

The Effect of Impact Angle and Meteorite Density on Crater Size

Student Research By: Andrew Betka, Stephanie Hartsig, Hannah Johnson, and Jenna Lee

The purpose of this experiment was to test and observe how various angles of impact affected the dimensions of meteorite craters. Testing was done by launching simulated meteorites into dirt at the angles of 30, 60, and 90 degrees. These tests were carried out from early October of 2006 to late December of 2006 at the Macomb Academy of Arts and Sciences in Armada, Michigan. The results of the crater dimensions were determined by measuring the length and width of the crater after impact, while the resulting velocity was analyzed through PEAK Motus software. It was concluded that the lower angles resulted in the greatest velocities, due to more velocity in the horizontal direction causing a higher combined velocity. The lower angles also had longer, more elliptical craters whereas the higher angle contained the wider crater, due to less horizontal velocity at greater angles resulting in less elliptical craters.

The Effect of the Presence and Tempo of Classical Music on Spatial Reasoning and Intelligence Quotient

Student Research By: Amanda Askew, Frances Dixon, Patrick Higgins, and Steven Schafka

Between October 18 and December 20, 2006, a study was done with the purpose of determining whether classical music would be a positive stimulant on either spatial reasoning or intelligence quotient test scores. Forty-five student volunteers were used as test subjects for the experimentation. All subjects took both the intelligence quotient and spatial reasoning tests by accessing online web pages in a special testing room. They were randomly divided into three different groups. The first group was the control, and the subjects from the group took the two tests in complete silence. The second group took the tests in the presence of slow tempo classical music. The third group listened to fast tempo classical music while taking the tests. The results from the data of the study did not show a correlation between the presence of music and the test scores of the subject.

The Effect of Time on the Amount of Bacteria Grown off of Various Foods Dropped onto a Linoleum Floor

Student Research By: Erin Harding and Kaitlyn Harding

The purpose of this study was to determine whether the amount of time food spent in contact with the ground and the moisture of the food had any affect on the amount of bacteria grown over time. The research was conducted at the Macomb Academy of Arts and Sciences in Armada, MI between October 18, 2006 and December 20th, 2006. Sixteen samples of five different food types (turkey, apple, jellybean, cheese and animal cracker) were divided into five groups of three with one left over for the control. Each group was designated a time interval, one second to five seconds, that the samples would be left in contact with a linoleum floor. Those samples were then swabbed and the bacteria from the swabs were transferred to a host, a pre-made agar dish, for the bacteria to grow on. The amount (%) of bacteria grown on the agar dishes from each group were then analyzed and compared to the control. Results showed that bacteria were not only present after one second, rejecting the myth of the "5 second rule", but the amount of bacteria grown increased as time increased.

The Effects of Performance Enhancers on the Growth Rate of *Tenebrio molitor*

Student Research By: Trisha Blake, Michael Polisei, Stacey Simon, and Byron Voelkert

For nine weeks, a study was conducted in research room 122 at the Macomb Academy of Arts and Sciences in Armada, Michigan. The purpose of the experiment was to determine the effect of two performance enhancing supplements on the growth rate of *Tenebrio molitor*. The performance enhancers used were Body Fortress Performance Creatine and Ribose Muscle Edge, which were chosen based on similarities of actions inside of the body, as well as the two supplements being body-building competitors. *T. molitor* was chosen because, like all holometabolic (complete metamorphosis) insects, four life stages are endured: egg, larva, pupa and beetle, which allowed the amount of time spent in certain life stages to be easily seen. The control group was fed only apples with no added supplement. The *T. molitor* in the other seven groups were fed supplement-soaked apple slices, and the control was just fed apple slices. The two supplements were given in three dosages, which were low, normal, and high. Also, to test the hypothesis, there was one mixture of the two enhancers, which was the creatine-ribose group. The high dosage of creatine had the greatest effect on the growth of *T. molitor*, causing the mealworms to enter the pupa and beetle stages one week prior to that of the other groups, which was believed to be due to the major role that creatine plays in the production of ATP in the body.

The Manipulation of Material and Length and its Effects on the Charge Retained by a Homemade Capacitor

Student Research By: Mike Breiling, Cory Hayes, Kyle Weirauch, and Eddie Zinger

An experiment was conducted at the Macomb Academy of Arts and Sciences to determine how materials and length affect the charge held by a homemade capacitor. Capacitors are made of two conductive plates separated by an insulator, or dielectric, and will hold a charge when exposed to an electrical current. The tested capacitors were made using combinations of aluminum foil or aluminum flashing along with saran wrap or waxed paper. The lengths of the capacitors were changed between fifty, forty, thirty, twenty, and ten inches, with a width that remained constant at ten inches. The charge held at the end of each trial was measured in nanofarads, a unit of capacitance, and recorded for further analysis. The capacitances increased as a direct correlation to the length of the conductive plates. This was because an increased surface area allowed the electricity to build up in a larger space and, therefore, hold a higher charge than a smaller capacitor. Furthermore, when testing a capacitor with aluminum foil, saran wrap increased the size of the retained charge. However, all of the data sets showed that, when a capacitor was tested using aluminum flashing, a waxed paper dielectric accounted for an increase in capacitance as opposed to saran wrap. The reason and validity of this trend was inconclusive because both of the conductive plates are chemically identical, and a saran wrap dielectric should increase the capacitance due to a smaller distance between the two conductive plates.

The Effect of Recycling on the Tensile Strength of Inked and Non-Inked Paper

Student Research By: Casey Beeman, Andrew Blake, Nathan Caruss, and Joey Zebelian

The purpose of this study was to determine the effect of the recycling process on the tensile strength of paper. The experiment took place at the Macomb Academy of Arts and Sciences in Armada, Michigan. The study took place between October 18, 2006 and December 20, 2006. For the experiment, the tensile strength of paper was tested prior to and after the recycling process took place. It was tested for 0, 1, 2, 3 and 4 times recycled. This was done for both inked and non-inked paper. The paper was made with a homemade mold and the strength was tested with an apparatus, which hung a bucket that was filled with sand from the paper. Once the results were recorded, the findings helped to conclude that the inked paper possessed a tensile strength which decreased at a lower rate than the non-inked paper, but the rate difference was only slightly lower.

The Degradation Rates of Various Perfumes Over Increasing Periods of Time

Student Research by: Elizabeth Fleming, Daniel Kaltz, Jenna Kegler, and Kylie Krause

The purpose of the experiment was to find the degradation rates of four different perfumes, (Tommy Boy by Tommy Hilfiger, OM by Gap, Glo by J. Lo, and Cucumber Melon Body Mist by Bath and Body Works), over five intervals of time (three, five, ten, fifteen, and thirty minutes). The tests were conducted using an Infrared Spectrophotometer. A perfume sample applied to a salt tab was allowed to set for a specific amount of time and then tested. The spectrophotometer sends IR radiation through the sample and displays data as "% Transmission" (amount received divided by percent sent).

The data collected in this experiment was inconclusive due to an abundance of errors caused by changing climatic conditions. These uncontrollable conditions made the collected data increasingly inconsistent. Regardless, many trends were found within the data. These trends supported the inconclusive data by bringing forth many of the problems encountered throughout the conduct of the experiment.

The Effect of Varying Angles and Distances on Light Intensity

Student Research By: Renee Bezaire and Sheri Lewis

The purpose of this experiment was to determine the effect that varying angles and distances from a light source has on light intensity. This was done using eleven solid colored computer screen (black, white, red, orange, yellow, green, blue, violet, magenta, brown, and gray), six different distances from the computer screen (0.5, 1.0, 1.5, 2.0, 2.5 and 3.0 meters) and five different angles (90, 80, 70, 60 and 45 degrees.) Data from both the varying angles and distances show that the greatest overall decrease in light intensity occurs as 1.5 meters and 90 degrees away from the light source. On average, intensity decreased with decreasing angle and increasing distance. The mean intensities of each angle group in relation to distance showed a general downward curve, and it became apparent that overall, both distance and angle had a significant effect on the light's intensity.

The Effect of Cycle Phase and Type of Detergent on Amount of Detergent Present in the Wash Water

Student Research By: Christine Bingham, Lindsay Hurd, and Merissa Seefried

The objective of the experiment conducted at the Macomb Academy of Arts and Sciences, in Armada, Michigan, was to determine if the greatest amount of detergent was present during the middle of a wash cycle. Tide, Woolite, and Tide with Woolite were tested in the experiment. These detergents, as well as most other cleaning agents, are mainly composed of surfactants, which have a hydrophobic and a hydrophilic component. The data was obtained from graphs produced by an Infrared Spectrophotometer. The results concluded that the most detergent was not found in the middle of the wash cycle; in fact, the least amount of the detergent was found at that point in the wash cycle. ANOVA tests were used to determine if the independent variables significantly affected the data. It was found that there was too much variability to conclude that the variables alone determined the results. Trends in the experiment showed the relation between the aroma and the cleaning agent. It showed that Tide had the greatest amount of aroma and the least amount of soap, giving it the highest ratio. Woolite had the least amount of aroma, and Tide with Woolite had the greatest amount of soap. Hence, Tide with Woolite combines the two detergents compromising the amount of aroma and the cleaning strength.

The Effect of Various Materials on the Reduction of Sound Levels at Various Frequencies

Student Research By: Grant Bartlett, Brandon Jackson, Matt Raska, and Mark Zeigler

Beginning on October 18, 2006 and ending on December 20, 2006, a research experiment was conducted at the Macomb Academy of Arts and Sciences in Armada, MI. The purpose of the experiment was to test the effectiveness of common materials as sound reducers. Using twelve different frequencies and five different distances, four different materials were tested. All the materials were tested using all of the different frequencies and all of the different distances. It was found that all of the materials did show a reduction of sound. The material that worked the best was wool and the least effective was the Egg foam. The spacing that worked the best was the 30 inch spacing, the two that reduced sound the least were the 12 inch and the 24 inch distances. It was believed that the reason the wool worked the best was due to its higher density. It was also thought that the 30 inch spacing worked the best for sound reduction because it was farthest away from the wall.

The Effects of Percent Composition on the Strength and Durability of Pykrete

Student Research By: Sarah Barr, Heidi Jenuwine, Laura O'Connor, and Don Yochim

The purpose of this experiment was to determine the percentage of sawdust mixed with water that would create the strongest pykrete sample. Two tests were performed, and eleven percentages were tested, ranging from 0 to 20 percent in increments of two. For the horizontal elongation test, the pykrete sample was placed so that its ends were resting on two pieces of wood, and a bucket was suspended from its center. Sand was poured into the bucket until it broke. For the vertical elongation test, the bar was suspended vertically from a piece of wood, and the bucket was clamped to its bottom end. Again, sand was poured into the bucket until the pykrete piece broke. It was determined that the 14 percent pykrete was the strongest. The 0 percent sample, pure water, was consistently weaker than the others, and as more sawdust was added, the pykrete became increasingly stronger until the percentage reached 14. Percentages higher than 14 produced increasingly weaker pykrete. Calorimetry tests were also performed, and the 12 percent sample was determined to have the greatest specific heat capacity.

The Effect of Varying Sound Amplitudes on Sand Movement

Student Research By: Logan Kinch, Melissa Lapp, Kristina Williams, and Alicia Winans

The purpose of this study was to determine the effect of varying voltages on the formation of sand. This experiment took place between October 18, 2006 and December 20, 2006 at the Macomb Academy of Arts and Sciences in Armada, Michigan. There were three different amplitudes tested: four, three and two volts. Each of these voltages was tested at one frequency, 285.7 hertz (Hz.) Each trial lasted five minutes and three pictures in a controlled setting were taken throughout each trial. All pictures were analyzed in Adobe Photoshop to determine their white intensities. The higher the white intensity was, the more the sand had moved, indicating that the sound impacted the movement. After finding these intensities, it was concluded that four volts created the most sand movement, while three and two volts followed, respectively. It was also observed that when sound was increased by one volt, the white intensity increased by six.

The Effects of Various Temperatures on Alkaline Battery Life

Student Research By: Blake Merrifield, Megan Rawlins, and Brittany Wattling

The experiment took place in the Physics room of the Macomb Academy of Arts and Sciences located in Armada, Michigan from October through December 2006. The experiment tested battery life under various temperatures. The experiment was done to test and determine results of placing batteries in the freezer to give them longer life. It was hypothesized that way and proven wrong that batteries in the freezer would have more amp-seconds than those that were not placed in the freezer, but it was not expected to be by much. The best results for amp-seconds were about 25-30 degrees Celsius, not tested in the freezer. Tests were also run at room temperatures and the freezer temperatures changed each time. As a reminder, batteries that were tested with the freezer were placed in the freezer twenty-four hours in advance. Then, they were either tested for amp seconds using Data Mate, a program used to test data, in or outside of the freezer. Others were tested outside of the freezer at all times.

The Effect of Ginkgo Biloba on the Memorization and Motor Skills of Perognathus Alticolus

Student Research By: Brandon Beaupre, Daryl Desrosiers, Levi Ekanger, and Ian McDonald

The experiment conducted at the Macomb Academy of Arts and Sciences in Armada, Michigan was executed to determine the effect of Ginkgo Biloba on the memorization and motor skills of Perognathus Alticolus. Nine white-eared mice, or Perognathus Alticolus, were selected to be used as test subjects. The nine mice, six male and 3 female, were randomly sorted in to three dosage groups, control, medium, and high. The control group recieved recieved no Ginkgo Biloba. With three mice in each group, two male and one female, the mice were given Ginko Biloba and were tested every week. The cages that the mice were kept in were cleaned every week and the cages were all kept the same and the cages were taken home every weekend. The effect of the Ginkgo Biloba was found by analyzing the times it took for the mice to run through a maze. The mice ran the maze twice per week so the times could be averaged to prevent skewed data, however, the results did not support the hypothesis due to the times of the mice showed no sign of relation between Ginkgo Biloba dosage and maze times.

The Effect of Environmental Factors on Bacterial Growth in Water

Student Research By: Bruce Chang, Devin Kutchuk, Tonya Lenont, and Aimee Thueme

The purpose of this experiment was to determine what type of water would have the most bacteria growth. The experiment took place at the Macomb Academy of Arts and Sciences in Armada, Michigan, from October 18th to December 20th, 2006. Four different types of water were tested: bottled spring water, tap water, distilled water, and purified water. The variables tested during this experiment include temperature, open or un-opened container, and the time it was left to set. The water was tested to find out how many bacteria cultures would grow. A sample of each type of water was placed into a small container and left to set in a certain temperature for a pre-determined amount of time ranging from one day to eight weeks. To filter the bacteria from the water, the water was run through a piece of filter paper and sucked through a vacuum, leaving only the bacteria. The paper was then swabbed, and plated on an agar-filled petri dish. The dish was incubated for one week to stimulate bacteria growth, and then examined. Three week old spring water had the most bacteria growth compared to every other sample tested. Spring water grew the least amount of bacteria overall.

The Effect of Paper Surface on the Complexity and Dimension of Collision Based Fractals

Student Research By: Corey Green, Jimmy Jordan, Sarah McCauley, and Cassandra Yaple

The purpose of this experiment was to successfully create fractals and manipulate the dimension and complexity by dropping calligraphy ink filled glass vessels onto three different types of paper; HP matte, 25% cotton fiber paper, and 100% cotton fiber paper. Tests were conducted at the Macomb Academy of Arts and Sciences in Armada, Michigan, from October 18, 2006, to December 20, 2006. In order to standardize the method of creating fractals, an apparatus was built to drop a glass vessel filled with calligraphy ink onto various types of paper. Three different types of paper were used, and each type was tested thirty times. For each trial, two pictures were taken, one with the glass shards of the vessel left intact and one taken when the free glass shards removed after the ink had dried. All photographs were then run through the fractal analysis software, Beniot 1.3, which rated the dimension of each photograph. If the dimension demonstrated was between one and two, the image was considered a fractal. A number closer to two would be a more complex fractal, whereas a number closer to one would be a less complex fractal. If a photograph, when analyzed, had a number outside of this range, there was no fractal present.

The independent variable was the type of paper being tested; the dependent variable was the dimension of the fractal created. Confounding variables included the type of ink and vessel used, the mechanism used to drop the vessel, and allotted drying time. In addition, the same software program and method for analyzing dimension remained constant for all trials. The averages collected demonstrated that intact images were more likely to display fractal images as opposed to images for which the trial was disrupted, however, the results displayed a lack of consistency among all test subjects.

The Effect of Barrel to Chamber Ratios on the Velocity of a Projectile Launched from a Pneumatic Cannon

Student Research By: Jason Deneweth

The purpose of this experiment was to determine the optimal barrel to chamber ratio (ratio that gives the greatest initial velocity) for any given pneumatic cannon. The experiment took place in a local barn in Macomb, Michigan, from October 18, 2006 to December 20, 2006. There was a total of 28 different barrel to chamber combinations resulting in 20 different barrel to chamber ratios ranging from 1:1 to 1:28. For each barrel to chamber combination, five trials were recorded. Each trial consisted of the projectile, a "C" size battery, being launched at 20 pounds per square inch at a target ten meters away. The initial velocity of each projectile was measured to see which barrel to chamber ratio would achieve the greatest velocity. The software program Peak Motus was used to find the initial velocity for each trial. The findings concluded that there is no optimal barrel to chamber ratio for any given pneumatic cannon. However, the results showed that as the barrel and chamber size continued to increase, so did the initial velocity. In addition, for a specific barrel size an optimal chamber size can be calculated.

The Effect of the Number of Pumps on the Bacteria Growth in Mascara

Student Research By: Danielle Beste, Holly Jurzysta, Shukria Shawqi, and Jill Szydloski

The purpose of this experiment was to determine if the number of pumps in a mascara tube would affect the amount of bacteria growth. The experiment took place at the Macomb Academy of Arts and Sciences in Armada, Michigan over a ten week period. Test subjects and the number of pumps were chosen randomly for each week. Test subjects were tested each week and bacteria colonies were given time to grow and counted at the end of each week. At the end of the experiment, it was concluded that the number of pumps had no direct effect on the number of bacteria colonies grown, but time had a larger correlation with the bacteria colonies grown. The most bacteria colonies were grown in the last trial. This trial also had the most overall pumps performed on the mascara itself when looking at the entire ten week period.

The Effect of Ethanol on the Burning Properties of Unleaded Gasoline

Student Research By: Jordan Krause, Chris Forehand, Robert Siewert, and David Wolf

The purpose of this experiment was to find out how ethanol affects the burn length and energy given off when mixed with unleaded gasoline. Mixtures ranging from 0% ethanol to 100% ethanol were created in 10% increments. Two tests were performed. One test was a length of burn test. This simulated a fuel mileage test. The second test dealt with change in temperature. This was done to determine how much energy was given off. It was found that as the percentage of the ethanol increased, the burn lengths decreased. Also, as the amount of ethanol increased, the change in temperature, or energy given off, increased.

The Effect of Motor Position on the Average Velocity of a Model Maglev Train

Student Research By: Mike Grix, Shannon Kline, Kurt Nieman, and Alex Pikunas

Magnetic levitation, or Maglev, trains are known for their safety, reliability, and efficiency. This experiment is important because of the growing necessity for alternative fuel sources. The purpose was to determine whether a motor and propeller positioned in the front, center, or rear of a model train would propel the train down a track in the lowest amount of time. No control was used because there was no way to propel the train without a motor. This was done by building a track and train which were not exact replicas of normal Maglev tracks and trains, but able to accomplish the same task and able to form a semi-frictionless surface. The results showed that with the motor and propeller in the rear of the model train, the train moved down the track in the lowest amount of time. This is due to the way aerodynamics had an effect on the train as it moved down the track with the weight of the motor positioned in different spots.

The Effect of Energy Drinks on a Persons Heart Rate

Student Research By: Katie Baert, Callan Banach, and Alissa Beeman

The purpose of this experiment was to determine the effect that different amounts of various energy drinks had on an individual's heart rate. This experiment was conducted at the Macomb Academy of Arts and Sciences and at the Armada High School. Four energy drinks; Rockstar, Rockstar Sugar Free, Full Throttle and Full Throttle Sugar Free were tested in two, four, six and eight ounce increments to determine the affect they would have on the heart rate. It was found that the heart rate increased from two ounces to four ounces and then decreased from four ounces to eight ounces. When comparing each energy drink against the control, it was found that the control group had the highest average heart rate. When comparing the sugar free energy drinks to the non-sugar free energy drinks, Full Throttle Sugar Free produced a lower average heart rate in the test subjects than Full Throttle, but Rockstar Sugar Free test subjects had a higher average heart rate than Rockstar.

The Effect of Fuel and Oil Combinations on the Performance of a Diesel Engine

Student Research By: Karl Cross, Mallory Diehl, Sarah Gutierrez, and Shannon Lynch

People across the world use different types of fuels and engines for transportation. The main fuels for transportation, such as fossil fuels, are being used at a rapid rate and the need for alternative fuels is increasing. It was questioned whether or not alternative fuels would have the same performance as standard fuels. A diesel engine was used to pump water from one area of a pond to another area, while the engine ran on different combinations of fuel and oil. While the engine was running, burn time of the fuel, temperature, and RPM (rotations per minute) of the engine were recorded for every four ounces of fuel burned. For each different component measured, there was a different fuel and oil combination that performed the best, except in the case of temperature. Overall, Premium Onroad with Ambergold synthetic oil was the best choice when looking at burn time, although B20 with Ambergold synthetic oil was the best fuel and oil combination when looking at RPM. The Premium Onroad with crude oil had the lowest temperature, which was the best result when looking at this area. When looking at the data, it was thought that the results for temperature were related to the outside temperature and the molecular structure of the fuels. RPM and burn time were also thought to be affected by the molecular structure of the fuels and oils.

The Effect of Varying Angles of a Reflective Surface on the Energy Output of a Solar Panel

Student Research By: David King, Julie Miller, Meagan Thrower, and Nick Weldon

The purpose of this experiment was to determine if a mirror would increase the energy output of a solar panel and if so, which angle would allow the solar panel to generate the largest voltage. The experiment took place at the Macomb Academy of Arts and Sciences from October 2006 to December 2006. An ultra-violet light was set into different positions around the solar panel in order to mimic the sun throughout the course of a day. The mirror was placed next to the solar panel to redirect light in an effort to maximize the amount of energy generated. Every week the mirror was changed from either no mirror (control) to 22.5°, 45°, 67.5°, or 90° angles in order to see which angle would redirect the largest amount of light. The solar panel was connected to a volt meter that recorded the energy produced. The data collected showed that the control trial generated the greatest number of volts. Contrary to what was believed, the mirror did not increase the number of volts to compensate for the ultra-violet rays that were blocked by the mirror which decreases the efficiency of the solar panel. However, it was found that facing a panel east rather than the precedent south allowed for a greater number of volts to be generated.

The Comparison of the Amounts of Bacteria on Highly Used Surfaces

Student Research By: Justin Roland and Beau Seigfreid

The purpose of this experiment was to test and determine by random sampling which surfaces would have the most bacteria. Boy's bathroom door handles, girl's bathroom door handles, and computer lab keyboards would be compared. The entire experiment was done at the Macomb Academy of Arts and Sciences in Armada, Michigan, between November 29 and December 17. There were three sample sites, the boy's bathroom door, the girl's bathroom door, and the school's keyboards. There were a total of 10 samples taken off each of the sites. The amount of bacteria was counted by placing clear grid paper on the petri dishes after the bacteria had been properly grown. Square grids measuring one centimeter would be used to determine the amount of bacteria growth. The school's keyboards had the highest bacteria count at fifty five percent because of the high usage rates. The girl's bathroom had the middle average bacteria count at eleven point one centimeters. The boy's bathroom had the lowest average bacteria count at five point four centimeters.

The Effect Different Anti-Fog Techniques Have on Fog on Plexiglass

Student Research By: Steve Peltier, R.J. Perry, Ryan Phillips, and Eric Young

The experiment was conducted in order to test and observe how well different anti-fog techniques would work at preventing fog from forming on Plexiglass. The technique that produced the best visibility was also observed. The different techniques consisted of two sprays and two theories. The two sprays were Zero anti-fog spray and Speedo anti-fog spray. The two theories were human saliva and toothpaste. To test the variables a plexi-glass box was used to represent goggles and the box was put into conditions that would normally create fog. Inside the box were weighing dishes with hot water that would meet the cold air after the box was taken out of the cooler. All the variables were compared back to the control, the control produced 97%. The testing ran from October through December, 2006, in Armada, Michigan, at the Macomb Academy of Arts and Sciences. The results were determined by observing how long it took fog to begin forming on the plexi-glass, how long the fog lasted, and the percent of the box cover in fog. It was concluded, that out of the four variables, toothpaste was the best at fog prevention. Also, the toothpaste did not create any visibility issues such as condensation forming. The Speedo anti-fog spray also completely prevented fog, but created a lot of water vapor or moisture that would form on the plexi-glass. Zero fog anti-fog spray worked third best at preventing fog. Human saliva was the least capable anti-fog method. The box was about 6.7% fogged.

The Effect of Heat on the Major Allergen in an Apple

Student Research By: Katie Fitzsimons, Ellery Henley, and Adam Suddon

The purpose of this experiment was to determine the effect of heat on a heat-labile allergen in an apple. The temperature and the time heated were changed to find a relationship between the amount of the allergen and those variables. The research was conducted from October 16, 2006 and continued through December 20, 2006 at the Macomb Academy of Arts and Sciences in Armada, Michigan. The spectrometer measured the absorption and wavelength at which the infrared light went through samples of apple juice. A graph produced by the spectrometer was analyzed by finding the areas of figures on the graph. A ratio of a constant substance to the heat-labile allergen was recorded. A reliable, reproducible regression equation could not be produced when analyzing the time, temperature, and ratio together. When the effect of time was analyzed, four minutes produced the highest ratio. There was almost no difference between the ratios found for two minutes and those found for six minutes. An accurate regression equation was produced for the curvature between the temperature and the ratio of the constant substance to the allergen. The equation and curve of line was cubic. Therefore, it was believed that a chemical reaction occurred during the heating of the apples.

The Effect of Time on the Contraction of Bacteria of Varying Foods

Student Research By: Jack Calderone, Jamie Dullea, Sean Gillis, and Andrew Rusek

The 'five second rule' is simply a myth uttered whenever someone's favorite foods are dropped on the ground and gives justification to the one eating it. The experiment conducted was to support whether or not the 'five-second rule' held validity or was completely false. The base principle of the rule states that any food dropped onto a surface will contract bacteria after five-seconds, but it is safe to recover before then. Experimentation consisted of testing Cheese Nips, Red Delicious apples, and blueberry muffins at varying increments of time at the Macomb Academy of Arts and Sciences in Armada, Michigan. The food samples were released onto the Macomb Academy of Arts and Science's entrance carpet and were then swabbed and tested for the bacteria each food sample contained. Comparing the bacteria harvested from each food sample to the control for that specific food type is the manner in which the experimenters collected data. The results of the experiment demonstrated that the blueberry muffins were the overall food type, from the 1, 3, and 5-second trials that collected the most *new* (varying from the control) bacteria. This confirms that the 'five-second rule' did not hold true and was in fact false, due to the fact that bacteria was present on time-trials at and below five-seconds.

The Effect of Liquid Nitrogen on the Vitrification of Water Mixtures

Student Research By: Allyssia Ashman, Kristen Patchel, Kathryn Van Ham, and Melissa Wesolowski

This research was conducted to determine which substance, and in what amount, could vitrify water. Liquid nitrogen was used because it was capable of causing water to freeze without forming ice crystals. In order to repair a cell, doctors use vitrification with liquid nitrogen. Doctors were searching for a substance that was able to stop the functions of a cell for a short time without damaging the cells. The substances used for testing in this experiment were salt, sugar, gelatin, dimethyl sulfoxide, and a mixture of salt and sugar. Each substance was used in four differing masses. The number of ice crystals formed was determined by displacement. The change in displacement, along with the mass, from before to after freezing was obtained. For the substances of salt, sugar, and gelatin, the regression lines had similar slopes. Dimethyl sulfoxide was the only substance in which the displacement change decreased. The trials of only water, without any substance, ended up having the least ice crystals form. The regression lines of both salt and sugar were dependent on their solubility in water. The mixture of salt and sugar had the second highest change in displacement. This was produced by the extra substance and the mix solubility rate. Dimethyl sulfoxide decreased in displacement as its volume increased due to a chemical reaction that occurred when it was added to water. A small change in mass was found, caused by freezing, but there were many outliers at the top of the box plots. This helped prove that the change in mass was due to error. This change was most likely caused by water vapor freezing both inside and outside of the bags.

The Effect of Temperature and Barrel Length on a Paintball's Accuracy

Student Research By: Adam Kozlowski and Zach Nawrot

The purpose of this study was to analyze and test the effects of temperature and barrel length on the accuracy of a projectile oriented paint-filled capsule, known as a paintball. The paintballs were fired at approximately -5 degrees Celsius, 13 degrees Celsius, 20 degrees Celsius, 39 degrees Celsius, and with 14, 16, and 20 inch barrels. The paintballs used were Whack! brand paintballs and the barrels were Smart Parts brand ordered over the internet. This experiment was also conducted to find a solid advantage for paintball players, and was an expansion of past research. When the paintballs reached their desired temperatures, the barrel length was adjusted as needed, and the paintballs were then fired at a stationary 8 inch by 11.5 inch paper target. A Spyder TL-R paintball gun attached to a wooden scratch-built gun stand, built up one meter off the ground, was used to fire the paintballs. To measure accuracy, the distance from the center of the target was measured to the center of the paintball splat. This meant that the smaller the number, the better the accuracy, zero being perfect. These tests were conducted between the dates of October 25, 2006 to December 20, 2006, in the temperature and humidity controlled basement of a student residence in Armada, Michigan.

It was found that the 20 inch barrel with 39 degrees Celsius paintballs were the most accurate. The worst accuracy was found to be 20-inch barrel with the 20 degrees Celsius paintballs.

The Effects of Acid Temperature on the Decomposition of Different Metals

Student Research By: Leila Breault, Crystal Knust, and Shelby Motoligin

This experiment was conducted to observe five different metals tested in three moles of sulfuric acid at various temperatures. It was conducted at the Macomb Academy of Arts and Sciences (MA²S) between the dates October 18, 2006 and December 20, 2006. The five metals tested were zinc, aluminum, copper, lead, and tin. The metals were chosen due to their ability to react, derived using the Periodic Table of Elements. The chemical reactions between the various metals were tested to compare the change in mass based on heating or cooling the sulfuric acid. Four temperatures were chosen. These temperatures were different extremes from one another including: 0 ° Celsius (C), 20° C (room temperature) 45° C, and 90° C. At 0° C the sulfuric acid would freeze and at 90° C it would boil. The metals were heated by the flame of a Bunsen burner under the beaker, which was holding the test tube that the chemical reaction took place in. They were cooled by using a technique called ice bathing. This allowed the researchers to determine which metal decreased the most in mass from the start to the finish of the experiment based on the temperature it was tested in. It was concluded that lead reacted the best with sulfuric acid for all four temperatures. Its mass difference, once averaged, resulted in 0.070111 grams. Also, all the metals tested had the best reaction (greatest mass change) to the sulfuric acid when they were heated at either 45° C or 90° C.

The Effect of Concrete Composition on Compression Strength

Student Research By: Chris Haller, Matt Martin, Alec Peterson, and Chris Tobey

The purpose of this study was to determine if modifying the ratio of coarse aggregate to fine aggregate, in the concrete formula, would increase the overall compression strength. Every other aspect of the formula remained constant and no reinforcements were added to the concrete. The research was conducted at the Macomb Academy of Arts and Sciences (MA²S) in the Junior and Senior research room beginning on October 18, 2006 and continuing through December 20, 2006. Before data was collected, the ratios of aggregate that were to be mixed had to be determined. These ratios were 0% rock and 67% sand, 16.75% rock and 50.25% sand, 33.5% rock and 33.5% sand, 41% rock and 26% sand, 50.25% rock and 16.25% sand, and 67% rock and 0% sand. The most common formula, the control, consisted of 6% air, 11% Portland cement, 16% water, 26% smooth aggregate and 41% coarse aggregate. The formulas were mixed and allowed to cure, or completely harden, for one week. They were subjected to compression testing immediately following the curing process. During the compression tests, the concrete samples were subjected to pressure with a 20 ton hydraulic press. The compression ratings were recorded in BARs, but were converted to tons per square inch for analytical purposes. In conclusion, the formula consisting of 16.75% rock and 50.25% sand withstood the most pressure. The formula consisting of 0% rock and 67% sand proved to be the weakest of the concrete mixtures. Some future experiments could involve adding multiple types of reinforcements to the concrete, adding other ingredients to the concrete formula, or even as simple as testing more formulas that are near the ratios of the two strongest mixtures.

The Effects of Velocity and Hand Angle on the Rotation of a Float Serve

Student Research By: Shana Knake, Brittany Ryan, and Katie Schlump

This study was done to determine what velocity of arm swing and which hand angle would create a float serve. This experiment was conducted in the Enberg gym at the Macomb Academy of Arts and Sciences in Armada, MI. This experiment began on October 18, 2006 and concluded on December 20, 2006. Six different weights were used to represent the six different velocities; 5, 10, 15, 20, 25, and 30 pounds. These six different weights were tested at six different hand angles, which were 0, 5, 10, 15, 20, and 25 degrees. A float serve in volleyball is a serve that has little to zero rotations. This serve is desired because it is difficult for the opponent to recognize and return. By assembling a structure to simulate a volleyball player's serve, the different variables were tested and recorded. It was observed that the lower the angle of the ball served, the lower number of rotations. As the velocity increased, the amount of rotations increased as well. It was also observed that all rotations of the serves that occurred were under one full rotation. It was concluded that it was due to the hand of the structure being stationary, instead of snapping as a wrist would, when the hand came in contact with the ball.

The Effect of Various Washing and Drying Methods on the Shrinkage of Cotton Fabric

Student Research By: Abby Czachorowski, Chelsea Frazier, Kyrene Teipel, and Katie Wylin

The objective of this experiment was to determine the most effective way to wash and dry clothes while causing the least amount of damage. The testing took place at the Macomb Academy of Arts and Sciences in Armada, Michigan between the dates of October 18th, 2006 and December 20th, 2006. Squares were cut to be eight centimeters in size, from 100% black cotton fabric. The squares were separated into eighteen groups of ten. After separation, each square was traced on graph paper to record its original shape. Then, using a bucket and washboard, each group was washed and detergent was added to the water if that group required it. The detergent amounts were 0, 25, 50, 75 and 100 milliliters. After washing the squares, they were dried with a hair dryer on either the cool, warm, or hot air setting. The squares were then traced again and the shrinkage was measured in square millimeters. The same process was repeated with eighteen more groups, of a different and more flexible fabric, which consisted of two squares each and better represented T-shirt fabric. The fading of each group was originally going to be measured as well, but none of the groups showed signs of fading. It was concluded that the use of detergent did increase the shrinking, regardless of how much was used. It also appeared that the drying temperature had a small effect on the amount of shrinking, because when the temperature of the air increased, the shrinkage also increased.

The Effect of Mass and PSI on the Flight Distance of a Model Rocket

Student Research By: Matt Karl, Bret Kirchner, Cody Tousignant, and Cole Waterstraat

The purpose of this experiment was to find the most effective way to shoot a model rocket and achieve the furthest flight distance. The rocket, a Chrome Domes - Gold Series, was shot from an air cannon constructed of standard PVC piping and a sprinkler valve, allowing the ability to release the air and launch the rocket on command. Five different masses were added to the nosecone of the rocket (10g, 20g, 30g, 40g, 50g) with no mass added being the control. The rocket was shot at five different pressure levels (5 PSI, 10 PSI, 15 PSI, 20 PSI, 25 PSI) to see which of the combinations between the two would project the rocket the furthest distance. After close observation of the data collected, it was concluded that rocket's achieved distance increased as the pressure inside the cannon increased. It was also concluded from the data that as the mass added to the nosecone increased the distance that the rocket traveled decreased. It was believed that as the pressure placed within the cannon increased, the distance that the rocket traveled increased because the added PSI caused more force to be exerted on the rocket resulting in a further traveling distance. It was also believed that as the mass added to the nosecone increased the distance traveled by the rocket decreased because, even though the rocket obtained a greater inertia, the rocket would start its decline of elevation much sooner than if the rocket were at a lighter mass. All of the experimentation was completed on the north court of the Macomb Academy of Arts and Sciences between the dates of October 18, 2006 and December 20, 2006.

The Effect of Speed on the Amount of Impact Force an Object Gives Off

Student Research By: Norman Florsheim, Kyle Marchetti, Travis Musall, Erica Pregano, and Nick Vanhaverbeck

The purpose of the research experiment was to find if speed affects the amount of total impact force an object gives off. A wooden frame that held a foam mat was hit by a rubber baseball pitched from a pitching machine. The trials were recorded by a digital camcorder and analyzed using PEAK Motus motional analysis software. The frame that held the foam pads was made of eleven 2x4's and had fifty pounds of sand holding it down so it did not move. During the experiment the researchers ran five different speeds, with thirty trials of each. In this experiment the researchers found that the higher the speed, the harder the impact and more impact force given off.

The Effect of Second Hand Smoke on Foods on Exposed Apples

Student Research By: Chelsea Antilla, Kelly Copely, Jamie Green, Torrin McDonald, and Amanda Shields

Many people die each year from the effects of secondhand smoke in the air. If the smoke particles are absorbed by food, eating the contaminated food could cause similar effects on the body. Seven apples were placed in a secondhand smoking environment for different amounts of time. The exposed samples were tested to see if smoke particles were absorbed by the apples. It was observed that the apples sitting in the bag for a few weeks before being tested began to grow mold. The surface of the apples that were cut in half turned black and were wrinkled. On the graphs of the results, the fitted line plots of the smoke showed that the amount of smoke particles inside of the apples did not increase, or decrease as thought. The amount of smoke remained the same throughout all of the tests. It was thought that oxidation, when the apples were exposed to air, caused the pores on the surface of the cut side to close up, which would explain why the smoke remained constant in all of the apples. Something had changed inside the apple. A chemical reaction occurs inside apples when the apple is exposed to air. The chemical reaction changes the starch inside of the apple to sugar, which in turn, turns the apple brown. This could have caused the change that was represented on the graphs from the *M500 Quick-Scan Infrared Spectrophotometer*. The mold on the apples could also account for the change.

The Effect of Increasing Octane Rating on the Gas Mileage of an Internal Combustion Engine

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

The purpose of this study was to determine the most fuel efficient octane rating using a four-wheeler as the test vehicle. Between the months of November and January, tests were run to see which of the five octane ratings would perform the best. The five octane ratings that were tested were 87, 88, 89, 90.5, and 92. Gasoline with octane ratings of 87, 89, and 92 were purchased directly from Marathon Oil on November 16, 2006. The 88 and 90.5 were created by mixing the other octanes to form hybrid octane ratings. Each gasoline was tested five times on the four-wheeler, and the distance traveled was recorded using a Rola-Tape measuring wheel. The throttle was regulated using a zip-tie so the speed was kept constant for all of the tests.

The measuring wheel showed that the 92 octane was the most fuel efficient rating and that 88 octane was the least fuel efficient. The 89 octane came in second, the 90.5 in third, and 87 in fourth. It was predicted that the higher the octane rating, the more fuel efficient the gasoline would be. The hypothesis was partially supported. The only difference was that the mixed octanes were always less efficient than their parent octanes. All of the data fit within two standard deviations, which shows the data is fairly reliable.

The Effect of Various Counterweight Masses on the Linear Flight Distance and Release Angle of the Ammunition of a Trebuchet

Student Research By: Chris Graham, Josh Kanke, Sean Steinberg, Raymond Van Ham, and Tom Zinger

This experiment was conducted in order to discover the effect of various counterweight masses on the linear flight distance and release angle of the ammunition of a trebuchet. The experiment occurred at the Macomb Academy of Arts and Sciences from October 18, 2006 to December 20, 2006. A total of eight different counterweights were tested thirty-one times each. The experiment resulted in a direct proportionality between the weight that was placed in the counterweight box and the distance the racquetball flew. Another direct correlation was between the times that the ball stayed in the air and the amount of counterweight. The release angles were not analyzed because there was an amount of error in the collection that forced the data to become inconclusive. The largest mean distance and mean time occurred in the forty pound trials, which were the largest weights tested.

The Effect of the Volumes of Different Liquids on the Height of a Bottle Rocket Pressurized at Different Pressures

Student Research By: AnnMarie Ede, Bradon Hayes, Hannah Miller, and Alex Schroeder

This experiment was conducted to examine the result of different liquids, pressures, and volumes of two-liter bottle rockets. Two-liter bottle rockets were constructed, pressurized, and launched using the following liquids: water, Big K Cola, and Big K Lemon-Lime soda. The purpose of launching the bottle rockets was to determine the highest flight. This was done by using different volumes of liquid and different pressures. The flight of the rocket was affected by the different air pressures, air resistance, and amount of liquid used in the rockets. After a rocket was constructed, it was filled up with eight ounces and ten ounces of water, Lemon Lime soda, and Cola. It was found that 10 ounces of water pressurized at 90 PSI traveled the highest.

The Effect of Changing the Angle at which a Green Screen was Hit by Light on Shadow Area

Student Research By: Ashley Margosian, Jacob Payne, and Melissa Wawrzyniak

The objective of the experiment was to reduce or eliminate shadow effects projected onto a green screen. The goal was studied by changing the combination of two angles that light was cast onto the screen by two light heads. Background substitution is vital to special effects and movie editing, because the technique allows editors to add optical illusions that catch a viewer's eye. By eliminating shadow in an image, the features look more realistic on a new background.

The testing began on October 18th, 2006, and ended on December 20th, 2006, at the Macomb Academy of Arts and Sciences located in Armada, Michigan. During testing, when the left head light was set at a 90° angle, and the right at 120°, a minimum shadow area was generated, approximately 1,715 cm². When both the right and left head lights were positioned at a 120° angle, the maximum mean for the shadow area was produced. The smallest mean of shadow area was generated with the left light at 90° and the right at 120°. The two angle combinations were similar, but opposite values appeared. By positioning one light at 90°, and the other at 105°, the overall shadow area was at a minimum degree. Furthermore, when both light heads were set at 120°, an increasing shadow area was produced.

The Effects of Launch Angles on the Splatter Patterns of Projectiles

Student Research By: Nicollette Brown, Alyssa Goike, and Danielle Krawczyk

The purpose of the experiment was to simulate a meteorite hitting the earth at various angles. A paint balloon was used to simulate the meteorite and the paint splatter represented the crater formed by the impact of the meteorite. This experiment took place in Ray Township, Michigan, from November 12, 2006 through November 26, 2006. Six different angles were tested over a two week span. The six angles that the paint balloons were launched from were 15°, 30°, 45°, 60°, 75°, and 90°, with 90° acting as the control for the experiment. A catapult was used to launch the paint balloons. After a paint balloon was launched, the paint splatter it created was measured in four different ways. The measurements taken were: the distance from the catapult to the end of the splatter, the length of the splatter, the widest point of the splatter, and from the widest point of the splatter to the end of the splatter. Thirty trials were conducted per angle during this experiment. After fifteen trial sets were completed, the water balloon launcher was stretched out, so it was replaced with a new one. A few trends were observed after the thirty trials were finished. As the angle increased, the width of the splatter increased and the length decreased. The distance and angle measurement were directly proportional and the greater the angle the more circular the splatter became.

The Effect of Ball Position on Distance and Straightness

Student Research By: Joe Kilpatrick, Jeff Medley, Matt Soulliere, and Austin Spalding

An experiment was conducted to find the positions on a putter that would hit a golf ball the furthest and straightest. Putting is one of the most important aspects of golf and requires a large amount of skill to perform well. The human aspect was taken out for this experiment and a machine was built to hit the ball. The golf ball's direction is affected by many different obstacles that needed to be taken into consideration during a real putt. The obstacles included putting surface level, how the ball was struck, and where it was struck. This experiment was conducted at the Macomb Academy of Arts and Sciences over a nine-week span. Golf balls were putted using the putting machine mentioned above. Data was gathered as the ball was moved to various positions on the ground changing both the location that the putter struck the ball as well as the angle at which the ball was contacted. The results showed the front middle position hit the ball the furthest and the even middle position hit the ball the straightest.

The Effect of a Frisbee's Weight and The Style by Which The Frisbee is Thrown on its Accuracy

Student Research By: Callan Bobcean, Gary Ezzo, Donald Goulette, and James Schneider

The purpose of this experiment was to find what Frisbee weight (out of the ones that were being tested) were the most accurate, and what throwing style was the most accurate. The hypothesis was that the most accurate throw would be the backhand throw with the 175 gram Frisbee disc. The two frisbee weights that were tested in this experiment were 175grams and 160grams. The four throwing styles that were being tested were the beach grip, the forehand throw, the backhand throw, and the waffle grip. Testing began on November 8, 2006 and testing ended on December 20, 2006. The project was conducted by having a volunteer throw one of two different weighted frisbees and one of four different throws at a target mounted on a mat. Before the subject threw the Frisbee, chalk was rubbed on the outer edge so that the Frisbee would make a mark on the mat. A piece of cardboard was the mounted target. This piece of cardboard had a dot in the center of it which was five centimeters. Each of the test subjects received three practice throws. The subject received one final throw which was recorded. If the frisbee missed the mat on the final throw the measurement was marked as 185 centimeters. The data was recorded by measuring from mark made by the chalked frisbee to the black dot in the center of the cardboard mounted on the mat. The findings concluded that the most accurate of all frisbee weights was the 160 gram disc. The testing also showed that the most accurate throwing style was the backhand throw.

The Effect of Channel Angles and Aerodynamics on a Basketball

Student Research By: Kristen Baert, Stephanie Herbert, Emily Markey, and Casey Murray

The purpose of this study was to determine if there was a consistent way to shoot a free-throw with a basketball. The study took place in the Enberg Center Gymnasium at the Macomb Academy of Arts and Sciences in Armada, Michigan, from October 18, 2006 until December 20, 2006. Before the experimenting began, seven angles were chosen to be studied. These seven angles were 0 degrees, 15 degrees, 30 degrees, 45 degrees, 60 degrees, and 90 degrees. The different angles chosen represented ways that a basketball could be held. For each of these angles, ten trials were conducted to make a total of 70 trials completed throughout the whole study. This experiment was conducted using a catapult, which was made specifically for this study. As the experimentation was conducted, the flight of the basketball after the basketball was released from the catapult was recorded with a camera. These recordings were later examined using PEAK Motus motion analysis software. The data collected showed how far the ball drifted (during it's time in the air) right or left, from the center of the rim. The data collected did not support the hypothesis made at the beginning of the study. This was a surprise due to the fact that so many basketball coaches spend large amounts of time teaching the "proper way" to shoot (0 degrees in this study), which is what the original hypothesis was based on. The "proper way" of shooting is to line the pointer finger, middle finger, and ring finger up with the three lines on the side of the basketball. Next, the ball should be held at the hip (guided by the other hand) and shot, so that it rolls off of the fingers. While in the air, it should form an arc and have back spin on it. This method of shooting is supposed to guarantee a basket every time. This method of shooting was the basis of the study done.

The Effects of Carpet Cleaners on Different Stains in Carpet

Student Research By: Alex Blake, Emily Fleming, Sarah Jurzysta, and Sidonie Shuler

The purpose of this experiment was to observe if brand-name carpet cleaners worked as well as they claim to on common household stains and to determine if cheaper cleaners could be found in the home. For this experiment, two brand name cleaners and four non-brand-name cleaners were used. The name brand solutions were OxiClean and Fantastik Oxy Power, and the non-brand-name cleaners were water, vinegar, baking soda and Hydrogen Peroxide. This experiment was conducted at the Macomb Academy of Arts and Sciences (Armada, Michigan) and at a researcher's residence. It was found that brand-name cleaners worked the best in most cases; the exception to this was when they were applied to a chocolate ice cream stain. The only cleaning agent that was effective on chocolate ice cream was water. It was observed that the stain that was mostly composed of water, coffee, was the easiest to remove. This was because it was less dense than the other two stains- ketchup and chocolate ice cream. A major finding in the data collection was that the ambient conditions could effect how well a stain could be removed. When the carpets were in a cold, shaded environment they did not come out as well as compared to when they were in a warm, sunny atmosphere. The brand-name cleaner that worked best was Fantastik Oxy Power, an uncommon brand. The non-brand-name cleaner that was most effective on the stains was baking soda.

The Effects of Creatine on Mealworms Mass

Student Research By: Fred Flaim, Clint Hyatt, Mich Kallek, and Jake Moegle

The purpose of this study was to determine the effect of creatine amounts on mealworms mass. Between September and December 2006 the experiment was conducted by giving six groups of mealworms varying amounts of creatine and bran mixed together. It was determined that the mealworms that were given the greatest amount of creatine actually lost more mass than the mealworms that were fed less creatine over the eight weeks of study. Every group of mealworms was fed 100 grams of food once weekly. The mealworms mass was then measured to see if any weight was gained. When the mealworms were being weighed the food was placed in their aquariums in which they lived. Of the six groups, there was one group whose diet consisted of just bran. This was the control group. The second group was fed 10 grams of creatine and 90 grams of wheat bran. This continued in increments of 10 up to 50 grams of creatine and 50 grams of wheat bran. The aquarium of mealworms that were fed 10% creatine showed little change while the rest of the aquariums showed significant changes. The aquarium with 50% creatine lost the most mass over the eight week period. The aquarium that was fed 20% creatine retained the most weight.

The Trebuchet: the Effect of Arm Length and Release Pin Angle on the Distance Thrown

Student Research By: Joshua Lewis and David Sheridan

This experiment was conducted to test the throwing distance of a trebuchet, by determining what the cause of its long range was; it even tried to improve upon that long range by manipulating the angle that the sling releases and the throwing arm length. The point of this experiment was to find the optimal throwing distance and further increase the distance the projectile was thrown.

The best throwing arm was a 46 inch arm; this is believed to be due to centrifugal force. The centrifugal force of a trebuchet is directly related to the speed of the throwing arm. In the experiment that was conducted the 46" throwing arm with an angle of 60° threw the farthest at 72 ft. A throwing arm of 36" and an angle of 90° was the worst and threw the least distance of 10.5 ft. There was a large jump in the data from the 36" throwing arm to the 41" throwing arm, which was believed to be caused by a too much friction on the axle and spacers, and also too much centrifugal force. There was a general trend of the lower the release pin angles (from horizontal) the farther the distance thrown. There was another trend from the data, the best pin angles were mostly 60° and 70° for all throwing arm lengths. Another general trend was the 46 inch arm was generally the best of all throwing arms.

Optimum Take Off Angles of a Car Launching Off of a Ramp

Student Research By: Becky Durbin, Kevin Kline, and Sean Mulvey

The purpose of the experiment was to find the take-off angle of a ramp at which a car would fly through the air the farthest. This experiment was conducted at the Macomb Academy of Arts and Sciences, Armada, Michigan, from October 18, 2006 - December 20, 2006. Ten take-off angles were used, 15° through 60° in increments of 5° 's. A ramp was constructed with a take-off angle attached by hinges so any angle could be tested. Three wedge derby cars were used to run down the ramp, 30 times each. It was determined that the 20° take-off angle had the longest distance traveled with an average of 99.5cm. The take-off angle that resulted in the shortest distances was angle 60 with an average distance of 19.96cm. That happened because if the take-off angle is too high then the cars would lose momentum trying to go up such a steep incline leading to a shorter launch distance. But if the take-off angle is too low then there will not be enough of an incline to launch the cars as far. It was a matter of finding that perfect take-off angle to launch the cars the farthest. It was found that the lowest standard deviations occurred with the two longest distances traveled, angle 20 and 25, with standard deviations of 10.03 and 10.82 and average lengths of 99.54cm and 99.07cm.

The Effect of Glass on the Elasticity of Asphalt

Student Research By: Kayla Allor, Bethany Clark, and Noelle Rastigue