CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Dalton W. Abrams

Project Number
J0201

Project Title
Stroke

Abstract

Objectives/Goals
This project examined the effects of stoke on a reciprocating engine. I am doing this experiment because I have always been curious why some engines have very long strokes, such as tractors, and others have very short strokes, such as formula 1 cars. I tested the long-stroke, medium-stroke, and short-stroke designs. I anticipated the short-stroke would produce the most milliamps because it can achieve the highest speed (rpms). I also anticipate that the long-stroke engine will produce the least amount of power because it cannot develop as many rpms as the short and medium strokes.

Methods/Materials
I built the engine using a 7/8" brass pipe for a cylinder "block". A carriage bolt served as a piston and another carriage bolt served as a valve. Various lengths of stainless steel rods served as connecting rods. A steel flywheel with several holes drilled in it was used to alter the stroke between long, medium, and short strokes. The engine is connected to an electric generator, which powers an amp meter to measure power. An air compressor running at 30 psi powers the engine. Each stroke was tested 6 times for 30 secs each time. Power outputs were recorded at peak milliamps to evaluate horsepower. The milliamps were also measured during startup to evaluate torque.

Results
The results were: the long-stroke engine produced the most power at 337.5 milliamps with an average of 56.25 milliamps. The short-stroke engine produced the second most power at 298.5 milliamps with an average of 49.75 milliamps. The medium stroke engine produced the least amount of power at 290.5 milliamps with an average of 48.42 milliamps. My hypothesis was incorrect. I rejected my hypothesis based on the long-stroke engine producing the most power.

Conclusions/Discussion
I would recommend an engine with a long-stroke for most applications because it produces more low-end power than the short-stroke or medium-stroke engines. However I would recommend an engine with a short-stroke for applications that require high speed because the short-stroke can reach a higher speed than an engine with a long stroke. If I were to continue this experiment I would strengthen the engine to run at a higher speed or create an engine that runs off gas or diesel and retest my hypothesis.

Summary Statement
The effect of stroke on the power output of an engine.

Help Received
Mother - proofreading Grandfather - supplied materials; helped weld

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Conner R. Bennett

Project Number
J0202

Project Title
Biomimetic Water Striders: Testing the Load-Bearing Capacity of Static Water Strider Models

Abstract

Objectives/Goals
To determine whether a static mechanical water strider model can be built that carries 15 times its body weight and does not break the surface tension of room temperature tap water during a 3 minute time trial.

Methods/Materials
A control and five test water strider models were made of stainless steel cotter pins, glue, and hardened stainless steel wire, shaped to mimic the water strider insect. Silicone-based spray simulated the hydrophobic quality of the insects legs. Each models ability to float was tested three times for 3 minutes using tap water. The results were recorded. A static force calculation was made for comparison.

Results
The stability of the static water strider models enabled them to carry 2X, 4X, 12X, and 15X its body weight in three trials, for 3 minutes. The water strider model carrying 20X its body weight sank during all three tests. The static force mathematical calculations indicated that the surface tension of water could theoretically support each models weight.

Conclusions/Discussion
The data supports my hypothesis that a static mechanical water strider model can be built that carries 15 times its body weight. The standing water strider model floated three times, for three minutes carrying 15 times body weight. The data demonstrates that some of the static weight bearing characteristics of water strider insects can be duplicated in a water strider model design.

Summary Statement
Test the carrying capacity of a static water strider model, relative to the water strider insect, using the static force calculation to indicate whether the surface tension of water could theoretically support each models weight.

Help Received
My parents provided tools, drove me to purchase materials, and answered questions during the research conducted primarily at home. Dr. P. J. Utz, Stanford University School of Medicine, provided access to the analytical balance.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Aiden D. Blood

Project Number
J0203

Project Title
Can Smaller Eggs Support More Weight?

Abstract

Objectives/Goals
This experiment was designed to determine the relative strengths of eggs of different sizes. We made an apparatus to load weights onto a wooden platform, which was supported by an egg. The weights were loaded onto each egg, in a stepwise fashion, in 0.5 kg increments. The weight at which they exploded was recorded as their maximum weight. Each group of eggs was tested sequentially in the same setting.

Methods/Materials
One dozen of each different sized eggs (jumbo, extra large, large, medium), Wood, Saw, Weights, Egg cartons, Scale, String, to measure the circumference, Ruler, Drill and drill bits, Screws, Screwdriver, 4 wooden dowels (1.8 cm in diameter), Wood glue.
1.Build wooden support platform for the eggs.
2.Weigh each egg in gm and measure both axes circumferences in cm.
3.Place one egg into the carton holder in the wooden box support.
4.Lower the top wooden frame onto the egg.
5.Test the eggs for the amount of weight they can each support.
a.Start with small weights, increase each time with 0.5 kg
b.Gradually add larger weights until the egg breaks.

Results
When the data was analyzed, we discovered that the middle-sized eggs were actually able to support the most weight. After measuring all of the eggs, we learned that the middle-sized eggs, were actually the eggs sold as "medium" eggs and the eggs sold as "extra-large" eggs. The "large" eggs were the smallest and the "jumbo" the largest. Both the largest and smallest eggs withstood the smallest amount of weight.

Conclusions/Discussion
The data demonstrates that the middle-sized eggs are, on average, the strongest. This is not intuitive, as one might guess that the larger, and heavier birds would lay the largest eggs and these eggs would need to support the weight of the larger birds and thereby be the strongest eggs. Alternatively, if eggs act like water balloons, then the smallest would be the strongest because they have thicker walls and are able to withstand the most weight.
We discovered that the eggs we bought varied in size within each carton, some mediums were smaller than other mediums, and likewise with each of the other sizes. Future tests might include the same "sized" eggs from different stores to determine other factors that influence their strength, like organic, or brown, or grade A, or grade AA, or free-range.

Summary Statement
I tested the relative strengths of different sized eggs as a function of their sizes as sold, their actual sizes and their weights.

Help Received
Dad helped type and build apparatus, Grandfather helped build apparatus.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Jacob R. Castellon

Project Number
J0204

Project Title
Which Bridge Design Is the Strongest?

Abstract

Objectives/Goals
The purpose of this project was to construct bridges of three different designs (span, truss, and modified arch) to determine which would be more structurally sound when weight was placed at the base of each bridge. My prediction was that the truss bridge would bear the most weight.

Methods/Materials
After researching numerous bridge designs, three bridges were constructed from Popsicle sticks held together with hot glue. The basic designs of the bridges were a span, truss, and modified arch bridge. The next step was to create weights that would test the load capability of each bridge. This was done by placing sand in three buckets, weighing them on a scale and recording their weight. They held 12.5, 35 and 70 pounds. Each bridge was placed between two tables with a chain wrapped around its base. The least heavy bucket was attached to the chain first, with an "s" hook, and then suspended in midair. If the bridge held the weight, the next heavier bucket was used and the test repeated.

Results
After conducting the tests on each bridge, it was determined that the modified arch bridge was the strongest.

Conclusions/Discussion
After conducting the initial experiment, it was determined that the modified arch bridge was able to bear more weight than the truss and span bridges because it was built with significantly more Popsicle sticks than the others. Further experimentation is necessary to test bridge designs that utilize approximately the same amount of building materials to produce more accurate results.

Summary Statement
This experiment demonstrates the importance of testing bridge designs to make sure they are structurally sound when constructed in order to ensure the safety of people travelling over them.

Help Received
My mom helped by taking pictures and proof reading my writing. My dad helped me weigh the buckets and place them on the hooks.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Alex L. Chang

Project Number

J0205

Project Title

A Study of Utilizing "Maglev" Base Isolation for Reduction of Structure Damage During an Earthquake

Abstract

Objectives/Goals

The objective of this experiment is to apply magnetic levitation as a way of effectively minimizing structure shaking and displacement during an earthquake.

Methods/Materials

A shaking table made of plywood and timber was constructed. A model building made of clay sticks, wooden dowels, and foam boards was assembled. The model building was affixed on a floating platform that was comprised of wooden planks with Neodymium magnets attached to the bottom. There were two series of experiments were conducted. The first series of tests subjected the building to shaking without the maglev base isolator. The second series of tests subjected the building to shaking with the maglev base isolator. The initial and final positions of the model building were compared.

Results

With the levitation (base isolation) provided by the Maglev base isolator, the model building accumulated an average of 1mm and 1.6mm of lateral displacements at the second floor level and the roof level, respectively, after 5 cycles of induced shaking, and the shape of the model building remained relatively intact. Without the levitation (base isolation) provided by the Maglev base isolator, the model building did not survive more than 5 shaking cycles.

Conclusions/Discussion

As clearly evidenced and supported by the results and data from the experiments, the Maglev base isolator indeed was able to separate the building from the underlying ground shaking, as opposed to the building founded directly on the ground. While the model building supported by the Maglev base isolator recorded an average 1 to 2 mm of lateral displacement at various points of the building after each experiment, the model building without the Maglev base isolator nearly collapsed after a mere 5 shaking cycles.

Summary Statement

My experiment clearly demonstrated that "maglev" is a viable method of separating the building from ground shaking during an earthquake, thus rendering the building safe and minimizing the potential property and human losses.

Help Received

Dad helped with the building of the shaking table; Science teacher, Mrs. Driscoll, helped with editing my notebook.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Derek W. Curtis

Project Number
J0206

Project Title
Pulling Weight on... Mars?

Abstract

Objectives/Goals
The objective was to determine which of four different types of tread would provide the best traction while pulling a weighted payload trailer on a model of the Martian landscape. I believed that the wide, rounded lugged wheels would provide the best traction, and the large, narrow lugged wheels would perform the worst because they cover the smallest surface area.

Methods/Materials
This year's project was a continuation of last year's project. The project was extended by adding weight to the rover to see how the robot's performance was affected. A Lego RCX brick from the Lego Mindstorms System was used to build a small robot with interchangeable treads. The four treads tested were: 1) large, narrow wheels with lugged tread; 2) wide, flat wheels with smooth tread; 3) wide, rounded wheels with lugged tread; and 4) plastic tank tread. A payload trailer, weighing 400 grams, was built to match the 400-gram weight of the robot itself. The Martian terrain simulation board built for last year's project was utilized again. A Lego computer program was created to carry the robot across the surface of the terrain. Each set of tread was tested 50 times, and the results recorded.

Results
The results were that the plastic tank tread performed the best by far, with an average distance of 88.90 centimeters. The wide, rounded, lugged wheels averaged 10.77 centimeters, the wide, flat, smooth wheels averaged 3.05 centimeters, and the narrow lugged wheels averaged 0.81 centimeters.

Conclusions/Discussion
My conclusion is that because the tank tread covered more surface area than the wheels, it maintained better traction on the terrain. In observing the performance of the robot, I have to wonder if the performance of the wheels would improve if my design had utilized more than four wheels. I hope to test this in the future.

Summary Statement
I utilized Lego Robotics to build a small rover and a weighted payload trailer, and tested the performance of 4 different treads on a model of the Martian terrain to determine which tread performs the best while pulling weight.

Help Received
My mom helped me type and proofread my report, my dad helped me (last year) build the martian terrain board, and Ota Lutz at JPL helped me with questions I had regarding my project.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
S. Annika Daug

Project Number
J0207

Project Title
Comparing the Strength of Solid and Laminate Wood Beams

Abstract

Objectives/Goals
The objective of this project was to compare the strength of solid and laminate wood beams and to determine if increasing the layers in a laminate would make it stronger.

Methods/Materials
The strength of balsa wood beams of the same size were compared--solid vs. 2-layer vs. 4-layer vs. 8-layer laminate. Each beam was suspended and secured by C-clamps over the seats of two chairs with a bucket hanging at the center of the beam. Sand was carefully poured into the bucket until the beam broke. The weight of the bucket with sand was recorded for each beam for a total of nine trials each. The average weight needed to break each beam was compared to find out which beam was the strongest.

Results
The 8-layer laminate carried the most weight before breaking at an average of 6.79kg, followed by the 4-layer laminate at 5.53kg, then the 2-layer laminate at 4.14kg. The solid wood beam carried the least weight at 3.54kg which was 48% less than that carried by the 8-layer laminate.

Conclusions/Discussion
My conclusion is that a laminate wood beam is stronger than a solid one and that increasing the number of layers in a laminate made it stronger.

Summary Statement
This project is about comparing the strength of solid and laminate wood beams and determining if increasing the layers in a laminate would make it stronger.

Help Received
My mother helped me get all the materials I needed and assisted in catching the bucket with sand.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Emma A. Debasitis

Project Number
J0208

Project Title
An Arrow's Flight

Abstract

Objectives/Goals
The goal of my experiment was to learn at what angle an arrow will fly the farthest distance.

Methods/Materials
The materials used were: a bow (with a set draw length and weight), three identical arrows, a range finder, a rag, a release, a quiver, a protractor, and an assistant. The procedure was to shoot the three arrows with the bow at different angles to see which angle makes the arrow travel the farthest. I then measured the distance the arrow traveled with the range finder. I then calculated the average distance traveled by the arrow at each angle.

Results
My result was that the arrow traveled the farthest distance when it was shot at the 45 degree angle. Although the arrows shot at 40 and 50 degrees traveled a great distance, they did not travel as far as the arrows shot at 45 degrees.

Conclusions/Discussion
My hypothesis was correct. The arrow traveled the farthest when shot at the 45 degree angle. To find the maximum distance an arrow can fly with a certain bow, shoot it at a 45 degree angle. Then you will be able to find the maximum distance an arrow can fly with a certain bow. This information would be helpful in archery tournaments when shooting without sights.

Summary Statement
My experiment determined at which angle an arrow will travel the greatest distance.

Help Received
Mother helped measure angle; Father helped measure distance; Kirigin Cellars supplied land.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Cory R. Hunter

Project Number
J0209

Project Title
Experimentation in Elasticity: How Can Temperature Affect a Golf Ball's Flight?

Abstract

Objectives/Goals

If I change the temperature of a golf ball from 0 ^oC to 40 ^oC in 10 degree increments, how will this ultimately affect ball flight distance and elasticity.

The goal of the project is to determine whether it would be beneficial to a golfer to either keep the golf balls "cold" or "hot" to improve performance.

Methods/Materials

I will hit at least 30 new golf balls at each temperature in no wind using a #6 iron in a blind study with 2 other people to complete the tasks. Exp. 1 measures ball flight, Exp. 2 measures % elasticity.

Supplies

48 New Nike One Golf Balls, Golf mat & tee, 6 iron, 200 ft tape measurer, Garden flags, Markers, Insulated containers, Thermometers, Water baths & ice, Towels, Ladder, Camera & computer

Procedure

1 Label balls; 2 Choose a field; 3 Hit all golf balls early in the morning. No wind, constant temp.; 4 Create hitting field with distance grid, and a hitting mat; 5 Use a #6 iron for all hits; 6 Measure ball temp. indirectly by measuring water temp; 7 Hit balls in random order determined by another; 8 Measure flight & record data.

Exp. #2

1 Drop golf balls of different temps. from 100 inches onto cement & measure the height it bounces back up on 1st bounce (% elasticity). 2 Record data, and graph results

Results

Exp. #1 shows that as the temperature increased so did the flight distance. My data charts also show that there was a steady increase until the temperature reached 40 ^oC.

Exp. #2 confirms that the warmer the ball, the more elastic it is and the higher it will bounce based confirming the hitting distance of the balls in Exp. #1

Conclusions/Discussion

My original hypothesis is not supported by my data measurements. My data showed that the warmer the golf ball, the farther it traveled. The balls are more elastic the higher the temperature in my experiment.

Higher temperatures increased the elasticity of the balls. This may be because the ball had a higher compression value. Golfers in cold weather would increase golf distance if they could keep their golf balls warm and exchange them before starting a new hole.

Summary Statement

This project tests the effects of golf ball temperature on the golf ball flight and the elasticity of the ball.

Help Received

Parents and brother helped to conduct the experiments as measurer's and father provided science equipment.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Fionna M. Jensen

Project Number
J0210

Project Title
How Does the Diameter and Type of a Pulley System Change the Force Needed to Lift 5 lbs?

Abstract

Objectives/Goals
My goal was to learn how pulleys can be used to make lifting heavy objects easier. I wanted to see if pulley size made a difference. I started by hypothesising that larger diameter pulleys would require less force.

Methods/Materials
I chose to limit my project to two different sized pulleys and three different pulley systems. By using different pulley sizes I could see if diameter affected the force required to lift a 5 lb weight. By using different pulley systems I could see if diameter alone affected force.

Results
My experiments showed that there was no difference in force required between the two different sized pulleys when used in a fixed system. However, when these two sizes were tested under systems with multiple pulleys the smaller pulley perfomed better in the movable system while the larger pulley performed better in the combined system.

Conclusions/Discussion
My hypothesis was wrong because my results didn't support my hypothesis. Pulley diamter is less important in reducing force than is the way the pulley is used. I now know that when pulleys are combined in certain ways they can reduce the force required to lift heavy objects. What I wasn't able to test was why the force was reduced. I think it may be along the pulley surface but that will have to be another expperiment.

Summary Statement
How can pulleys be used to reduce the force required to lift heavy objects?

Help Received
Parents helped obtain materials and build the pulley frame.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Spencer Jones; Gunner Little; Caleb Sager

Project Number

J0211

Project Title

The Heat Is On: The Effect of Golf Ball Temperature on Distance

Abstract

Objectives/Goals

The purpose of this study was to investigate the effect of golf ball temperature on the distance that the ball would travel upon impact. We predicted that when the golf ball is warmer it will travel a longer distance and when the golf ball is cooler it will travel a shorter distance.

Methods/Materials

The methods employed in this study were to first build an apparatus that would allow us to consistently strike the ball with equal force at an equal angle. For each trial the hammer was raised to a consistent height, 4 feet, measured from the ground surface. Then the hammer was released so that it would rotate downward and strike a tee mounted ball driving it out onto a grassy surface. The distance that the ball traveled was measured with a tape measure and recorded. The measurement was taken from the tee to the center of the ball. A total of 9 golf balls were tested at three different temperatures: near 30° F, ambient, and near 200°F.

Results

The average distance traveled was greatest for the golf balls at ambient temperature. The lowest average distance traveled was measured for the golf balls at the highest temperature.

Consistent with our hypothesis, the golf balls at ambient temperature traveled farther than the golf balls at cooler temperature. Unexpectedly, the average distance for the heated golf balls was the lowest, even lower than the golf balls at near freezing temperature. It seems likely that at some high temperature the golf balls become soft and do not rebound when struck by the wooden hammer. The golf balls that were in the boiling water bath became soft enough that they flattened out on the bottom.

Conclusions/Discussion

The outcome of our study suggests that warm golf balls travel further than cold golf balls, up to an undetermined maximum temperature. This result is consistent with the findings of the literature review that suggest that an increase in golf ball temperature enhances the elastic properties of the golf ball. The data suggest, however, that at an extremely high temperature, the golf ball#s elastic properties are diminished. It is possible that the coefficient of restitution was effected, thereby, the warm ball may have recovered less kinetic energy. When this occurred, it is possible that the distance the golf ball was able to travel was compromised.

Summary Statement

The purpose of this study was to investigate the effect of golf ball temperature on the distance that the ball would travel upon impact.

Help Received

Caleb's dad helped build swinging hammer. Gunner's mom helped with the display board.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Sami J. Kirkpatrick

Project Number
J0212

Project Title
Wheel Friction

Abstract

Objectives/Goals
The goal of this experiment was to see if expensive fingerboard wheels go farther and create less friction than less expensive wheels.

Methods/Materials
Four wheels were tested: Tech Deck non-bearing wheels, FingerDecks single bearing wheels, G6e single bearing wheels with bushings and G7.1e duel bearing wheels. To test this experiment the wheels were all put on the same fingerboard and rolled down a ramp. The distance that the fingerboard traveled was then measured to see how far it rolled. A backstop was used to make sure that the wheels started at the same spot every time. Each set of wheels was rolled down the ramp 30 times and the mean was calculated for each pair.

Results
From shortest distance traveled to longest distance, the results were as follows: the Tech Deck non-bearing wheels traveled the shortest distance at an average of 116.15 inches. Next, the FingerDecks single bearing wheels traveled 129.9 inches, the G7.1e duel bearing wheels went 165 inches followed by the G6e single bearing wheels with bushings which went 195.17 inches.

Conclusions/Discussion
Expensive wheels are supposedly much better than the cheaper wheels, but the G6e wheels are twenty dollars less then the G7.1e and go a lot further. This proves that even if something is expensive, it doesn't always mean it's better than the less expensive version.

Summary Statement
My project is about the effects that ball bearings have in reducing sliding friction in fingerboard wheels.

Help Received
My dad helped me build the ramp.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Madeline C. Kuney

Project Number
J0213

Project Title
Does Temperature Affect a Tennis Ball's Bounce?

Abstract

Objectives/Goals
My question is if I place tennis balls in different temperature environments, will the temperature of the surrounding air affect how high the ball will bounce?

Methods/Materials
Methods: 1) I divided 100 new tennis balls into five groups of 20 balls. Each group was placed in one of five temperature environments (cold, cool, room temperature, warm and hot); 2) I wrapped two groups of 20 balls individually in foil and placed one group in an oven set at 100 degrees Celsius and the other group in an oven set at 120 degrees Celsius. I placed the third group of balls in a refrigerator at 6 degrees Celsius, the fourth group in a freezer at -15 degrees Celsius, and the final group was left at room temperature, or 46 degrees Celsius; 3) Each group was removed from its environment after 30 minutes and was taken immediately to the test area. Each ball from each group was dropped from the same height and with same amount of force by use of a ball dropper I made; 4) For each group of balls, I measured each ball's bounce using a) a poster that I marked with a ruler, b) a videotape, and c) photographs; 5) I calculated the average height of each test group to determine whether temperature affected the ball's bounce.

Materials: 100 brand new tennis balls; "L" bracket; door; boards; butcher paper; ruler; black marker; red masking tape; metric measuring chart; tin foil; plastic baggies; thermometer; ladder; oven; refrigerator; freezer; saw; screwdriver; and video camera.

Results
The average height of the ball's bounce for the five temperature groups ranged significantly from lowest to highest. The Cold Group (-15C) averaged 53.5 cm; the Cool Group (6C) averaged 98.5 cm; the Room Temperature Group (46C) averaged 114.5 cm; the Warm Group (100C) averaged 136.5 cm; and the Hot Group (120C) averaged 142.5 cm.

Conclusions/Discussion
My hypothesis was correct. The hot balls bounced the highest and the cold balls bounced the lowest. The change in temperature affected the height of the ball's bounce by altering the temperature of the air in the ball and also the elasticity of the rubber.

Summary Statement
I exposed new tennis balls to five different environments (cold, cool, room temperature, warm and hot) to learn whether temperature affects a tennis ball's bounce.

Help Received
My father help me by building the wooden supports to hold the door upright, fastening the L bracket to the door, and sawing the tennis balls in half.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Sierra H. Laird

Project Number
J0214

Project Title
Remotely Operated Vehicles: Remote vs. Local Power

Abstract

Objectives/Goals
the purpose of this project is to design and build a Remotely Operated Vehicle and find out whether a Remotely Operated Vehicle works better with a power source on land, connected with a cable, or a power source right on the Remotely Operated Vehicle.

Methods/Materials
Material list: 1.30 ft of PVC pipe. 2.32 PVC pipe Ts. 3.8 PVC pipe corners. 4. 1 bag of 50 plastic ties. 5.1 1/4 pint of PVC cement. 6.3 sealed beam headlights. 7.3 4in PVC end caps. 8.1 spare inner tube from tire of 1973 MG car. 9.6in x 6in x 4in PVC electrical j-box. 10.marine battery box. (first 10 materials only.) METHOD: I measured and cut the PVC pipe, then glued and assembled it with a few pieces of rebar in the bottom frame for weight. Then my father and I wired it and put on the lights. Next, we spray painted it bright yellow. We then connected the propellers to the moters and fitted it to the ROV with plastic ties and put grill surrounding the inner tube and bottem of the ROV. We then put on the wheels, then we put the battery case onto the bottom of the ROV, we then tested the motors and lights to make sure they worked. After that we did a water test, switching the battery from inside the ROV to onto land with a cable transferring the power. And them i wrote out my report with the results.

Results
SPEED: 1. the local powered ROV went about 4 mph. 2. the remote powered ROV went about 2 mph. STABILITY: 1. the local powered ROV was fairly stable and didn't tip over. 2. the remote powered ROV was fairly stable and didn't tip over. USER CONTROL: 1. the local powered ROV turned with uneven bursts of speed and took a second to stop. 2. the remote Rov turned more slowly, but more consistently, and stopped more quickly.

Conclusions/Discussion
My conclusion is that without further tests it is difficult to tell whether my hypothesis was correct or not. I think that the Rov with local power was faster and the ROV with remote power had more control. I will continue to test the ROV untill I have a clear answer and i am certain that eventually i will.

Summary Statement
Whether a ROV with remote or local power works better.

Help Received
Father helped design, build and test ROV; wrote and typed report myself.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Caroline E. Lamoureux

Project Number
J0215

Project Title
The Effect of Weight Distribution on Bridges

Abstract

Objectives/Goals
The objective of this experiment is to determine whether weight distribution (the number of pressure points) affects the amount of weight a truss bridge can hold. The scientist hypothesized that if weight is distributed throughout multiple pressure points on a truss bridge, then the bridge is less likely to collapse.

Methods/Materials
Nine identical truss bridges were constructed out of basswood and aliphatic wood glue. U-bolts were used to suspend a bucket from the underside of the bridges. Each bridge was tested by filling the bucket with sand until the bridge collapsed. Three of the bridges were tested using a single U-bolt, placed in the center of the bridge to suspend the bucket of sand, three bridges were tested using three evenly placed U-bolts to suspend the bucket of sand, and three bridges were tested using five evenly placed U-bolts to suspend the bucket of sand. After the bridge collapsed, the bucket of sand and U-bolts were weighed and results recorded.

Results
The results showed that as the number of pressure points (U-bolts) increased the bridges were able to hold more weight. The average weight held by one pressure point was 12.2 kg, by three pressure points was 14.6kg, and by five pressure points was 31.7 kg. The weight held using five pressure points was substantially larger than when one and three pressure points were used.

Conclusions/Discussion
The scientist proved that the way weight is distributed on truss bridges affects the amount of weight that the bridge is able to hold. As more pressure points (U-bolts) were added to suspend the weight, the amount of weight that the bridges were able to hold increased as weight was more evenly distributed throughout the bridge. Bridges have been used for thousands of years for passage over natural boundaries and man-made obstacles. Since weight distribution over bridges affects how much the truss bridge is able to hold, engineers should consider ways in which to keep weight distributed when building bridges.

Summary Statement
My project shows the relationship between weight distribution (pressure points) and the ability of bridges to hold weight.

Help Received
Father helped collect materials.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Grant M. Lilya

Project Number
J0216

Project Title
Roof Truss Designs

Abstract

Objectives/Goals
My objective for this experiment was to see which roof truss design can hold the most amount of weight and how much the roof truss bends before breaking.

Methods/Materials
50) 3/16 x 3/8 x 24 in. basswood; 2) 1/2 x 3/4 x 13 in. pine wood strips; 1) 26 x 12 1/4 in. thick hardboard; 1) Wood glue; 1) Bathroom scale; 1) 12 in. ruler; 1) 12 x .5 in. plywood; 3) 1/32 in. plywood; 4) Tee track tee bolts; 2) Toilet flange tee bolts; 1) Clear packing tape; 6) Tee nuts; 1) Clamp; 2) Stop blocks; 1) 20 x 4 7/8 in. plywood; 1) Drill press board; 1) Stapler with staples; 2) Bar clamps; 1) Coping saw; 8) Nails; 1) Table saw; 1) Framing square; 1) Pencil.
After building all of the five types of trusses, I built a jig made out of 2 stop blocks, a drill press board, a 2 x 6 shaped to go around the exterior of the truss, a bathroom scale, bar clamps, and 2 more 2 x 6 cut in half. This jig will compress pressure on to each truss distributing the pressure evenly through the whole truss. Once the truss breaks, look at the scale to see how many pounds of pressure got put on the truss.

Results
From the experiment, "what type of roof truss can hold the most weight," the modified howe roof truss held the most amount of weight at an average of 261.4 pounds. Following very close with an average of 261.2 pounds was the howe roof truss. Then the fink roof truss held an average of 240 pounds. Following the fink, the queenpost held an average of 227.8 pounds. Last but not least, the kingpost held an average of 171.8 pounds. The results for how much each truss bends before breaking were the Fink at 8 mm, queenpost at 7 mm, modified howe at 5.6 mm, the howe at 5.2 mm, and the kingpost at 5.2 mm.

Conclusions/Discussion
The end results were very close but the modified roof truss held the most weight at an average of 261.4 pounds beating the howe roof truss by .2 pounds. Today, roof trusses are used when building new houses or buildings. When building a house or building, you have to incorporate some type of roof truss to support your roof. As you walk in your house, you are relying on your roof trusses because they keep your roof from collapsing. That is why I did this experiment so people know what types of roof trusses will hold the most weight for safety reasons.

Summary Statement
I tested to see which type of roof truss can hold the most weight

Help Received
Dad heped me build some of the trusses

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Nicholas L. Matta

Project Number
J0217

Project Title
How Shear Walls Work to Limit Earthquake Damage

Abstract

Objectives/Goals
To test the effects of a horizontal movement applied to a normal wall and compare it to a more resistant shear wall.

Methods/Materials
Two walls built out of wood; one shear wall and one normal wall. The pieces were held together with glue and pins. I put a string between both walls which hooked to a paper clip that held quarters in a small bag. In order to see the movement of the two walls, a paper ruler was attached to measure the movement.

Results
The experiment showed that the hypothesis was correct.

Conclusions/Discussion
The shear wall is stronger than the regular wall, and furthermore, the normal wall deformed permanetly with repetitive loads.

Summary Statement
My project is about testing how shear walls are stronger to horizontal movement than regular walls.

Help Received
Mom helped with graphs. A friend (Pete) helped me plan and build the walls. Dad helped me test the experiment.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Prachi Nawathe

Project Number
J0218

Project Title
Air Powered Engine

Abstract

Objectives/Goals
The use of gasoline in the industry is polluting our atmosphere, and creating all sorts of complications. Worldwide, there is a search going on for the next big energy source. Pressurized air is a big candidate, and it is used in engines in factories, and there are even prototypes for air powered cars. My objective was to figure out if I could build an air engine using common materials.

Methods/Materials
This project mainly uses pine and poplar boards, PVC, PVC fittings/accessories, and screws. Each model was to have some sort of valve to make the piston move, a piston, and a flywheel. I designed three different models, the first with three sub-models, in the process of making this engine. The first (with its sub-models) was made of mostly PVC. The second was made of more wood than PVC, and the third is still being made at the time of this submission. It is going to be made with mostly wood, solenoids, and PVC.

Results
The first model had three sub models. The first two's valves did not work, and the third's valve worked, but the total engine did not work. In the second model the engine worked, but had very high leakage levels. The third model is expected to work, but at the time of the application is still being built.

Conclusions/Discussion
Air powered engines are indeed a candidate for alternate energy sources. Yes, they may need high P.S.I.'s for operation, but all energy sources are needed in certain quantities to ensure good results. An air powered engine could be built using common materials.

Summary Statement
My project is about building an engine using common materials such as wood that will be powered by pressurized airs, which will show pressurized airs a ready candidate for being the US's, and the world's, next big energy source.

Help Received
Father taught me how to use tools, drove me where I needed to go for supplies;

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Lam L. Nguyen

Project Number
J0219

Project Title
Launch It!

Abstract

Objectives/Goals
I was wondering what the effect of variance in settings on the range of a trebuchet was. I believed that a ratio of 1-4 on the arm would produce the best ranges. I also thought that the greater the counterweight, the more the range. The ratio is between the end of the arm with the counterweight and the end of the arm with the sling.

Methods/Materials
The materials I used were the trebuchet, a logbook, pennies, marbles, a book, a tape measure, a pen, and rubber bands. The procedure I used was to first prepare the trebuchet, launch the projectile, measure the distance, record the distance, then repeat 4 more times. Then I would change settings and repeat.

Results
The ratio of 1-4 was higher than 1-7 or 4-11. The trajectory of 4-11 was a relatively straight line slanting downwards, but the trajectory of the 1-7 was an upward bell curve.

Conclusions/Discussion
The 1-7 produced the most consistent data, but the 4-11 was random. My hypothesis was mostly proven, because the ratio of 1-4 was the highest range, and also because the counterweight had a positive correlation with the range.

Summary Statement
My project is an investigation on how a variance of settings can affect the range of a trebuchet.

Help Received
Dad helped count pennies, helped build trebuchet; Teacher(Mark Hobbs) helped on binder.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Ravi K. Nidumolu

Project Number
J0220

Project Title
It Will Blow You Away

Abstract

Objectives/Goals
I wished to see which variables on a vortex cannon (lip size, diaphragm tension, and distance between cannon and force meter) affected the force produced by the vortex cannon, and what combination produces the most force.

Methods/Materials
I built my own cannon and setup for the measuring device out of plywood, hot glue, nails, and regular thick wood. I tested using four different hypotheses. Three hypotheses were each for a separate variable, and the last was for all of the variables combined (which combination made the most force).

Results
When tested, the variable(s) that I was testing for always made the most force in their hypothesis group.

Conclusions/Discussion
I found out that the smaller the lip size, the more bungee cords you have on each I-hook, and the closest the cannon is fired from the measuring device, the more force will be measured. All hypotheses were proven correct using two-tailed matched pair T-tests.

Summary Statement
I saw which variables on a vortex cannon (lip size, diaphragm tension, and distance between cannon and force meter) affected the force produced by the vortex cannon, and what combination produces the most force.

Help Received
Rod Atchley(teacher) helped explain statistics, mother,sister helped cut and paste board, Ms. Seales (another science teacher) donated force meter, neighbor helped form question, other neighbor helped make air cannon, measuring device plate.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Paige E. Roper

Project Number
J0221

Project Title
Which Bridge Type Is Strongest: Arch, Beam, or Truss?

Abstract

Objectives/Goals
The purpose of this project was to find out which type of bridge is the strongest - arch, beam, or truss. My hypothesis was that the arch bridge would be the strongest.

Methods/Materials
The experiment involved building and testing the strength three bridge types (arch, beam, and truss) by increasing the amount of weight on each bridge while measuring how much each deflected (bent), and at what point the bridges failed (broke). I built five sets of each type of bridge from wood, using approximately the same amount of material in each bridge to make a fair comparison. The bridges were designed to span a 13 5/8 inch gap. Each bridge was tested by adding weight to the center of the bridge 15 pounds at a time and measuring how much each bridge deflected, until the bridge failed or until I reached 150 pounds.

Results
My experiment showed that the truss bridge was the most rigid, but beam bridge failed the least. The truss bridge also had the lowest average point of failure - about 30 pounds less than either the arch bridge or beam bridge. The arch bridges bent more than either the truss or beam bridges.

Conclusions/Discussion
My hypothesis was incorrect. Overall the beam bridge appeared to be the strongest type, although the truss bridge was more rigid up until the point of failure. I observed that all of the truss bridge failures involved the separation of an end post joint, which were glued. Therefore, it is possible that stronger end post joints might lead to the conclusion that the truss bridge is the strongest.

Summary Statement
My project involved building, testing, and comparing the strength of arch, beam, and truss bridges.

Help Received
My science teacher, Mr. Scott, helped to edit my paper and advised me on my project; my father helped me with the construction and testing of the bridges and the preparation of my report; my mother made sure that I got everything done on time and helped me with my research on the topic.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Connor B. Shands-Sparks

Project Number
J0222

Project Title
The Trebuchet Weight vs. Distance Test

Abstract

Objectives/Goals
Hypothesis: The more massive the counterweight, the further the projectile travels. The more potential energy stored in the counterweight, the more kinetic energy the projectile will have. The energy comes from gravity's pull on the counterweight, and is transferred to the momentum of the projectile.

Methods/Materials
Methods/Procedures:
1) Construct trebuchet
2) Load 16 oz. counterweight
3) Add 1 oz. into counterweight
4) Hook pouch's string onto nail; Set the pin; Straighten string; Center the counterweight; Pull pin
5) Measure distance projectile is thrown; Record distance
6) Reload and repeat steps 3-5 until you're out of weights
7) Graph results
Materials:1 can, 1 16oz. weight, 20 1oz. weights, Trebuchet (9 pieces of wood, 11 screws, Wire, Wood base, Nail for hook, Nail for pin), 1 pouch, 1 large marble, 22 in. of string, Tape measure

Results
The trebuchet threw the projectiles further the more weight there was. The last projectile didn't travel as far as the 2 projectiles before it. But the measurements kept at an increasing rate. The average increase was 10.49 cm.

Conclusions/Discussion
The test was to see how the mass of a counterweight would affect the throwing distance of a trebuchet. I thought the heavier the counterweight the further the projectile would travel. We launched 20 projectiles, increasing the counterweight#s mass each time. The data showed that as I put more weight into the counterweight, the projectile flew further. However, the final projectile didn#t go as far as it did during the two previous launches, but the decrease was one out of twenty data points. The decrease happened because the counterweight put too much friction on the pivot and slowed the arm down, and caused the arm and pivot to wobble, adding to the friction. My hypothesis was supported despite the last data point.

Summary Statement
I'm trying to see how a counterweight affects a trebuchet's throwing distance.

Help Received
Grandfather designed a trebuchet I could put together; Father helped with the science; Mother helped organize the project.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Megan L. Spencer

Project Number
J0223

Project Title
The Physics of Roller Coasters

Abstract

Objectives/Goals
My favorite subject being math, I wanted to do something that included many formulas and calculations. I decided to design an experiment in which I could learn more about how roller coasters work and what forces act upon them. After completing my research, I decided to build a roller coaster for marbles out of 1 inch foam pipe insulation.

Methods/Materials
I made a loop 11 inches in diameter and then I used the extra track to make a starting hill exactly 20 inches away from the bottom of the loop. I started with a hill height of 20 inches and then worked my way up or down until I found a height that got the marble through the loop 10 out of 10 times.

Results
I found that the lowest height at which the marble made the loop all 10 times was 22.5 inches. After that, I did my calculations. First, I figured out how steep the slope of the winning height was by using Sine to calculate the angle of elevation. Then, I calculated the marble's potential energy. Lastly, I calculated how big my loop could have been, based on the height of my hill, had no energy been lost to outside forces like friction (kinetic energy = potential energy.) My loop could have been 44 percent larger than it actually was.

Conclusions/Discussion
I think that the main reason for the loss of energy was movement of the track. If I had built a solid, steady wooden frame, then I would have lost less potential energy. If I were to continue this project, I would try to isolate different aspects of what caused the loss of energy, and I would use the wobbling track as my starting point.

Summary Statement
My project explored the relationship between potential and kinetic energy in roller coasters.

Help Received
My mother proofread my written work, and my sister helped me run the experiment.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Michael A. Swerdlow

Project Number
J0224

Project Title
Loop the Loop: Physics of Vertical Loop Roller Coasters

Abstract

Objectives/Goals
My general objective was to investigate how the shape of a roller coaster's vertical loop affects the ability of the roller-coaster car to complete the loop. At the top of the loop, the car's velocity must exceed a critical value at which centripetal force balances the force of gravity. Based on this, my project tested the hypothesis that the minimum velocity to complete vertical loops with equal height varies directly with the radius of curvature (R) at the top of the loop.

Methods/Materials
I modeled the roller coaster using clear plastic aquarium tubing as tracks and ball bearings as cars. Tubing was bent into 1 of 3 vertical-loop shapes with equal height: Tear Drop (R = 6.1 cm), Circle (R = 13.1 cm), and Watermelon (R = 16.5 cm). Ball bearings were released from 3 different heights, 5 times for each loop shape (total 45 trials). Results were classified as (1) incomplete loop, does not reach top; (2) incomplete loop, reaches top but falls off outer rim; or (3) complete loop. Each trial was recorded on high-speed, digital video at 210 frames per second (fps), imported into Logger Pro software, and digitized to measure the position of the ball bearing in each video frame using the time-motion analysis module. From this, I determined the velocity at the bottom and top of the loop.

Results
For the Tear Drop, Circle, and Watermelon, ball bearings reached the top on 13, 8, and 5 trials, respectively. They completed the loop on 10, 1, and 0 trials. The minimum velocity at the bottom required to reach the top (with or without a complete loop) was least for the Tear Drop, intermediate for the Circle, and greatest for the Watermelon: 2.1, 2.7, and 2.8 m/s. For completed loops, the minimum measured velocity at the top was 0.80 m/s for the Tear Drop and 1.40 m/s for the Circle.

Conclusions/Discussion
The minimum velocity required to complete vertical loops of equal height was lowest for the Tear Drop, intermediate for the Circle, and highest for the Watermelon. This finding is consistent with my hypothesis that the minimum velocity varies directly with the radius of curvature at the top of the loop. It explains why amusement park roller coasters use the Tear Drop shape for their vertical loops.

Summary Statement
This project investigated how the shape of a roller coaster's vertical loop affects the ability of the roller-coaster car to complete the loop.

Help Received
At school, my science teacher Mr. Norman Brennen showed me how to use Logger Pro software, and my math teacher Mr. Larry Weiner helped me measure the radius of curvature of the loops. My father helped me attach the tubing to the back board. My mother helped me paste up my presentation.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Amit S. Talreja

Project Number
J0225

Project Title
Yo-Yo Physics

Abstract

Objectives/Goals
Determine what effect (if any) the weight and string length of a yo-yo have on its "sleep time," which is the time it stays at the bottom of the string when the yo-yo is thrown

Methods/Materials
One yo-yo, yo-yo strings, two dimes and two pennies. The weight of the coins was determined using a scale accurate to one-thousandth of a gram. The strings were measured and cut to 96.5 centimeters. 1 string was left as it was, and the other three were cut to lengths decreasing in increments of 5.5 centimeters. Duct tape was used to affix the coins (weights) to each side of the yo-yo. In this experiment, three(3) different yo-yo weights and four(4) different string lenghts were used to give twelve(12) different test combinations. Each variation was thrown fifty times to ensure accuracy and minimize the impact of outliers.

Results
It was found that a string length of 96.5 centimeters and pennies taped to the side of the yo-yo produced the best result (the longest sleep time). The measurements indicated that on average when the string got shorter, the time the yo-yo stayed at the bottom of the string decreased. However, when weight was added the time it stayed at the bottom of the string increased

Conclusions/Discussion
The string lenght has a direct correlation with the #sleep time# because the yo-yo gets its energy by unwinding from the string. Therefore, if there is less string to unwind from, there is less energy for it to spin at the bottom of the string. When weight is added, the yo-yo has more mass as a whole, and therefore has more momentum when going down the string, giving it more energy to spin at the bottom of the string.

Summary Statement
What is the effect of a yo-yo's weight and string length on it's spinning motion (as measured by "sleep" time)?

Help Received
Brother weighed the coins in his high school lab.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Joshua J. Van Benschoten

Project Number
J0226

Project Title
Friction Dampers: Putting the Brakes on Earthquakes

Abstract

Objectives/Goals
Every year major earthquakes around the world damage buildings, cause severe injuries, and death. Damaged buildings can be dangerous to enter after an earthquake. Families may have to move and businesses may need to relocate. Protecting buildings from earthquake damage saves lives, homes and businesses.

The intent of this experiment is to show how much a friction damper reduces the side-to-side motion (sway) of a building due to strong ground motion. I intend to show that frictions dampers significantly reduce building damage by reducing sway and possibly saving lives.

Methods/Materials
I plan to show how friction dampers work by simulating an earthquake on a building by using a shaker table. One building will have dampers and the other will not. I will take a video and measure the sway of the building with and without friction dampers and compare the results.

Results
Friction Dampers significantly reduced building sway.

Conclusions/Discussion
My original hypothesis was correct because the friction dampers reduced the sway of the building by 75%! Reducing the sway of a building reduces the likelihood that the building will be damaged or collapse in a strong earthquake. Also, reducing the sway protects people in the building and their belongings.

Summary Statement
Show how friction dampers reduce building sway in earthquakes

Help Received
Father helped with making shaker table and was a resource in making the research report

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Thomas A. Wood

Project Number
J0227

Project Title
Concrete on Fire: The Effects of High Heat Temperatures on Concrete

Abstract

Objectives/Goals
The objective is to determine if the less time concrete has to cure and the longer it is exposed to heat of varying temperatures, the more the concrete will crack and crumble.

Methods/Materials
Ready mix concrete,paper cups for molds and stirring sticks. 36 paper cups of concrete were mixed and molded. The first batch of 12 cured for 10 days. The second batch cured for 7 days and the last batch of 12 cured for 3 days. All samples were placed in an oven with a starting temperature of 350' and an ending temperature of 550'.The samples were checked for any changes daily.

Results
The concrete samples with less cure time that were exposed to higher temperatures cracked and crumbled the most.

Conclusions/Discussion
My conclusion is that concrete that is allowed to cure or dry for longer periods of time will consistently be more stable when exposed to varying temperatures.

Summary Statement
Finding out if cure time and high heat effects the stability of concrete for purposes of building foundations

Help Received
Mother helped with board layout,Father with samples,typingand hot oven,Sister with layout