

# Independent Student Research Project Abstracts

This year at the Academy, all students participated in doing one, yearlong, independent research project. Students were allowed to pick their own groups that they worked closely with for the entire year. The first phase of the research project, producing proposal ideas, was completed in late September. Ideas that were submitted spanned all areas of math and science and some even used our new motion analysis equipment from Peak Motus. Students were then required to write literature reviews and create professional Power Point presentations that were given in front of the entire staff at MA<sup>2</sup>S for final proposal ratification. Experimentation and data collection started on October 8<sup>th</sup> and continued until the beginning of winter break. Students were encouraged to do their research at the academy. One block of time each Wednesday was dedicated to completing experiments and collecting data. Students then spent approximately one month analyzing their data with the assistance of MA<sup>2</sup>S staff. Students used the statistics learned in their D.O.E. classes to make meaning of their results. Writing began on February 11<sup>th</sup> and continued until March 24<sup>th</sup>. During this time students learned how to both critique and accept critique about scientific writing. The projects will be concluded with tri-fold and Power Point presentations made to the entire MA<sup>2</sup>S student body, staff, and guests on April 22<sup>nd</sup> and 23<sup>rd</sup>. Everyone is welcome to attend these presentations.



[The Effects of Music on the Distance in which People are Able to Run in Three Minute Running Trials](#)

[Substances' Effects on Impatiens](#)

[The Effects of Various Liquids on the Growth of Cherry Belle Radishes](#)

[A Study that Compares the Growth of Marigold Seeds in Dirt, Dirt with Mulch, and Sand](#)

[The Effects of Electricity on Rapid Radishes](#)

[Charting the Effects of Water plants on the Lives of Guppies](#)

[Growth Rate of Mold Depending on Different Types of Containers](#)

[Immediate Effects of Current Events on Stock Values in the Stock Market](#)

[Using Dance Dance Revolution to Compare hand-Eye and Foot-Eye Coordination among High School Students](#)

[The Comparison of Knot Types and 4 lb. Fishing Line Integrity](#)

[The Effect of Various Background Music on Short Term Memorization](#)

[The Effect of a Venturi in a Paintball Marker](#)

[“Energizer AA batteries: Titanium vs. Cadmium”](#)

[Supported Particleboard Shelves vs. Non-supported particleboard Shelves](#)

[The Effect Of Cleaning Agents On The Skeleton Of A Possum](#)

[Levels of pH in Plant Growth Areas](#)

[Fertilization Effects on Groundwater](#)

[The Effect of Light on the Glucose in Marigolds](#)

[How Various Colored Light Bulbs Affect the CO<sub>2</sub> and O<sub>2</sub> Levels of Grass](#)

[Bacteria Elimination By Use of Household Chemicals](#)

[The Effects Farms Have on the Amount of Nitrates and the pH Levels in Surrounding Bodies of Water](#)

[The Effects of Stress on Manila File-Folder Trusses](#)

[The Effect of the Distance of Golf Balls Using a Man Made Machine](#)

[Utilization of an Iron Byron Testing Golf Ball Distance](#)

[The Effects of the Sense of Vision on the Sense of Taste](#)

[The Effect of Temperature and Types of Bread on Mold Growth](#)

[Degradation Rate of Smarties as a Function of Water Temperature](#)

[To Achieve Optimum Velocity of a .68 Caliber Gas Propelled Projectile Due to Manipulation of the Barrel, Firing Mechanism, and Projectile Brand](#)

[The Quantity of Caffeine Extracted From Common Soft Drink Syrups](#)

[The Effects of Carpet Cleaners on Various Staining Agents](#)

[A Study of the Fracture Patterns of Laminated Glass Caused When Struck by a Claw Hammer with a Translational Kinetic Energy of 0.83 Joules](#)

[Study to Determine the Effects of Music on Mood and Color Perception](#)

[A Study That Compares the Water Quality of Romeo Well Water and Bottled Water](#)

[Calcium Hypochlorite Acid Solution as a Growth Retardant in Bean Plants](#)

[The Effects of Different Masses of Books in a Backpack on a Carrier's Lateral Flexion in the Spine](#)

[The Quality of Water Filtration Systems Using Clinton River Water](#)

[Maximum Trebuchet Throwing Distance and Consistency through Manipulation of Sling Length, Throwing Arm and Arm Placement](#)

[Listerine Effects on the Amount of Oral Bacteria in the Mouths of Teenagers](#)

[The Efficiency of Synthetic and Non-Synthetic Oil to Cool a Computer Processor In a Liquid Cooling System](#)

[Carbon Dioxide After Lactobacillus Sanfranciscensis has been Distorted](#)

[The Effects of Ammonia on Guppy Fish](#)

[Determining the Effectiveness of Antibacterial Products at Killing Bacteria](#)

[VHF Radio Propagation in the Macomb County Area](#)

[The Effect of Racket Velocity Before Contact on the Ball Velocity After Contact](#)

[Mineral Content in Bottled Water, Culligan Purified Tap Water, and Non-Culligan Purified Tap Water](#)

[The Effect of Corking Baseball Bats on Ball Velocity](#)

[Will Bottled Spring Water Promote Greater Germination and Growth Rates In Plants Than Well Water, Armada City Tap Water And Rainwater?](#)

[The Effects of Weather Conditions on the Structural Integrity of Pinewood](#)

[Effects of Centripetal Force On Plant Growth](#)

[Manufacturers Rating Testing of Leading Brand Fishing Lines](#)

[Water Temperature as A Factor in Marigold Growth](#)

[The Effects of Heating and Cooling Different Types of Metal on Their Properties](#)

[The Effects of Chemical and Organic Fertilizers on Bean Plant Growth](#)

[The Effects of Music on the Distance in which People are Able to](#)

## Run in Three Minute Running Trials

Student Research by: Reanna Golab, Erin Harding, Kaitlyn Harding, and Mary Sucaet

The purpose of this experiment was to determine if listening to music increased a person's running distance. This would help determine a more efficient way to exercise. From October 15, 2003 to December 17, 2003, twenty students, from the Macomb Academy of Arts and Sciences in Armada, Michigan (MA2S), participated in this experiment. Each person ran one trial without music and two trials with music. All of the trials took place on different days in the Enberg Gym at MA2S. Each trial was run for a duration of three minutes. Four different songs, of four different genres, were chosen. Using a random number generator on a TI-83+ Calculator, two of the four songs were chosen for the two trials with music, which were played on a radio. No major differences were found between the distances for the trials with music and the trials without music. The hypothesis stated that when a person listens to music while running, a greater distance will be accomplished than while not listening to music. The overall averages show that students were able to accomplish a greater distance while not listening to music with a distance of 641.9m than while listening to music with a distance of 636.0m. This showed that the hypothesis was incorrect. [\[Return to top of Experiment List\]](#)

## Substances' Effects on Impatiens

Student Research by: Jenna Lee, Heather Lulek, and Michael Polisei

The purpose of the experiment was to test whether red pepper or baking soda had an effect on impatiens. Impatiens are herbaceous flowers that can grow up to 8 inches, with flowers up to 2 inches wide. These were planted in front of the east window of a house located on 25-mile Rd. and Chesterfield Rd in Chesterfield, Michigan. Every day between October 15, 2003 and December 10, 2003 red pepper and baking soda were added to impatiens twice a day along with the water that was given to them. Water was a constant in each group and was given in  $\frac{1}{4}$  cup quantities at a time, the red pepper and baking soda was given in  $\frac{1}{2}$  tablespoon amounts at a time. Each group consisted of fifteen impatiens. Group 1 consisted of the impatiens that were given red pepper, Group 2 contained the plants that were given baking soda and, Group 3 was the control of the experiment.

Group1 and Group 3 gave very similar results when it came to the amount of plants that grew, the heights, the amount of leaves, and the width. Unexpectedly, the impatiens that received baking soda had not grown at all, which gave the result that baking soda had a major negative effect on the impatiens. It was expected that the baking soda would help the impatiens grow. However, it was concluded that the red pepper did help the plants grow.

[\[Return to top of Experiment List\]](#)

## The Effects of Various Liquids on the Growth of Cherry Belle Radishes

Student Research by: Andrew Betka, Cory Hayes, and Jake Weldon

The purpose of this study was to determine the effects of various liquids on the growth of Cherry Belle Radishes. The hypothesis stated that the Lipton Brand tea would have the greatest effect on the growth of the radishes. The individual group of radishes given the Lipton tea grew to the highest heights. Plants given skim milk also grew to some of the highest heights. Plants given well water however had a overall better growing pattern than either skim milk or tea fed plants. The reason for the resultant heights of the radishes being so low was due to the fact of the high temperatures in the research room. The temperatures affected the plants greatly seeing as the temperatures were 21 to 26 degree Celsius.

[\[Return to top of Experiment List\]](#)

## A Study that Compares the Growth of Marigold Seeds in Dirt, Dirt with Mulch, and Sand

Student Research by: Michael Gonczar, Stephanie Hartsig, Hannah Johnson, and Kim Madden

The purpose of the experiment was to determine if Marigold seeds would grow more effectively in sand, dirt with mulch on top, or dirt by itself. The experiment was conducted at the Macomb Academy of Arts and Science in Armada, Michigan, to test the hypothesis that marigold seeds grow more in dirt than in sand or much with dirt. The lab was conducted on October 22,2003 through December 17,2003. There were thirty samples of each soil were used, but only ten of each was planted every two weeks, making it thirty samples of each kind of

soil at the end of the six weeks.

[\[Return to top of Experiment List\]](#)

## The Effects of Electricity on Rapid Radishes

Student Research by: Michael Breiling, Byron Voelkert, Kyle Weirauch, and Eddie Zinger

The purpose of this experiment was to find out if an electric current would affect the growth of Rapid Radishes. This experiment could determine if farmers, that have crops close to power lines, benefit from the electricity in the area. The hypothesis stated that electricity would stunt the growth of Rapid Radishes, if the plants even grew at all. On Wednesdays starting on November 5th, 2003 and continuing through November 19th, 2003, the heights of thirty rapid radishes from two terrariums were measured in centimeters and then recorded. One terrarium was connected to a Numark power supply, and the other terrarium represented the normal growing conditions of Rapid Radishes, without electricity. The plants in the tank with the electricity grew much faster, but did not live as long as those without. The plants that were not exposed to the current grew steadily, and lived for four weeks. The results showed that electricity makes plants mature and grow faster, but electricity also makes those plants exposed to it die faster than those that are not. [\[Return to top of Experiment List\]](#)

## Charting the Effects of Water plants on the Lives of Guppies

Student Research by: Maria Gillis, Patrick Higgins, Angelica Jones, and Steven Schafka

The purpose of this study was to determine the effects of plants on the lifespan and breeding rate of feeder guppies. On the weekdays between October 15 and December 19, 2003, sixty guppies divided evenly between two fish tanks were fed and counted. Plants were put into one tank but not the other. The hypothesis was that the fish in the tank with the water plants would have a longer lifespan and higher breeding rate than the other tank. This hypothesis proved true, since the tank with the plants had more guppies and the least amount of deaths in the end. This was thought to be because the plants may have added more nutrients to the water, helping the guppies to

survive. Since there was not a drastic change between the tanks, the conclusion was the more research would be needed to provide further, more accurate results. [\[Return to top of Experiment List\]](#)

## Growth Rate of Mold Depending on Different Types of Containers

Student Research by: Esther Afolabi, Lisa Frontiera, Patrick Higgins, and Cassie Yaple

The purpose of this experiment was to determine whether the growth rate of mold varies depending on different types of containers. The experiment was conducted from October 15 through December 17, 2003. Ninety pieces of Kroger white bread were placed into three different groups; bread in the open, bread in Kroger Ziploc bags, and bread in Gladware entrée-size containers. The growth rate of mold was then observed and recorded each week. The bread in the Kroger Ziploc bags, and the bread in the Gladware entrée-size containers were compared to the bread in the open, the control. It was found that the bread in the Kroger Ziploc bags grew the most mold, while the bread in the Gladware containers had the first appearances of mold. Once the mold appeared in the Kroger Ziploc bags, it grew rapidly. The bread in the open had zero percent mold growth, the bread in the Gladware entrée size containers had an overall eighty-six and six-tenths percent mold growth, and the bread in the Kroger Ziploc bags had an overall one hundred percent mold growth. [\[Return to top of Experiment List\]](#)

## Immediate Effects of Current Events on Stock Values in the Stock Market

Student Research by: Nicole Gabridge and Melissa Mueller

The purpose of this study was to determine if daily world and national events had any immediate affect on the companies in the stock market. Between October 29, and December 16, 2003, values of sixty different stocks were recorded for each day at the Macomb Academy of Arts and Sciences in Armada, Michigan. The sixty companies were divided into fifteen groups, according to the products or services they each provided. After all data was analyzed, it was

concluded that the events had no immediate affect on the values of the stocks. [\[Return to top of Experiment List\]](#)

## Using Dance Dance Revolution to Compare hand-Eye and Foot-Eye Coordination among High School Students

Student Research by: John Gardner, Jon Granada, Kenny Greenia, and Jake Sweeney

The purpose of this experiment was to determine how high school students would score in hand-eye coordination and foot-eye coordination tests. The hypothesis was that people would score higher with a controller rather than with the Dance Pad. Beginning on October 8<sup>th</sup>, 2003, and carrying on for ten weeks, data was collected using the Dance Dance Revolution: Konamix video game. This was done to observe correlation between daily activities and hand and foot-eye coordination. The subjects tested were 14 to 17 years of age. The subjects were first tested for hand-eye coordination using a controller on three songs. Then the subjects were tested for foot-eye coordination using a Dance Pad on the same three songs with the same difficulty. A majority of the people tested scored higher with the controller than with the Dance Pad. [\[Return to top of Experiment List\]](#)

## The Comparison of Knot Types and 4 lb. Fishing Line Integrity

Student Research by: Chad Bleske, Bob Delmotte, Nathan Johnson, and Ian Orzel

The purpose of this study was to determine fishing line integrity and see how much a type of knot affects its integrity. Between October 8 and December 17, 2003, Berkley and Stren line (4 lb.) strands were tested with three different knots to see how much weight each could hold before breaking. The tests were done in six trials; Trial One contained the Berkley line with the seven loop hitch, Trial Two contained the Berkley line with the tautline hitch, Trial Three contained the Berkley line with the rolling hitch, and Trials Four through Six contained the Stren line with the same three hitch knots. Each trial was tested thirty times and the maximum strength of the line recorded. [\[Return to top of Experiment List\]](#)

## The Effect of Various Background Music on Short Term Memorization

Student Research by: Tiffany Black, Morgan Douglas, Brian Reid, and Erin Stemmer

An experiment was done to determine what type of music (rock, rap, classical, country, or no music) would produce the highest average score when testing people on their short term memorization. The hypothesis was that classical music would have the best results, and rock and rap would have the worst results. The procedure was to have thirty people from the Macomb Academy of Arts and Sciences take five tests, one for each of the different music groups. The tests had the person look at a sheet of paper with twenty words on it for three minutes while listening to the type of music that went with that list. After the three minutes, the music would be turned off and the people would write down as many of the words as they could remember. Once all the tests were completed, the average scores were compared to each other.

The results of the experiment were as follows: rock music (Linkin Park: Somewhere I Belong) had an average score of 41%, classical music (Music From the Nutcracker) had an average score of 39%, no music had an average score of 37%, country music (Tim McGraw: My Best Friend) had an average score of 36%, and rap music (Eminem: Without Me) had a score of 31%. One of the reasons that the results turned out to be this way might have been because the rock music was the most preferred type of music by the people being tested.

[\[Return to top of Experiment List\]](#)

## The Effect of a Venturi in a Paintball Marker

Student Research by: John Essenmacher, Jack Johnston, Ted Patchel, and Alex Rusek

The purpose of the experiment was to determine whether a paintball traveled faster with a venturi bolt or a non-venturi bolt. The experiment was conducted on October 25, 2003, November 1, 8, 29, 2003, and on December 6, 2003 at 3938 Church Road Casco Township, Michigan. Here, hundreds of paintballs were fired through a velocity-

testing device, called a Photogate. All of the data was placed into a spreadsheet and later converted into feet per second from seconds per six inches. Through the trials, the paintball marker was first fitted with a venturi bolt, and then fired over the Photogate, which read the speed of the paintballs. Then, the marker was fitted with a non-venturi bolt. It was then fired over the Photogate again, and readings were taken. The major finding of the experiment was that the bolt equipped with the venturi, produced, on average, higher velocities in the fired paintballs. One trend that was found was higher humidity, on average, produced lower velocities. Also, when the temperature was lower overall, the average velocities of paintballs fired were lower.

[\[Return to top of Experiment List\]](#)

### “Energizer AA batteries: Titanium vs. Cadmium”

Student Research by: Alex Egle, Ben Moore, and Kyle Thornton

The purpose of this experiment was to determine what kind of energizer battery was superior to the other: the Cadmium Energizer battery or the Titanium Energizer battery. This was established simply by putting the two different kinds of batteries through simple tests. Between October 13<sup>th</sup>, 2003 and November 26<sup>th</sup>, 2003, experiments were performed at the Egle residence, 3072 Meldrum, Casco, Michigan. The experiments were performed and data was collected by a setup of the two different kinds of batteries placed in separate flashlights, and then measured with a CBL light sensor attached to a TI-83+ Graphing Calculator. Every forty-five minutes, the sensor would measure the intensity of the light created by the output of the batteries. The results found that the Titanium energizer batteries burned to their maximum output until the battery did not have a high enough output to create a measurable amount of light. Through this experiment it was found that the Titanium Energizer batteries would only be desirable for an item that needed a high output in order to function. [\[Return to top of Experiment List\]](#)

### Supported Particleboard Shelves vs. Non-supported particleboard Shelves

Student Research by: Grant Bartlett

The purpose of this project was to find what type of support best stabilizes a 5/8" particleboard shelf. A shelf that could balance strength, size, cost, and ease of assembly was needed. The project was chosen because most particleboard shelves with no supports show visible sag within weeks of weight being applied. The Hypothesis was that the angle iron supported shelf would be the most stable over time. The shelves were placed on a box frame constructed of 3/4" particleboard and braced with wire and hardboard. Three of the four shelves were built from 8"x48" boards of 5/8" particleboard. The shelves A-D (A at floor, D at top) were (A) (no supports for control), (B) a hardboard laminate, (C) a 2" rail shelf (cut to be 6 3/4" wide so it is 8" when 5/8" rails fastened), and (D) an angle iron supported shelf. Forty-pound bags of salt were used as the weight for all of the shelves.

The starting heights with no weight on the shelves were: (A) 6 3/4" (B) 17 3/16" (C) 27 15/16" (D) 37 1/8". The start heights with weight were: (A) 5 5/16" (B) 16 7/8" (C) 27 9/16" (D) 36 7/8". The end heights of the shelves were: (A) 3 3/16" (B) 16 11/16" (C) 27 3/16" (D) 36 13/16". Several trends were noted during the experiment but the two most evident were (1) that the humidity and temperature caused the shelves flexibility to change. And (2) the position of the salt's weight changed slightly when the shelves sagged, causing the weight to be slightly more concentrated on a smaller area. If the temperature and humidity had been totally constant the shelves' sagging may also have been more constant. If the salt was spread thinner, and over a greater area the shelves may not have sagged as much and been more stable.

[\[Return to top of Experiment List\]](#)

## The Effect Of Cleaning Agents On The Skeleton Of A Possum

Student Research by: Daniel Kaltz

The purpose of this experiment was to determine the best way to remove all organic material from an animal of prey. Between October 15th and December 3rd, this experiment was conducted. The carcass of a full-grown possum, which was found under a pile of rotted firewood, was tested using three different methods of bone whitening and two methods of flesh removal. The carcass was found by the owner of "Kaltz Stump Grinding and Tree Service" who then donated it to the Macomb Academy of Arts and Sciences, located in Armada, for study. The carcass was divided into four areas for testing, legs, ribs, tail, and skull. [\[Return to top of Experiment List\]](#)

## Levels of pH in Plant Growth Areas

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

The purpose of this study was to determine the pH of soil that had been collected to grow a variety of plants, (i.e. corn, tomatoes, peaches and apples). The samples were collected on November 1, 2003. Thirty samples were taken from each of four sites. After the testing was complete, it was found that all the pH measurements were less than 4, indicating that they were acidic. The pH was measured using a Computer Based Laboratory (CBL). The final results showed that the soil used to grow corn and peaches had an average pH of 3.3, soil surrounding the apples had an average pH of 3.1, and the lowest level of pH were the samples collected from the tomato plants with a pH of 2.8. The study was successful in the sense that all the areas were measured and differences in the four different areas were found. However, the hypothesis that was predicted at first, (the apples and peaches would have the highest level of acidity) did not hold true.

[\[Return to top of Experiment List\]](#)

## Fertilization Effects on Groundwater

Student Research by: Lindsay Hurd, Jenna Kegler, and Laura O'Connor

The purpose of this experiment was to determine whether the effects of fertilization (through the soil of Armada, Michigan with Miracle Grow fertilizer) would have a harmful effect on the nitrate levels in Armada's community well. Nitrate is a chemical fertilizer and is a common contaminate of waters. The reason this experiment was done to see of the water in Armada was being contaminated by nitrate from the fertilizer used by local farms. The experiment was conducted with two ten-gallon fish tanks that were to simulate the Earth's layers. The two fish tanks were divided with a piece of plexi glass. There was a water level on the bottom that was separated from the soil with a metal screen, filtration paper and a layer of peat gravel. The tanks were tested over an eight-week period, while evenly distributed Miracle Grow fertilizer every Monday. The water was drawn up from

the water level through PVC pipes labeled appropriately. The nitrate level of the water was then tested with a TI-83 Calculator, a Computer Based Laboratory (CBL), and the Nitrate Ion Selective Electrode attachment.

The results of the experiment were sporadic. On average, it was found that the tanks with the least amount of soil had more nitrate, and the higher levels had a lesser amount of nitrate. The greater amounts of soil there were, the fewer amount of nitrate present. The more water and the less soil present, a greater amount of nitrate. The control was higher in nitrate than the proceeding tests because the water was diluted. This occurred possibly because of the Miracle Grow its state of matter while entering the soil.

[\[Return to top of Experiment List\]](#)

## The Effect of Light on the Glucose in Marigolds

Student Research by: Christine Bingham, Heidi Jenuine, Merissa Seerfried, and Alicia Winans

The purpose of this experiment was to find whether or not changing the amount of light affects the amount of glucose found in a Marigold. The hypothesis was that the Marigolds that received more light would have a greater amount of glucose than the Marigolds that received less light. The experiment took approximately six weeks starting on October 25, 2003 and ending December 17, 2003. Eighty Marigolds for each group were planted and grown for one week before being brought to the Macomb Academy of Arts and Sciences for experimentation. The manipulated group was covered from 2 P.M. to 8 A.M. on the weekdays. To test the Marigolds' glucose, each plant was ground, mixed with saliva, and ground again. This mixture was measured on the glucose meter to find the glucose. The number of dead plants, glucose measurements and other information was collected on December 3, 10 and 17, 2003. Plant glucose measurements were not taken on the 17, due to lack of testing materials. It was found that there was a difference of 0.7 milligrams per deciliter (mg/dl) between the glucose measurements of the two groups of Marigolds. The difference was determined to be too small and insignificant a number to be considered a major factor.

[\[Return to top of Experiment List\]](#)

## How Various Colored Light Bulbs Affect the CO<sub>2</sub> and O<sub>2</sub> Levels of Grass

Student Research by: Elizabeth Fleming, Melissa Lapp, Kristina Williams, and Sarah Barr

The purpose of this experiment was to find how the carbon dioxide and oxygen levels of grass are affected by five different color lights. The five different color lights used were regular, green, yellow, blue, and red. It was hypothesized that the darker the color of the light bulb the more carbon dioxide the plant would take in and the less oxygen the plant would emit. A few essential materials used in this experiment were 20 mL of grass seed for each plant, 450 mL of soil for each plant, wood to build a box to house the plants in, and five 25-watt light bulbs. To test this experiment we used a CBL (Computer Based Laboratory), carbon dioxide and oxygen sensors, and a Texas Instruments Calculator (TI-83 plus). First and foremost, a 152.5 x 30 x 60 cm box was built to house the plants. The box was split into five equal parts. A different color light bulb was put into each of the sections along with the pots of grass. Each week, the carbon dioxide and oxygen levels were measured inside each section. The oxygen levels were measured in percent and the carbon dioxide levels were measured in parts per million.

The following results are the averages from the oxygen and carbon dioxide levels. The average oxygen level for the grass under the regular light bulb was 19.54, and the average carbon dioxide level was 910. For the grass under the green light bulb, the average oxygen level was 19.18, and the average carbon dioxide level was 968. For the grass under the blue light bulb, the average oxygen level was 19.74 and the average carbon dioxide level was 1048. For the grass under the red light bulb, the average oxygen level was 19.86 and the average carbon dioxide level was 1104. It was concluded that the plants under the warm colored light bulbs, red and yellow, had a combined average carbon dioxide level of 1050 ppm. The grass under the cool colored light bulbs, which were blue and green, had a combined average carbon dioxide level of 1008 ppm, while the grass under the white light's average carbon dioxide level 910 ppm. Meanwhile, combined average oxygen levels of the cool colored light bulbs were 19.46%, the combined average oxygen levels of the warm colored lights were 19.51%, and the average oxygen level of the grass under the white light was 19.54%. This showed a difference of only .08% between the white and cool colored lights.

[\[Return to top of Experiment List\]](#)

## Bacteria Elimination By Use of Household Chemicals

Student Research by: Renee Bezaire, Frances Dixson, Sheri Lewis, and Angela Rummell

The purpose of this experiment was to determine how effective household chemicals were in the elimination of bacterial colonies contained in samples of creek water from the locations off the east branch of Coon Creek in Armada, Michigan. Between October 8, 2003, and December 28, 2003, samples of creek water from three different sites were collected (sites A, B, and C). Site A was located thirty-five meters east of North Avenue, site B was located fifteen meters southeast of Dayton Road, and site C was located seven meters south of the connection of Armada Center and Spencer Road. The three locations were divided into three different groups. The groups were determined from the locations from which the samples were taken. Sites A and B were abbreviations for before and after the rapids in the east branch of Coon Creek. Ten common household cleaning products were randomly chosen and used in this experiment. The sample creek water was separated into half-cut Dixie cups then bacterial colonies were counted and designated as before colonies. One teaspoon of a single chemical was stirred into each sample and by letting it set, it was thought that bacterial colonies would be eliminated. The chemical remained in the sample creek water for approximately thirty seconds before colonies were again counted. After a series of tests, it was concluded that site C had the highest amount of bacterial colonies contained within the samples taken. Therefore, the hypothesis, which stated that chemicals that contained bleach or ammonia would eliminate more bacterial colonies than those without ammonia or bleach, had been supported.

[\[Return to top of Experiment List\]](#)

## The Effects Farms Have on the Amount of Nitrates and the pH Levels in Surrounding Bodies of Water

Student Research by: Brandon Jackson, Matt Raska, Tabettha Williams, and Donald Yochim

The purpose of this experiment was to find out whether or not water supplies in Armada, Michigan near farms have more nitrate

and higher pH levels than water supplies that are not near farms. The hypothesis was that water near farms would have more nitrate and higher pH levels. Starting on October 14, 2003 and continuing on to December 17 2003, water samples were collected from streams and ponds near Armada and tested using a Computer Based Laboratory (CBL) borrowed from the Macomb Academy of Arts and Sciences (MA<sup>2</sup>S). The results were then analyzed and trends, such as water speed, and clarity, were picked out. Six sites were chosen, one being the control. Five of the sites had varying numbers of farms nearby, while the control had no farms near it. The results showed that pH levels were higher in water near three farms and that there was more nitrate in the water of the control. The pH levels and nitrate in the water near two farms was almost identical to that of the control. It was concluded that the farms did not have a great impact on the pH levels and amount of nitrate in the water.

[\[Return to top of Experiment List\]](#)

## The Effects of Stress on Manila File-Folder Trusses

Student Research by: Rachel Beaupre, Christine Kiehler, Lindsay Knake, and Mark Zeigler

The purpose of this experiment was to find out which truss structure was most effective in holding a load on a miniature railroad. Two truss designs were built according to the instructions in *Designing and Building File-Folder Bridges* by Stephen J. Ressler, P.E., Ph.D and tested between the dates of October 15 and December 17, 2003 at the Macomb Academy of Arts and Sciences in Armada, Michigan. Thirty of each type were tested. All the parts of the trusses were constructed before the trusses were put together in two separate parts, the main and sub assemblies. In testing, each truss was put into a holder that was constructed from wood. A bucket was then hung from the truss. Silica sand was slowly poured into the bucket until the stress on the truss became too great, which resulted in the truss breaking. The mass of sand the truss was able to hold was measured. The process was then repeated until all trusses had been tested. The results of the average weight each type held were then compared. It was found that the Type 1 structure was able to hold weight more efficiently. This is due to the fact that the Type 1 truss had a superior design, which distributed weight across the truss more evenly.

[\[Return to top of Experiment List\]](#)

## The Effect of the Distance of Golf Balls Using a Man Made Machine

Student Research by: Emily Cowhy, Kenny Deneweth, and Alex Schlump

The purpose of this study was to determine which golf ball out of, Titleist Pro V1, Strata Green Arrow, Nike Power Distance, Top Flight XL 3000, and Maxfli Distance Pro, would travel the greatest distance. This was done using a mechanical golf ball machine that hits the balls with the same amount of force each time. On the dates of November 7, 14, and 23, 2003 the travel distance as well as weather conditions were collected. The golf balls were compared and ranked according to the overall averages from each trial. It was concluded that the Nike Power Distance golf ball had the overall furthest average distance traveled. [\[Return to top of Experiment List\]](#)

## Utilization of an Iron Byron Testing Golf Ball Distance

Student Research by: Paul Gianferrara, Kyle Goodmen, and Steven Riebel

The purpose of this study was to determine which brand of distance golf ball travels the farthest. The brands tested in this study were the Callaway HX Blue, Condor S-Gold, Dunlop Tour Ti, Intech Beta Ti, Maxfli A3, Nike Double C, Pinnacle Gold Velocity, Precept Tour Premium, Titleist Pro V1, and Top Flite XL 2000. The study was conducted between November 16, 2003 and December 13, 2003, at 22630 33-Mile Rd. in Armada, Michigan. Each brand of golf ball was hit 30 times by an Iron Byron, which was constructed by the researchers to hit all of the golf balls with the same force each time. The club used to hit the balls was a Delta 1 iron. The distance the ball traveled was measured and recorded. Wind speed and direction, barometric changes, temperature and the amount of rainfall was also recorded to determine if weather affected distance. The balls were analyzed based upon the average distance each brand traveled and the average distance to price ratio. The balls were also analyzed based upon the performance under the certain weather conditions. It was found that the Intech Beta Ti was the best "all around ball," because this ball had the best price to performance ratio and a one and one half-yard spread of data points. This also means that it was the most consistent ball.

[\[Return to top of Experiment List\]](#)

## The Effects of the Sense of Vision on the Sense of Taste

Student Research by: Caitlyn Jeanguenat, Christa Rummell, and Ashley Walling

The purpose of this study was to determine the affect color had on the senses of vision and taste in teenagers ages 14-17 at the Macomb Academy of Arts and Sciences (MA2S), located on 23211 Prospect in Armada, MI by adding food coloring to both pudding and applesauce. Between October 8, 2003 and December 17, 2003 30 students at the MA2S were tested twice; once with colored pudding, and once again with colored applesauce. The test was divided by pudding and applesauce, and each test food was dyed four times each using different colors which were; Red, yellow, blue and green. The pudding was store bought vanilla, and the applesauce was store bought apple. The subjects were given surveys in which to place their perceived flavor of the substance. It was concluded that due to the overall results, color had an effect on both the sense of vision and the sense of taste.

[\[Return to top of Experiment List\]](#)

## The Effect of Temperature and Types of Bread on Mold Growth

Student Research by: Theresa Krawczyk, Nicole Kusminski, Amanda Malburg, and Anne Schoenherr

The purpose of the experiment was to determine the effect of different temperatures on the percentage of mold growth of various types of bread. The five varieties of bread that were tested in the experiment were Country Buttermilk, Cracked Wheat, Deli Rye, Seeded Italian, and Western Potato; all of them were Aunt Millie's brand. The temperatures were divided into four environments which consisted of environment one that was held in a freezer at a constant -10° C, environment two contained in a refrigerator at a constant temperature of 22.5° C, environment three with a constant temperature of 25° C held in an incubator, and environment four also held in an incubator, but at a higher temperature of 33.5° C. In each environment, two slices of each type of bread were used. However, one slice was placed inside a Ziploc bag whereas, the second slice was

left exposed on a paper plate. Two-week trials were carried out for each of the environments and the area of mold growth was measured in centimeters cubed and converted into a percentage. It was concluded that the warmer environments and the breads with the most water content contained the greater amount of mold growth. It was also found that each slice of bread that remained uncovered grew, on average, significantly lower amount of mold than those slices that were contained within Ziploc bags. [\[Return to top of Experiment List\]](#)

## Degradation Rate of Smarties as a Function of Water Temperature

Student research by: Sarah Adams, Luke Mackewich, and Justine Pinsky

The purpose of this experiment was to find whether the amount of heat in distilled water would affect the degradation rate of Smarties candies. To do this, three teams were assembled, one being the control team. The two other teams collected data every five minutes about the mass of Smarties candies in freezing temperature distilled water, room temperature distilled water, and boiling distilled water. The data supported the hypothesis, in that the rate of degradation of the Smarties was increased greatly when more heat was added. Smarties exposed to freezing temperature water showed a slower rate of degradation than the two other sets, while Smarties exposed to boiling temperature water showed a faster rate of degradation than the two other sets. The masses of the Smarties also increased briefly before being dissolved. This was replicated in all sets except for the boiling water, because, with the five-minute intervals, the candies were completely dissolved before this type of variance could be measured. The densities of the smarties slightly varied. White and purple Smarties had slightly more mass and dissolved at a slightly slower rate. Because the hypothesis was supported, the null hypothesis was rejected. This experiment successfully supported the hypothesis and presented additional data as to why some Smarties dissolve more slowly or quickly than others. Both temperature and density affected the rate of degradation. [\[Return to top of Experiment List\]](#)

## To Achieve Optimum Velocity of a .68 Caliber Gas Propelled

## Projectile Due to Manipulation of the Barrel, Firing Mechanism, and Projectile Brand

Student Research by: Chris Ballard and Michael Mellick

The purpose of this experiment was to determine the most accurate combination of paintballs, barrels, and markers. The study was conducted in Lambs, Michigan. Over a thousand shots were fired. Each shot was fired from a distance of ten yards. There were 30 trials for each paint, marker, and barrel. The brands of paint were Diablo, 32 Degrees, ZAP, and Big Ball. The markers used were all Kingman brand but different models; Classic, AMG LCD, and the e-99. The barrels used were the 12-inch stock, 12-inch custom, and the 8.5-inch stock. It was concluded that the best combination in terms of accuracy was the AMG LCD with the 12 inch custom barrel installed on it while using the Diablo paint. This happens to also be the most expensive combination. Over all the experiment was a success.  
[\[Return to top of Experiment List\]](#)

## The Quantity of Caffeine Extracted From Common Soft Drink Syrups

Student Research by: Amanda Desrosiers, Christina Egle, and Jill Martindale

The purpose of this experiment was to determine if Mountain Dew truly has more caffeine than other common soft drinks. This was done by extracting the caffeine from the soft drinks in their concentrated form (fountain syrups). This study was conducted at the Macomb Academy of Arts and Sciences in Armanda, Michigan. Between December 19, 2003 and January 19, 2004, ninety-three trials of extracting caffeine from four different soda syrups were performed. These syrups were name-brand syrups and were obtained from several local gas stations. The caffeine was extracted from each of the syrups by adding methylene chloride, ammonium hydroxide, and sodium sulfate to the syrups in a plastic separatory funnel. This isolated the caffeine from the rest of the chemicals. Sprite contained no caffeine so only three trials were performed. Mountain Dew had the most caffeine (0.046 grams per ten milliliters). This syrup had the most caffeine likely due to the result of merchandizing since caffeine creates a physical dependence in the body, and thus mountain dew becomes a drink that is often craved.

[\[Return to top of Experiment List\]](#)

## The Effects of Carpet Cleaners on Various Staining Agents

Student Research by: Jeremy Bond, Beth Hartsig, Rhieley Pitts, and Whitney Walendowski

The purpose of this experiment was to compare the effectiveness of several different carpet cleaners and their ability to remove different organic and inorganic stains. The study took place at The Macomb Academy of Arts and Sciences over a period of nine weeks. Over this period, grape juice, melted chocolate, mustard, and washable paint were used to stain un-dyed, scotch guarded carpet. To clean these stains, three carpet cleaners were used: 409 Oxygen Action, Fantastic Oxy Power, and Bissell Fabric and Upholstery Cleaner. The stains were then analyzed using a Likert scale, assigning zero to “Clean”, five to “Partially Clean”, and ten to “Not Clean”. Mustard proved to be the hardest stain to remove, while grape juice was the easiest. However, sugar was left in the carpet from the grape juice because it was later discovered that the “cleaned” samples had molded. Bissell Fabric and Upholstery Cleaner proved to be the most effective cleaner. This experiment supported the hypothesis developed at the beginning of the experiment: Every product that is used will fail to remove the stains like they guarantee on their label.

[\[Return to top of Experiment List\]](#)

## A Study of the Fracture Patterns of Laminated Glass Caused When Struck by a Claw Hammer with a Translational Kinetic Energy of 0.83 Joules

Student Research by: Nick Egle, Andrea Krajewski, Kaitlin Moore, and Heather Munoz

The purpose of the study was to create an average model of the crack pattern caused in a laminated piece of glass that was struck with a blunt object traveling with a kinetic energy of 0.83 Joules. Between October 8, 2003, and January 10, 2004, twenty-seven panes of glass were put on trial at the Macomb Academy of Arts and Sciences in Armada, Michigan. Using a pendulum apparatus to swing a hammer, four distinct fracture patterns occurred: feathered radial, radials only,

radials with concentrics, and fish-scale patterns. The arm was released from an angle of  $175^\circ$  and hit the glass at a perpendicular angle. The average number radials, the average number of concentrics, the average radii for concentric arcs, and the percentage of occurrences where all used to module an average crack pattern. The average module had twenty-six radial crack lines and each radial was approximately  $13.85^\circ$  apart. The average model of this type of glass fracture pattern was drawn, and the method used to reach this result could be used in the safety-glass industry, the automobile industry, or even the video game industry.

[\[Return to top of Experiment List\]](#)

### Study to Determine the Effects of Music on Mood and Color Perception

Student research by: Ryan Johnson, Rory McCarty, and Brandon Vasos

The purpose of this study was to determine whether a person's mood has an effect on his or her perception of color. The study was performed at the Macomb Academy of Arts and Sciences, Armada, Michigan between October 8, 2003 and December 17, 2003. A group of 30 test subjects (15 male and 15 female) were randomly selected for testing. Each test subject listened to different types of music, each for a period of 90 seconds while blindfolded. At the end of this period, the test subjects' blindfold was removed, and the participants were asked to choose the color they first noticed out of an arrangement of six colors upon the wall. This choice was recorded, and the process was repeated for each test subject for a total of four different types of music and one period of total silence. The data did not show that the test subjects chose a certain color based on the type of music, nor did it match with the participants' favorite color. However, there was a high correlation with colors that were arranged in the center of the test subjects' field of vision. This was based on whether or not they met or exceeded a ratio of 75% congruency. It was determined that the test subjects' choices were influenced only by the position of the colors. Therefore, the hypothesis that the test subject's mood affected their choices was not supported by the hypothesis. [\[Return to top of Experiment List\]](#)

### A Study That Compares the Water Quality of Romeo Well Water

## and Bottled Water

Student Research by: Kristine Madden

The purpose of this study was to determine the quality and preferred taste of bottled water, Romeo city water, and Romeo well water at the Macomb Academy of Arts and Sciences, Armada, Michigan and 11017 Kilarney, Washington, Michigan. Between October 9, 2003 and January 5, 2004, samples of bottled, city, and well water were tested for biochemical oxygen demand, dissolved oxygen, fecal coliform, nitrate, pH, phosphate, turbidity, and water temperature levels at two sites. After an examination, it was determined that bottled water possessed a peripheral margin in correspondence to Romeo city water and Romeo well water. In like manner, the taste test produced similar results; however, an expansive margin existed between the water types.

[\[Return to top of Experiment List\]](#)

## Calcium Hypochlorite Acid Solution as a Growth Retardant in Bean Plants

Student Research by: Jenna Parks

Calcium hypochlorite acid solution is the chemical mixture, which most people refer to as the “chlorine” in a pool. Bean plants were grown and watered with different amounts of hypochlorite acid solution mixed with distilled water to see if it would in any way effect the growth of the plants. From November 3 to December 8, 2003, 120 bean plants were grown in an empty classroom in the Macomb Academy of Arts and Sciences building in Armada, Michigan. The plants were split into four groups and the growth of plants was measured while various amounts of calcium hypochlorite acid solution mixed with distilled water was used to water the plants. The hypothesis was that the plant growth would be stunted and not completely inhibited; this theory, however, was not supported by the experiment, all of the plants that were watered with the calcium hypochlorite acid solution mixed with distilled water in any amount did not grow at all. The control group, which was watered with only distilled water, was the only group that grew. [\[Return to top of Experiment List\]](#)

## The Effects of Different Masses of Books in a Backpack on a Carrier's Lateral Flexion in the Spine

Student Research by: Stephanie Deneweth, JoJo Hollweg, Matthew Manzella, and Kim Quandt

The purpose of this study was to determine whether carrying a backpack has an effect on the curvature of the spine, and if the amount of mass in the backpack increases the amount of curvature. It was hypothesized that when more mass was added to the subject's backpack the subject's spine curvature would increase. Beginning on October 8, 2003, data was collected by video taping 30 students walking on a treadmill while carrying a backpack on one shoulder containing five, ten, and fifteen percent of their body weight in school supplies. These videos were then digitized into the Peak Motus program where six angles were found for six subjects, to determine their back curvature. The hypothesis was proven incorrect because of inconsistent data that varied from trial to trial. [\[Return to top of Experiment List\]](#)

## The Quality of Water Filtration Systems Using Clinton River Water

Student Research by: Brittany Floer, Daryl Kinney, and Lindsey Toothacker

The purpose of this study was to determine which brand of filtration system, Brita, Sunbeam, or Pur, would filter certain contaminants, that were claimed to be reduce or eliminated, out of the Clinton River water better than the other brands. However, before the testing began, 15 gallons of Clinton River water were collected and divided into five groups (number of trials) of three (number of brands) by the turbidity of the water in the water jugs. Between November 10, 2003 and December 8, 2003, the 15 gallons of the Clinton River water were tested before and after filtration under refrigerator temperature to see if the temperature would affect the filtering process. The tests included alkalinity, chloride, chlorine, hardness, iron, nitrate, pH, and phosphate. Each test was conducted by following the directions that came with the specific test. During analysis the means, medians, and modes were evaluated between the brands, as well as, the trial numbers to see if the data supported the hypothesis. It was concluded that Sunbeam Filtration System did not

filter out the contaminants as well as Brita and Pur Filtrations Systems as hypothesized. [\[Return to top of Experiment List\]](#)

## Maximum Trebuchet Throwing Distance and Consistency through Manipulation of Sling Length, Throwing Arm and Arm Placement

Student Research by: Matt Gehringer, Shawn Partin, and Ben Wood

The purpose of this experiment was to create a trebuchet that obtained a maximum throwing distance with the model created and consistently achieved this distance. The construction of the trebuchet began on October 15, 2003, and continued to December 8, 2003. Three throwing arms were used for this experiment. Each arm used different positioned axel holes to change its length ratio across the axel. Each arm during testing then used two different positions, one at 32 ° and the other at 46° to the base of the trebuchet. In addition, two different sling lengths were of 6' and 9' were used with each of these positions for the throwing arm. With the variables each arm had four different models that were created. Once testing was completed with the trebuchet, the hypothesis was not supported, that the original model created did obtain the maximum throwing distance possible. It was shown that Arm 2 at a 32° angle and a 6' sling length obtained the furthest throwing distance and proved to launch the projectile more consistently than the other models. The shorter sling created enough force to have tension throughout each of the launches. The increase in the distance that the throwing arm gained from being lowered from 46° to 36° gave the counterweight more potential energy for each launch increasing the throwing distances. [\[Return to top of Experiment List\]](#)

## Listerine Effects on the Amount of Oral Bacteria in the Mouths of Teenagers

Student Research by: Brianne Krause and Desiree Seidel

The purpose of this experiment was to study the antiseptic properties of FreshBurst Listerine mouth rinse. The hypothesis was that after the use of Listerine 99.9% of oral bacteria would be eliminated. To test this hypothesis, the mouths of thirty-six subjects, students at the Macomb Academy of Arts and Sciences in Armada, Michigan, were

swabbed before and after the use of the Listerine. The swabs of the mouths were put onto agar dishes and incubated for a period of eight days. A grid was developed to count the number of bacteria colonies in three randomly chosen squares, which were averaged, and that number was used in the comparisons to determine the effect of Listerine. For each before and after swab, there was a corresponding dish. The results did not support the hypothesis of 99.9% of bacteria being eliminated, as they bacteria populations only decreased by 36.6%

. [\[Return to top of Experiment List\]](#)

## The Efficiency of Synthetic and Non-Synthetic Oil to Cool a Computer Processor In a Liquid Cooling System

Student Research by: Chris Krawczyk and Omar Shawqi

This experiment was conducted to advance the cooling ability of water cooling systems for computers. The basic principle of a water cooling system is to have a pump that pushes water through a water block, which conducts heat away from the processor, and a radiator to cool the water down again. With further advances in technology comes the problem of additional heat, and water cooling systems are very efficient at dealing with this when it comes to computer processors. Water cooling systems are efficient now, but as technology advances even this method of cooling will become insufficient, so an experiment was done to see if liquids other than water can cool the computer processor more efficiently than water. A water cooling system was built so that it could handle pushing thicker liquids such as motor oil through the tubing instead of just water, and various monitors were placed along the system for data collection. Using this system, water, synthetic motor oil, and non-synthetic motor oil were tested by using the computer to apply heat to the liquids. The hypothesis was that the synthetic oil would cool the processor more efficiently than either water or non-synthetic oil because of the plastics it contained. The results showed that water cooled more efficiently than either of the motor oils, which did not even let the computer finish the trial time. This could have been due to the turbidity of the water, which was much higher than the slow moving oil, meaning the layer of oil closest to the processor was being heated repeatedly. Further experimentation with a stronger pump could change the turbidity of the oil and possibly improve performance.

[\[Return to top of Experiment List\]](#)

## Carbon Dioxide After Lactobacillus Sanfranciscensis has been Distorted

Student Research by: Kristen Parise

The purpose of this study was to determine the carbon dioxide release from sourdough bread when changing the temperature. Between October 8 and December 17, 2003, temperature and carbon dioxide measurements were collected and analyzed at the Macomb Academy of Arts and Sciences and the experimenters home, both in Armada, Michigan. The sourdough was separated into 30 separate pieces and placed into individual bowls where the temperature and carbon dioxide measurements were taken. The data was then analyzed and put into graphs. There was, however, no conclusive data; the problem was never identified as to why the experiment was unsuccessful. [\[Return to top of Experiment List\]](#)

## The Effects of Ammonia on Guppy Fish

Student Research by: Deanna Beste, Rebecca Nieman, and Gina Riebel

An experiment was conducted at the Macomb Academy of Arts and Sciences to determine if the survival rate of guppies is affected by ammonia. Beginning on November 5, 2003, and continuing through December 17, 2003, the survival rate of guppies in a control and ammonia test tank was observed. Ten female guppies and five male guppies were placed into each of the ten-gallon tanks. In both tanks, water levels and the temperature of the water were kept constant during the test period. Every Wednesday during the test period, .5 mL of ammonia was added to the ammonia test tank. As the guppies died, they were removed from the tank and the number of guppies that remained in the tank was recorded. Since there was a greater survival rate in the ammonia test tank, it was concluded that ammonia increased the survival rate of guppies in this experiment. No definitive conclusions regarding the overall effect of ammonia on guppy survival could be drawn from this experiment because of the flaws in the experimental design.

[\[Return to top of Experiment List\]](#)

## Determining the Effectiveness of Antibacterial Products at Killing Bacteria

Student Research by: Rachael Nieman, Breanna Rawlins, and Alex Russell

The purpose of this experiment was to determine the effectiveness of antibacterial products at killing bacteria and other microorganisms. Before testing began, it was hypothesized that Purell Instant Hand Sanitizer would be the most effective antibacterial product, Dial Antibacterial Soap would be the second most effective, and Lysol Disinfectant Spray would be the least effective. Between November 19, 2003 and December 13, 2003, 108 trials were completed at the Macomb Academy of Arts and Sciences. In order to test the hypothesis, samples of microorganisms were taken before an antibacterial product was used and after a product was used. In addition, a control was tested by taking two samples of microorganisms without using an antibacterial product. By comparing the samples taken from each trial, the effectiveness of each product was found. The results of the experiment were that Lysol killed an average of 12.75% of the microorganisms present, Dial produced an additional 5.04%, and Purell produced an additional 73.91%. It is unlikely that the products themselves produced the additional microorganisms present in the samples, and, therefore, leads to the conclusion that the experiment was flawed. Therefore, the results from this experiment are not reliable enough to use to conclude anything. [\[Return to top of Experiment List\]](#)

## VHF Radio Propagation in the Macomb County Area

Student Research by: Harry Awdey, Mark Dehring, and Ryan Spencer

The purpose of this study was to determine the VHF radio propagation pattern of the Macomb County, Michigan area on the two-meter band at three different power levels (5 watts, 25 watts, and 50 watts). It was hypothesized that distance would have no effect on signal strength, which was a null hypothesis. Between the dates of October 12, 2003 and January 18, 2004, an experiment was conducted to test radio propagation. 214 locations, each up to a maximum of 25 miles away from a fixed transmission point, were randomly chosen throughout the Macomb County area. A mobile radio, attached to a vehicle was then driven to each of the locations and a researcher at

the transmission point would proceed to broadcast a countdown from ten. The researchers in the mobile vehicle then recorded the signal strength of the radio, which was given on the radio's display. The GPS coordinates of the location, the GPS satellite accuracy, the altitude of the location, the weather, and tropospheric conditions were also recorded.

After analyzing the data, several trends were found. One trend was that relatively high altitudes did not directly correlate to the highest possible signal strengths. For example, points in the mid-section of Mt. Trombley (the highest point in Macomb County) had extremely poor signal strength readings, while the top of Mt. Trombley had very high signal strengths. The most probable reason that the middle points had a low signal strength was that the mountain itself was blocking the signal or because some man-made structure or natural landform was in the way. Once the top of the mountain was reached, the signal strength was heightened because there was open space, which led to a better line of sight to the transmitter. Another trend was that as the receiver gains more distance from the transmitter, the signal strengths goes down due to the fact that radio waves lose energy as the distance increases. The null hypothesis that distance would have no effect on signal strength was disproved. [\[Return to top of Experiment List\]](#)

## The Effect of Racket Velocity Before Contact on the Ball Velocity After Contact

Student Research by: Noel Bezaire, Kristen Clark, Jake Hanley, and Amy Martin

The purpose of this study was to find the relationship between racket velocity before contact and ball velocity after contact during a tennis serve. If the velocity of the racket increased, then the velocity of the ball was expected to increase as well. Research was conducted between December 10, 2003 and December 19, 2003. The subject served three sets of 30 serves each, categorized into groups of slow, medium, and fast velocities. By digitizing the racket head and tennis ball during service, the Peak Motus computer program was used to calculate the velocities of the two points. The results obtained throughout the experiment indicated that racket velocity and ball velocity are directly related. This result was due to the conservation of momentum. When the racket hit the ball, it transferred its

momentum to the ball. Since momentum is equal to mass multiplied by velocity, an increase of momentum caused an increase in velocity. The data also showed that ball velocity was always greater than racket head velocity. This was due to the potential elastic energy stored in the strings of the racket head that converted to kinetic energy, which in turn increased the velocity of the tennis ball.

[\[Return to top of Experiment List\]](#)

### Mineral Content in Bottled Water, Culligan Purified Tap Water, and Non-Culligan Purified Tap Water

Student Research by: Lindsay Chmielewski, Stephanie Drob, and Trista Pabisz

The purpose of the experiment was to determine which water source (Culligan purified tap water, non-Culligan purified tap water, and Deja-Blue bottled water) was the safest, and therefore most pure. This was done by testing for the levels of five different water elements; iron, hardness, nitrites, nitrates, and pH, using HAOH® testing products supplied by a Romeo, MI chapter Culligan distributor. Beginning on October 5, 2003, and continuing until December 17, 2003, the three types of water were tested for each of the aforementioned element levels at the Macomb Academy of Arts and Sciences, located in Armada, Michigan. The results of the study indicated that there was very little significant difference between the waters' nitrite and nitrate levels, however, the Culligan water did contain the highest amount of nitrates. It was also observed that the Deja-Blue bottled water had an iron count of 0 parts per million (ppm), making it the purest of the three water types. The Culligan water was found to have a mean hardness level 0.167 grains per gallon (gpg), which was the lowest of the three types. Thus, it was concluded that since it also had the highest iron content, that iron content contributes significantly to the hardness level of drinking water. Finally, when based on pH, Culligan purified water along with bottled water had the best pH, being 5.92 and 5.81 respectively. All in all, the Culligan purified water was the purest of the three, the bottled had the middle quality, and the tap/well water had the most contaminants. [\[Return to top of Experiment List\]](#)

### The Effect of Corking Baseball Bats on Ball

## Velocity

Student Research by: Ryan Kiernicki, Nick Knust, Brandon Pinskey, and Tom Ward

This experiment was designed to determine if corking a baseball bat actually increases the velocity of swing. It was hypothesized that the corked bat would yield a higher velocity than the uncorked bats. The research began on October 1, 2003 and was conducted to determine whether or not cork affects the bat. A machine was constructed to swing the bats with an equal amount of force consistently. Four bats were then purchased, and three of these were corked with varying amounts. Thirty swings of each bat hitting a ball were recorded using a digital video recorder. These video clips were loaded onto a computer based motion analysis system called the Peak Motus. Using this software it was calculated that the average velocity for the control bat was 12.67 m/s. The average velocity for the corked bats were 12.67 m/s, 12.34 m/s, and 12.62 m/s respectively. The results of the testing supported the hypothesis that corked bats do perform at greater velocities than uncorked bats.

[\[Return to top of Experiment List\]](#)

## Will Bottled Spring Water Promote Greater Germination and Growth Rates In Plants Than Well Water, Armada City Tap Water And Rainwater?

Student Research by: Elizabeth Wolfe

In this experiment four types of water were used to test, which type of water promoted a better germination and growth rate of the seeds and or plants. The four types of water are Armada, Michigan city tap water, well water, bottled spring water and rainwater. The hypothesis stated that the plants that had received bottled spring water would have a higher germination and growth rate and averages than the plants that were water with the other three types of water. In this experiment plants were divided into four groups of forty and labeled by the type of water they had received. The plants were placed on two shelves. Rainwater and Armada, Michigan city tap water were placed on the bottom shelf while the other two groups were placed on the top shelf. The lights on the bottom shelf were three feet from the plants while the lights above the top shelf were in the ceiling light holders. The plants were watered on a periodical basis of

every Monday, Wednesday and Friday or when needed. The plants were measured every Wednesday. It was found that Armada city tap water and rainwater promoted a high germination and growth rate. It was also found that the plants that had been placed on the bottom shelf appeared to be healthier than the plants that were placed on the top shelf. It appeared that the plants on the top shelf had blight. Blight is caused when plants do not receive enough light. The top shelf was far from the lights when the bottom shelf was 3 feet from the grow light. [\[Return to top of Experiment List\]](#)

## The Effects of Weather Conditions on the Structural Integrity of Pinewood

Student Research by: Kyle Kilpatrick, Keith Miller, Scott Suarez and Steven Zeigler

The purpose of this experiment was to determine whether certain environmental factors, cold temperature, water and a mixture of both, would destabilize the structural integrity of wood. Between October 7, 2003 and December 17, 2003 pinewood that was in four states, dry, wet, frozen and wet frozen, were broken by placing them between two sawhorses. A bucket with was then hung from the wood, and weight was added to the bucket until the wood broke. The most important result, the one that told which state the wood was the strongest in, stated that the dry frozen wood had the ability to hold the most weight. Wood that was warmer held less weight than its frozen counterpart and the wood with water in it also held less weight than its dry counterpart. The hypothesis, stating that dry wood in room temperature would hold the most weight, was slightly correct due to the fact that dry wood held more wood when compared to the wet wood, however, it was unexpected that dry frozen wood would be stronger than the unmodified wood. It is believed that this happened due to the molecules of the wood being more compact in the frozen pieces. For the wet pieces, the wood become less strong, indicating that particles of the water seeped into it, weakening the pieces.

[\[Return to top of Experiment List\]](#)

## Effects of Centripetal Force On Plant Growth

Student Research by: Logan Kinch, Brice Matthews, Chris Pagano, and

Daryn Schluentz

This experiment was conducted because of the interest in plant modification. The purpose of this experiment was to modify oat plants with centripetal force and cause them to grow at an accelerated rate. It was hypothesized that plants undergoing centripetal force would grow larger than plants growing under normal conditions. The plants were separated into two groups: a test group that was tested with centripetal force, and the control group which was not tested with any outside forces besides gravity. The test group and the control group each had thirty plants. A motor was constructed to hold thirty Dixie cups and to spin for the entire life cycle of the plants in the test group to inflict the plants with centripetal force. The plants were watered everyday and both received the same amount of water. The plants were in the same environment and were in the same amount of sunlight as the tested against.

The experiment lasted for the life cycle of the oat plants, which was 20-25 days. The results of the experiment were that the plants that underwent centripetal force cause a decreased growing. The test plants also had root systems that grew unlike normal root system, but horizontal. Also the exterior of the plant above the root was then caused to grow sideways and some never reached the surface causing more of the test group to die than the control group. The control group plants grew at a normal rate and were much larger in size and in the amount survived. The extra force caused the test plants to become less stable and the soil to dry at a faster rate than the control group. This experiment shows that negative effect centripetal force caused on the plant growth. [\[Return to top of Experiment List\]](#)

## Manufacturers Rating Testing of Leading Brand Fishing Lines

Student Research by: Sean Matusko and Jon Miller

The purpose of this experiment was to determine whether the fishing line could hold the manufacturers rating for the maximum weight capacity, and if the line could hold the manufacturers rating, which of the leading brands could hold the most weight. The testing of the fishing lines started on November 12, 2003 and carried through January 3, 2004. This experiment was carried out using a simple procedure. A bucket was connected to an eyehook that was screwed into a plank of wood. The bucket was then connected from the

eyehook by tying the subject fishing line to the eyehook and the bucket. Sand was then poured slowly into the bucket until the line broke. Extra weight was added to the bucket in some cases to reduce time it took to complete the test. The amount of sand that the line held was recorded, along with any extra weight that was added. There were four lines that were tested in this experiment. The four lines were Berkley Trilene, Berkley Fireline, Yo-Zuri Hybrid, and Stren Original. The lines had a manufacturer's rating of a six-pound test. This means that the fishing lines could hold an average of at least six pounds before breaking. The results showed that three out of the four fishing lines held at least six pounds. The Yo-Zuri Hybrid held the most amount of weight by holding approximately 4.57kg of sand. The Berkley Fireline held the second most amount of weight, by holding approximately 3.81kg of sand. The Berkley Trilene held the third most amount of weight, by holding approximately 3.06kg of sand. The only line that didn't hold the manufacturer's rating was the Stren Original, by holding approximately 2.23kg of sand. The results showed that the experiment was successful in determining whether or not fishing line could tolerate the manufacturer's rating for the amount of weight that the line could hold. The results disproved the hypothesis that all of the lines would be able to hold the manufacturer's rating. [\[Return to top of Experiment List\]](#)

## Water Temperature as A Factor in Marigold Growth

Student Research by: Emily Cross, Norman Rawls, and David Svenson

The purpose of the experiment was to determine if different water temperatures affected the growth of marigolds and allowed them to grow to their full potential. Testing was conducted at the Macomb Academy of Arts and Sciences (MA<sup>2</sup>S) in Armada, Michigan. Beginning on October 8, 2003, and continuing until December 10, 2003, marigolds were watered according to the temperature group they were placed in. The different conditions of water were the control, which came from a tap located in research room 124 at MA<sup>2</sup>S, and the three others, which were chilled, heated, and room temperature. The hypothesis was that the water temperature would insignificantly affect the growth of the plants. The plants were watered with 50mL of water every Wednesday until November 12, 2003. On that date, the plants were replanted, and the watering schedule changed to 15mL of water ever Monday, Wednesday, and Friday. The results show that overall, the water temperature did affect the marigolds growth significantly

enough, for the duration of the testing. The plants watered at 48°C (110°F) grew better than those at lower temperatures. The plants were replanted halfway through the experiment, in turn; this may have negatively affected the results by not allowing time for full growth. It was concluded that the hypothesis was disproved. [\[Return to top of Experiment List\]](#)

## The Effects of Heating and Cooling Different Types of Metal on Their Properties

Student Research by: Kylie Krause, Hatham Shawqi, and Brad Wagner

The purpose of the study was to determine whether or not the temperature of a metal would have an effect on five different physical properties of the metals. The experiment took place at the Macomb Academy of Arts and Sciences in Armada, Michigan. Throughout the months of August to December of 2003, five different types of metal were heated and cooled while their physical properties were measured. The five types of metals were aluminum, steel, stainless steel, copper, and iron rods used to conduct the experiment. The five physical properties that were tested were magnetism, length, mass, resistance and diameter. The data from the experiment indicated that there was a large variation in the physical properties between the heated, cooled, and room temperature metals. When the metals were heated, the lengths increased and the magnetism decreased. When the metals were cooled, the lengths of the metals decreased, the resistance increased, and the magnetism decreased. [\[Return to top of Experiment List\]](#)

## The Effects of Chemical and Organic Fertilizers on Bean Plant Growth

Student Research by: Corey Beyerchen

The purpose of this study was to determine which type of fertilizer would most efficiently grow a bean plant. Between the dates of October 27, 2003 and December 17, 2003 five different types of fertilizers were tested at the Macomb Academy of Arts and Sciences (MA2S) in Armada, Michigan. The five fertilizers were manure (horse), leaf compost, 10-10-10 chemical fertilizer, 18-24-8 chemical fertilizer, and 10-6-8 chemical fertilizer. It was hypothesized that the organic

fertilizer, horse manure, would produce the best efficiency in plant growth. Each fertilizer was separated into its own set of pots with 30 plants in each set. Each pot had 65 grams of the designated soil/fertilizer, and the seeds were planted a half of an inch deep into the soil. Then the plant's height was measured and watered every Monday, Wednesday and Friday until the experiment was concluded. The final yield of research concluded that the hypothesis was correct and the manure-grown plants grew faster than the other plants using chemical fertilizers. [\[Return to top of Experiment List\]](#)

### The Manipulation of the Conditions of Temperature, Coil Amount, and Type of Coil to Test Electromagnetic Strength on Five Different Metal Rods

Student Research by: Nick Burmann, Alison Krajewski, Brent Merhar, and Patti Wojtowicz

The main purpose of this research experiment was to create an electromagnet that would generate a magnetic force by manipulating different conditions in which it would be tested. The conditions consisted of decreasing temperature, increasing coil amount, and the type of coil among five different metal rods including aluminum, brass, bronze, copper, and steel. These metal rods were chosen based upon their different components, only one of which had an iron substance present. The hypothesis of this experiment was that the steel rod with a decrease in temperature and increase in coils would create the strongest magnetic strength. First the electromagnet was constructed by taking five different metal rods and creating coils around each individual rod with insulated copper wire, leaving excess wire on each end of the rod. Then, the battery charger was connected to one of the rods with alligator clamps. Once connected, the strength of the rod was tested, adding masses accordingly. This procedure was repeated for each rod. A second layer of coil was added and tested the same way. Then a third layer of coil was added and masses were added to test its strength. The rods were then cooled in a freezer. After the rods cooled down, the strength of the rods were tested once again with single, double, and triple layers of coils. The results showed that the experiment supported the original hypothesis. The steel rod was able to produce the strongest magnetic strength when the different coil amounts, as well as cooler temperature were tested. It was observed that insulated copper wire produced stronger magnetism than non-insulated copper wire. It was

also discovered that the four metal rods of copper, bronze, brass, and aluminum were not able to generate any magnetic strength. Finally, it was found that an increase in coils and a decrease in temperature produced stronger magnetism.

[\[Return to top of Experiment List\]](#)