
A Comparison of Bridge Type and Bridge Strength

Abstract

Objectives/Goals
This project was done to test the strength of various types of bridges including the arch, cantilever, and suspension bridge.

Methods/Materials
To conduct the experiment I built three bridge types. The bridges were constructed out of Popsicle sticks and Styrofoam. I tested the strength of each bridge by placing rectangular cinder blocks on each bridge until it broke.

Results
In the end, the arch bridge held the most weight. I think this is because the arch bridge has more support on the base.

Conclusions/Discussion
Each bridge has a specific role to play based upon its location, but there are some areas where different bridge types could improve safety. Since the Arch Bridge can not span long distances without the arch losing its strength arch bridges should be placed in more small areas.

Summary Statement
My project was about testing the strength of major bridge types and the experience of engineering

Help Received
My mother helped cut and paist and father helped carry bricks

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Amanda B. Castilo

Project Number
J0206

Project Title
Goal! Can You Handle the Pressure?

Abstract

Objectives/Goals
Show how different inflation levels affect the distance that a soccer ball will travel when it is kicked.

Methods/Materials
First, we made a large pendulum using 2 ten foot ladders and a sledgehammer taped onto 1# electrical metallic tubing. The ball was hit ten times for each air pressure; 3 psi, 8 psi, 14 psi. Record the distance at where the ball first hits the ground.

Results
Although the inflation levels were different, the distance that the soccer ball traveled stayed in the range of 25#-0# to 30#-0.#

Conclusions/Discussion
The ideal air pressure for a soccer ball is 6-8 psi. Higher inflation levels may make the ball travel further but it doesn#t make a big difference. I think acceleration is a bigger factor in making the ball travel further.

Summary Statement
Changes in inflation levels does not adversely affect the distance a soccer ball travels when kicked.

Help Received
Mr. Dettmer, advice on how to eliminate variables.; Dad helped me set up the pendulum ; Mom recorded measurements; Sister retrieved balls hit.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Foster D. Collins

Project Number
J0207

Project Title
Urban Solar, Year Two: Dual-Axis Panel Tracking Tests

Abstract

Objectives/Goals
Last year, a single-axis photovoltaic panel steering system was built, which demonstrated large power output advantages compared to fixed panels for any given day. That led to a proposed new rooftop tracker product concept, for which, a dual-axis system would be better; so that similar improved output efficiencies can be gotten all year as the sun elevation changes. This year, the objective was to test the accuracy of a new design for a dual-axis tracking system which uses the calculated positions of the sun to know where to steer; so that the cost of such a product could be reduced by eliminating the need for any sun angle sensors.

Methods/Materials
A new dual-axis steering system was designed and constructed using Lego pieces and programmed using the Lego MindStorms NXT controller. To be able to measure how well the tracking worked during each test, a special panel was built with four small solar cells positioned around a center shadow column; so whenever the panel was not pointing perfectly at the sun, a shadow reduced the voltage produced on at least one of the solar cells. The voltages were recorded with a 4-channel data acquisition system to provide graphs of the accuracy of the steering system.

Results
The test setup had several design and construction problems including: cracking of fragile solar cells, too little programming memory, too low recording resolution, and too much drive gear backlash. After serious accuracy problems in the initial testing led to extensive redesigns and rebuilds of several system components, the last 2 of the 10 test days produced good results.

Conclusions/Discussion
The final graphs document the excellent accuracy of the astronomically positioned, dual-axis, solar panel tracking system and the feasibility of reducing the cost of higher-output rooftop solar trackers.

Summary Statement
In order to get last years high output advantages over an entire year, a new dual-axis solar panel tracking system was created using Lego components; and then proven during tests to steer accurately using calculated sun positions.

Help Received
Father helped with panel design/building, algorithm calculations, calibration procedures, photos, and display board; Engineer friend, Selena Forman provided some LabView/NXT software language instruction; Engineer friend, Conrad Lindberg created schematic for power amplifier.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)

Satyaprit Das; Ashu Shrestha

Project Number

J0208

Project Title

How Much Energy Is Lost to Friction?

Abstract

Objectives/Goals

Hypothesis: Friction constitute most of the resisting energy of the motor
Objective is to Measure how much energy is lost to Friction in a Motor
Assumption: Rotating motor has a resisting force acting against it in the opposite direction (Rotational Friction)

Methods/Materials

Method:
- Bring out the stripped hard drive, tachometer, D.M.M, paper clip and the power supply. Straighten out the paper clip, and then cut off two inches off the paper clip. After that is done, shape the paper clip in U-shape.
- The power supply will have many cables, use the biggest cable, and then plug in the paper clip at the top where the green wires is and the black wire diagonal from it. Then connect the wire that reads p-3 into the hard drive.
Bring out the black construction paper and trace the hard drive disk onto the black paper. Draw two propellers onto the black construction paper. Cut out the propellers that you have just made. Later, there will be the rest of the paper disk that#s left over. Cut the part out.
- Assemble the disks back together. While the disk is spinning, point the tachometer at the disk.
- Find out the weight of the motor and discs, which is equal to mass. Record you results. Next, find the velocity or RPM (Rotation Per Minute), record your results. Then plug the Mass and Velocity in to the equation K(Kinetic Energy)= 1/2m(Mass)v(Velocity)^2
Materials: - 400 watt Power Supply, Stripped Hard Drive, Tachometer, Reflective tape, Black construction paper, Tape, Screw driver set, Compass, Ruler, D.M.M.(Digital Multi Meter), Stopwatch, Calculator, Scale, 1 Paper Clip

Results

Rotational Kinetic energy of the running motor is the energy lost to friction. Angular velocity = Omega (Ѳ)/t Where Omega (Ѳ) = angle traveled, t = in time t, Rotational inertia = Ѳ/t. Per the experiments the Results are: Work/second = 9.81 joules per 4 seconds, That equals 2.425 joules per second or 2.425 watts.

Conclusions/Discussion

- Our hypothesis is correct i.e. Friction constitute most of the resisting energy of the motor
- Every second the motor runs, it uses 2.424 joules of energy in the backward direction

Summary Statement

Our project was to find out how much energy is lost to friction when it opposes motion in angular direction.

Help Received

Both parents drove us to the destination, and both dads helped do a practice judging. Satyaprit's dad helped get materials and wirte report.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Alex M. DiFante

Project Number
J0209

Project Title
Supporting Bridges

Abstract

Objectives/Goals
Does the weight on a Bridge affect the amount of shaking it endures during an earthquake.

Methods/Materials
Materials: Five Steel Wires, Solder, Flux, Butane, Butane Torch Saw, Two Bricks, Ruler, Electric Motor, Wire, Steel Bar, Drill, Drill bit, Batteries, Weights, Tape, Pencil, Paper.
Procedure:
Cut steel wires to length
Solder wires together
Drill off-center hole in bar
Slide bar on motor shaft
Connect wires to each motor terminal
Support bridge with bricks on each end
Tape on motor and battery
Set 100g on bridge
Put ruler up to bridge and measure from ground to bottom of bridge, record
Connect wires to battery terminals to start shaking
Measure Lowest and highest height, record
Take off 100g, repeat with each interval of weight

Results
First trial I placed 100g on my bridge, it flexed down to 18.9cm. lowest shaking height was 18.4cm as well as the highest being 19.3cm. Second trial starting was 18.7cm the lowest shaking height was 18.3cm and the highest was 19.0cm. Third trial where I placed 200g start 18.5cm lowest shaking height was 18.1cm highest being 18.7cm. last trial 250g on bridge, 18.3cm lowest shaking height 18.0cm and the highest was 18.5cm.

Conclusions/Discussion
My hypothesis stated, If I shake a bridge with different amounts of weight on it and measure the flex, then I believe there will be less bending when there is more weight on the bridge. The data showed increased weight led to less shaking. With 100 grams there was 0.9cm of shake. With 250 grams there was 0.5cm shake. The experiment was a sucess proving the hypothesis.

Summary Statement
How does the weight on a Bridge affect the amount of shaking it endures during an earthquake.

Help Received
n/a

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Graham M. Francis

Project Number
J0210

Project Title
Tensile Strength of Wood

Abstract

Objectives/Goals
The main reason I did this project was to test which wood is the strongest. This is valuable for construction and/or recreational purposes.

Methods/Materials
In my experiment I had a control group that consisted of: temperature, humidity, elevation, air pressure, length of wood, length of wood being supported by the work bench, height from the floor of the work area to the platform tare. I gathered the equipment: steel weights in varying increments; 3 ft pieces of poplar, redwood, oak, maple, and douglas fir; an inches tape measure; a tare made of wood, chain, and a s-hook; graph paper; pencil; and an I-bolt. I set up a rig with a consistent length of unsupported wood and a consistent length of supported wood on a three foot piece of wood. I changed the independent variable, weight, by either adding a weight or taking one off and adding a heavier one consistently rising by 5 pounds. To measure the dependent variable, distance from the ground, I simply measured the distance from the ground to the lowest point of the wood with the inches tape measure. I recorded my results for every five pounds. I then followed the same procedures for the four other types of wood until they splintered or broke. .Because of the destructive nature of the experiment and the high cost of materials the test was only run once per wood type.

Footnote: Originally the experiment was preformed with six foot lengths of wood. However the wood flexed and reached the floor before they reached a breaking point.

Results
The maple broke at 130 lbs making it the strongest. The oak fractured at 100 lbs making it the second strongest. The poplar snapped at 90 lbs. Douglas fir broke at 65 lbs and lastly, redwood, the weakest, splintered at 35 lbs.

Conclusions/Discussion
My experiment showed what I had hoped it would show. Harder woods can hold more weight, but that does not mean a hardwood is always the wood to use. The wood used depends on the strength needed. Although redwood broke first it is still a very popular wood for fences because it is durable enough and inexpensive. If furniture is the final product, oak and maple are popular choices.

Summary Statement
I evaluated the tensile strength of five common wood types.

Help Received
Mother help jot down data. Father helped apply weight to wood.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)

Cameron Fuller; Adam Goldman

Project Number

J0211

Project Title

How the Materials of Bushings Affect a Skateboard's Turning Performance

Abstract

Objectives/Goals

The goal of this project is to determine how much the material of a skateboard#s bushings effect its turning performance.

Methods/Materials

Eight bushing pairs made from different plastic materials, manufactured for consumers, machined from industrial products and home cast from molds, were tested to compare turning performance. All were tested in a skateboard, weighted to turn on a 30 foot by 40 foot gradually sloping grid. Securing straps and registration marks ensured identical testing conditions. A secured rolling chalk device trailed and marked the skateboard#s path. Paths were photographed and plotted on a grid. The compression of the bushings, indicated by the path#s curve, was compared with manufacturers Durometer rating specifications.

Materials:Urethane casting rubber, Urethane casting systems, high strength silicone rubber, silicone casting rubber, Hapol sanding resin, Epoxy, Urethane, Doh-Doh bushings, UHMW Polyethylene rod, popsicle sticks, plastic measuring cups, gas masks, goggles, latex gloves, camera, skate board, plastic box, bungee cords, 50lb sand bag, wood plank, rolling chalk marker, ladder, string, fan, putty, muffin tin, data sheets, graph paper, pencil, tape measure, Chalk line, sticks and powder, Duct tape.

Results

All of the bushings manufactured by the same company performed consistently with their ratings, but only in relation to one another. Polyurethanes tested varied the most in hardness, one being among the hardest, another the softest.

Conclusions/Discussion

The results suggest that plastics, polyurethane in particular, range in hardness, depending on their formula, and, contrary to expectation, a (poly)urethane with a lower hardness value performed as if it were much harder than one with a higher value. With all the data about plastics: specific gravity, density, and tensile strength, the hardness value or Durometer rating was the only specification consistently available for each material tested. Turning performance is greatly effected by the bushing material, but the Durometer rating is, apparently, not the only determining factor.

Summary Statement

This project tests how the materials of skateboard bushings affect a skateboard#s turning performance by using a chalk marker to trace the path of a weighted skateboard that is rolled down a hill several times each with a different set of b

Help Received

Mother provided transportation, supervised resin casting of volatile substances

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Ramon Gomez Jr.; Sergio Ramirez

Project Number
J0212

Project Title
Trebuchet 3... 2... 1... Fire!

Abstract

Objectives/Goals
The purpose of this project is to build and construct a trebuchet to experiment and test certain variables to hit certain targets. Along with those things we have to put together a technical paper and make a display board to show data, graphs, photographs, and drawings. One of the two tasks is to see which trebuchet can throw the projectile the furthest distance. The other is to see which trebuchet has the most accuracy to throw the projectile the closest to two ground level targets.

Methods/Materials
The materials we used to test the trebuchet#s performance were wood, dental floss, sand, PVC tubing, a plastic container, 2 hula hoops, safety goggles, a meter stick, and material (hackie sack). The procedures that we followed: Vary the length of the string from 60 # 90 centimeters. Change the angle of the hook from 30-90 degrees. To hit the target we adjusted the sling length and hook angle. According to our results, when the sling length was shorter, the projectile went a further distance. We also predicted that if the hook angle was acute, then the projectile would travel a further distance. When we adjusted the hook angle to 45 and 60 degrees, we got the best results.

Results
While we were analyzing the data we saw interesting things. One thing we observed was that the best fulcrum height was exactly what the best sling length was. We also thought of an idea that could help our trebuchet be more efficient. All the things we hypothesized were correct, except for when we believed that the higher the fulcrum, the farther the projectile will travel. After looking at the results, we recognized that our machine was not very efficient. Its efficiency was 22.5%. Instead of fixing the old machine, we decided to make a new one.

The new and improved trebuchet was a success. It hit both of the designated targets and threw the projectile about 12 to 13 feet. We saw that the machine was very efficient and worked amazingly well.

Conclusions/Discussion
In conclusion, our hypothesis was correct for our second machine. According to our results, when the sling length was shorter, the projectile went a further distance. We also predicted that if the hook angle was acute, then the projectile would travel a further distance. When we adjusted the hook angle to 30, 45, and 60 degrees, we got the best results.

Summary Statement
To construct and test a trebuchet by using the specified measurements and materials that will allow the projectile to travel the furthest distance and hit the 6.25m and the 10m level targets.

Help Received
Mom provided materials, Teacher helped in construction of the device.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Katherine A. Hudgens

Project Number
J0213

Project Title
Frenetic, Kinetic Coaster

Abstract

Objectives/Goals
This experiment discovered if the density of a sphere had anything to do with the speed it traveled or if the height that a sphere was dropped from caused the sphere to go a farther distance and which combination converted the most potential energy into kinetic energy. The hypothesis stated if the most dense sphere was dropped from the highest height then it would go farthest, fastest and convert the most potential energy into kinetic energy.

Methods/Materials
A model roller coaster with a drop, loop, and two hills was constructed from foam tubing. Spheres of varying densities were dropped from 1m, 1.5m, and 2m several times. Distance traveled, time elapsed, speed, potential energy, and kinetic energy were recorded, calculated and compared.

Results
Spheres dropped from 2m traveled farther than the spheres dropped from lesser heights. From all three heights, the least dense sphere traveled farthest. The sphere with medium density traveled fastest and converted the most potential energy into kinetic energy.

Conclusions/Discussion
Parts of the hypothesis were correct and others were incorrect. The height a sphere was dropped from influenced the distance it traveled. Spheres dropped from 2m traveled the farthest distance as predicted in the hypothesis. However, the sphere dropped from 2m did not have the fastest speed or convert the most potential energy into kinetic energy disproving two parts of the hypothesis.

Summary Statement
Density, friction, speed, distance, starting heights and conversion of potential energy into kinetic energy all must be considered when designing a roller coaster.

Help Received
My parents bought supplies and helped with the construction of the roller coaster. My brother took pictures. My aunt and my grandpa proofread my final report.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Monique C. Iuster

Project Number
J0214

Project Title
Which Web Withstands Weights? The Application of Force Decomposition to Spider Webs

Abstract

Objectives/Goals
The purpose of my project is to determine the strength of two different spider web designs: an orb web, and a triangle web, using weights. My hypothesis was that the orb spider web would be stronger because it is attached in more places than the triangle web so the stress is distributed along more strands.

Methods/Materials
Twenty square frames, one foot by one foot were made. A basic orb spider web design was strung onto ten of the frames and a basic triangle spider web design was strung on the other ten frames using tacks and silk thread. The spider web frames were set on a Styrofoam stand with a piece of yarn going from the web to the bottom of the stand. The increase in length of the yarn laying on the bottom was used to measure the amount that the web stretched. For the Orb web the starting weight was 1 kg and smaller weights were added incrementally until the orb web broke. For the triangle web the starting weight was 200 g and smaller weights were added incrementally until the triangle web broke. Every time a weight was added the total weight hanging on the web and the web stretch was noted. The stretch was measured by measuring the length of the yarn laying on the bottom of the stand. This procedure was repeated over and over again until all of the webs were broken.

Results
The results of my project indicated the average maximum weight the orb web could withstand before breaking was 1 kg 404 g vs. 440 g for the triangle web. The average tensile stretch of the orb web was 5.5 cm vs. 4.2 cm for the triangle web.

Conclusions/Discussion
My hypothesis was proven correct. In every single case the orb web held more weight than the triangle web. On the average the orb web withstood three times more weight than the triangle web. I used the principles of force decomposition to prove that that the orb web was stronger because the stress was distributed across eight strands in the orb web, as opposed to three strands in the triangle web. Using Young#s Modulus of Elasticity I documented the relationship between the stretch (strain) and the weight (stress). I determined the tensile strength of each web thus predicting the amount of weight each web could withstand before breaking.

Summary Statement
My project was to determine whether an orb web or a triangle web design was stronger applying the principles of force decomposition, graphing a modified version of Young#s Modulus of Elasticity and measuring the tensile strength of the webs

Help Received
Professor Emeritus Bill Purves of Harvey Mudd College helped me come up with the project and understand the physics in it; my parents helped me with "another pair of hands" while running the experiment; my dad nailed down the 20 frames

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Sucharita Kumar

Project Number
J0215

Project Title
"Truss" That Structure

Abstract

Objectives/Goals
How does the configuration of an object#s framework affect its ability to withstand weight? I believe that the more supports used in the truss configuration of an object#s framework, the higher its ability to withstand weight. By having different configurations in the models I will build, I believe there will be variations in the abilities to withstand weight.

Methods/Materials
Materials: Grid paper to design, Wax paper,Flat toothpicks 2-3 Packs(700/pack) Wood glue,Tape,Nail clippers,Cardboard,Soda can,small metal beads,Thumbtacks, Rubber bands
Procedure: 1. Plan different configurations for the structure on gird papers. 2. Test each toothpick and remove the ones that are defective. 3. Tape the grid paper on your work area. 4. Tape the wax paper on top the grid paper to avoid any glue. 5.Using the grid paper diagram as a guide, build the structure for each configuration 6. Use rubber bands and thumbtacks to support the structure as you build. 7. Let the structure dry for 24-48 hours prior to testing the stability. 8.Determine the weight it will supports before breaking by slowly adding weight to the structure.9. Make two holes on each side at the top of a soda can and tie a string through the holes 14. Tie a piece of string to a pencil to form a loop. 16. Bend a large paperclip into a hook shape. 17. Connect one end of the hook to the pencil and another end to the soda can handle. 18. Allow the can and paperclip to hang through the hole in the cardboard that is supporting the structure. 19. 20. Add the metal balls to the soda can until the structure is pulled down and eventually broken. 21. Measure the weight that is used to break each structure. 22. Build a total 25 structures: 5 configurations X 5 structures for each.

Results
The bridge type with the most Truss configuration withstood more weight with an average of 825 grams before it broke. The bridge type with the least Truss configuration withstood less weight with an average of 600 grams .

Conclusions/Discussion
When I added weight to tooth pick bridges with different configurations, the bridge with the most truss withstood more weight.

Summary Statement
How does the configuration of an object#s framework affect its ability to withstand weight?

Help Received
my mom helped me with the entire process of my project and the supplies. My brother shared his toys for the experiment. They helped me add weight to the bridges. my dad reviewed my project . The engineers at #Ask a Scientist night# gave their feed back about my project. My teacher Mr. Nelson tought me how the

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Alexandra A. Lamoureux

Project Number
J0216

Project Title
Bridges: Which Design Is Best?

Abstract

Objectives/Goals
This project was an engineering experiment on the strength of different bridge structures. The bridge structures tested include: simple frame (control group), railroad, rigid frame, and Warren truss bridge structures. The researcher hypothesized, if the triangular design of the truss bridge structure more effectively spreads the weight throughout the bridge (tension and compression forces), then the truss bridge structure will be able to hold the most weight of the structures tested.

Methods/Materials
Twelve bridges (three of each type) were built with pieces of basswood glued with wood glue and set out to dry for 24 hours. After drying, each bridge was laid across two chairs and a bucket was attached to the center of the bridge. Cups of sand were poured slowly into the bucket until the bridge collapsed.

Results
After each bridge collapsed, results were taken and analyzed. The researcher found the simple frame bridges (control group) held the lowest average weight (4.1 kg), rigid frame bridges held the second lowest average weight (4.467 kg), rail road bridges held the second highest average weight (4.567 kg), and the Warren truss bridges held the highest avereage weight (11.050 kg).

Conclusions/Discussion
In conclusion, the researcher's hypothesis proved true. The Warren truss structure withstood the greatest tension and compression forces allowing it to hold more than twice the weight of the other bridge frame designs. The researcher found that the spreading out of weight of the truss design helps the bridge hold more weight and should be considered when determining bridge safety.

Summary Statement
This project was an engineering experiment on the strength of different bridge structures.

Help Received
Father helped gather specified supplies and materials; Mother helped gather specified research books.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Nicole A. Lopez

Project Number
J0217

Project Title
The Physics of Cheating in Baseball

Abstract

Objectives/Goals
My objective was to determine whether cork, sawdust, or sponge, when illegally used as fillers in hollowed-out wooden baseball bats, will cause a baseball to travel farther upon impact compared to a heavier, solid wooden bat.

Methods/Materials
With adult supervision I drilled through the tips of three different bats and hollowed out a chamber. The three different bats were filled with different fillers ranging from sawdust, a household sponge, and rolled cork. The fourth bat was kept solid. A batting device was built to test the four different bats. One at a time each bat would be attached to the batting device and the distance it hit the ball off of the batting tee would be recorded.

Results
The experiment showed that the saw-dust-filled bat which averaged a longer distance than anticipated, 97.92 inches in distance, allows a baseball to travel farther than the other substance filled bats and the heavier, solid wooden bat. The solid wooden bat launched the batted-ball an averaged of 95.28 inches. I found that the cork-filled bat only averaged to 89.88 inches. Using a sponge-filler bat only decreased the average compared to the solid bat, to 89.36 inches.

Conclusions/Discussion
Using sawdust as filler in a wooden baseball bat will enable a baseball to travel farther upon impact, compared to a heavier, solid wooden baseball bat. By building a batting device I was able to test the baseball bats and conclude that my prediction was incorrect. I hypothesized that a cork-filled bat would hit a baseball farther than a heavier, solid wooden bat. Changes in the batting device could possibly be made to obtain more accurate results. The coiled spring could have possibly lost some of its tension after it was used repetitively and the use of human subjects in place of the batting device may be a way to attain more reasonable results.

Summary Statement
My project is about determining whether cork, sawdust, or sponge, when illegally used as fillers in hollowed-out wooden baseball bats, will cause a baseball to travel farther upon impact compared to a heavier, solid wooden bat.

Help Received
Father helped build batting device.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Blake S. Mattern

Project Number
J0218

Project Title
Football Kicking Comparison

Abstract

Objectives/Goals
My objective is to see which area of a football, when kicked with a pendulum, will cause the football to travel the furthest distance. I wanted to learn how the laws of physics played a part in my experiment.

Methods/Materials
My materials include:
One Nike Junior size and weight football, one orange Official Youth size kicking tee, one standard tape measure, one Black marker, one role of 50mm masking tape, one home made Pendulum, one #2 pencil, three lined paper (for recording data), and one calculator(for converting to Metric units)

Results
After kicking the football ten times in the top, middle, and bottom areas, the data showed the middle area was the best place to kick to get the furthest flight distance. The Middle kick showed a 20% further distance then the bottom kick and 58% further distance then the top kick.

Conclusions/Discussion
After sorting through the results, I found that my hypothesis for the flight distance was incorrect. I believed the bottom area would be the #sweet spot# of the football but it was not. It was the Middle area that showed the greatest distance.
Newton#s laws of physics helped me understand and explain why I got the results that I did. I would like to further my research in this area by changing variables like metal instead of wood pendulum (F=ma), putting helium in the ball, compare height with length of distance, and by using different types of balls(soccer,baseballs,etc.)

Summary Statement
My project was about understanding why a football reacts when kicked in different areas and measuring the distance it traveled when kicked in these areas.

Help Received
Dad helped correct typing errors; Dad helped build pendulum; Brother helped measure kicks; Teacher advised on board arrangement.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Julio A. Medina

Project Number
J0219

Project Title
How to Build a Better Bridge

Abstract

Objectives/Goals
The purpose of this project was to find out how vertical or horizontal reinforcements affect a bridge's ability to hold weight. I am interested in engineering and this project could help me in later life if I need to build something strong.

Methods/Materials
I started by researching different bridges to find out how other people built their bridges and how to build mine. I used truss bridges for this experiment. One bridge I tested had horizontal reinforcements, one had vertical reinforcements and the last had nothing. The bridges were built as similarly as possible to reduce the variables. I hung weights off of the bridges and weighed the weights to see how strong the bridge was.

Results
At the end of this experiment, I concluded that the bridge with horizontal reinforcements held the most weight (95 lbs) compared to the control (57 lbs) and the bridge with vertical reinforcements (55 lbs).

Conclusions/Discussion
The bridge with horizontal reinforcements held the most weight because it spread the weight evenly. The control bridge had its weight concentrated at the bottom joints. The vertical bridge had all of the weight concentrated at one point and was pulling apart at another point. Also The vertical bridge was very brittle while the control was extremely flexible and the horizontal bridge was in between

Summary Statement
This project finds out how vertical and horizontal reinforcements affect a bridge and why.

Help Received
Mother critisized report.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Gathenji B. Njoroge

Project Number
J0220

Project Title
Bridging the World

Abstract

Objectives/Goals
The purpose of this experiment was to get an understanding of why bridges collapse and how the design affects bridge structure. My hypothesis was that the arch bridge would be the strongest, the cantilever would be the second strongest and the beam bridge would be the weakest. I thought that would be the case because arch bridges are made with a unique design that allows the top brick (keystone) to push on the bricks that make the arches. The arches push on the ground and then the ground returns the pressure to the key stone.

Methods/Materials
I built the bridges using wood blocks, cardboard, wooden dowels, a heavy-duty stapler, and wood glue. I then placed a plastic container in the middle of the bridge that I was testing and slowly filled it up with sand. I did this until the bridge started to crack and then I would weigh the sand and then continue filling up the container until the bridge broke and make another recording. I did this three times testing each type of bridge during all of the tests.

Results
I thought that the beam bridge would be the weakest, the cantilever would be second and the arch bridge would be the strongest and I was correct. The first beam bridge that I made was only able to hold up to 370g before it started cracking. I continued adding more sand until it broke at 2.5 pounds. The second beam bridge cracked and broke at 3.5 pounds and the third one broke at 2.5 pounds.
The first cantilever bridge started cracking at 3.5 pounds and it broke at 5.0 pounds. The second cantilever cracked and broke at 4.0 pounds, while the third one broke at 5.0 pounds. The arch bridge did not break at all.

Conclusions/Discussion
My hypothesis was correct. The beam bridges were the weakest, the cantilevers were the second strongest, and the arch bridges were the strongest.

Summary Statement
The purpose of this experiment was to get an understanding of why bridges collapse and how design affects bridge structure.

Help Received
My Mom helped me edit my graphs. She also checked my grammar. My dad helped me staple the frames and dowels on to the bridges.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Jacob M. Osterloh

Project Number
J0221

Project Title
IED Defense

Abstract

Objectives/Goals
My goal was to determine what shape undercarriage for an armed forces vehicle would deflect the greatest amount of energy if attacked by an IED.

Methods/Materials
I began by building a model car and multiple types of undercarriages. I built three different undercarriages: triangular, curved and flat. Putty was added to each undercarriage in order to insure that they all had the same mass. I then built a testing rig using two pulley systems. I placed the car on top of a box and fed the compressed air through the top of the box so that the blast would hit directly on the undercarriage of the car. Each blast of air lasted one half second. I measured the height risen in centimeters in order to determine how well each undercarriage deflected the energy.

Results
After completing all ten trials of each model the model with the triangular bottom most effectively deflected the explosion. When I tested the triangular bottom resting flat on the box it did not rise at all. This is because with the undercarriage shaped in this way it leaves very little room between the explosion and the bottom of the vehicle. The air nozzle was almost touching the bottom of the car. When the triangular model was set one centimeter above the box it still raised the least when compared to the control and the curved bottom. On average, there was a 10 centimeter difference in height between the control/curved and the triangular bottom. When comparing the curved and control, the curved out performed the control when lying flat on the box and they had the same results when placed one centimeter above the box. The average height raised for the control flat on the box was 23.5 centimeters, for the triangular bottom it was 0 centimeters and for the curved bottom it was 14 centimeters. For the second test, when the vehicle was raised one centimeter above the top of the box, the average height raised for the control was 33 centimeters, for the triangular bottom it was 24 centimeters and lastly, for the curved bottom it was 34 centimeters.

Conclusions/Discussion
My results proved that my hypothesis was correct. The triangular cap deflected the most energy and resulted in the least amount of movement by the vehicle. After competing at the Central Valley Regional Science Fair I decided it would be best to complete more testing and to test more undercarriages with varying shapes.

Summary Statement
My project is about determining what shaped undercarriage of an armed forces vehicle would deflect the most energy if attacked by an IED.

Help Received
Mr. Kinney, another science teacher, provided the materials and helped me determine the best way to conduct the experiment. Miss Kruser assisted me in designing the board and checked my written information to make sure it was appropriate.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Payal A. Patel

Project Number
J0222

Project Title
What's The Breaking Point?

Abstract

Objectives/Goals
Which truss bridge (Warren, Pratt or Howe) will hold the most water?
Hypothesis: Because of how the compressive and tension forces are handled by the vertical and diagonal beams in a Pratt Truss, I believe the Pratt Truss will hold the most weight compared to the Warren and Howe Truss.

Methods/Materials
Materials: Ruler; Graph Paper; Pencil; Small wood saw; Balsa wood; Hot glue or superglue; Supports; Bucket with handles; String with clips; Jug; Measuring jar (mL); Water.
Method:
1.Draw a full-scale, side-view drawing (on the graph paper) of each of the three trusses (Warren, Pratt and Howe)
2.Cut balsa wood to fit onto the bridge templates
3. Connect wood pieces with glue and let dry until bridge is firm
4.Repeat steps 2-3 to make 5 of each type of truss
5.Attach one clip to bucket, slip other clip through truss then put remaining clip on bucket.
6.Pour water slowly in intervals of 20 ml (1g=1 ml) and record how much weight bridge holds until it breaks

Results
After 3 trials of testing the Warren, Pratt and Howe Truss, the averages for each of the bridges are as follows- Warren-4733 mL Pratt-4896 mL, Howe-4776 mL

Conclusions/Discussion
My experiment clearly showed that the Pratt Truss on average held the most water out of the three trusses. On average, the Pratt Truss held about 100 more milliliters of water as compared to the Howe and Warren Truss.

Summary Statement
Which truss bridge (Warren, Pratt or Howe) will hold the most water?

Help Received
Parents bought supplies. Father helped construct the truss bridges. Science teacher helped with clarifications.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Aaron H. Smith

Project Number
J0223

Project Title
How Different Surfaces Affect the Velocity of a Rolling Object

Abstract

Objectives/Goals

The purpose of my project was to discuss how different surfaces would affect the velocity of a rolling object. I used a fifteen centimeter ramp, a pool table, and a pool ball. The three surfaces I used in my experiment were the plastic ramp itself, the ramp covered with a medium thick felt, and the ramp covered with medium grade sandpaper. I then marked every twenty centimeters on the pool table with a piece of tape. When I rolled the ball down the ramp and along the pool table, I videotaped the movement and downloaded it onto my computer. I then used Adobe Premier Elements 4.0 to measure how many frames it would take for the ball to roll from one piece of tape to the next. There are thirty frames per second. With this information I created a chart and a graph to compare the average velocities on each surface. I measured the average speed that the ball traveled between each mark after all of my different tests and found that my findings confirmed my hypothesis which stated that the sandpaper surface would allow the ball's velocity to be greater than the other two surfaces. This was because the ball on the sandpaper achieved the greatest rotational velocity and had to work the least on this surface when traveling down the ramp than it did on the other two surfaces. The reason that the ball went the slowest on the felt was because it was soft and the ball had to work to move over and through the felt. This caused it to expend more energy and travel at a slower velocity. The velocity of the ball on the smooth surface was between the velocities on the sandpaper surface and the felt surface because it slid intermittently as it traveled down the smooth surface and while it did not expend energy in pushing its way down the smooth surface as the ball on the felt did, the intermittent slipping caused it to expend energy and not achieve as great a rotational velocity. Therefore, it traveled at a slower velocity than the sandpaper covered surface. Finally, I tested my results by determining the standard deviation for each test sample. From this, I determined that the test results were very accurate.

Summary Statement

My project shows how different surfaces affect the speed of a pool ball traveling down a ramp and across a pool table.

Help Received

Family friend, Aaron Kvamme, helped with understanding and interpreting the results. Neighbor, Tom Carr, helped in coming up with the idea for the project.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Sean P. Traynor

Project Number
J0224

Project Title
Ready, Aim, Fire! Maximizing the Trebuchet's Range

Abstract

Objectives/Goals
The objective was to determine the best design for a trebuchet to maximize the distance a projectile is thrown. My hypothesis was that a heavier counterweight will launch the projectile the farthest, using elastics will work better than the counterweight, using a sling will launch the projectile farther than using a cup and using a lighter projectile will go farther than using a heavier one.

Methods/Materials
Extensive research occurred throughout the project from topic selection to conclusion. Materials were: trebuchet, projectiles, elastics, measuring tape, counterweights, stopwatch, distance markers, and the collection form. 20 tests each were completed varying Counterweight, Elastics with Crash Bar, Projectile Mass, and Cup Instead of Sling for a grand total of 120 tests. Tests included launching the projectile, timing the flight time, and then measuring the distance from the end of the trebuchet to the landing spot. Distance/second (horizontal velocity), average, standard deviation, range and median for all test variations were calculated and graphed. Analysis was completed to arrive at a summary and conclusion. Afterwards, I applied the findings to what happened in history and how the findings impact toy, playground, fair and other mechanical designs.

Results
The data showed that an effective trebuchet would use a projectile to counterweight ratio of 1:95. The greatest range will result from using the lightest projectile (with a forward motion) using a sling, with the heaviest counterweight available that does not break the throwing arm.

Conclusions/Discussion
This study explained why the trebuchet was prominent in medieval warfare. The attackers tested and revised their machine in order to achieve an effective range slightly greater than that of the defending archers. They applied Science and Math concepts outlined in Newton's Laws of Motion, Momentum Theory, Mechanical Advantage of a Lever and Potential and Kinetic Energy and determined heavy counterweight, light projectile, and a sling work best. Toys, play gear and machinery employ these concepts on every design today. We can continue to employ these concepts to designs to maximize effectiveness and to increase safety.

Summary Statement
Using mathematic and scientific principles, this project studied the optimal counterweight mass, projectile mass, energy transfer design and fling method to maximize the distance a projectile is thrown from a trebuchet.

Help Received
In the testing phase, 3 people were required to assist me (time observer, distance observer, and date/time controller) while I was managing the tests as Launch Controller. My mother taught me Excel for graphing and data analysis. All input, analysis and presentation was completed entirely on my own.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Ryan E. Warriner

Project Number
J0225

Project Title
Catapault: Variables and Distance

Abstract

Objectives/Goals
The objective is to determine whether or not the weight or size of an object affects the distance it will travel when propelled by a catapault.

Methods/Materials
A catapault, a ping-pong ball, a marble, and a pebble, goggles, pencil, paper, and a tape measure were used to conduct this project.

Results
The marble traveled an average of 1730 centimeters, which was an average of 754 centimeters further than the ping-pong ball (1009 centimeters), and 556 centimeters fruther than the pebble (1207 centimeters). In fact, during all but one of the five trials, the marble consistently traveled further than either the ping-pong ball or the pebble.

Conclusions/Discussion
The marble clearly traveled the furthest in this experiment. Based on my experiment and findings, I concluded that size and weight do influence the distance an item travels when launched under the exact same conditions as other items.

Summary Statement
The purpose of this project is to determine whether or not size or weight of an object influences the distace traveled when launched from a catapault.

Help Received
Mother helped type report; Local shipper weighed objects; brothers helped launch items and measure distances traveled

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Justo R. Padron, III

Project Number
J0299

Project Title
What Is the Effect of Admixtures on Concrete Strength?

Abstract

Objectives/Goals
The objective of the project is to determine if the concrete additives affect the strength of concrete prepared in a controlled enviroment.

Methods/Materials
The procedure used was testing the compressive strength of concrete cubes of several mix designs. These samples were prepared in accordance with ASTM C109. These samples were cured in a moisture room in compliance with ASTM C511. The samples were then tested by a concrete compression test machine supplied by Technicon Engineering Services.

Results
The results of the test show that the various concrete admixtures used did increased the strength of the concrete samples. These sample specimens were all prepared in accordance with the ASTM standards for testing in a controlled environment.

Conclusions/Discussion
The conclusion is that concrete admixtures do affect the strength of concrete. Depending on the type of Admixture used will affect the strength of the concrete differently.

Summary Statement
Testing of concrete strenghts by using different admixtures.

Help Received
I used lab equipment that was furnished by Techicon Engineering Services under the suppervision of Darren Williams