

The Effect of Mass Amount and Placement on the Amount of Water Collected in Each Row of Seats in a Log Flume Ride

Student Research by: Mike Copley, Jake Serilla, and Preston Treend

Thousands of tourists ride the Snake River Falls log flume ride at Cedar Point every year. Many of them go in wondering which seat will keep them the driest during the ride. The following experiment replicated a log flume ride. The amount of water that landed on each of the four rows of seats was measured. Mass was added to the rows to replicate various numbers of people sitting in each row. The cart was run down a model hill to determine if the changes in mass affected the amount of water that landed on each seat. After testing each combination of mass amount and placement, it was determined that the middle seat collected the most water and the front seat collected the least. Additionally, when more mass was added to the cart, each seat collected more water.

The Effect of Laundering on Flame-Retardant Properties

Student Research by: Chelsea Antilla, Kelly Copley, Jacob Payne, and Amanda Shields

This experiment was conducted at the Macomb Academy of Arts and Sciences between the dates of October 14, 2009 and December 16, 2009. The purpose of the experiment was to find out if the number of launderings to which flame retardant fabric is subjected has any effect on the flame retardant capabilities of the fabric. There have recently been many concerns about the durability of chemically treated, flame retardant fabrics and whether or not they should be discarded after certain periods of time. These questions are what prompted the idea for this research project. To conduct this experiment, four fabric squares were laundered in gradients of zero, one, five, and ten washes. The data showed that the fabric only ignited if the flame underneath it was carried over to the stray fringes on the edge of the fabric squares. It was concluded that the difference in the number of washes was not great enough to show any measurable effect and, although some fabric did light in a few cases, this was only due to the variability of the testing environment. To improve the experiment, all of the rough or torn edges on the fabric should be properly hemmed prior to testing in order to reduce ignition of the fabric's non-flame retardant frays.

The Effect of Varying Amounts of Oil to Water Ratios on the Total Degradation of Oil by Microorganisms

Student Research by: AnnMarie Ede, Torrin McDonald, Hannah Miller, and Erica Pregano

This experiment was conducted at the Macomb Academy of Arts and Sciences (MA²S) in Armada, Michigan starting October 14th, 2009 to December 16th of 2009 . Bioremediation is an effective way to degrade oil without harming the surrounding environment, and was also the basis of this experiment. The mixtures tested were: 10%, 15%, 20%, 25%, 30%, and 100%, along with 10 milliliters of Petro-Clean, which is the bioremediation solution used in each solution. Five beakers of each solution were allowed to sit a week once contaminated. Then the solutions were plated on to petri dishes and allowed another week to culture new growths. Any significant or useable growths were recorded. All dishes plaqued over or were contaminated with outside bacteria, yielding only observations. The observations did not yield any specific trends from the experiment.

The Effect of Various Insulation Combination Ratios on the Sound Intensity Transmitted

Student Research by: Amanda Douglas, Allan Husketh, Michael Pollari, and Derek Schornak

The two most common uses of insulation are to retain a temperature and to deafen sound. Different insulations work in different ways. Two common insulations used to deafen sound are fiberglass and cellulose. The experiment conducted tested different ratios of these insulations on the sound intensity they transmitted. A constant sound was transmitted through different percent ratios ranging from 100% to 0% fiberglass. After testing was complete, it was found that 100% fiberglass blocked the most sound. Likewise, it transmitted the lowest sound intensity. The 0% fiberglass, 100% cellulose, transmitted the most. The changing ratios of fiberglass, resulting in different thicknesses in materials, caused a change in sound intensity transmitted.

The Effect of Storage Temperature on the Ignition Time and Enthalpy of Different Combinations of Ethanol and Gasoline

Student Research by: Chris Graham, Cole McCloskey, Tyler Nichols, and Sean Woods

The experiment had two separate purposes. One purpose of igniting the fuel in the lab was to determine the ignition time of different concentrations of gasoline and ethanol. The other purpose of testing the concentrations of gasoline and ethanol in the bomb calorimeter was to determine the energy output in order to determine fuel economy. Each fuel combination was tested at room temperature, fridge temperature and freezer temperature. To test ignition time, a cup was placed on a piece of wire mesh that was above a Bunsen burner. When the Bunsen burner was lit, it would heat up the cup and the fuel to its ignition point and then ignite. The fire would then be blown out and the time to ignite from the lighting of the Bunsen burner was recorded. For the bomb calorimeter, the sample was placed into a crucible and then placed into the bomb. The bomb was placed into the calorimeter and the test was run. The energy output was recorded once the sample was done burning. The results displayed a trend within the fuels. It showed that the ethanol ignited quicker when it was cool. However, this trend is contradictory to the calculations done earlier. This trend was determined void due to the fact of many errors in the procedures regarding lighting the fuels.

The Effect of Sodium Ferrocyanide on the Chemiluminescent Property of Luminol

Student Research by: Evan Baumann, Caitlin Bouchey, Kelsey Noteboom, and David Schornak

Glow sticks are toys that children have used to light up the summer months nights. A characteristic of glow sticks is that they lack light intensity. Luminol is a versatile chemical that exhibits a very interesting chemiluminescent property that is utilized in glow sticks. Chemiluminescence is the emission of light and heat from a chemical reaction¹. The purpose of this experiment was to discover which amount of sodium ferrocyanide was needed to create the brightest glow for a homemade, luminol glow stick. Two solutions were made: one luminol potassium hydroxide solution and one sodium ferrocyanide hydrogen peroxide solution. Varying amounts of sodium ferrocyanide were used in the solutions to find which amount would give off the highest light intensity. The two solutions were mixed together and the light intensity emitted was recorded. The testing showed that the less sodium ferrocyanide added to the solutions, excluding 0 grams, the more intense the glow would become. The reason for the decrease in light intensity when adding more sodium ferrocyanide, the roles each chemical played in the reaction and the effects of each chemical is discussed and future research is recommended.

The Effect of Temperature on the Rotation of a Tennis Ball

Student Research by: Joe Kilpatrick, Tyler Kinch, Jeff Medley, and Matt Soulliere

An experiment was conducted to discover how temperature affects a tennis ball's spin. Five different temperature gradients were tested: 4.4, 12.7, 21.1, 29.44, and 37.77 degrees Celsius. Three tennis balls were assigned to each temperature gradient. A video camera was used to record and analyze each trial. Analysis revealed as the temperature increased, so did the amount of rotations, which was believed to have happened because when the temperature was increased the nitrogen inside the ball gained more energy and resulted in a larger energy transfer between the ball and the racket. The energy transfer between the ball and the racket caused the ball to bounce. A larger energy transfer allowed the tennis ball to bounce higher. A higher temperature then resulted in a longer time in the air and allowed balls to spin for a longer time. It was found that when all gradients were compared the p-values were less than .01. This meant that there was over a 99% confidence level each gradient tested was significantly different from the other four gradients.

The Effect of Caffeine on the Regeneration Rate of Eisenia Fetida

Student Research by: Rebecca Durbin and Sean Mulvey

Regeneration is the unique process of cell regeneration that takes place after a limb is cut; these cells create a new limb to replace the one lost. Caffeine is a stimulate drug that can have multiple effects on the body. This experiment took this unique ability and combined it with this widely used drug today. Research on the effects of caffeine on the regeneration rate of earthworms was done to find interesting results. Multiple worms were divided among six test groups with different amounts of caffeine. The worms were cut and results were measured in two weeks to check the length measurement (cm). After data collection it was shown that 0mg ó 1200mg yielded positive regeneration, and 1800mg ó 3000mg yielded degradation. The p-values confirmed the similarity in all data points though, which make the data unreliable as a consequence. The reasoning behind the increase in length when ignoring the p-values was that the small amounts of caffeine were able to become dissolved into the water in the dirt and more easily passed through the worms pours, then the larger amounts of around 1800mg and above. These larger amounts yielded higher concentration amounts, which could not be passed. When in terms of data, the hypothesis was deemed not supported due to the lack of difference within the data points.

The Effect of Fertilizer on the Growth of Chlorella Algae in an Open Pond Water System

Student Research by: Alex Blake, Fred Flaim, Mitchell Kallek and David Sheridan

The production of lipids from different samples of chlorella algae that were growing in different amounts of fertilizer was the basis of the project. The algae that was under the influence of the largest amount of fertilizer was thought to contain the largest amount of lipids. Tanks were constructed that hold 15 L of water and various amounts of fertilizer was also combined with the water as the dependent variable. The ratios were from 0 to 1 gram per liter at .25 increments. In order to extract the algae, the evaporation process was accelerated through the use of heat lamps and fans. After drying, the algae was collected and massed. Due to error and other factors, the lipid factor was disregarded and then the new data point would become the mass of the algae. The only statistic received was that each tank produced an average of 5.596 grams of algae. These results were thought to have happened from the lack of time to conduct the research. The tank with the highest fertilizer did not yield the most algae as thought because of an excess amount of fertilizer causing harm to the algae. It was found that 0.75 grams of fertilizer was optimal for the growth of chlorella algae in the environment. This conclusion was not reported in confidence due to the excess amount of error that occurred during the experiment.

The Effect of Various Oil Amounts and Time on the Coefficient of Static Friction between Rubber and Asphalt

Student Research by: Emily Fleming, Stephanie Herbert, Sarah Jurzysta, and Kevin Kline

Oil substances from automobiles are leaked onto roadways- this reduces friction and is known to cause accidents with the addition of water like rain or snow. An experiment was conducted to observe the effect of varying oil amounts on the coefficient of static friction between a roadway and a tire. The study took place at the Macomb Academy of Arts and Sciences from September to December 2009. Six oil amounts, ranging from zero to fifty milliliters, were applied to asphalt road sections, and eight randomly selected tires were dragged across the asphalt surface to find the coefficient of static friction. Two variables were tested: the effect of time and the effect of oil on the coefficient of static friction. As the oil increased, it was found that the coefficient of static friction decreased logarithmically. Time had an opposite effect, resulting in an increase of static friction.

The Effect of pH Level and Exposure Time on the Mass of Teeth

Student Research by: Nicollette Brown and Alyssa Goike

The purpose of this experiment was to determine the effect of pH level on teeth. Research was conducted at the Macomb Academy of Arts and Sciences in the fall of 2009. Human teeth were exposed to various beverages with pH levels ranging from acidic to slightly basic. Teeth soaked in these liquids for one, three, and seven days. The teeth were massed before and after, determining the amount of enamel loss. The results showed neutral pH levels did not cause significant damage, and acidic pH levels caused a gradual loss of mass. When acids are exposed to tooth enamel, which is composed of crystallized calcium phosphate, they demineralize the tooth by breaking it into two separate pieces. This is believed to have caused the mass loss. An increase in submersion time also caused an increase in damage. This was caused by the acids' extended opportunity to erode the tooth enamel.

Electromagnetic Propulsion: The Effect of Coil Diameter on Initial Projectile Velocity

Student Research by: Josh Lewis

Electromagnetic propulsion is the concept of using an electromagnetic force to move ferromagnetic objects. It has many applications in products and machines of industry, but many of these depend on the velocity of the projectile. An Electromagnetic Propulsion Device, or EMPD, was constructed using copper wire, PVC, a micro switch, and a car battery. The projectile launched was fashioned from a 2 ½ inch piece of 1/4" steel rod. The velocity of the projectile was manipulated by increasing the number of wraps of wire in a coil: 8, 10, 12, 14 and 16 wraps. It was found that as the number of coils, or resistance in the circuit, increased, the velocity of a projectile decreased. This could have been caused by the effect that current, related to resistance through Ohm's equation $I=V/R$, has upon the magnetic field force produced by the solenoid. Because the resistance and voltage running through each coil was held constant, the current would also change. A change in current affects the amount of force a wire produces, and the changes all wires in a coil undergo together and the force on the projectile changes. Less force means less acceleration; less acceleration results in less velocity. This was the major trend that was found during the course of the experiment which took place in the fall of 2009 at the Macomb Academy of Arts and Sciences.

The Effect of Stride Length on Force on a Runner's Quadriceps

Student Research by: Gary Ezzo

To test how a running stride length affects running efficiency, various stride lengths were tested. Angular accelerations of the hip and ankle around the knee were analyzed for the force that the quadriceps was required to pull upwards on the knee with. The stride lengths tested included 100cm, 120cm, 140cm, 160cm, and 180cm. Each running stride length was achieved by placing six pieces of tape on the ground, spaced at the interval of the randomly selected stride length, with the runner running so that each foot landed on each piece of tape. Each day of testing, each stride length was tested once in addition to one additional test for one of the stride lengths. A mean force for each stride length was difficult to deduce because each trial contained slightly different phases of the runner's stride because the video that was analyzed was not cut with complete consistency throughout the data analysis. This caused the initial and final forces from each trial to vary greatly, which altered the mean force calculated for each trial in a way that had nothing to do with a change in stride length.

The Effect of Paddle Angle on the Amount of Voltage Produced by a Water Wheel

Student Research by: Ashley Brodacki, Don Goulette, and Casey Murray

"Going green" has been on the minds of many people lately. This "green" movement has focused heavily on alternative energies: wind, solar, water, and geothermal power. There are now wind turbines powering cities and solar panels placed on roof tops. Geothermal energy is usually used on a larger scale, factories. They harness natural heat from the earth through hot spots. Since water is more impractical in today's modern society, water turbines are used in man-made dams. Water wheels have faded away throughout the years. The purpose of this experiment was to discover the most effective way to produce alternative energy by using water wheels. Water wheel paddles were manipulated, through their angles, to affect the voltage output. Before testing began, six water wheel replicas were manufactured. Each wheel represented one of the six different angles that were established: 0 to 75 degrees in increments of 15. The wheels were then measured, marked, and glued to the corresponding angled paddles for a total of eight paddles per wheel. Stands for both the stream and wheels were constructed. A DC motor and GLX were connected to the wheels to measure the voltage. It was found that as the angle increased, the voltage also increased to a specific measurement. The voltage produced increased with higher angles until a peak was found at 60 degrees. This peak was reached, but when the 75 degrees water wheel was tested it dropped significantly. This caused a parabolic shape in the regression line, generating a quadratic equation. Testing was done between October and December of 2009, at the Macomb Academy of Arts and Sciences (MA²S).

The Effect of Spiral Blade Count on the Voltage Produced by a Vertical Axis Wind Turbine

Student Research by: Elizabeth Crawford, Taylor Krause, Haley Waterstraat, and Alyssa Williams

The purpose of this experiment was to discover the most efficient way to produce alternative energy through wind turbines. This was done by varying the different amounts of blades on a vertical axis wind turbine, in attempt to increase the voltage and rpms being produced. For testing to begin, a vertical axis wind turbine and five separate blade heads had to be created. Twenty blades were constructed using a template; they were distributed into the five blade heads starting with two blades increasing to six blades. These were attached to a dowel that was mounted onto the center of wooden circle base. The blades were twisted in a spiral pattern around the base and were secured to the base at the correct angle. A rubber stopper with a small hole in the center was glued to the bottom center of the base, and PVC pipe was glued around that so that the blade heads could have stability while spinning. Using alligator clips, the multimeter was then connected to the motor's wires so the voltage would be visible during testing. The rotations per minute (rpms) were also counted during this time. The smaller blade amount, such as the two blade head allowed too much air to pass by not having the force to turn the blades. In contrast, the larger amount of blades blocked the wind as it tried to pass by, once again not having the force to spin the blade head. Since the three blade head let neither too much air through or not enough, this variable produced the greatest voltage and rpms. Therefore, the three blade head was at the most efficient because it could utilize the greatest amount of wind while still keeping a constant rotation compared to the two blade head.

The Effect of Speed on a Car's Motion When Driving on a Dirt Road.

Student Research by: Nicole Ewert, Grace Gregory, and Eric Kosek

Dirt roads are commonly traveled on and often result in very damaging and uncomfortable rides. It is commonly debated whether or not the speed a vehicle travels down dirt roads effects the smoothness of the ride. An experiment was conducted at the Macomb Academy of Arts and Sciences (MA²S) to attempt to find a speed that should be posted on dirt roads that would result in the smoothest possible ride. A model Chevrolet 300 was pulled across a dirt road simulation at different speeds. Each mass was put to scale so the results could compare to speeds traveled in a actual vehicle. In addition, the average amount of bumps per speed was compared to the average vertical motion experienced by the car. The results showed that the fastest speed, 67 miles per hour, to scale, resulted in the least amount of bumps; this speed was produced by the 600 gram mass. However, the bumps it hit were more intense than at the lower speeds. From results such as this, it was found that the speed of a car has a clear result on the path the car takes. As the speed increases, the amount of bumps decrease.

The Transfiguration of Aspartame into Formaldehyde

Student Research by: Braden Hayes, Joshua Kanke, Sean Steinberg, and Melissa Wawrzyniak

Aspartame, introduced in the 1980s, is used as a "healthy" sugar alternative in numerous diet sodas and artificial sweeteners like Equal® and NutraSweet®. Aspartame has been associated with various health issues and several severe health problems. The connotation of "diet" implies healthy, safe, even nutritious; however, when broken down by heat, aspartame decomposes into methanol, aspartic acid, and phenylalanine. When the methanol produced from the aspartame reaches the human's liver, then it is broken down by alcohol dehydrogenase, which turns it into formaldehyde, a known carcinogen. By using the infrared spectrophotometer and the gas chamber attachment, samples of the Equal® brand sweetener, water, methanol, and alcohol dehydrogenase were tested. It was determined that aspartame went through a series of steps before actually becoming formaldehyde. When aspartame, alcohol dehydrogenase, and water were kept in an incubator at a constant temperature of 35 degrees Celsius for three days, formaldehyde, in the form of gas, was produced from the methanol when aspartame was heated.

The Effect of the Amount of Time Lysol Disinfecting Spray is Left on a Table on the Growth of Bacteria

Student Research by: Caylyn Boadway, Kristie Harms, Kate Shellenbarger, and April Wesolowski

This experiment was conducted at the Macomb Academy of Arts and Sciences in Armada, Michigan. The purpose of this experiment was to find out if Lysol 4 in 1 all purpose spray killed bacteria, and if so, for how long. Six different time gradients were tested: 0 weeks, 1 week, 2 weeks, 3 weeks, 4 weeks, and 7 weeks, with 0 weeks being the control and having no Lysol. To begin, agar was made in Petri dishes to grow bacteria on. Next, the table was washed with regular dish soap and swabbed in ten randomly chosen locations on a gridded table. These swabs were serial diluted and swabbed onto a Petri dish with agar. This was allowed to grow for one week. This experiment was started because a friend of the researchers have young children and the friend wanted to know how often they would have to spray Lysol so that germs could be kept to a minimum. At each time gradient the counter was swabbed and serial diluted, and then swabbed onto a Petri dish. Ten samples were taken of each gradient. The following week the percentage of growth was counted and appearances were noted. After analyzing the data, the researchers concluded that Lysol does work, but for only a short period of time. This shows that in order to keep surfaces free of bacteria, they need to be sprayed or washed with Lysol about once a week.

The Effect of Rock Salt on the Mass of Cement Blocks

Student Research by: Kourtnie Kurtz, Jeremy Martyniak, and Raschelle Scheinost

It was believed that the rock salt, used on the roads in winter, caused the roads to wear down resulting in costly road reconstruction. This experiment tested if the amount of salt added to a cement block would affect the mass loss. The blocks were not allowed to cure for the correct amount of time because data collection needed to begin; this caused some errors for our initial and second massings. Each day, half of the blocks would be put in the freezer, because of limited space, and then 10mL of water and salt was spread evenly on each block. After about a week the blocks that had been in the freezer would be taken out and they would then be rinsed off and set aside to dry and be massed in the next week, then the process was repeated the next week. The results showed that after the initial mass there was a significant amount of mass loss, but after the second massing the mass loss leveled off. This initial drop in the mass was most likely due to error in the experiment. The data shows that the salt had no effect on the cement blocks and that any mass lost was due to error or from the procedure used in the experiment.

The Effect of the Change in Heat on the RPM of a Stirling Engine

Student Research by: Ted Binkowski, Jacob Caporuscio, Trevor Goolsby, and Kevin Jutila

Although the external combustion engines have been around for many years, the invention of the internal combustion engine quickly quelled the advance of these engines, such as the Stirling Engine, into widespread use. These engines are now being investigated, however, as having potential for use in places a conventional internal combustion engine would be impractical. This experiment was performed to test the efficiency of the low-heat Stirling Engine, and was performed at the Macomb Academy of Arts and Sciences in the Fall of 2009. The engine was placed at varying distances from a heat source and then the rotation of the engine's crankshaft was measured as the dependent variable. Unfortunately, the engine used in this experiment did not work. No data was obtained, although many observations were obtained to improve the engine for use in future research. The most important of these observations was that the engine's material was not uniform throughout, resulting in a difference in expansion rates and consequently a breakdown of the engine. Future researchers could easily, given time, obtain an engine consisting of uniform material and test the use of the Stirling Engine further. This information could then be used to put Stirling Engines in places where heat is given off and wasted, and the engine could recapture this energy, saving time and money.

The Effect of PSI in a Football and Ball Placement on the Distance a Football Travels

Student Research by: Eli Becht, Singen Chang, Brad Fistler, and Josh Tschiggfrey

When a kicker kicks a football into the air, there is more to it than just kicking a football. Many different types of factors affect how the ball will be kicked. A research experiment was done to figure out which PSI would be the best to kick a ball the furthest, and where a kicker should place his feet before kicking a ball. The placement of the foot was represented by placing the tee different positions in front or behind the foot when the foot was perpendicular with the ground. A machine was build in order to kick a football with an almost consistent force. The machine was a stand with a swinging leg. Fifteen trials were done for each combination of PSI and distance from the foot. The different PSIs used were 9.5, 10.5, 11.5, 12.5, and 13.5 PSI. The different distances from the foot were 0 cm, 5 cm, 10cm, -5 cm, -10 cm, and -15 cm. The best result was the 12.5 PSI after the research was conducted. The 13.5 PSI gave the lowest average distance. The ball traveled between 100 cm ó 200 cm for each data set. The data did however prove to show variation throughout.

The Effect of Hydrochloric Acid and Time on Beef Fat

Student Research by: Robin Bliss, Dallas Bonkowski, and Shannon Klee

Safety rules in labs are typically the same in every setting. Lab safety rules include wearing protective eyewear when it comes to harmful chemicals, also wearing gloves, when the chemicals that are being used are deemed as irritants. This includes wearing protective eyewear when it comes to harmful chemicals, wearing gloves when the chemicals being used are deemed as irritants. Questioning the importance of these rules, an experiment was conducted to observe how harmful 6M HCl would be to the skin if the acid got onto the skin without being noticed. . Whether or not Hydrochloric Acid (HCL) affected the fat of a human, and not only just the skin was the question to be answered. HCl is a powerful acid, which means the acid dissociates entirely in a water solution. Using different time variables, 6M HCl was placed on to beef fat and left there for their respective time limits. Masses would be taken prior to and subsequent to the Hydrochloric Acid being placed on the fat. The data stated that after the HCL sat on the beef fat for more than ten minutes, the hypothesis started to be disproved. This caused the results to completely different than expected.

The Effect of Angle and Drop Height on the Length and Width of Blood Spatter

Student Research by: Sarah Doering, Rachel Goubert, Katrina Prohaszka, and Desirae Tibaldo

Blood spatter analysis is an important factor in the field of forensic science. This analysis can give one the velocity of the blood droplet and the angle at which the droplet hit. As a result, this experiment was conducted to re-enact a low velocity blood drop, or a stab wound, to be more accurate. Blood was dropped via pipette at varying heights onto a surface that varied in angle and then measured according to width and length. After the experiment was conducted, it was found that the hypothesis was only partially supported. As the angle increased, the width of the droplet decreased and the length of said droplets increased. When the height increased, both width and length of these drops increased. This was thought to have been because of gravity, which has a greater effect on the steeper angles and a more of a spread effect on the lesser angles. Later, after the data was analyzed, it was discovered that the angle had a greater effect on the data than did the height, which was due to the closely related heights.

The Effect of Landslide Angle Entry on the Wave Height of a Tsunami

Student Research by: Kaitlyn Bushbaker, Cecelia Goulette, Jessie Hyatt, and Ashten Lindeman

The purpose of this experiment was to determine the entry angle of a landslide that would create the largest tsunami. The experiment was conducted in the junior/senior research room at the Macomb Academy of Arts and Sciences (MA²S) in Armada, MI, in the fall of 2009. Six different angles were tested and fifteen trials were conducted on each: 45, 50, 55, 60, 65, and 70 degree angles. A rock was slid down a constructed apparatus into a fish tank filled with water. Each trial was recorded on a video camera and then analyzed on the computer. Peak Motus, a software motion analysis program, was used to slow the recording of the trial down frame by frame to determine the height of each wave created. The results from this experiment can best be explained as the transfer of energy. The 55 and 60 degrees created the highest waves; this is thought to be because the most energy was transferred in to the wave. When the energy was incorrectly transferred, the smallest waves formed; this occurred during the 45 and 70 degree trials.

The Effect of Dropping Hockey Stick into Gelatin

Student Research by: Daniel Finn and Michael Frost

An abundance of people like to watch hockey because of the fights that erupt during both on and off of the ice. Sometimes, these fights can be quite dangerous. One aspect of the fights that not many people think about is the hockey stick. What would happen if a player threw their hockey stick at another player? An experiment was conducted to test what would happen if the flying hockey stick's blade struck another player in the neck. Ballistic gelatin was used to replicate the muscle of the victim's neck. The angle the hockey stick was dropped at was the independent variable. The hockey stick was dropped by a wooden stand at different angles: 105°, 120°, and 135°. The depth that the hockey stick blade cut into the ballistic gel at the front and back of the block was the dependent variable. The hypothesis of this experiment was that the angle 135° would cause the deepest cut in the gelatin. The data that was collected partially supported the hypothesis.

The Effect of Biodiesel on the Energy Output of Diesel

Student Research by: Alex Asbury, Dan Binder, Robert Okray, and Aaron Solomon

This experiment was conducted during the 2009-2010 school year in the faculty lounge and chemistry lab of the Macomb Academy of Arts and Sciences. This experiment was to determine if there was a more powerful and efficient diesel fuel that could be created and in turn, help the environment. During this study, multiple mixtures of biodiesel and diesel were tested to see which mixture gave off the most energy. Also, to see if a mixture could be more efficient than pure diesel. Mixtures were made of biodiesel and diesel, starting at 100% diesel and going down to 100% biodiesel, at 20% intervals. It was found that the six different mixtures supported the hypothesis that stated "The higher percentage of diesel in each mixture, the more energy that would be given off." Also, the trends showed that there were few errors- while using the two bomb calorimeters. It was concluded that, the more biodiesel that was added to the commercial diesel, the less efficient it became.

The Effect of Reflective Angle on Light Intensity

Student Research by: David Duncan, Austin Penzien, Vince Seefried, and Chris Sledz

The purpose of this experiment was to create a reflective box that would produce the highest light intensity. This was done by creating different reflective boxes that are made to shine light at different angles. There was six different reflective boxes made by cutting out cardboard and covering them with aluminum foil and gluing them together to form different angles. At the back of the boxes, a small hole was cut for the light bulb to fit through. The light bulb was connected to a power source that was plugged into the wall. The power source would allow the light to shine; the light bulb was put into the back of the reflective box. Then there was two tables set up at opposite ends of the room. One table had the reflective box on it and the other table had a light sensor on it. The lights were then turned off making it completely dark for accurate data collection. The light sensor was then turned on and left on for thirty seconds. The data was recorded and later analyzed.

The Effect of Time and Saltwater on the Oxidation of Steel Rebar

Student Research by: Kaitlyn Clough, Lauren Grobbel, and Elizabeth Ulinski

The purpose of the experiment was to determine the amount of rust accumulation after steel rebar was subjected to a salt/water solution for a period of eight weeks. Iron is a metal that accumulates rust when exposed to the elements. This metal, being one of the main ingredients in steel, is used to support buildings and bridges alike. Pieces of steel rebar were submerged in saltwater resembling the ocean's salinity for a period ranging from 0 to 75 minutes, with increments of 15, before being allowed to dry for a week while suspended by cradles constructed of drinking straws. The data obtained was found to be inconclusive due to the lack of time.

The Effect of Water to Soil Ratio and Ramp Angle on How Far a Car is Projected

Student Research by: Sarah Haller, Kelsey Job, Alyson Kline, and Dallas Shafer

The purpose of this experiment was to find if the angle of the ramp and the water to soil ratio of the mud effected the distance a car traveled. There were three water to soil ratios of mud, 30:70 (1.2 L of water and 2.8 L of soil), 50:50 (2 L of water and 2 L of soil) and 70:30 which (contained 2.8 L of water and 1.2 L of soil). The ramp was positioned at five different angles, 25 degrees, 35 degrees, 45 degrees, 55 degrees, and 65 degrees. The ramp was set at the randomized angle and the mud was poured down the ramp. Once the data was collected and analyzed it was found that the angle of 45 degrees with a mixture of 70:30 created the furthest distance because it produced the highest velocity. The 70:30 mixtures had the least amount of density which caused the least friction against the ramp. The 45 degree angle had a smooth slant and was not too dramatic of a slope.

The Effect of the Water Angle and the Amount of Salt in the Water on the Displacement of the Sand

Student Research by: Ashley Ewert, Matt Michalewicz, Jade Woodruff, Brett Zebelian

The purpose of the experiment was to find out how the angle of the water's entry and the amount of salt in the water would effect the sand displacement. To begin the experiment a ramp was built as a place for the water to run down. Then a runoff zone was also built as a place to measure the displacement. The two parts were then attached. In testing, the ramp would be set at 10, 20, 30, or 40 degrees. Salt was added to the water; 0, 2.5, 5, 7.5, 10, and 12.5 mL. 150 mL of sand was measured out and poured between the lines drawn on the run off zone. The water was then poured down the ramp and the displacement was measured. This had to be repeated five times for each gradient. The building of the experiment took place at Jade Woodruff's house, and the testing took place in the room across from the Physics Lab at the Macomb Academy of Arts and Sciences in September through December of 2009. The results showed the lowest displacement occurred at 10 degrees $5.6\text{cm} \pm 1.14$, this supports the hypothesis. While the highest displacement occurred at 40 degrees $29.2\text{ cm} \pm 1.483$ this also supports the hypothesis. The reason this occurred is because of gravity. The greater the incline of the ramp, the greater the pull of gravity would be causing the water to travel faster. This caused a greater sand displacement. The faster the water travels the more energy it would have and the more energy it would exert on the sand causing it to go further. The testing showed that as the angle of the water's entry and the amount of salt in the water increased the displacement of the sand increased.

The Effect of the Volume and Angle on the Rotations of a Waterwheel

Student Research by: Ian Clark, Emily Herbert and Tyler Switchulis

This paper refers to a study that tests the effect of changing the angle and amount of water that hits a waterwheel on the wheel's rotations per second. A structure was built around the waterwheel and water flow pipe so the water's angle of impact would be accurate every trial. Different combinations of water angle and amount were tested and recorded using a video camera, then uploaded to a Mac program known as Final Cut Express to analyze each trial's rotations per second. Disproving the original hypothesis, the data suggested that increasing the water amounts only increased the wheel's rotations per second until eight deciliters was reached; after this, the rotations per second drastically decreased. Furthermore, it was noticed that the sixty degrees trials produced the highest rotations per second, on average. However, they were also the least accurate of the data combinations. These peaks were believed to have occurred because with the lower and higher angles, the water was not evenly spread when hitting the waterwheel; it was either hitting it too head-on, or barely at all. Also, less water would not have as much force when pushing the waterwheel as the higher water amounts would, but too much water could have gotten backed up and actually slowed it down.

The Effect of the Amount of Liquid and Amount of Paper Towel on the Weight it Takes to Break the Paper Towel

Student Research by: Trevor Fistler, Jesse Spalding, and Aaron Walkowski

The experiment was conducted at the Macomb Academy of Arts and Sciences (MA²S) in the fall of 2009. The purpose of the study was to see how much paper towel was needed for different size spills. Often when people spill something, it's a liquid; so water was tested in this experiment. The two independent variables within the conducted experiment was the amount of sheets (1-4 sheets) and the amount of water (100, 200, 300 mL). The research was conducted by clamping paper towel to a wood frame with legs and water was poured onto the paper towel. It was concluded that as the amount of sheets was increased then the weight it took to break the paper towel also increased. As the milliliters of water were increased, the weight it took to break often decreased, but not always. Not all of the liquid was absorbed by the paper towel so it was as if not all of the liquid was being used, which showed in the results. If there is a larger spill that occurs, more paper towels should be used; using less pressure on the paper towel, so the paper towel(s) did not rip or simply break.

The Effect of Sodium Chloride on the Conductivity of Water

Student Research by: Nathan Antilla, Eric Mustaffa, Vincent Ragap, Kurt Wieber

During the fall and winter of 2009, the effect of salinity on the conductivity of water was tested at the Macomb Academy of Arts and Sciences. The purpose of this experiment was to evaluate if varying the amount of sodium chloride dissolved in water would make it more conductive. Solutions were prepared and subjected to an electrical charge. Data was collected, and showed that the addition of Sodium Chloride enhanced the electrical characteristics of the solutions, until the solutions could not be fully dissolved any more, at which point the solute inhibited the conductive properties of the solution. Errors were then factored in, and they showed that even if the experiment had been as skewed as possible, the trend would still exist. Therefore, it became possible to say that the solute in a solution does have an effect on its electrical properties.

The Effect of Dropping Various Masses aAttached to a Parachute of a Constant Diameter on the Rate at Which They Fall

Student Research by: Stephen Ireland, Nick Nixon, Cody Schmidt, and Brandon Townsend

The purpose of the experiment was to determine if the heavier weight would fall the fastest when it was and was not attached to a parachute. The experiment was conducted at the Macomb Academy of Arts and Sciences in Armada, Michigan, in the gym. The data was collected between October of 2009, and December of 2010. The experiment consisted of various weights, 1lb, 2lb, 3lb, and 5lb being dropped from a constant height with and without a parachute attached to them. Our control was these weights being dropped without a parachute. Three trials were conducted for each weight with and without the parachute, and all of the trials were recorded on video camera, so they later could be put into Peak Motus. At the end of data collection the data concluded that the 5 lb weight fell the fastest for both with and without a parachute.

The Effect of Amount of Axe Body Spray On the Combustibility of Bedsheets

Student Research by: Alyssa Baker, Michael Graham, Garrett Hutcheson, and Jessica Payne

The purpose of this experiment was to determine if spraying Axe on cloth with different thread counts for different amounts of time had effect on the time it took the cloth to catch fire and completely burn. 100% cotton sheets of four thread counts; 200, 250, 300, and 350 threads per square inch of cloth, were cut into 1 inch by 1 inch squares. They were sprayed with Axe cologne, for three different amounts of time; 0 seconds, 2 seconds, and 4 seconds, and then suspended over a flame. The amount of time it took them to catch fire and completely burn was recorded. The results showed that Axe did help the sheets to catch fire and burn, because as spray time increased, the amount of time it took the cloth to burn decreased. This happened by a much greater margin between 0 and 2 seconds than 2 and 4, showing that the largest difference was made not by the amount of Axe, but whether any Axe was present or not. It was also found that thread count made no significant difference. The Axe made the sheets more flammable because several ingredients in Axe are easily combustible, such as N-Butanol, which gave Axe an NFPA (National Fire Protection Association) rating of 2 out of 4. These ingredients attach themselves to the sheets and become present in the air around them. The heat from the flame causes the Axe around the sheet to ignite, and then the sheet. This experiment can be applied to real life because people spray themselves with varying amounts of Axe all the time, and this helps show that doing so makes it more likely that their clothes will catch fire. It also shows that consumers do not need to take flammability into account when deciding which thread count or quality of cloth to buy. This experiment could be expanded by adding additional variables such as cloth material, color, distances from which the sheets were sprayed, and body sprays. In addition to that, the time it took the sheets to burn, rather than ignite and burn, could be found.

The Effect of the Velocity of a Soccer Ball Hit at Different Angles By a Mechanical Foot

Student Research by: Katherine Isaacs, Courtney Kurkules, Jennifer Suddon, and Tiffini Valuet

The experiment was conducted by mechanically simulating the kicking of a soccer ball at different angles to observe the velocities. The research studied the preconceived notion that the foot contact upon the soccer ball should be at a 45 degree angle for optimal velocity. According to the study a toe kick and 75 degrees foot contact produced the fastest velocity and 45 degrees angle resulted in the slowest velocity of the six tested gradients.

The Effect of Different Amounts of Voltage on the Time of Separating Water into Hydrogen and Oxygen

Student Research by: Jessica Barjaktarovich, John Gaffney, and Isabella Kesler

The purpose of the experiment was to work with hydrogen electrolysis. The question studied was will the process of water electrolysis be sped up if electricity is used. The voltage amounts that were used for this experiment were 9 volts, 11 volts, and 13 volts. In order to begin the experiment, the researchers had to set up the electrolysis apparatus by clamping it to a large ring stand and filling it with 1 M of sulfuric acid solution. The experimenters then hooked up an external battery using butterfly clamps to connect the copper wires at the bottom of the apparatus, and the external battery. The group then set the external controllable power source by using a voltmeter to display the voltage. After the voltage was set, the group would switch on the external battery and start timing the water using stopwatches. When the water on the hydrogen side would reach a certain point, the researchers would stop their stopwatches and record the times. The data that was collected in this experiment displayed that 13 volts of electricity had the fastest times than any of the other voltages. The data with the second fastest times was 11 volts. The slowest voltage was 9 volts. 13 volts had the fastest times because the higher potential difference supplied to the water causes the water molecules to split faster and create more bubbles.

The Effect of Coca-Cola on Rusted Nails

Student Research by: Ashley Ede, Marisa Green, Carlie Harms, and Holly Hutcheson

Ever since Coca Cola became commercially produced, it has been the subject of many myths and rumors. One of these rumors claims that Coke can remove rust off of nails. This myth was put to the test at the Macomb Academy of Arts and Science in Armada, MI so k. To conduct this experiment, 30 new nails were soaking in 1 cm of water for a week before pouring in different amounts of Coke (1/4 cm, 1/2 cm, and 1 cm) for different lengths of time (30, 40, 50, and 60 minutes). The nails that were rusty from soaking in the water were then put in Coke, for the certain amount of times. After the nail were finished soaking for the desired time, the Coke was poured out and the nails were dried for a week. After a week, the nails were massed. It was found that soaking the nails for 50 minutes in either 1/2 cm or 1/4cm removed the rust the most. The averages show that the nails weighed more after soaking in Coke for 60 minutes. This was caused because the Coke dried and left a residue on the nails, which increased the mass

The Effect of Whirlpool Speed and Water Depth on the Survival Time of a Boat

Student Research by: Brian Batayeh, Mitchell Bobcean, and Vincent DiGiorgio

The purpose of this experiment was to find out how fast a boat would sink in a whirlpool if the whirlpool speed and water depth were changed. The experiment was conducted by obtaining an ice cream pail and labeling the container with water depths of 3.81, 5.08, 6.35, 7.62, and 8.89 cm. The pail was then placed on a magnetic stirrer, a magnet was placed into the container, and the pail was filled with water at the desired depth. The magnetic stirrer was then turned on at speeds of 500, 1000, and 1500 RPM. The boat was then placed in the water near the edge of the ice cream container and the time the boat stayed afloat was measured. The results show that at 500 RPM, the time the boat survived increased as the water depth increased. The results of the data at 1000 RPM show that the highest survival time of the boat was at the lowest water depth. The results show that at 1500 RPM, the longest time the boat stayed afloat was at the lowest water depth. As the water depth increased, the time the boat stayed afloat decreased, increased, then decreased again. This is most likely because as the speed of the whirlpool increases, the more turbulent the water's flow becomes.

The Effect of the Angle and Weight Delivered by an Airbag on the Amount of Force Exerted on a Driver

Holly Ernst, Alyssa Hartsig, and Danielle Kehrig

The research conducted was based on the replication of a driver in a crash with an airbag deploying. The contraption consisted of a pendulum which was pulled back to act as a force. It was released to hit a soccer ball that was dangling in front of a crash dummy's head. When the ball collided with the crash dummy, the head hit the force plate that calculated the force of the impact in Newtons. The force traveled through the soccer ball and dummy's head until it got to the force plate. This stopped the force from traveling which refers to the conservation of energy. The conservation of energy states that when force is exerted on an object it will stay the same until an outside force is acted upon it. The angles at which the pendulum was dropped were placed at 70, 80, 90, 100, and 110 degrees using a protractor. The three masses tested were placed at the back of the pendulum which consisted of 5, 10, and 15 pounds. The purpose of this study was to research what angle and weight combination would produce the largest amount of force which was assumed to create the greatest amount of damage to a driver from an airbag. When the pendulum was placed at an angle of 70 degrees with a 5 pound mass a smaller amount of force was created in comparison to an angle of 110 degrees with a 15 pound mass. The highest force was produced by the 15 pounds positioned at 110 degrees. It was believed that these results were obtained due to gravity. When there was more weight gravity had more weight to pull down and when the angle was higher gravity had more time to pull the leg down. This increased the speed and therefore increased the force.

The Effect of Tee Position on the Distance a Golf Ball Travels

Student Research by: Zach Kilpatrick, Ryan Sawitzky, and Cristhian Tollis

This research experiment was conducted to find the spot on the face of a golf club head where the ball traveled the greatest distance. A contraption was built to simulate someone swinging a golf club. Five different spots on the club face were tested to find the one with the greatest distance. To have the ball hit at these five different places, golf tees were cut to different lengths. The different tee heights created different trajectory, speed, lift, and distance for each ball struck. The distances from each trial were recorded and put into mini tab. After compiling all the data it was found that when the tee was at a height of 4cm the golf ball traveled the furthest average distance. The golf ball traveled the least average distance at a tee height of 6cm. The ball had the best trajectory and lift at a tee height of 4cm and that is why it traveled the furthest on average distance. When the tee was at a height of 6cm it had the least speed and the highest trajectory and that is why it traveled the least average distance. When the distances were graphed it showed that the trend was quadratic. The distances the ball traveled increased until the ball was at a height of 4cm, then decreased gradually until the last tee height of 6cm.

The Effect of Salt Levels on the Amount of Voltage

Student Research by: Natalie Bytner and Sabrina Tibaudo

The research was conducted on October 22, 2009, through December 10, 2009, at the Macomb Academy of Arts and Sciences (MA²S). Alternative batteries that used a salt water solution as its electrolyte was used in this project. The batteries used in the experiment were fashioned from pennies, paper towel, tin foil, tape, and wires. The twenty batteries that were made for each salt level were soaked for 30 seconds in a salt water solution that included either 0 cm³, 1.25 cm³, 2.5 cm³, 3.75 cm³, 5 cm³, or 6.25 cm³ of salt that were randomly chosen. They were then removed from the electrolyte and were tested for the amount of millivolts that the battery contained by using a volt meter and alligator clips. The results revealed that the changing levels of salt per solution made no significant difference in the outcome of the voltage. This was thought to have happened because of an uncontrolled and un-equal amount of impurities in the water thus rendering the results inconclusive. The data was believed to be misleading because past research done supported the idea that more salt in the salt water solution would then, in turn, lead to a significantly higher amount of voltage.

The Effect of Arm Angle and Height on the Distance a Volleyball Travels

Student Research by: Sarah Herbert, Megan LaCavera, and Chase Rhein

The purpose of this experiment was to find how the angle of the arms of a volleyball player and the height the ball is dropped from has an effect on the distance a volleyball travels when it is bumped. It was hypothesized that the higher angles would increase the distance the ball travels and the change in height would make little difference in the distance. For this experiment, five heights were used and five angles were chosen. The five angles were 0°, 10°, 15°, 20°, 30°. The five heights were 150 cm, 175 cm, 200 cm, 225, and 250 cm. The ball was bounced off a platform while being recorded with a video camera. The recordings were then analyzed using PEAK Motis for further analysis. The distance was measured in centimeters after each trial. Each combination of angles and heights were tested 15 times. Force of the ball hitting the platform was also found for each of the combinations of height and angle. This was found using a GLX and a force plate. The results, as predicted, showed that largest angle, the 30° angle, had the greatest distance traveled. As the angle decreased so did the distance traveled, but the height of the volleyball increased. These results remained less consistent for each height tested. The force data seemed to be very consistent for each combination. Height 2, angle 1 did, have the greatest force, but the remaining combinations were very similar. This experiment showed what angles are best for the bump of a volleyball depending on the distance wanted.

The Effect of the Moving Velocity and Fulcrum Point of a Catapult on the Distance that the Projectile Launches

Student Research by: Krystal Diel and Alexandria Kesek

This experiment was based on whether an increased speed of a cart that a catapult was set on or the fulcrum point of the arm of the catapult would increase the distance of a flying projectile. The experiment was conducted October 14, 2009 through December 16, 2009 at the Macomb Academy of Arts and Sciences (MA²S). A catapult was placed on a cart and rolled down an incline at different distances to obtain different speeds. The distances that the cart traveled down the incline were one meter and two meters. The arm of the catapult had five different fulcrum points that were used to determine if it would affect the distance that the golf ball traveled. The fulcrum points are referred to as Pivot 1, Pivot 2, Pivot 3, Pivot 4, and Pivot 5, with Pivot 5 being the closest to the counterweight. A chalked-up golf ball was launched from the catapult and landed on black paper. As the speed of the cart increased, the golf ball traveled further. As the fulcrum point moved further away from the counterweight, the golf ball traveled further as well.

The Effect of Car Mass on the Stopping Distance

Student Research by: Gabriella Dabain and Maija Manninen

The purpose of this experiment was to find how the mass of a remote control car affected the stopping distance. This information can help drivers determine at what point they would need to begin stopping during a hazardous situation. Although the time that it would take to stop would vary because of the car model, brand, size, etc., it can still give drivers an estimation of how long it would take to fully stop their vehicle. This experiment, conducted at the Macomb Academy of Arts and Sciences in Armada, MI, used a store-bought remote control car that would accelerate for 183 cm. Once the car had accelerated to the 183 cm mark, the control was released so the car would coast to a stop. To represent different masses, five ziploc bags were filled with 100g of flour each. After the car had coasted to a complete stop, the distance was recorded. The results had shown that the distance hardly changed between each gradient. This is because the heavier cars had more friction than the lighter cars, which increased the stopping distance. This was the opposite for the lighter cars. However, because the heavier cars went slower, the stopping distance decreased. The friction and the velocity of each car had balanced out, which made the data points overlap.

The Effect of Bat Type and the Position the Bat Hits the Ball

Student Research by: Michael Medley and Michael Stewart

The project was undertaken after the mutual interest in baseball. It was able to be taken beyond the game, into some of the many sciences behind it. The research was based on which of the two bats would be most effective. The two bats performance, composite and wood, has been questioned on a professional and recreational level. This also helped the experiment develop. The researchers were also expecting to try to find out where the best place on the baseball bat it would be to hit the ball. There were five positions tested, in increments of five, starting from the tip going to the bottom of the bat. They were also tested using five different speeds. The constant of the experiment was the height at which the ball was struck. The experiment took place in the MA²S gymnasium, on a wooden sheet of plywood. The first speed at each position on the bat the ball went roughly the same distance. As the speed increased though the bat showed that position two on the bat became better as the speed got higher. The single piece wood bat consistently proved that the two best positions to hit the ball off the bat was at position one and position two. These positions were better than the composite bats at positions one and two, although the composite bat hit further at positions three, four, and five. The composite also did not vary between positions as much, giving it a larger area to receive a decent hit from. As speed/force increased, so did the distance traveled by the ball.

The Effect of the Total Mass of a Car on Its Acceleration

Student Research by: Stephen Kline, Isaac Krause, Luke Mackley, and Douglas Phillips

The objective of the experiment was to find how acceleration was affected by a change in mass. One of the main reasons this experiment was chosen was the fact that most Americans can relate to the subject. A car which had eight different clay masses (1406.136 g, 1502.4 g, 1598.7 g, 1695g, 1791.3 g, 1887.6 g, 1983.9 g, and 2080.2 g) attached or placed on to the top in specific spots, it was pulled along a table by a string that had a mass of X g attached to the other end. The car had to travel 1.5 meters in the forward direction from its starting position and how long it took to travel that distance was recorded. Twenty trials were conducted on each different mass. The data showed that the car with a smaller mass accelerated faster than the car when it had a larger mass attached. This difference was measured to be a .6 second difference. Changing the mass caused there to be higher or lower amounts of friction; the weight displacement created some problems in wheel rotation.

The Effect of the Circumference of a Soccer Ball on the Ground Following a Kick

Student Research by: Rosie Cunningham, Melissa Mikolowski, and Kaye Suarez

In soccer, different age groups play with different sized soccer balls. The goal of this experiment was to see how the circumference of a soccer ball affected the distance it traveled. The change in circumference might give an advantage to a certain age group because it could make a soccer ball easier to kick or harder to stop. A machine was built to make sure that the soccer balls were being kicked consistently. All the soccer balls were pumped to the same PSI to decrease variability. The soccer balls were kicked and their distances were measured and recorded. The final conclusion from the experiment is that the larger soccer balls traveled farther than the smaller soccer balls. All combinations of the five mean distances were proven to be statistically different. All the means were proven statistically different, even though the 48.00 cm circumference soccer ball had less statistical difference to the 68.58 cm circumference soccer ball. It traveled the second farthest instead of fourth farthest, as we predicted. The smaller soccer balls, other than the 48.00 cm soccer ball, traveled smaller distances because they could not overcome the resisting forces like friction and drag, making them stop sooner. Therefore, the largest soccer ball traveled the farthest distance.

The Effect of Arm and Hammer Age Defying Toothpaste on Tooth Enamel

Student Research by: Brittany Bergstrom, Victoria Breiling, Armelle Henley, and Hannah Townsend

Enamel on teeth is constantly being eaten away by acids and sugars that people consume in everyday foods and drinks. Many types of toothpaste advertise the ability to regrow and strengthen the enamel. Arm and Hammer Age Defying Toothpaste claimed to bond with the remaining enamel and therefore, strengthen it. The liquid calcium claimed to be the cause of strengthening, and hydrated silica, along with sodium bicarbonate in the toothpaste were said to whiten the teeth. The main substances responsible for the erosion of enamel in soda are the numerous chemicals, dyes, and sugars. With these two ideas in mind, an experiment was created to see how these two products affect each others effect on teeth. Seventy-five teeth were selected and five different time sets were determined. The teeth were soaked in soda and then massed. The increments of time set started at zero minutes, and rose in increments of 10 until the teeth were exposed to 40 minutes in the soda. The time marked how long the teeth would soak in Pepsi before being brushed with Arm and Hammer Age Defying Toothpaste.

The Effect of Brewing Time on the Relationship between Caffeine Content and Color of Coffee

Student Research by: Nicholas Fitzsimons, Brett Muylaert and Aljban Sinistaj

The study reviewed the relationship between the time coffee is brewed for, the caffeine content, and the darkness of the coffee. The coffee was steeped over a Bunsen burner for different increments of time. The caffeine was then extracted from one sample of each increment of time using the chemical solvent methylene chloride. A UV ó Vis (Ultraviolet ó Visual Spectrophotometer SP 2000 ó UV, Corlinville, IL, Cynmar Corporation) was used to examine the darkness of the coffee for both the samples that the caffeine was extracted from prior to the tests and the samples that were unexamined prior to the UV ó Vis tests. These tests were used to find a relationship between the caffeine content and darkness. This relationship was used to calculate caffeine content, as actually extracting and massing the caffeine is a time consuming process.

The Effects of Varying Concentrations of Liquid Calcium on the Growth Rate of Tenebrio Molitor

Student Research by: Anna Smith, Erin Steinberg, and Alexis Verstraete

The purpose of this experiment was to see if calcium affected the growth rate of mealworms. The experiment involved having five different gradients of calcium being put into containers of oats where mealworms were placed and put into a refrigerator. The mealworms were massed and measured in centimeters over the nine weeks. Rather than making the mealworms increase in size, the mealworms decreased in size over the nine weeks. A factor was that the calcium used was meant for reptiles, not mealworms.

The Effect of Copper Sulfate on the Conductivity of an Electric Current in Water

Student Research by: Andrew De Bucce, Jon Horton, Erin St. James, and Tyler Wawrzyniak

This experiment was about how varying the concentration of copper sulfate solutions affected the voltage of an electric current traveling through water. Five different gradients of copper sulfate were tested for the change in voltage. A tank was filled with distilled water and a battery was attached to a voltmeter and alligator clips. The alligator clips were put into the water and the voltage running through it was measured. Forty trials were tested for each amount. When adding copper sulfate to the water, the voltage that was measured varied little. The amount of copper sulfate in water did not increase the voltage running through the water. Distilled water contains limited ions that electricity needs to flow through it. Adding copper sulfate to the water gave it the ions it needs to conduct electricity. Even though the copper sulfate should have had an impact on the voltage, the water still didn't support the electric current enough for it to be seen in any pattern. It is believed that the battery had some effect on the voltage; it could have recharged too much or not recharged enough, changing the voltage. The battery could have had a different charge than when the experiment was started the week before, varying the results. The averages show that there was no pattern of how the copper sulfate affected the voltage reading in the water.

The Effects of the Angle of Wind Turbine Blades on the Speed at Which it Rotates

Student Research by: Jacob Gritzinger, Katie Karl and Lauren Okray

The experiment was conducted at the beginning of fall of 2009 and continued until early December of 2009 at The Macomb Academy of Arts and Sciences, Armada, MI. This project was meant to find which blade angle on a wind turbine would have the greatest amount of rotations. (3) Wind turbines are mainly used in big fields as an electricity source. (3) They are economy friendly and are good for the environment, because they do not use fossil fuels. This experiment has shown that the blade angle has a significant distinction in the amount of rotations the blades will spin in thirty seconds. Since the blade angles play a big role in rotation, an appropriate angle can make a turbine more efficient. According to the data collection, the lower the degree, the higher amount of rotations occurred, with an exception to 0 and 90. Data collection was conducted by building a two foot tall model turbine with three fins. The blades were placed at the different angles in front of an industrial fan; the rotation count was recorded in a thirty-second time frame. Twelve trials per week were conducted. The other variables that could have been tested ranged from blade size, blade shape, blade material, blade width and length, and shaft height. The degree manipulation was the easiest to test by far for a small scale wind turbine project. The other variables that could have caused change that was controlled to the best ability was random air currents and the error that could have been caused by miss counting the rotation recording by eye. By not having a material that was error-proof for counting rotations, it all depended on our individual eye sight and memorization to keep up to speed with the blades.

The Effect of Pressure on a Pair of High Heels While Walking at Different Velocities

Student Research by: Lauren Goedtel, Lindsey Hart, Makayla McCarthy, and Alyssa Wrubel

Many women wear high heels without realizing the effects of changing velocities can have; a faster or slower speed can influence the amount of force exerted by a particular area of the foot. After walking at five different velocities across a box of sand, the imprints of the toe and heel left behind in the sand were measured using Popsicle sticks and a permanent marker. It was found that when comparing the different velocities, the faster velocities differed more than the slower velocities. The slower velocities exerted more pressure, leaving a deeper imprint in the sand. The faster velocities exerted less pressure leaving a shallower imprint. The results are discussed in relation to the speed each step was taken versus the amount of pressure exerted.

The Effect of Room Temperature Water on the Stability of a Popsicle Stick Bridge

Student Research by: Jackie Farrier, Lauren Heimler, Majesta Muylaert, and Alex Sheppard

The purpose of the experiment was to determine the effects of water on a Popsicle stick bridge, depending on the amount of time it was soaked in water. Sixty Popsicle stick bridges were created and soaked in a five-gallon bucket full of room temperature water for varying amounts of time. Each group of bridges were soaked for a different amount of time. After the bridges were soaked, mass was placed on the bridges to see how much force each could support before they broke. It was found that the longer a bridge was kept submerged in water, the less weight it was able to hold, collapsing sooner than the others. The results are discussed in relation to the amount of time each bridge was held in water versus the amount of weight each bridge held.

The Effect of Gear Ratios on a RC Car

Student Research by: Gino Campis, Jacob Goike, and Markus Hoskin

An experiment was conducted to find the effect of different gear ratios on the time it took a remote control car to travel fifteen feet. To test the experiment, a 16-foot track was constructed to run the car down. Photogates were placed at each end of the track 15 feet apart. The process was repeated 15 times for each gear ratio. Five motor gears and two final drive gears were used, which produced ten gear ratios. This was a two-variable experiment since two gears were manipulated. A trend was found; larger gear ratios resulted in having a higher top speed than acceleration. With the lower gear ratios, the experiment showed a higher acceleration than top speed.

The Effect of the Bass and Pitch Level on the Intensity of Sound

Student Research by: Rebecca Bertrand, Lauren Caruss, Michaela DeGrande, and Tori Lindeman

The purpose of this experiment was to determine the appropriate level of a tone to listen to without the decibels being too high. The experiment took place at the Macomb Academy of Arts and Sciences in the fall of 2009. Thirteen different kinds of pitch levels were tested during the experiment; -3, -2.5, -2, -1.5, -1, -.5, 0, 1, 1.5, 2, 2.5, 3. The dBc (Decibel level) of the sound was recorded thirty five times for each of the thirteen levels. It was expected that higher pitch would produce higher decibel levels, and that lower pitches would produce lower decibel levels. The data collection did not support this hypothesis to be right. The lower the pitch level was the higher the number of dBc level.

The Effect of Barrel Length on the Precision of a Marshmallow Being Fired From an Air Cannon

Student Research by: Nick Burton, Adam Flaim, Collin Kanachki, and Daniel Trombley

This project is about precision of a projectile and how different barrel lengths can have an effect on the precision of the shot. Six different barrels were chosen to test during this experiment. (0.5', 1', 1.5', 2', 2.5', 3') Thirty trials were conducted for each of the six barrel lengths, giving a total of 180 total data points. Ten trials were completed per day and the experiment took three months to complete data collection. The precision was found by taking five shots per barrel and then measuring the diameter of the two furthest shots. Different barrel lengths were all compared statistically and showed to all be different from each other. The change in precision was specifically from the change in the barrel lengths. It was found that the greater the barrel length, the more precise the air cannon was. This is believed to have happened because with a longer barrel length, the end of the barrel was closer to the target than the shorter barrels.

The Effect of Moisture Content on the Structural Integrity of Pine Boards

Student Research by: Mark Casamer, AJ Doering, Zach King, and Andrew Kraemer

The purpose of the experiment was to see what the effect of water would have on pine boards. The pine boards were placed inside a cooler filled with water for times of zero, five, ten, fifteen, and twenty minutes. Twenty trials were performed for each of the different time increments, giving a total of one hundred trials. Each board, with a gradient number on them, were soaked in the cooler for the needed amount of time. A tote container, filled with sand, was attached to the underside of a board as it was on the table. When broken, the sand needed to break the pine board was placed on a scale. It was discovered that the amount of sand needed to break a pine board decreased as the amount of time soaked in water increased. Showing that the longer the board was soaked in the water the less mass it was able to hold.

The Effect of Velocity on Cast-off During A Collision

Student Research by: Kenny Brohl, Dillon Frost, and Vince Messina

The purpose of the experiment was to determine if velocity affected the amount of cast-off of a collision. To accomplish this goal, the researchers fired marshmallows that had been coated in all purpose flour, at different velocities, at a brick wall that had been covered with a large piece of black construction paper. The velocities were changed by pulling the slingshot's band back farther and measuring the tension of the band in pounds with an electronic fish scale. (The measurements were later converted into SI units.) The variables ranged from 10lbs to 55lbs (4.54kg-25kg). They were increased in increments of 5lbs or 2.27kg. Each gradient was tested three times a week for 8 weeks. It was found that the velocities in the middle of the data set had the greatest amount of cast-off, because they had generated enough kinetic energy so that when they collided with the wall the majority of the flour was cast-off of the marshmallow, thus the term "cast-off".

The Effect of Foot Angle on the Speed of a Kicked Soccer Ball

Student Research by: Kyle Baert, Jack Sabelhaus, and Eric Tobey

The game of soccer is very well known in the United States and even more in Europe however, most may not know what angle of the foot should be used to properly kick a ball for maximum speed. This paper is going to show how to kick a soccer ball for maximum speed depending on four angles. A pendulum was constructed out of simple materials, then an artificial leg was built out of steel, epoxy foam, and a size ten soccer cleat. The soccer ball was placed in the center of the pendulum and the leg was lifted and released. Four timers were used to find the ball's time interval that it took to reach the six meter mark. The results were looked over and discussed. The best angle to kick the ball at was found.

The Effect of Position of the Bucket on a Catapult Throwing Arm on the Depth of Indent Caused By a Marble Projectile

Student Research by: Ally Chapoton and Morgan Payne

An experiment was performed beginning in late 2009 and ending in early 2010. The experiment was conducted by launching a marble at a piece of polystyrene, leaving an indent which was measured in millimeters using a toothpick, a piece of paper, and a ruler. The independent variable was the position of the bucket along the catapult arm. This was repeated with each bucket placement and each data point was recorded. The results showed that all of the indents were statistically the same and any change was due to random chance, not the placement of the bucket along the arm.

The Effect of Changing the Length of Sound Amplification Boxes on a Sound's Loudness

Student Research by: Erika Borucki and Elizabeth Delikta

An experiment was conducted in the fall of 2009 which ties together the properties of sound and waves, and the way in which certain devices can produce and amplify it. Five different sound amplification boxes were constructed out of pine, which consisted of the same width and height, but varied in lengths of three, five, seven, nine, and eleven inches. A 125 Hz tuning fork was placed in the center of the boxes and struck with a bob, consisting of a nut and washer, suspended by a pine and plywood pendulum. The resulting sound was measured with a decibel meter placed one centimeter outside of the box's entrance. During the testing period of eight weeks, forty trials were conducted in random selection. There was a general trend of an increasing average decibel level between the control and the three-inch box. From three inches to nine inches, there was no significant difference in the mean. For the trend between nine and eleven inches, the data again showed an increase. The results of the eleven inch box were due to constructive interference, whereas the other four boxes by destructive interference.