



Macomb Academy of Arts and Sciences

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# RESEARCH ABSTRACTS

**2011  
RESEARCH  
PRESENTATIONS  
AND DEFENSE**

**Seniors – May 11<sup>th</sup>  
MA<sup>2</sup>S Gallery**

**Freshmen, Sophomores and Juniors – May 18<sup>th</sup>  
MA<sup>2</sup>S Classrooms**

## **AM SENIORS (5/11/11)**

### **The Effect of Varying Ratios of Lightning Powder and Charcoal Powder on the Percentage of Fingerprint Covered by Powder**

*Student Research By: Caitlin Bouchey, Michael Pollari, David Schornak, and Derek Schornak*

Fingerprints are left behind whenever a surface is touched; however, those fingerprints are only visible when brushed with a fingerprint powder. Since each fingerprint is unique to the individual, fingerprints are one of the most useful pieces of evidence found at a crime scene. The purpose of this experiment was to find which fingerprint powder combinations would be the most effective in coverage of a print. Lightning powder and charcoal powder were mixed together, fingerprints were transferred onto transparent paper, and different combinations of powder were brushed with a brushing apparatus. The prints were analyzed for the percent covered by the different powder combinations. After the data was collected, data analysis found that the hypothesis was incorrect; the more charcoal powder added, the greater the percent coverage was. The data collected and trends found in the data are related to how the two different powders are supposed to work.

### **The Effect of Oolong Tea on the Memory Formation of Mice During Cloudy-Water Platform Testing**

*Student Research By: Cole McCloskey, Tyler Nichols, Kelsey Noteboom, Sean Woods*

The positive benefits of consuming tea is an accepted notion, but there are debates on how perverse the benefits are, and how effective. Tea contains a myriad of helpful chemicals such as antioxidants, and caffeine. It is thought that the consumption of these chemicals can aid in cognitive functions such as memory formation. The effects of tea on long term memory formation was tested and observed in mice over a ten week span. Four mice were given varying amounts of brewed tea that was placed in their water supply. The amounts of tea used in the different brews were 0.5g, 1.0g, and 2.0g. 0.0g was used as a control. Each mouse was placed in a tank filled with cloudy water and timed until the mouse found a submerged, hidden platform. It was found that when tea was added to the water, there was a significant decrease in time it took for the mice to find the platform. It was observed that the amount of tea added did not have an effect, only the presence of the tea in the water. The results indicate that tea does have noticeable positive effects on cognitive functioning over a long term consumption bases.

## **The Effects of Water to Vinegar Ratio and Time on the Light Intensity of a Stain on a T-shirt**

*Student Research By: Raschelle Scheinost*

There are many consumer products available in the marketplace intended for household cleaning tasks. A common household product used by the general population for cleaning is white vinegar. This experiment tested to see how changing the water to vinegar ratio in a solution affected the amount of light intensity of a stain on T-shirt material. A stain, made from a permanent marker, was put on each piece of T-shirt material. The light intensity of the T-shirt was taken before the stain was applied as part of the control. Once the stain was applied the T-shirt sections were soaked in the water to vinegar ratio solutions. The trials were rinsed and hung on a line to dry. Near the end of data collection the trials that had dried, had their light intensity taken again. The data showed that the trials soaked in zero percent and one-hundred percent water for twenty minutes had the highest light intensity. The trials soaked for fifteen minutes had a high light intensity at seventy five percent water and the lowest light intensity at twenty five percent water.

## **The Effects of Gasoline and Ethanol Fuel Mixtures on the Energy Output and Temperature Change during Combustion**

*Student Research By: Evan Baumann, Singen Chang, Amanda Douglas, and Shannon Klee*

Ethanol has been used more frequently as an alternative, cheaper fuel source. An experiment was conducted to find out if using different octane level fuels would increase energy output and if using ethanol will affect the energy output when mixed with gasoline. Two methods were used to test the hypothesis. A homemade bomb calorimeter was used to find the change in heat over time while a C200 Bomb calorimeter was used to find the energy output of each of the gasoline types and gasoline mixtures. The results show that octane ratings do not have any effect on the energy output. Higher ethanol percentage lowered the energy output in the C200 trials, but raised the temperature change in the home-made calorimeter trials. The results can be explained by the gasoline's' burning rate. Gasoline burns at a slower rate than ethanol but also burns with more overall energy as time progresses. The ethanol gives off more energy in a shorter period of time than gasoline, but gives off less energy over time because the ethanol burns out so fast. The burn rates are affected by the bonds in the gasoline and ethanol. The research showed that octane level does not have any effect on energy output and lower octane fuels should be used.

## **The Effect of Voltage Change on the Electromagnetic Shielding Capacity of a Faraday Cage**

*Student Research By: Ted Binkowski, Jacob Caporuscio, and Trevor Goolsby*

The purpose of this experiment was to determine if an increase in voltage in the wire mesh of a Faraday Cage would affect the percent of communication loss between a laptop and router. This was done to test the efficiency of a Faraday Cage for potential use as electromagnetic shielding.

Wireless signals are electromagnetic waves, same as radiation, so it was assumed that wireless signal would exhibit a similar behavior to shielding as radiation. To do this, a wireless router was placed inside of a Faraday Cage. The Faraday cage is a box of metal screen that blocks electromagnetic waves, so it was used as shielding. The cage was attached to a power supply, and a current at various voltages was run through it. A laptop was connected to the wireless router, and the effect of the current in the shielding on the efficiency of the shielding was tested. The results were measured in percentage of data lost in communication. The results showed that there is no statistical change in the data. The data was extremely similar, and the differences between all but the first and last gradient can be attributed to chance. It is believed that using a greater range of voltages could result in statistically different data. Future research could be done to test this, as well as testing different materials for the cage.

## **The Effect of the Concentration of Fluoride on the Flexibility of Different Gauges of Steel Wire**

*Student Research By: Marisa Green, Carlie Harms, Kristie Harms, and Kate Shellenbarger*

An experiment was conducted at the Macomb Academy of Arts and Sciences in Armada, Michigan. The purpose of this experiment was to find out if sodium fluoride had any affect on the metal that braces and filling are comprised of. Six different gradients of sodium fluoride were tested: 0ppm, 250ppm, 500ppm, 750ppm, and 1000ppm, with 0ppm being the control and containing no fluoride. To begin, sections of wire were soaked in different concentrations of fluoride for one minute. The wire was then tested to see how much weight it took for the wire to move down three centimeters, which would in turn show how flexible the wire was. This experiment was started because several of the researchers either had braces and/or fillings or they had had braces in the past. Each fluoride concentration was tested on 22 gauge and 17 gauge galvanized steel wire. Fifteen samples were taken of each gradient. While analyzing the data it was noted that there were not any significant trends. After analyzing the data the researchers concluded that sodium fluoride does not have any affect on the flexibility of wire.

## **PM SENIORS (5/11/11)**

### **The Effect of Light Visibility on the Evaporation Rate of Saltwater in a Desalination Chamber**

*Student Research By: Kaitlyn Clough, Rachel Goubert, Jessie Hyatt, and Taylor Krause*

The purpose of this experiment was to determine the most efficient mode of evaporating saltwater in a desalination chamber. This experiment was chosen as a response to third world countries' scarcity of freshwater and as a way of providing drinkable water at a low cost. Preparations for testing involved building Plexiglas domes and applying layers of sticker tint. Light and heat levels were altered using layers of tint applied to the domes. Thus, the visibility of the different domes was the independent variable, and the changes in the water's mass, volume, and temperature were the dependent variables. While the opaque dome had the least evaporation, all other domes showed the same level of performance. It is believed that this occurred due to the fact that the translucent domes allowed in more light energy to reach the water and overcome the salt water's colligative properties. However, through further examination, it was determined that the results were not substantial enough to provide distinct results.

### **The Effect of Fog Concentration on Voltage Produced by a Solar Panel**

*Student Research By: Kaitlyn Bushbaker and Ashten Lindeman*

The interest in this experiment was spawned from a new invention – solar roadways. An experiment was formed to test how fog, which was meant to represent car exhaust, would affect the efficiency of a solar panel. This was done by placing a fog machine in a Plexiglas box with a solar panel and running the fog machine for different time intervals: 0, 3, 6, 9, 12, and 15 seconds. The initial and final voltage output of the solar panel was analyzed and the changes in percent were calculated. It was found that no fog produced the smallest percent change, meaning no voltage was lost. The 15 seconds of fog released had the largest percent change, meaning voltage was lost due to the fog. The fog particles either scattered the light waves or absorbed them. This means that the more car exhaust existing on a roadway, the less voltage the solar roadway will produce.

## **The Effect of Width, Distance, and Wind on the Voltage Output of Solar-Wind Spirals**

*Student Research By: Katrina Prohaszka, Desirae Tibaudo, and Elizabeth Ulinski*

Solar energy involves the use of photovoltaic cells to absorb energy from the sun, and with the increasing need for efficiency, this method is gaining popularity every day. Additionally, wind-generated power, harnessed through the use of turbines, is growing as more people switch to this eco-friendly source. With both of these energy-producing methods becoming more and more common, the idea of combining them and measuring the energy output was proposed. Six solar film strips were attached to the lower ends of three wind spirals made of straws and held upright by a wood frame. The spirals were placed, in increments of 20, at distances between 0 (directly under) and 100 centimeters away from a growth light; a fan placed in front of them caused them to spin while a voltmeter measured the energy output of each. The data found showed the largest spiral produced the most energy when it was 20 centimeters away from the light, though the range between each spiral's data was considerably slim. Also, it was found that the combination of wind and solar energy was more beneficial than separating them.

## **The Effect of Incline on the Path of a Car Driving on a Simulated Ice Covered Surface**

*Student Research By: Nicole Ewert, Michael Frost, Grace Gregory, and Eric Kosek*

An experiment was created at the Macomb Academy of Arts and Sciences in Armada, Michigan to test whether the degree of an incline had an affect on the path of a vehicle. Driving on ice covered hills are situations that winter drivers often experience. Therefore, a remote controlled car was driven across a slick surface at different angles in order to simulate on upward and downward hills. The results from the experiment could be used to conclude whether or not the degree of incline had impact on a vehicles motion. The surface used to simulate ice covered inclines was a glass window covered with vegetable oil. As the remote controlled vehicle traveled across the surface it was video taped, and the video recordings for each trial were evaluated using Vicon Motus. Vicon Motus allowed the intensity of the car's swerves to be evaluated. When traveling uphill, the vehicle resulted in the most swerves as well as the most intense swerves. It was concluded that as the incline increased, the number and intensity of swerves the vehicle took on increased as well. As the angle increased it was difficult for the vehicle to travel up the incline, which caused the wheels to turn- resulting in excess swerving. When the incline decreased, the remote controlled car traveled at such a high speed that its path remained straight. After evaluating data, it was concluded with supporting data that when driving on ice covered inclines, drivers must beware of immense swerving. To help reduce fatalities in vehicle collisions, ice covered inclines as well as declines should be approached with caution no matter their degree.

## **The Effects of Varying pH Levels of Hydrochloric Acid on the Dissolving Rate of Aspirin and Acetaminophen**

*Student Research By: Sarah Doering and Cecelia Goulette*

Discomforts in life are common, and people most often turn to medicine for help. Painkillers are a commonly used substance to treat those discomforts. However, there has been debate on which pill, aspirin or acetaminophen, is the most effective based on how quickly they dissolve within the body. An experiment was created that questioned what stomach pH would dissolve the pill the quickest as well as which pill would be impacted the greatest. The experiment was structured to replicate a human stomach through the use of a magnetic stir machine, magnetic stir rods, and hydrochloric acid. The stirring machine and rods were for the motion of the stomach and the acid was the same acid inside the stomach. Various pH levels were used because each stomach pH differs from person to person. It could be concluded that the stronger the pH level, the faster the pills dissolved. Also, it was found that the acetaminophen dissolved quicker than the aspirin. The scientific reasoning for that result was the structures of the pills. Also, the temperature of the testing room changed over the course of trials, by the end it was warm inside. This would mean that the pills were tested at a temperature closer to that of normal body temperature, decreasing the time need to dissolve.

## **The Effect of Varying Hydrogen Peroxide Amounts on the Glow Produced by Luminol Solutions**

*Student Research By: Ashley Brodacki, Elizabeth Crawford, and Haley Waterstraat*

The purpose of this experiment was to discover the affect of hydrogen peroxide on the glow intensity produced by the chemiluminescent reaction of luminol and iron. This was done by varying the amount of 3% hydrogen peroxide in attempt to find the ideal amount which produced the greatest glow intensity. Sanitized blood was dropped on individually cut carpet squares and left to dry. Five luminol solutions were made with different amounts of hydrogen peroxide and were sprayed on the carpet pieces. They were analyzed in a dark room using a light scale created to show different levels of glow intensity. The larger the amount of hydrogen peroxide in the solution, the greater the intensity of the glow was. In contrast, as the hydrogen peroxide continued to increase, it hit a solubility point where the increase of the glow ceased. Due to this, it was found that the luminol solution containing 9.25mL of 3% hydrogen peroxide produced the most intense luminescent glow.

## **The Effect of the Change in Diameter on Decibel Output**

*Student Research By: Dan Binder and Robbie Okray*

For nine weeks, a study was conducted at the Macomb Academy of Arts and Sciences in Armada, Michigan. The purpose of this experiment was to test the decibel output of several different diameter headphones. Three different headphone diameter headphones were tested on a single song at several volumes. The reason for this experiment was because of an interest in whether a larger or smaller diameter would affect the decibel output of the headphone. There are many small hairs in the inner part of the ear which interpret sound so the sound can be understood by the brain. As the amount of decibels put into an ear is increased, the damage to the hairs is increased and once damaged can no longer help the brain understand the sound and the person becomes deaf. The control in this experiment was 100% volume with the middle diameter, 1.2cm headphone. The headphones were tested on four different percentages of the full volume: 25%, 50%, 75% and 100%. The headphones were tested at each of the volumes, and the decibel outputs were recorded. The largest diameter headphone had the least decibel output, and the 1.2cm diameter headphone had the largest decibel output.

## **AM ROOM 1 (5/18/11)**

### **The Effect of White Strips on Mass Change and White Value of Teeth**

*Student Research By: Trevor Fistler, Zach Kilpatrick and Jade Woodruff*

This research experiment was conducted at the Macomb Academy of Arts and Sciences in Armada, Michigan. The purpose of conducting the experiment was to find out if whitening strips reduce the mass of teeth and if they really make teeth whiter. This experiment used 21 teeth and six different time variables (including the control). The teeth were split up into groups of three and each group was labeled for a different time variable (between 0 and 60 minutes in intervals of 10). The teeth labeled 0 never had white strips placed on them. The teeth were massed and the whiteness values were checked each week to determine if changes occurred. The results found were that all whitening values changed along with the mass of the teeth. The greatest change in whiteness took place with the group of teeth that had the white strips on for the longest amount of time. The group with the least amount of change was the 40 minute group. The longer the white strips were left on did not necessarily mean the more mass the teeth lost. The teeth which lost the most mass were when the white strips were left on for 30 minutes. When left on for 30 minutes at a time the teeth lost an average of 9.45 percent of the total mass. The control group of teeth even lost mass which never had a white strip put on. They lost an average of 3.72 percent of their total mass. The teeth that had the white strips on for 40 minutes at a time actually gained mass. These teeth gained an average mass of 6.25 percent. The hydrogen peroxide may cause little hole in the dentin (which is what gives a tooth its color) exposing small parts of the enamel. This is where almost all the tooth's mass is found. The component that affects the whiteness of the tooth the most is the small amount of sodium acid in the white strip. The acid over a period of time strips away layers of dentin making the teeth whiter. This causes the tooth to lose mass and will usually cause irritation and sensitive teeth.

### **The Effect of Temperature on the Light Intensity of a Glow Stick**

*Student Research By: Andrew De Bucce, Jon Horton, and Tyler Wawrzyniak*

The purpose of this experiment was to find the relationship between changing the temperature of chemiluminescent compounds and the brightness when they are mixed together. The results showed a direct correlation between temperature and brightness which states that as temperature increases, the brightness will increase as well. Sodium carbonate, ammonium carbonate, luminol, hydrogen peroxide, water, and copper sulfate pentahydrate were mixed together in a beaker inside a darkened room in the school. The glow was measured by the light sensor on the GLX and was used to determine the brightness. An ice bath and heating plate were used to change the temperatures of the mixtures to the gradients that were meant to be measured. To confirm that the temperature had reached the levels that were desired, a temperature probe on the GLX was used to measure the temperature of the mixture. The p-values calculated from the results proved the experiment's viability as the chance that the results received were due to outside factors is close to non-existent.

## **The Combustion Effect of Antiperspirant on a Cotton T-shirt**

*Student Research By: Makayla McCarthy and Lauren Heimler*

The experiment was conducted in the Fall of 2010 at the Macomb Academy of Arts and Sciences in Armada, Michigan. The purpose of this experiment was to determine how flammable cotton t-shirts were, depending on the amount of time that elapsed after they were sprayed with 3 different store purchased antiperspirants. Sixty pieces of a cotton t-shirt were cut and sprayed with an antiperspirant for varying amounts of time. After the t-shirt pieces had sat for the allotted time with the antiperspirants on, the t-shirt piece was placed on a pre-designed metal structure. The t-shirt piece was then burned and massed. The temperature of the flame was recorded. It was found that while one antiperspirant had the highest burn temperature it did not burn the cotton t-shirt pieces tested as much as the other two antiperspirants did.

## **The Effect of Sodium Chloride on the Conductance of Hydrogen Dioxide**

*Student Research By: Victoria Breiling, Armelle Henley, and Hannah Townsend*

In society, added electrolytes are becoming one of the most popular dietary fads. Electrolytes are free-ions which help carry electrical signals throughout the body, which aid neurological functions. Electrolytes are crucial for regulating hydration levels in the body. An experiment was created to test conductance of varying amounts of electrolytes in a fixed amount of water. The five gradients were 0g, 5g, 10g, 15g, and 20g of sodium chloride, which was mixed with 312mL of water. The hypothesis stated that as the mass amount of sodium chloride increased, the level of the solutions conductance would increase at a constant interval as well. Conductance was found by sending a charge of 10V through the water and the output was measured by amps, which provided the conductance of the solution. After eight weeks of testing the hypothesis, the results disproved the hypothesis. Instead of conductance increasing relative to the increase of sodium chloride, the conductance showed a sporadic trend that was not reliable. The gradient of 0g sodium chloride had virtually no conductance, and the trial of 5g of sodium chloride had a very large spike in conductance. The results also showed that 10g sodium chloride and upward, were similar in conductance. This can have future implications on how much sodium chloride is given to people when they are in need of electrolytes. Different electrolytes could be researched and tested to create more accurate results of conductance in future experiments.

## **The Effect of Energy Output from Salt Combustion on the Light Intensity of a Flame**

*Student Research By: Andy Binkowski, Michael Patrick, and Anyssa Schember*

The purpose of this experimental study was to see if varying the salt composition or the amount of the salt burned would increase the intensity of the flame. The energy output of the flames from various salts was measured to determine the light intensity of the flames. The salts were held over a Bunsen burner and the intensity was recorded with a GLX for sixty seconds. Every week roughly twenty trials were conducted with the chemicals chosen at random for each trial, along with a randomly chosen amount for that chemical. The salts used were potassium chloride, sodium chloride, calcium chloride, and magnesium sulfate. Chemicals with longer wavelengths gave off less energy than chemicals with longer wavelengths, but the chemicals with longer wavelengths had greater intensities than those with shorter wavelengths. The chemicals potassium chloride, sodium chloride, and calcium chloride had an increase of intensity as the mass of the chemical was increased, agreeing with the hypothesis. However, the intensity of magnesium sulfate decreased with the increase of the mass of the respective chemical, differing from the hypothesis. It was concluded that increasing the amount of chemicals increased intensity, but not energy output of the flame.

## **The Effect of Disinfectant on Bacteria over the Period of Ten Weeks**

*Student Research By: Paige Heimler, Holly Metz, and Brittany Schmidt*

For ten weeks, a study was conducted at the Macomb Academy of Arts and Sciences in Armada, Michigan. The purpose of the experiment was to determine the effect of disinfectant on bacteria. There are four phases in the life cycle of bacteria, the Lag Phase, Log or Exponential Phase, Stationary Phase and the Death phase in that order. The Lag Phase is usually the longest next to the Log or Exponential Phase. The shortest phase is the Death Phase. In order for bacteria to spread, it must multiply. The bacteria grow until material to separate it from two progeny cells. Binary fission is the name of this process. The results showed that Clorox® disinfecting wipes are only effective for so long and then they stop killing bacteria. The standard deviation for the non-disinfected side and the disinfected side were pretty much the same. There was a point one difference. This means the disinfectant wipes did not last as long as expected. There was almost the same amount of bacteria on the disinfected side and on the non disinfected side.

## **AM ROOM 2 (5/18/11)**

### **The Effect of Different Amounts of Aluminum, Magnesium and Iron Powder on the Burn Time of a Sparkler**

*Student Research By: Ashley Ede and Holly Hutcheson*

Sparklers are enjoyed for their brilliant colors and luminous flame, they work with various metals and chemical solutions, which are carefully prepared to create just the right effect. The following experiment explored the effect of three metals, magnesium, iron and aluminum, on the burn time of sparklers. It was tested if having one metal present or absent caused the sparkler's burn time to increase or decrease. The different metals were added to a solution. This solution varied week to week depending on which metal was omitted or had excess of. Twenty sparklers were dipped into a single solution and left to dry for a week until they were ready to burn. It was found that adding more iron and aluminum increased the burn time when compared to a solution without any aluminum or iron. It was also concluded that sparklers with excess iron present did burn the fastest out of the three metals. This experiment was conducted at the Macomb Academy of Arts and Sciences from October 10th to December 8th.

### **The Effect of Time Soaked in Gastric Acid and Sugar Amount on the Mass Loss of Gum**

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

The purpose of this experiment was to determine if soaking gum in gastric acid for different amounts of time and the sugar content caused a change in mass of the gum. Gum with 0 grams and 2 grams of sugar were soaked in acid for different amounts of time (1-8 weeks). The gum pieces were put into vials filled with 12 mL of gastric acid, left to soak for their specified time, and removed so they could dry for a week. Once dry, the total change in mass was calculated. The results showed that as the number of weeks soaked increased, the mass decreased, but that sugar amount had no effect. Gum with 0 grams and 2 grams of sugar decreased in mass approximately the same amount. This was because of the properties of gastric acid, which breaks down food in the stomach. The gastric acid would break down the sugar and other components of the gum; causing a decrease in mass the longer the gum was in the acid. However, the polymer gum base, which enveloped the gum, was more resistant to the gastric acid, causing the acid to take longer to break through the outside layer. Once this happened, the acid was able to break down the other exposed, more easily digestible components of the gum at a much faster rate.

## **The Effects of Varying Amounts of Luminol on the Emitted Light Intensity of a Hydrogen Peroxide and Luminol Solution**

*Student Research by: Anna Smith and Alexis Verstraete*

Luminol solutions are often seen on crime scene shows. When luminol is mixed with an oxidant and applied to a surface, it can detect certain substances when exposed to a black light. The oxidant that was used in this experiment was hydrogen peroxide. Luminol is most often used to find blood in a crime scene. When luminol is applied to a substance, the glow produced by the luminol appears to be more concentrated. However, a liquid substance was not used in the experiment because the process that would have had to occur to make sure the substance was consistent for each trial would have been too time consuming. In the experiment, solutions with varying amounts of luminol were applied to black paper. During the trials, the luminol was measured into the appropriate amounts and mixed with hydrogen peroxide. The solution was then applied to the black paper and exposed to a black light. The dependent variable was the hydrogen peroxide because stayed constant throughout the trials. It was found that there was no quantitative trend. However, there was a qualitative trend in that the color of the solution changed as the amount of luminol changed.

## **The Effects of Air Pressure and Launch Angle on a Ball Launched from an Air Cannon**

*Student Research By: Giovanni Campis and Dillon Frost*

Cannons have been used throughout the history of human warfare and are commonly used in many types of launch related experiments. The effects of force and angle of launch on the distance traveled by a ball was investigated. The air pressure and launch angle were manipulated on a home-made air cannon. It was found that if either of these variables were increased, then the distance the ball traveled would also increase. As the pressure of the air within the cannon increased, the force applied to the ball would also increase. When the angle of the cannon was increased, the maximum height of the ball during flight was increased also. With a greater height, the ball was allowed more time to travel.

## **The Effects of Boiling Time on Bacteria Colonies**

*Student Research By: Grant Baker and Caleb Birdsley*

The purpose of this study was to determine if boiling water had any effect on the levels of certain substances. Some of these substances being chemicals like phosphates (fertilizers), nitrates (fertilizers), and pH (acidity). Others being dissolved oxygen and turbidity with the final being bacteria, single celled microorganisms with no nucleus. Pond water was collected and then poured into five beakers. One beaker was not boiled or heated while the other four beakers were boiled for one minute, two minutes, three minutes, and four minutes. The water from these beakers was then tested for levels of phosphates, nitrates, pH, dissolved oxygen, and turbidity using the LaMotte Water Testing kit. The remaining water was then tested for bacteria colonies per 100mL using the process of serial dilution. The levels of nitrates and dissolved oxygen were both zero because the heat did not affect them. The levels of dissolved oxygen tell how much oxygen is in the water and more oxygen in a water source can indicate a more diverse ecosystem. The levels of the phosphate, pH, and turbidity all had no trends because the heat did not affect them. The levels of turbidity can indicate the clarity of water and the amount of particles in a water source. The average levels of bacteria colonies for no heat was  $3125 \pm 1743.4$ , for one minute  $1612.5 \pm 1084.2$ , for two minutes  $812.5 \pm 344.1$ , for three minutes  $350 \pm 141.421$ , and finally for four minutes  $137.5 \pm 51.8$ . The trend of this was after a longer time of boiling the levels decreased. The reason for this is the heat killed more bacteria after a longer time period. Bacteria can indicate what kind of bacteria are in a water source and certain bacteria can cause serious diseases.

## **AM ROOM 3 (5/18/11)**

### **The Effect of Blade Angle and Number of Windmill Blades on the Voltage Produced**

*Student Research By: Brad Fistler, Brandon Townsend, and Josh Tschiggfrey*

The experiment was performed to find the highest possible output of volts to increase the energy produced by windmills. The experiment used a windmill to generate volts from wind produced by an average household fan. Twenty trials were conducted for each of the two independent variable gradients in this experiment. The maximum voltage that occurred during the 15 minute trial was recorded. The results of this experiment showed that the number of blades and the angles of the blades impacted the amount of volts created. If more blades were on the windmill along with the blade angles being closer to 45 degrees, then the windmill was found to be spinning faster, which made the number of volts increase. These results were found due to the wind pressure produced from the independent variables.

### **The Effect of Mass on the Surface Area of a Crater Created by a Model Roller Coaster Cart**

*Student Research By: Jessica Barjaktarovich, Robin Bliss, John Gaffney, and Bella Kesler*

Mass dispersed in different areas of a car upon impact can cause dramatic results. This experiment focused on how the change of position of a mass affects the flight path of an object that is being sent off a launch ramp. A car and ramp was made out of K'NEX pieces from a K'NEX Rollercoaster building set. The experiment was performed to observe the different surface areas of craters left in a sand pit by a K'NEX car with different weights distributed in various places on the car. Weights, represented by washers, were placed in the front, middle, or back of the car for each trial. The amount of weight placed on the randomly chosen position on the car varied by 3, 6, or 9 washers. The car was then sent down a ramp which dropped off into a sandpit. A photograph was then taken of each crater and later scaled to size to determine the surface area. The change in position of the mass when the washers were placed in the front of the car did relate to a change in the area of the impact crater.

## **The Effect of Wattage and Color on the Energy Output of a Solar Panel**

*Student Research By: Jacob Goike, Kyle Baert, Collin Kanachki*

The purpose was to find the effect of different wavelengths and wattages on the energy output from a solar panel. To test this experiment, two boxes were made to hold a solar panel and lamp. The lamp and solar panel were placed three feet apart from each other. A light bulb was placed in the lamp and the lamp was turned on. Combinations of eight different colors and four different wattages, creating thirty-two different combinations, were tested. A light bulb with a higher wattage produced a higher energy output, which was due to the higher amount of Lumens being produced. Also, a light bulb with a color with a higher wavelength produced a higher energy output.

## **The Effect of Different pH Levels of Hydrochloric Acid on the Dissolving of a Vitamin**

*Student Researched By: Brett Muylaert, Lauren Okray, and Alyssa Wrubel*

Vitamins are taken daily by people all over the world to improve overall body health. An experiment was conducted to discover how different acid levels (pH levels/molarities) of hydrochloric acid which can be closely compared to a human's stomach acid to see whether or not each vitamin would dissolve in a time that was set. The experiment was conducted using five different increments of pH/molarity of hydrochloric acid. A vitamin was dropped into a heated beaker (at the temperature of a human body) of hydrochloric acid and then left to dissolve. Data collected showed that the lower the pH level (the higher the molarity), the quicker the vitamin dissolved.

## **The Effects of Insulating Air Pockets of a Solar Cover on the Temperature of a Chlorinated Pool**

*Student Research by: Colleen Gaffney, Mianna Gonczar, and Olivia Kesler*

Solar covers are manufactured with insulating pockets designed to keep heat in the pool water.. This study, conducted at the Macomb Academy of Arts and Sciences in Armada, Michigan, tested the effect of solar covers have on the temperature of a pool. The experiment was designed to compare the insulating effects of a pool solar cover containing various levels of damaged insulating pockets to a pool without any cover at all. This study was accomplished by creating pools and solar covers with a ratio of popped bubbles. The pools were under a lamp for three days, simulating the heat of the sun. The start temperature, end temperature, and evaporation were measured and recorded for all five pools after each trial. The control was the pool with no solar cover. The results indicated that popping the bubbles on the solar cover did not directly affect the data. The difference between the covers with popped bubbles and the cover without any bubbles popped was not significant. The pool without a solar cover and the pools with a cover did not collect any numerical data to show a considerable increase or decrease in pool temperature. The experiment also included the solar covers stop evaporation and save water.

## **The Effect of Multi-Gradient Filters on Residual Mass after Filtration of Pond Water**

*Student Research By: Denis Rozek II Jacob Thomas*

This experiment had very different results from what we had originally planned. For some of our filters the standard deviation was higher than the mean. That's obviously a bad thing. If this experiment were to be redone the filters would have been replaced weekly, this would be done because the filters in this experiment started to break unexpectedly. Due to that unexpected breaking our results turned out very irregular. Another thing worth mentioning is that the filters with a majority of sand worked noticeably better then the filters with a majority of gravel.

## **AM ROOM 4**

### **The Effect of Impact Angle on the Force Applied on an Object**

*Student Research By: Nathan Antilla, Vincent Ragap, and Kurt Wieber*

Researchers tested the effect of angle of impact on the force transferred to an object at the Macomb Academy of Arts and Science. This was intended to simulate an automobile accident, in order to find the safest angle to be hit at if a collision is inevitable. A force plate was set at various different angles and hit with a baseball bat. The force transferred perpendicular to the force plate was recorded, and then later analyzed. As the angle of impact moved towards the extreme, the force transferred increased. This trend was exactly opposite the hypothesized trend. After further analysis, this trend was determined to be due, in part, to a flaw in the design of the testing apparatus. This flaw is easily fixable, requiring only the reconstruction of the testing apparatus. Because of the flaw in the design, the data was deemed inconclusive and the experiment should be repeated to determine for certain if the angle of impact truly has any effect on the force transferred to an object.

### **The Effects of Various Molarities of Hydrochloric and Sulfuric Acid on the Mass of Latex Gloves**

*Student Research By: Lauren Grobbel, Alexandria Kesek, and Jeremy Martyniak*

Often at times, teachers tell their students to use safety precautions when using acids by wearing latex gloves to protect their hands. The research conducted was to see if there were changes in mass when the latex fingertips were soaked in different concentrations of hydrochloric and sulfuric acid. The research was conducted at the Macomb Academy of Arts and Sciences. The different molarities of each of the acids that were tested were 0.1 M, 0.5 M, 1 M, 2 M, and 6 M. Some of the concentrations of different molarities had to be made. The concentrations that were made were not pure acid. Instead, the acids were dissociated in the water, which caused the little or no change in mass in each different test. The average change of mass of the latex fingertips were +0.01 grams.

## **The Effect of Bat to Ball Collision on the Distance a Softball Will Travel**

*Student Research By: Rebecca Bertrand, and Jaclyn Farrier*

The experiment took place at the Macomb Academy of Arts and Sciences. It was conducted to determine how far a softball would travel depending on the spot it was hit on the bat. The bat was measured off and broken up into six different positions starting from the closest part of the handle to the end of the barrel. Position one started at the handle and worked its way down the barrel to the sixth position. A softball was placed on a tee in front of the bat, the bat was cocked and released hitting the ball. An average of three trials were tested each week for nine weeks recording the data. The data that was collected supported the hypothesis meaning that the sweet spot of the bat hit the ball the farthest out of the six positions. As the ball was hit closer to each end of the barrel the trend stayed the same and slowly decreased in distance traveled. In the experiment, the sweet spot was positions 3 and 4 on the bat which was directly in the center. Depending on the bat, its size, weight, and what it is made of, the sweet spot will be in a different location for each. There is a sweet spot on every bat where the ball comes off the fastest and hardest, but it is never the same. This is also where the ball is hit the greatest distance when the bat is swung its hardest.

## **The Effect of the Percent Ratio of Ethanol to *n*-Butanol on the Energy Output of a Combustion Reaction**

*Student Research By: Brittany Bergstrom, Nicholas Fitzsimons, Erin St. James, Erin Steinberg*

Research of alternative fuels is an area of high interest given the current price of oil and gasoline. Any sources of fuel used to power vehicles and replace regular gasoline must produce similar levels of power and energy. If they are considerably less efficient, they will not be used to replace gasoline. Towards this end, an experiment was conducted to determine whether ethanol or *n*-butanol produced a higher energy output. Each week, four different mixtures of the two fuels were tested (%ethanol/%*n*-butanol): 100/0, 30/70, 70/30, and 0/100. Each mixture was lit and placed underneath a homemade bomb calorimeter. Then, the time each mixture stayed lit and the change in water temperature were recorded to later find the energy output of each mixture. The results of the experiment showed that the 100% *n*-butanol mixture had the highest energy output and the 100% ethanol mixture had the lowest energy output.

## **The Effect of Angles of Wood on Simulated Blood Spatters**

*Student Research by: Addison Andonoff, Emily Carbery, and Brianna Kriss*

The purpose of the experiment performed was to determine whether the angle of a surface that a drop of blood falls on affects the length and width of the spatter of the initial blood droplet. The experimenters performing the study became interested in the idea of doing an experiment that involved blood due to their common interest in crime scene investigation and the fact that the same methods used in the project are also used by crime scene analysis experts. Based on the size of the blood spatter, the height the blood was dropped from and how much blood was dropped, the spatter dealt with would be considered low velocity by the standards of experts such as crime scene investigators. Though the experiment was considered an overall success, there were many flaws that affected the overall result slightly. The biggest problem was accuracy overall. If this experiment was to be copied another person or group would have to develop a system to make the measurements correctly.

## **The Effect of Mass of the Cart and Angle of the Track on the Time it Takes to Reach the End of the Track**

*Student Research By: Andrew Graham and Evan Serilla*

The purpose of this experiment was to find out how changing the mass of a cart and changing the angle of a track, affects a cart's movement down a track. This experiment shows how much of an effect gravity can have on an object. A cart was released from the top of track and was pulled down the track by gravity. The cart was timed using two PASCO photogates and a PASCO GLX. The results received were unusual. The times did not change much with different amounts of mass on the cart, but differed greatly when the angle was changed. The cart traveled fastest when the track was at fifteen degrees and slowest when the track was at five degrees. In the middle was 10 degrees. Each angle had about a two tenths of a second difference between each other. This pattern can be used to find the data for other trials.

## **PM ROOM 1 (5/18/11)**

### **The Effect of the Material of the Cloth and the Amount of Hairspray on the Final Mass of Burned Cloth**

*Student Research By: Krystal Diel*

This experiment was based on whether an increased amount of hairspray would decrease the final mass of cloth as it was burned over the time span of ninety seconds. The two cloths used were cotton and polyester. The experiment was conducted October 6, 2010 through December 1, 2010 at the Macomb Academy of Arts and Sciences (MA<sup>2</sup>S). Different amounts of hairspray, 0 ml, 2 ml, 4 ml, 6 ml, and 8 ml, were placed on 12.7 cm by 12.7 cm square pieces of polyester and cotton cloth. The cloth proceeded to be burned for ninety seconds. As the amount of hairspray used increased, the mass of the polyester increased, and the mass of the cotton cloth decreased. After adding 4 ml of hairspray, the polyester did not have as great of a rate of change in the mass. Additionally, cotton had a lower rate of change after this point as well. Hydrolysis was the prime reason that polyester gained mass. Cotton lost mass because of a complete combustion reaction.

### **The Effect of Different Steel Types Exposed to Varying Temperatures on the Overall Strength of the Metal**

*Student Research By: Mitch Bobcean, Holly Ernst, Alyssa Hartsig, and Danielle Kehrig*

Over 10 weeks, an experiment was conducted to test the strength of three commonly-used metals: galvanized, hot rolled, and stainless steel. These metals were tested for strength at different temperatures: 15.075° C, 23.4° C, and 54.85° C. This type of experiment was selected because these metals are used for various building structures today that undergo multiple changes in temperature. During testing, each metal type was clamped into a vise and bent with pliers at a constant speed, while the number of bends until the steel broke was counted. The results show that the stainless steel was the strongest because the chromium inside the stainless steel forms a self-repairing film, preventing fracture. Also, stainless steel has a high carbon content, increasing its strength. The data also shows that the second strongest steel, hot rolled, had the highest number of bends at 15.075° C, with 81.067±8.0019 bends, followed by 54.85° C with 78.433±10.0674 bends, and 67.017±12.4336 bends at 23.4° C. The weakest steel used, galvanized steel, was the strongest at 23.4° C, with 80.067±14.0075 bends on average, a medium strength at 54.85° C, with an average of 65.833±4.8722 bends, and weakest at 15.075° C, with an average number of bends at just 62.133±6.3961. This is because the zinc within the galvanized steel, used to prevent rust, weakens the metal, making it more vulnerable to fracture. Therefore, the concluding result was that stainless steel was strongest under varying temperatures.

## **The Effect of the Ratio of Oil to Gas on the Heat Produced**

*Student Research By: Kenny Brohl, Katie Karl, Jack Sabelhaus, and Eric Tobey*

The objective of this experiment was to burn different oil to gas ratios based on volume, (16:1, 32:1, 40:1, 50:1 and 100:1), to find which would produce the greatest change in temperature when burned. A small copper cap was filled with 1mL of the correct ratio, lit on fire, and placed under a home-made bomb calorimeter for one minute. A test tube with water and a thermometer was placed in the bomb calorimeter to record the change in temperature. A direct relationship between an increase in the amount of oil to gas ratio and the change in temperature was not found. Instead, the gas to oil ratio of 32:1 burned the hottest, whereas the ratio of 40:1 burned the coolest. Therefore, the smaller oil to gas ratios would be more appropriate for use with larger engines while the larger oil to gas ratios would be recommended for us in smaller engines.

## **The Effect the Location of Impact has on the Acceleration of a Football Helmet**

*Student Research By: Nick Burton, Adam Flaim, Dan Trombley*

This project was set up to find how the different sides of a football helmet would have an effect on the player's brain in the event of an impact. To conduct this, an apparatus was assembled to implement a set level of force on the different sides of a football helmet. The apparatus can be described as a machine that has a mallet and uses elastic energy to propel the mallet into the football helmet. After each side was struck a number of times the data was recorded. After reviewing the data, it was decided that the side of the helmet that the mallet struck had no effect on the acceleration of the helmet. This was decided after each side produced a similar range of numbers, thus meaning that the side the helmet was struck on did not play a role.

## **The Effect of the Amount of Sticky Tack on How Much Weight the Sticky Tack Can Hold**

Student Research By: *Deanna Flaim, Luc LaBelle, Amanda Robichaud, Collin Tobey*

The purpose of the experiment was to test whether sticky tack holds a greater amount of weight if the amount of sticky tack is increased. A wooden structure was built to test this. A piece of sticky tack was placed on a large aluminum tray and another smaller piece of aluminum was stuck to it. This was slid into a tray at the top of the structure and a bucket was attached to a string hanging from the bottom of the smaller aluminum plate. Sand was then poured into the bucket until the small aluminum plate fell. This weight was recorded and the averages were taken for each gradient. These gradients were: two, four, six, eight, 10, 12, and 14 grams of sticky tack. The order in which the gradients were tested was randomized by using a TI-84 calculator. The experiment took place in the freshman workroom at the Macomb Academy of Arts and Sciences (MA2S) between the months of September 2010 and December 2010. There was an upward trend in the data. The two grams of sticky tack held the least amount of weight and the 14 grams held the greatest amount. The reason for the significant difference between the two and 14 grams was the properties of the ingredients the sticky tack was made up of. Mineral fillers, mineral oil, hydrocarbons, polymers, and pigment made up the sticky tack. The mineral fillers made up the structure of the sticky tack and the hydrocarbons made it sticky. The main reason for the sticky tack holding up the weight was from hydrocarbons. The sticky tack created a larger surface area when more was used, which allowed more bonds to form, allowing the sticky tack to hold up a larger mass.

## **The Effect of Cooking Time on the Amount of Calories in Peas and Corn**

Student Research By: *Ashley Cefali, Alissa Gianferrara, Brittany Groen, and Sarah Sheridan*

The purpose of this experiment was to find out if vegetables lose calories by the time they are cooked increases. This experiment is useful in life because a lot of people are trying to lose weight and be healthier. The experiment was conducted by boiling corn and peas at 0 minutes, 5 minutes, 10 minutes, 15 minutes, and 20 minutes. After the vegetables had been cooked they were weighed in grams and then put into a bomb calorimeter. The bomb calorimeter calculated the joules per gram of the vegetables, and then they were converted into food calories. The corn and peas lost calories because the protein, sugar, and carbohydrates which contain the calories, were boiled out. The calories did not disappear; they were just boiled into the water.

## **PM ROOM 2 (5/18/11)**

### **The Effect of $n$ -Mirrors on a Laser's Intensity**

*Student Research By: Ian Clark, Ryan Sawitzky, and Cristhian Tollis*

The research experiment, the effect of reflections on the intensity of a laser, was conducted at the Macomb Academy of Arts and Sciences during the fall and winter of 2010. Seven stands were constructed out of thin cardboard to hold seven 4"x4" mirrors. A Pasco laser was then placed at the edge of the table and the first mirror was placed ten cm away from the laser in such a fashion that it caused the laser beam to form a ninety degree angle into the GLX light sensor, which was placed ten cm away from the mirror. After this was done, a second mirror was placed ten cm away from the first mirror so that the laser would form another ninety degree angle shining into the GLX light sensor. This was repeated until all seven mirrors were used with a sample size of 30 for each amount of mirrors being used. The data showed that as the amount of mirrors used increased, the overall laser intensity decreased. As more mirrors were used, there were more mirrors for the lasers to refract off of. Also as more mirrors were used, the distance the laser traveled increased, causing more opportunities to for the laser to be blocked by or refracted off of airborne particles, such as dust.

### **The Effect of Different Chemical Solutions on the Growth of *Achillea Millefolium***

*Student Research By: Natalie Bytner, Emily Herbert, and Sabrina Tibaudó*

At the Macomb Academy of Arts & Sciences (MA<sup>2</sup>S), from October 2010 to December 2010, an experiment on plant growth was conducted. The researchers tested the effects of four different chemical solutions on the growth of *Achillea Millefolium*, yarrow plants. Distilled water acted as a control group and each of the 0.1 molar solutions consisted of one of the following chemicals: calcium chloride, cobalt (II) chloride, ferrous (II) sulfate, or nickel (II) chloride. Twenty-five plants total were used in the experiment; each of the solutions, including the control, were given to five assigned plants. Then five leaves on each plant were marked with tape so the researchers could record the plants' growth over time. Every Wednesday, the plants were watered with the assigned solution and the marked leaves were measured in centimeters. On Fridays and Mondays, all of the plants were watered with distilled water. After analyzing the lengths of the marked leaves, it was found that ferrous (II) sulfate created the longest leaf length overall. This solution created the largest mean of 12.9 centimeters, producing the longest leaf lengths of all the weeks. This was found to have happened because of the sulfur in the solution - a major contributor to plant growth.

## **The Effect of Sodium Chloride and Glucose on the Dissolution Quality of Painkillers**

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

The pain reliever, Ibuprofen, is often ingested with food to be sure that the ibuprofen is not the only variable in the stomach. Glucose and sodium chloride were added to the hydrochloric acid, before submerging the ibuprofen, to see how they affected the dissolution of ibuprofen. Glucose, a substance often related with slowing down the metabolism, had the same slowing effect on the dissolution of the ibuprofen. Salt, however, was the median to the mixture because with its presence, more ibuprofen was dissolved than with glucose, but less was dissolved in solely hydrochloric acid. Three different solutions were used: solely hydrochloric acid [(HCl) 0.1 M], hydrochloric acid and glucose (60 mL of 0.1M HCl and 2.64 g of glucose) and hydrochloric acid and sodium chloride (60 mL of HCl and 2.64 g of salt). Along with these mixtures, five increments of ibuprofen milligram doses were used: 100 mg, 200 mg, 400 mg, 600 mg, and 800 mg. Different hydrochloric acid mixtures along with a dose of ibuprofen were combined together after randomizing variables to create a testing pair. This testing pair was then placed together in a beaker to react for fifteen minutes. It was concluded that 100 mg of ibuprofen had dissolved the most in 0.1 M solution of HCl. The conclusion was made due to the pill being spilt in half which broke its protective layer, and the HCl's molarity had over powered the small dosage of ibuprofen making the innards of the pill react faster than a higher dosage.

## **The Effect of the Surface Area of Impact and the Tenseness of Ballistics Gel on the Transfer of Force Through the Ballistics Gel**

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

Sports are a major part of everyday life. With more and more people playing sports, the number of injuries caused by this form of entertainment is on the rise. The factors of one type of injury, muscle injury in relation to the impacting object and the amount of tenseness of the muscle, were tested. To test these factors, three ballistics gelatins with differing tensenesses were created and used along with four steel impact disks ranging from one inch to four inches. A ballistics gel was placed onto a force plate which measured how much force was transferred through the gel when the steel disk impacted it. The results revealed that the smaller the surface area of the steel disk, the less force was transferred through the gel. Meanwhile, the most tense and least tense ballistics gels transferred the most force.

## **The Effect of Air Pressure in an Air Cannon on Velocity of the Projectile**

*Student Research By: Eric Bytner, Ronald Kyllonen III, and Jacob Radatz*

This experiment was conducted to record the change in velocity of a tennis ball as varying amounts of force were applied to it by the use of an air cannon. The purpose of this experiment was to test how pressure applied as a driving force of a projectile affects the velocity of the projectile. The amounts of force applied to the tennis ball were 20 psi, 25 psi, 30 psi, 35 psi, 40 psi, and 45 psi with 20 trials per force amount, equal to 120 trials total. To measure the velocity, an air cannon was built out of PVC and an electronic sprinkler valve was used as a release valve to quickly release the air from the tank. The cannon tank was then filled with air and the barrel was reloaded. The tests were then executed by measuring the velocity of the ball as it left the barrel using a PASCO photogate. As the force applied to the ball was increased, the velocity of the ball also increased because the greater force caused the ball to accelerate at a greater rate. A trend of the data going up at a consistent rate for the test range that was selected was noticed. This is explained by Newton's Second Law of Motion (force is equal to mass multiplied by acceleration). This means that if force increases and mass stays the same, acceleration increases.

## **The Effect of Temperature on the Elastic Properties of Rubber Bands**

*Student Research By: Zachary Chodnicki, Daniel Goubert, Michael Messina, and Eric Zieman*

Rubber is a universally used material found in several different forms. This study was performed to test the elastic properties of polymers at different temperatures. The experiment was conducted by using a refrigerator and freezer to cool and microwave to heat rubber bands to six different temperatures, (6, 14, 22, 30, 38, and 46 degrees Celsius). The rubber bands were stretched until broken and the breaking point (the length of the rubber band when it snapped) of the rubber band was recorded. The study shows that as the temperature of a rubber band increases, so does the length it is able to stretch to without breaking. This occurred in all trials except for the lowest temperature trial. The rubber bands tested at greater temperature (30, 38, and 46 degrees Celsius) stretched farther than the rubber bands tested at lower temperatures (6 and 14 degrees Celsius) and the room temperature (22 degrees Celsius) rubber bands. The effect of temperature change on the elasticity properties of a polymer is that when the temperature of a polymer is raised, the polymer's molecules spread out and are able to move more unrestricted, whereas when the temperature of a polymer is lowered, the polymer's chains freeze and restrict free movement.

## **PM ROOM 3 (5/18/11)**

### **The Effect of Greenhouse Roof Pitch on the Percent Change in Temperature**

*Student Research By: Lauren Caruss, Sarah Herbert, Megan LaCavera*

For nine weeks, a study was conducted at the Macomb Academy of Arts and Sciences in Armada, Michigan. The purpose of this experiment was to find the effect changing the roof pitch angles of both glass and plastic greenhouses had on the change in temperature inside in degrees Celsius. The pitch angles 70°, 80°, 90°, 100°, and 110° were tested for both the plastic and glass greenhouses. A-frame greenhouses were built along with wooden boxes for the greenhouses to sit in during tested. The temperature inside and outside the greenhouse was recorded after 4 minutes. The 110° angle had the highest change in temperature overall, for both the glass and plastic. The glass greenhouses, however, had the highest temperatures when compared to the plastic. The mean for the glass greenhouse at the 110° angle was  $24.34 \pm 4.88$  C° compared to  $23.99 \pm 4.91$  C° for the plastic greenhouse. The differences between the two materials were not exactly great, but significant enough to see a change. When looking into the reasons for these differences how infrared rays reflected and absorbed in the greenhouse. The surface area available to the heat lamp was also considered. Cutting down costs and increasing efficiency of greenhouses has been an interesting topic lately and this experiment helps with that.

### **The Effect of Car Mass and Acceleration Distance on the Displacement of an Object When Struck**

*Student Research By: Gabriella Dabain, Maija Manninen*

The purpose of this experiment was to find how the mass of a car and the distance it travelled affected the displacement of a doll when struck. This information can help forensic scientists and drivers know how the type of vehicle and the speed at which it is moving affects pedestrians who are victims in a car accident. This experiment consisted of using a store-bought remote control car that was accelerated with different masses and distances to hit a doll and see how its displacement changed. The horizontal and vertical displacements from rest were measured. The results showed that the distance the car travelled had more affect on the doll's displacement than the mass of the car did. This is because when the distance was only 1 meter, the car lost speed during deceleration as it approached the doll. When the car travelled two meters, it had no time to decelerate, which resulted in a larger overall displacement of the doll.

## **The Effect of Blood Quantity and Impact Angle on the Area of Blood Spatter**

*Student Research By: Mark Casamer, Andrew Doering, Andrew Kraemer, and Alex Sheppard*

The purpose of the experiment was to see what effect the angle of impact and amount of blood had on the area of a blood spatter. It was also done to see how blood spatters were used in forensic and detective work. The angle and amount of blood that would impact a rough surface may be key in finding the area of any blood spatter. Ten trials for each gradient were conducted, giving a total of one hundred fifty trials in all. A blood drop mechanism was built and blood was dropped at angles ranging from zero degrees to sixty degrees at 15 degree increments. At each of these angles, artificial blood in the amounts of 1mm, 2mm, and 3mm were dropped onto a twenty-one by twenty-one centimeter piece of paper. The control group of the experiment was the angle at a degree of 0 and the amount of blood dropped at one. The vertical and horizontal diameters were measured on each blood spatter. The area of each spatter was calculated. It was found that as the angle increased, the area did not, but as the amount of blood dropped increased, so did the area.

## **The Effect of Rust Remover Concentrations on the Mass of a Steel Washer**

*Research by: Morgan Payne, Ally Chapoton, and Majesta Muylaert*

Removing rust from the surface of metal equipment is necessary in order to enhance the longevity of the equipment. However, many industrial rust removers damage the metal surface as well, which may affect the performance of the machinery, especially when the metal was a necessary piece that kept the machine functioning properly. This experiment was performed in order to determine whether or not changing the concentrations of rust remover would affect how much mass was removed from an unrusted washer. During this experiment, washers were submerged in sealed jars full of rust remover and water. The washers were allowed to sit and were massed after one week to determine whether or not higher concentrations of rust remover took off more mass. The lower concentrations removed more mass from individual washers, but the higher concentrations took off more mass as an average, which was believed to be cause by the presence of the water in the jar acting as a stimulant for the formation of rust on the surface of the washers.

## **The Effect of Ramp Angle and Surface on the Speed of a Car**

*Student Research By: Nicole Bailey, Anja Manninen and Jamie Penzien*

Testing of this experiment started on October 6, 2010 and went for ten weeks at Macomb Academy of the Arts and Sciences (MA<sup>2</sup>S) in Armada, MI. The purpose of this experiment was to find out if cars change speed on different kinds of roads and different inclines. This testing was also performed to see if a car travels faster on a paved road instead of a dirt road, represented by the rough ramp and the smooth ramp. The testing was done by making a dog agility jump. PVC pipes and connectors held up the boards for the car to go down. Five different angles were tested to find the speed of the car and they were 25°, 30°, 35°, 40° and 45°. During testing the 45° angle on the smoothest ramp was the fastest, and as the angle decreased the time increased. It was concluded that the higher and the smoother the ramp, the faster the car will move.

## **The Effect of the Dimensions of a Solar Oven on the Internal Temperature**

*Student Research By: Alysa Brice, Renae Greenia, Heather Prohaszka, Ashley Sowinski*

The purpose of this experiment was to see if the dimensions of a solar oven change the amount of heat generated. This was conducted in the Freshman Research Room at the Macomb Academy of Arts and Sciences from September 2010 to December 2010. A heat lamp was suspended from the ceiling, 70 cm above five aluminum foil boxes, which were being used to model solar ovens. The sizes of the aluminum foil boxes without tops were: 10x10cm, 15x15cm, 20x20cm, 25x25cm, and 30x30cm. The internal temperatures of the model solar ovens were measured by a type K thermocouple attached to a GLX, every five minutes for each twenty-five minute interval. The average temperature and standard deviation of the 10x10cm box was 34.8°C ±2.608. The average temperature and standard deviation of the 15x15cm box was 33.45°C±1.877. The average temperature and standard deviation of the 20x20cm box was 32.65°C ±1.755. The average temperature and standard deviation of the 25x25cm box was 32.5°C±2.188. The average temperature and standard deviation of the 30x30cm box was 32.45°C±2.417. The bigger the box's volume was, the lower the temperature. This happened because the 10x10cm had the least amount of area that heat could escape. This makes sense because the 30cm x 30cm box had a lot of space and the heat escaped before it reached the bottom of the box.

## **PM ROOM 4 (5/18/11)**

### **The Effect of the Change in Molar Solutions on the Growth of Rust on an Iron Nail**

*Student Research By: Brian Batayeh, Vincent DiGiorgio, Jesse Spalding, and Aaron Walkowski*

For nine weeks, a study was conducted at the Macomb Academy of Arts and Sciences in Armada, Michigan. The purpose of the experiment was to find if changing the molarity ratio of salt to water would decrease the mass of iron nails. The nails would rust mainly through the process of oxidation where the oxygen in the water reacts with the metal to create rust. The independent variable within the conducted experiment was the different molarities (M) used: 0.2 M, 0.4 M, 0.6 M, 0.8 M, and 1.0 M. The research was conducted by placing 5 sets of 30 iron nails in a covered tray with a molar solution in each. The nails were then submerged in the salt water with an aerator attached to provide oxygen molecules to create the rust on the iron nails, and then every week the nails would be cleaned and massed. It was concluded that as the molarities were changed, the amount of iron ore that had diminished, did not change. The results of each set of nails submerged in the molar solutions were all very similar in the amount of iron ore loss; no amount of mass loss was drastically greater than the other. However, of the 5 water solutions, the 0.4 molarity attained a slightly greater average loss throughout each molar solution.

### **The Effect of an Acid Catalyst on the Degradation of Chewing Gum**

*Student Research By: Erika Borucki*

The myth stating that chewing gum takes seven years to digest inspired students at the Macomb Academy of Arts and Sciences to form an experiment which simulated the effect of human digestive agents on Wrigley's Double Mint gum. Variable solutions of hydrochloric acid in molarities of 0.05M, 0.15M, 0.25M, 0.35M, and 0.5M were observed taking effects on a  $0.2\text{g} \pm 0.09\text{g}$  segment of moistened and balled gum. A resulting mean of the 0.05M acid was  $0.15\text{g} \pm 0.02\text{g}$  compared to the mean of the 0.5M acid, which was reduced to  $0.11\text{g} \pm 0.02\text{g}$ . An overall change in mass between the gum exposed to the highest and lowest molarity was a loss of 0.044 grams. Dissociation had occurred between water and hydrochloric acid, which resulted in a conjugate base and conjugate acid. This acid catalyst caused hydrolysis, the separation of the gum's sugar bonds, accounting for a mass loss. In future research, improvements could be made to the environmental quality to control variability and better simulate the digestion process.

## **The Effect of Solar Panel Placement Relative to the Sun on the Voltage Generated**

*Student Research By: Rosie Cunningham, Melissa Mikolowski, and Kaye Suarez*

Solar energy is a potential replacement for fossil fuels. The purpose of the experiment was to determine the optimal location for roof-top solar panels. When the sun's position changes in the sky, the efficiency of a solar panel can change depending on the amount of sunlight reaching the panel. A model house was built on a turntable to allow the angle of the house to be changed and a metal arc was built to act as the path of the sun as it changes angles in the sky. The voltage generated from each gradient was recorded using a voltmeter and a solar panel. Data was collected at varying combinations of roof placement and sun movement along the arc. Light position  $90^\circ$  generated the most consistent amount of voltage because the lamp was always directly over the solar panel. Light position  $135^\circ$  combined with house position  $90^\circ$  generated the most voltage because the light was directly facing the solar panel. The most efficient position for a solar panel is perpendicular to the path of the sun. If solar panels were installed on both sides of the roof, sunlight would be constantly supplied to the solar panel, making north-south facing houses the best for solar panels.

## **The Effect of Projectile Weight and Launch Angle on the Precision of a Projectile**

*Student Research by: Jake Blackstock, Michael Scaglione, Steven Scaglione, and Mitchell Warren*

The purpose of this experiment is to see how the launch angle of a projectile launcher and mass of a projectile affects its precision. It was also performed to demonstrate knowledge of the various parts in a research project. A 3x3 foot sandbox, sand leveler and cardboard backstop were created prior to performing the experiment. Tape was used to mark and label a spot on the floor where the sandbox could be placed so that the launcher would shoot the projectile into the sandbox. The launcher was placed aiming at the box. The sandbox was placed in the correct spot for the angle and ball being used. The angle was set and the ball was loaded. The landing points of every launch were recorded using a coordinate grid that was placed on the sandbox. Lower precision and a higher distance from the midpoint was found at trials using around a 45 degree angle, and high precision was found at 15 degrees. The steel ball had an overall greater precision than trials using the nylon ball. Some outside forces such as friction and gravity that cannot be controlled and may change the trajectory of the ball, which would change the landing point. Angles launching a ball a farther distance allowed the ball to be affected by outside, uncontrolled variables. Using a less massive ball allowed the ball to be more severely affected by these variables. If the ball was heavier, it would take much more force to shift the ball off of its path.

## **The Effect of Temperature on the pH of Orange Juice**

*Student Research By: Dana Bushbaker, Brooke Fetty*

The purpose of this experiment was to determine if temperature affects the pH of orange juice. Experimentally, ten beakers containing 30 milliliter of orange juice were held at -12.16, 4, 21.5, and 33° Celsius for 24 hours. Following the 24 hours time period, the orange juice was removed and measured with a pH sensor. The data shows that as the temperature increased, the pH decreased, but not significantly. The acidity was increased slightly when it was put in higher temperatures. Orange juice was chosen because it has a fairly high acidity of 3-4.

*Presenting at a Later Date:*

## **The Effect of Water Temperature on the Growth of Algae**

*Student Research By: Ashley Ewert, Matt Michalewicz, Brett Zebelian*

The purpose of the experiment was to find the effect that temperature had on the growth of algae. To begin the experiment, five 10-gallon tanks were filled with water. Fertilizer, amino acids, and dextrose sugar were added to the water to form a suitable environment for the algae. Two aerators were connected to the tanks to supply air flow and two ultraviolet (UV) plant lights were set across the tanks to provide twelve hours of light per day. A heater was placed in each tank. The five temperatures that the tanks were set to were 21.1°C, 22.2°C, 23.3° C, 24.4°C, and 25.6°C. The density of the water from each tank was collected every week for seven weeks to measure the growth of the algae. It was found that the 25.6°C tank had the lowest density, which made it the tank with the highest growth of algae. The reason for this was because of the lipids in the algae. As more algae grew, more lipids were produced, which decreased the density of the water. The heat affected the growth of algae by altering the rate of photosynthesis in the algae. The increase in heat caused photosynthesis to occur more frequently, which allowed the algae to grow faster. It was found that as the temperature increased, the growth of the algae increased as well.