NORTHERN VIRGINIA REGIONAL SCIENCE AND ENGINEERING FAIR

MARCH 21-22, 2020

WAKEFIELD HIGH SCHOOL

ARLINGTON, VA

CONTENTS

7 AS 100

Bushardt, Isabella

Dorothy Hamm Middle School

Teacher: Araya

The Effect Of Visual Stimuli on Hermit Crab Latency

A stimulus directly influences the activity or growth of a living organism. Specialized cells enable animals to detect stimuli and convert them into electrical signals in nerve cells. The way an animal reacts to a stimulus is called a response, which results in a change in behavior. Many animals, such as hermit crabs, use vision to help detect threats. This project examines various visual stimuli on hermit crab behavior. This study tests the hypothesis that an in-motion visual stimulus will result in the shortest reaction time (defensive reaction) in hermit crabs. The hermit crab's main predator is the seagull, which swoops down to capture the crab presenting an in-motion visual stimulus. The purpose of this experiment is to test if crabs' defensive behaviors have changed with human care.

Four hermit crabs from a pet store were tested in this experiment. Crabs were subjected to visual stimuli on an Ipad as a blue circle; the stimulus was presented as in-motion, pulsating, brightened, darkened, enlarged or small. Reaction time (latency) was measured by stopwatch. Three trials for each visual stimulus was conducted on all crabs. Latency ranged from 1.21-18.95 seconds. Latency by stimulus were: still, 4.68; enlarged, 3.35; small, 13.59; bright, 2.90; dark, 16.85; in motion 2.04; pulsating, 3.11. The results supported my hypothesis with the crabs' reactions to in-motion stimuli being the quickest, probably because it simulated predator behavior. Future studies could test larger populations of hermit crabs or different invertebrates.

7 AS 101

Fireison, Hope

George Washington Middle School

Teacher: Breslin

No Flies With Climate Change

The purpose of this experiment is to observe the effects of climate change on the survival rate of fruit flies. Separate fruit flies and put thermometers in and heat lamps on top of each container. Set correct temperature for each and regulate so they stay correct. Make observations everyday during the 5 day period. Record data in data table for each trial.

The data shows that the fruit flies in the higher temperature containers, died off quicker than the control. In the containers with the added five degrees, all of the fruit flies were dead by at least the 5th day. The fruit flies proved the hypothesis because the ones in the higher temperature containers, dies off faster than the ones in the control container.

7 AS 102

Goldstein, Lillian

George Washington Middle School

Teacher: Owens

Run Fast, Think Fast: The Effect of Exercise on Memory

The purpose of this experiment was to test the effect of different exercise intensity levels on short term memory. A memory test was conducted on a Labrador directly after a sprint, a 15 minute walk, a 5 minute walk, and nap. The test consisted of placing a treat in one compartment of a muffin tin. Location of the treat changed with each test. One ball was placed over each hole, and the Labrador was timed on recall of the location of the treat. The test was conducted following each form of exercise, for a total of five trials. In conclusion, the Labrador had the fastest memory reaction time after sprinting, with an average reaction of 3.18 seconds. However, it took the Labrador an average of 14.67 seconds to recall the treat's location after a nap. In future experiments, more Labradors could be used to enhance the experiment's reliability.

7 AS 103

Kapur, Ines

Thomas Jefferson Middle School

Teacher: Golden

What is the Effect of Sugar and Caffeine in Coffee, Alcohol, and Coca-Cola on the Heart Rate of Daphnia?

The purpose of this study was to see which of three common drinks has the most effect on the Daphnia heart rate. The independent variable was the type of drink which were coffee, alcohol, and coca-cola. The dependent variable was the Daphnia, a shrimp-like organism that has a clear exoskeleton so the heart is visible. The control group was spring water, the substance where the Daphnia lives in. The hypothesis was if the daphnia is soaked in coffee, then the heart rate of the Daphnia will have the highest heart rate.

The study used a microscope to measure the heartbeat of Daphnia soaked for ten minutes in the three liquids (coffee, alcohol, and Coca-Cola) and compared them to the heart beats of Daphnia in spring water. The results showed that alcohol increased the heart rate the most, followed by Coca-Cola. Coffee slowed down the heart rate. These results rejected the hypothesis. One reason the hypothesis was rejected may be because the drinks affect humans and Daphnia differently or that the Daphnia's heart rate is not increased by caffeine but by sugar. In conclusion, the study suggests that the Daphnia's heart rate is not increased by caffeine but by sugar.

8 AS 104

Olson, Freya

Williamsburg Middle School

Teacher: Thomas

The Effect of the pH of Water on the Survival Rates of Amano Shrimp

Acid rain and other pollution can affect water quality and the ability of organisms to survive. One indicator of water quality is pH. As the pH of water goes farther from neutral, the hatching and survival rates of animals can be severely impacted. This project studies the effect of the pH of water on the survival rates of Amano Shrimp.

To test the effects of pH, the Amano Shrimp were placed in mason jars filled with different pH levels of water and left for three days. After three days the results were recorded, and the Amano Shrimp were disposed of. The pH levels tested were 6.5, 6, 5, and 4. After three days the results show that the shrimp survived best in a pH of 6.5 with an average of 2.66 shrimp surviving each trial. In levels 4 and 5 no shrimp survived. In the pH level 6 an average of 1 shrimp survived each trial.

In conclusion, the shrimp survived best in the most neutral water. This result shows that in the real world, even small changes in pH of water can have severe impacts on the organisms that inhabit it.

9 AS 105

Beasley, Elise

Yorktown High School

Teacher: Dorman

The Effect of Concentrations of Fertilizer on the Heart Beat Rate of Daphnia magna

The purpose of this experiment was to show how fertilization affects the environment by testing different amounts of fertilizer on Daphnia magna. The heart beat rate of Daphnia magna is a good indicator of the health of an ecosystem, and they are often used to test freshwater quality. It was hypothesized that the highest concentration of fertilizer will decrease the heart rate of Daphnia magna the most. Concentrations of 0%, 50%, 100%, and 200% of the recommended amount of fertilizer were measured per flask of spring water. The control was the concentration level of 0% which was the water that was shipped with the Daphnia magna. After measuring the heart beats for fifteen seconds in their natural water, the natural water was extracted, one of the concentrations was added in place, and the process was repeated. The 0% fertilizer slightly decreased the average heart beat rate of Daphnia magna, but then the rate increased in the 50% and 100% levels. The level with the highest average bpm was the 100% level. Instead of increasing from the 100% level, the average heart beat rate dramatically decreased in the 200% level. There are no clear reasons for this data, so several factors such as environmental stress, toxicity, and dose response could have caused this variation. This experiment could be improved by using a camera to record heart beats for more accurate counting, free from human error.

9 AS 106

Day, Madeleine

Washington-Liberty High School

Teacher: Sotomayor

The Effect of Water Temperature on the Hatching of Artemia francescana

Due to the fact that oceans are warming from the absorption of heat from the atmosphere, it can be assumed that marine life will also be affected by this warming. In order to examine and predict how marine life would be affected, brine shrimp were placed into containers of water of different temperatures. The hypothesis was if the temperature of water habituated in is changed, then the most brine shrimp will hatch at 26°C because that is the temperature in which brine shrimp typically hatch. The different temperatures tested were based on predicted ocean warming over the next 100 years, with each new temperature representing a difference of 33 years, and the current ocean temperature. These temperatures were 26.6°C, 27.3°C, and 28°C. All other factors of the organisms' environment remained stable (salt content, pH, etc.) throughout each trial of the experiment. Each container was given three days for all cysts to hatch, then data was collected.

The data found that the average number of brine shrimp in a 1 mL sample of water for 26°C was 5.2, 26.6°C was 35.1, 27.3°C was 24.4, and 28°C was 24.2. From this, it can be concluded that brine shrimp hatch best at 26.6°C and slowly decline in hatching rates after this. Therefore, brine shrimp will most likely not be affected by rising temperatures; however, other marines could be, and this should be further tested. The variability of this experiment was high.

9 AS 107

Henshaw, Morgan

Yorktown High School

Teacher: Dorman

The Effect of Magnetism on Regeneration of Planaria

Planarians are used for research to improve the treatment of brain damage and neurological disorders, and understanding their regenerative capabilities is a promising area of modern medicine.

Ten bisected planarian segments were placed in each of four petri dishes, with magnets of increasing strengths arranged under each dish. The bisected planarian segments were then measured daily for 11 days.

Results indicated that as the magnetic pull force strengthened, the average regenerative growth of the planarian increased. However, the control group with no magnets had the highest mean growth. Using the statistical test ANOVA, the p value was 0.72591, meaning the null was accepted while the alternative hypothesis was rejected.

The results could be explained by the smaller starting lengths of the control group, which could be a result of inaccurate measurements. The impact magnetism has on regeneration is explained in scientific research by the formation of reactive oxygen species at the site of regeneration. Reactive oxygen species, which are free radicals, can be caused by magnetism and are important for the regeneration of planarian.

The experiment could be improved by measuring the planarian over a longer time span, implementing a more efficient way of collecting data, using stronger magnets, and ensuring the planarian segments start at the same length. The experiment could be expanded in scope by testing which bisected segment, anterior or posterior, regenerates more quickly and testing the effect of water pH on planarian regeneration.

7 BE 200

Gorman, Katherine

H-B Woodlawn Secondary Program

Teacher: Taggart

The Power of Suggestion

This experiment was performed to see if suggestion could influence perception. The research question asked for this experiment was, Is it possible to shift taste perception with the power of suggestion? The hypothesis for this experiment was that a person's taste can be influenced by suggestion, because it is not just your sense of taste going into your perception of flavor, but all of your senses. This hypothesis was tested by giving someone a plastic cup with half a cup of plain water in it, but it was implied that there was lemon in the water. The question asked to imply this was “How many drops of lemon do you think are in this cup of water?” There was also a cut and squeezed lemon placed near the cups of water. Once the test subject gave their answer, it was recorded on a piece of paper where no names were given away. The results of this experiment were that fourteen out of twenty people tested for this experiment believed that there was at least half a drop of lemon in their water. All the different amounts that were guessed were 0 drops, half a drop, one drop, two drops, two and a half drops, three drops, and four drops. The conclusion of this experiment was that the hypothesis was supported.

7 BE 201

Young, Jay

H-B Woodlawn Secondary Program

Teacher: Taggart

Bikers, Signal When You Pass! The Effect of a Pedestrian's Appearance on a Biker's Likelihood to Signal When Passing

Trail safety is an important issue. Failure to follow trail rules can reduce safety for users. This experiment focuses on one important rule, that bikers must audibly signal when passing. It tests the likeliness of a biker passing based on the type of biker and the appearance of the pedestrian. The hypotheses for this experiment were that commuting bikers are more likely to signal, that a pedestrian with headphones is less likely to receive a signal, and a person on crutches is more likely to receive a signal. Subjects with varying appearances (typical walker, headphones, and crutches) walked along a trail recording whether a biker signaled. Overall bikers signaled less than they didn't and commuters were more likely to signal then non commuters. Bikers were less likely to signal if the pedestrian was wearing headphones and surprisingly the same happened with pedestrians on crutches. In conclusion trails are not as safe as they could be.

8 BE 202

Bolte, Aidan

George Washington Middle School

Teacher: Goodman

Which Sense Has the Fastest Reaction Time?

My experiment was based on three different senses and which had the fastest reaction time. The reason that I did this experiment was that I wanted to determine which sense (vision, hearing, and touch) had the fastest reaction time. I think this information could be used in the future in military cases, as well as many other cases, where every second counts. In order to make the testing device that I used, I ordered some components from amazon but I had most of the materials that I needed. Once I built the device to measure the reaction times of vision, hearing, and touch, I tested it to make sure that it was reliable and safe. I then tested people at school during lunchtime so I could test the most people possible. I also made sure to test each sense twice on each of the nine subjects to ensure accuracy. In conclusion, I found that the fastest reaction time was for touch. While I was doing my experiment I had many challenges getting the code to work, but I managed to figure it out before testing started.

8 BE 203

Kappler, Rachel

H-B Woodlawn Secondary Program

Teacher: Vanevera

What Affects the Amount of Time Spent on a School iPad?

What affects the amount of time spent on a school iPad? The reason this experiment was chosen was because there are very little experiments like it. Most experiments ask what effects the devices have on humans, but this experiment asks what in humans may affect why people use a device (in this case a school iPad). The hypothesis is that if a student has another device, that will affect the amount of time spent on an iPad the most rather than other factors (age, grade, etc.). This is because a personal device is less restricted and more personalized so that would cause someone to want to go on their personal device. Therefore, if someone spends more time on their personal device they will spend less time on their school iPad. The hypothesis was tested by sending out a survey that included questions that asked about age, grade, gender, and personal devices as well as the amount of time. The major findings were that age and grade (which tend to be correlated) most affected the amount of time spent on a school iPad. While the data also showed that people with personal devices spend more time on their school iPads than people without personal devices, this result is less meaningful because almost all respondents owned a personal device. This was all made possible with the feature on an iPad called Screen Time, that tracks the time when the iPad is in use.

8 BE 204

Laughlin, Pierce

Williamsburg Middle School

Teacher: Warden

The Effect of Electronic Reading on Eye Strain

Over 250 million Americans use a computer daily. This means that over 250 million people are putting themselves at risk for severe eye strain. When you read on a computer blue light is emitted from the screen. Our eyes are not made to process blue light. Eyes must strain in order to retain the blue light. In the experiment multiple students were tested to see the effects of this theory. Students read on a computer for set variables of 5,10, and 15 minutes. Through rigorous testing the hypothesis was proven correct.

8 BE 205

Pick, Casey

H-B Woodlawn Secondary Program

Teacher: Vanevera

Do Clothes Affect Perceived Trustworthiness?

The reason this experiment was chosen was because in is interesting to learn about how us humans think, and knowing our own biases could help us to be better people. The research question was “Do Clothes Affect Perceived Trustworthiness?”. Different types of clothing were tested to see if they influenced people’s thoughts and perceptions about the wearer. The hypothesis was that the nicer the clothes, the more trustworthy the person would be perceived as. This was the hypothesis because nice clothes are a sign of wealth, prosperity, and a desire to present oneself well. The hypothesis was tested by taking four pictures of the same person in four different outfits. The outfits were sloppy, casual, business, and formal clothes. The pictures were then each shown individually to twenty people. Each person was asked to rate the picture in terms of how trustworthy the person seemed. The results gathered disproved the hypothesis. The most trustworthy type of attire was business clothes, the second nicest clothing option. The conclusions were that even though business was the most trustworthy, more thorough studies would need to take place to prove that clothing affects perceived trust.

8 BE 206

Ross, Alexa

H-B Woodlawn Secondary Program

Teacher: Vanevera

Why are Teenagers Stressed?

I chose the topic of teenage stress because I have witnessed almost all teenagers in some kind of stressed out state and wanted to find out if we are all stressed out about the same things. My research question is why are teenagers stressed? My hypothesis is that school gives teenagers the most stress because of how big the workloads are in middle and high school as well as grades. I tested my hypothesis by making a survey and asking 20 teenagers between the grades 6th and 9th 18 questions.

My results are that school does give students the most stress followed by social life. So my hypothesis was correct. One reason why school gives teenagers the most stress is how much pressure kids have now a days to get good grades starting in middle school so they can get into good colleges even though they still have years till college. The pressure is on for teenagers now more than ever before.

8 BE 207

Crawford, Clara; Hodges, Brita; Young, Addison

Gunston Middle School

Teacher: Robles

The Effect of Encouragement on Motivation and Productivity

The researchers were interested in seeing how encouragement affects motivation and productivity, specifically on middle school teachers. Teachers motivate students every single day to try their hardest and the researchers were curious in seeing what made them feel motivated and productive. The researchers compared giving teachers no encouragement, a handwritten note, and showing them an inspiring video. To collect the data, the researchers gave the subjects two surveys to measure their motivation and productivity, one before the work day and one after they had taught their classes. The surveys included questions such as “On a scale from 1 to 5, how motivated do you feel?” and the same for productivity. The survey given to the subjects at the end of the day also asked teachers if they thought back to the form of encouragement they received that day and how much they thought it effected them. When asked if subjects thought back to the encouragement while they were teaching and throughout the day, 90% of teachers said they had thought back to the note and only 60% of teachers said they had thought back to the video. Teachers obviously did not think back to the video throughout the day and did not continue to be motivated by it. With their research, it was concluded that the written note was more effective because of the personal connection that the handwritten note symbolizes.

8 BE 208

Cura, Marina; Gillen, Christine; Kamber, Morgan

Gunston Middle School

Teacher: Robles

The Effect of Music Genres on Running Speed

The motivation and drive to work for an unremitting amount of time to improve someone's speed is scarce. The three researchers wanted to aid that common strife, by discovering a solution for an unimproving score. They landed on a topic after reflection on their own relationships with running. Music Genres work for a variety of people from a robust array of backgrounds.

Which music genre will make the subject run the fastest? That question was the backbone of the experiment. The music genres used as the independent variable were EDM, Pop, Country and Classical, and the dependent variable was the speed in seconds of a subject. A subject holds a phone to their ear, plays the first level of independent variable - no music: the control, and one researcher begins a timer. When the subject finishes running 100m the timer is ended and the score recorded. This procedure will repeat 4 more times with the residual levels of independent variables: Cyber Whale by Eliminate (EDM), One Kiss by Dua Lipa (Pop), Heaven by Kane Brown (Country), and finally Fur Elise by Beethoven (Classical). The two most rapid paced genres (EDM and Pop) outscored the competitors of Country and Classical. The analysis method that best substantiated the prediction was the mean, showing the divide between Pop the fastest at 10.34 (sec) and Classical the slowest at 10.98 (sec). This experiment proved our hypothesis and will be highly beneficial to casual and competitive runners without a drastic change in their habits.

8 BE 209

Snell, Julia; Chuukwu, Naomi

Gunston Middle School

Teacher: Pentland

The Effect of Previous Task Difficulty on Test Performance

This experiment was conducted to test if what a person does before a test affects the person's result on the test. The goal of this experiment was to help teachers understand that students will have increased test scores if students perform a non-related easy task prior to taking a test in class. The subjects played a game at different difficulty levels prior to taking a math test that was given at the same math level each time. A constant was used where the subjects did not play a game prior to the math test. The game the subjects played had four levels going from easiest to hardest. The researchers found that if a subject did an easy task and then took a test, they did better on the test. If the subjects completed a hard task first, they then scored worse on the test. According to the research, this is likely because of stress or confidence caused from the level of the easy and difficult tasks. The researchers found that completing an unrelated easy task will help a person succeed, or perform better in the next task that is performed.

9 BE 210

Carey, Julia

Yorktown High School

Teacher: Dorman

The Effect of Age on Interest in Genealogy

The purpose of this experiment was to determine if age impacted interest in genealogy. Education and gender were also investigated as control variables. No recent research on this subject was found.

A survey was created that asked about age group, interest level, educational level, and gender. Respondents circled their choice on a labeled scale for education, age, and interest, and wrote in their gender. The question measuring interest, “Are you interested in learning more about your ancestors?” was measured on a scale of one to five, with one being the most interested and five the least interested. There were 30 individuals in each of the three age groups (Under 18, 18-50, and 50+).

Statistical analysis was used to investigate the relationships. The Kruskal-Wallis test was appropriate for examining one variable at a time since the interest variable was ordinal. The null hypothesis was accepted for all three variables. Ordered Logistic Regression was appropriate for analyzing all three variables at once but did not work because some combinations of age and education values had no respondents. Instead, Linear Regression was used. An assumption that values of the interest variable were in proportion to the person’s interest was necessary for that to be appropriate. P-values for the variables were still higher than 0.05, except for higher levels of education, which were associated with more interest. Therefore, some evidence was found that education is related to interest in genealogy.

9 BE 211

Fanning, Lily

T.C. Williams High School

Teacher: Matthews

Misdiagnoses in Female Autism

Autism is a disorder with different levels of severity. When autism was discovered, it was thought to only affect males. Because of this reasoning, all of the neurological tests were performed solely on male subjects. Autism presents itself differently in females compared to males, and therefore women are often misdiagnosed. Low functioning autism is when the affected person struggle to perform everyday functions properly like walking or talking, these people often have special nurses and are put into separate classes with trained personnel. Autism like this is simple to diagnose in people of all genders due to different physical behaviors. High functioning autism on the other hand, is the hardest to diagnose in females because there are no obvious behavioral clues. People with this type of autism are able to perform day to day functions and most people don't know that they have autism until the affected person mentions it. This is where most females are misdiagnosed. Females with high functioning autism have certain habits and behaviors that exist because of autism that many medical personnels chalk out to social awkwardness or ADHD and because of these misdiagnoses, there are so many females that aren't able to get the proper help and/or medication. I wanted to contribute to the research and come to my own conclusions in the hopes of helping these females get the proper medical assistance and diagnosis.

9 BE 212

Rahman, Nabela

Wakefield High School

Teacher: Thacker

The Effect of Teachers' Average Annual Salary on SOL Pass Rates in Virginia

The purpose was to determine if teachers are underpaid in Virginia and decide if their salary can affect how well they teach or if it was a factor in students' academics. This was done by comparing the teachers' salaries and the SOL pass rate for each county in Virginia in 2016. The hypothesis was if the teachers receive a higher income then there would be a higher SOL pass rate for that particular county. The independent variable was the average annual teacher salary in each county. There were 94 counties involved in this experiment. The dependent variable was the SOL pass rate. The SOL is a required assessment for all students in grades 3-12, enacted by Virginia Public Schools

The experiment was performed by collecting data from the website Virginia Department of Education. First, all the statistics were found and recorded onto Excel Spreadsheets. Next, the average of the teachers' salaries and the average percentage of SOL pass rates were calculated. The counties were then ranked from above or below average. Finally, to determine if the hypothesis was accepted or rejected, graphs were conducted and tests were taken, specifically, a p-value and a correlation test.

The p-value score was 5.34 10-142. The null hypothesis was rejected. The r-value for the experiment was 0.4 meaning there is a weak, positive correlation between the two variables. The hypothesis was accepted.

9 BE 213

Ramirez Graves, Mercedes; DeMarco, Kaya; Sparks, Adriana

Arlington Tech and Career Center

Teacher: Le

The Effect of Different Ages on Gender Role Stereotypes

This experiment was about determining if gender role stereotypes differ or stay the same as one gets older. In many cases, our view of the world in certain roles may change due to us seeing more individuals in stereotypically unexpected roles. Due to the Expectancy Effect, some children think that specific activities and roles pertain to a specific gender. The Expectancy Effect is when parents raise each gender differently and expect a certain gender to perform certain roles. This effect plays a major role in our lives by affecting how people act and what they like. Often, parents may force or try to influence their child's opinion based on stereotypical activities because of their gender. When a child is introduced to a concept and the concept is continually instilled in their lifestyle, then the child will pick up on this. Many children realize this once they get older, however, there are still many children who don't realize and continue the Expectancy Effect through future generations. The hypothesis created for this experiment is that if the child is given a choice to answer a stereotypical question about gender roles, then the child will choose the stereotype because the child is exposed to gender stereotypes more often than not, through school and other influences such as family.

10 BE 214

Kerns, Michael; Westergren, Evan

Arlington Tech and Career Center

Teacher: Neal

The Effect of Gender on the Ability to Differentiate Shades of Color

Recently, through pictures on the internet, the perception of color has become a talking point. Whether it be the color of a dress or the color of a shoe, people have debated what color is being seen. Although these questions have been asked to people at random, scientists have found a correlation to gender as a variable that impacts color perception. This experiment will prove whether if it is true that gender impacts your color perception through the use of color shade tests. After research through peer-reviewed articles, it was found that scientists have proven that women can perceive more shades of color.

The hypothesis was if different sexes view four different colors with six boxes of different shades, then females will be able to see more shades of color because females have been proven to be able to see more shades of color. To test this hypothesis, we created a color survey test with four pictures with questions. Each picture had a solid background with six squares arranged circularly. Each square was of varying shades of a color. The four colors used in the test were white as a control, red, green, and blue. After completing the experiment, our data was not sufficient enough to support our hypothesis, therefore, promoting our null hypothesis where gender has no effect on the ability to differentiate different shades of the same color.

10 BE 215

Nix, Ellie; Daget, Stephanie; Muir, Maddie

Arlington Tech and Career Center

Teacher: Neal

The Effects of Entertainment Screen Time on High School Students' Work Completion

The experiment was conducted to see if there was a correlation between entertainment screen time and high school students' work completion. The project hypothesis stated: if the student had less screen time, then the student would have fewer missing assignments. A vast majority of high schoolers have cell phones that are used in their spare time the goal of this experiment was to test this if there was a problem, students recorded the number of minutes of entertainment screen time in one week by recording their minutes in the creativity, games, social networking, and entertainment categories in the IOS screen time tracker in settings, then students were told to record how many missing or late assignments the subjects had in that same week. The trial was conducted 3 times with 30 candidates each week. A positive trendline was found for all of the collected data, showing that the higher the screen time, the more missing assignments that students would have. This data supported our hypothesis and proved a negative correlation between GPA and TV use.

10 BE 216

Singer, Jacob; Torg, William

H-B Woodlawn Secondary Program

Teacher: Sensharma

The Effect of Sleep and Caffeine on SAT Scores and GPA

Do you get enough sleep? Recently, awareness of sleep and how sleep duration and quality affect social and mental health has been on the rise. Perhaps that if it is shown that sleep is linked to test scores and GPA, students would be motivated to get more and higher quality sleep. We investigated the effect of sleep and caffeine on GPA and SAT scores. To measure sleep quality and duration, we used a modified shortened version of the PSQI (Pittsburgh Sleep Quality Index), which generates a numeric value to represent the quality of sleep each participant received. All information received was self-reported anonymously by the participants. It was hypothesized that both lower sleep quality and decreased sleep duration would lead to a lower GPA and SAT scores. Our hypothesis was partially confirmed, as both decreased sleep duration and quality leads to both lower GPA and SAT scores. However, caffeine had no significant correlation with GPA and SAT scores. This project provides useful information on how sleep can affect both short term and long term academic performance, and on the importance of sleep in general.

11 BE 217

Gibson, Julia

Bishop O'Connell High School

Teacher: O'Connor

Synesthesia in Students: How Synesthesia Impacts Memory

For my experiment, I will be expanding on my project from last year. Last year, I focused on synesthesia in students and the percentage of students who were affected by this neurological condition. This year, I will be focusing on how synesthesia impacts a student's memory and quickness with responding to certain tasks. For example, I will be testing their memory by giving them 10 seconds to memorize a certain pattern of words or letters. Then I will give them a word search to see how quickly they can find the words. This experiment is to see if students with synesthesia rely on their synesthesia to help them in situations where they might need to find a word quickly or memorize a pattern of words quickly. This experiment might also show a correlation between memory and those with synesthesia.

11 BE 218

McCormack, Michaela

T.C. Williams High School

Teacher: Lowe

Too Cool for JUUL: The Effect of Pod-Based E-cigarettes on Sleep and Subsequent Cognitive Function

Insufficient sleep, especially during adolescent development, interferes with daytime functioning increasing sleepiness, depressive mood, and risk-taking behavior. This study determines how learning and memory are affected by sleep and risk-taking, specifically in the form of pod-based e-cigarettes (vaping) in both humans and in a Drosophila melanogaster model. Human subjects will complete a demographics survey, wear a fitbit for seven nights and take two cognitive tests: a concussion baseline test measuring reaction time and short term memory and a balance test assessing spatial awareness and long-term memory. Risk-taking vaping data was obtained from the 2019 Alexandria City Risk Assessment Survey. Wingless D. melanogaster were given two cognitive tests: an olfactory avoidance test for short term memory and a spatial orientational test for long term memory. Vaping usage was tested using Imidacloprid, a neonicotinoid insecticide. Similar to nicotine it is an agonist of the nAChR receptor. Comparisons will be drawn between the short-term and long-term memory results in both subjects. Prototyping is complete, and experimentation is in progress. Analysis of human and fruit fly data is expected to show a modest decrease in cognitive ability with sleep deprivation. Furthermore, nicotine/neonicotinoid exposure is expected to negatively impact short and long term memory.

12 BE 219

Loftis, Kate

Yorktown High School

Teacher: Amarasinghe

The Effect of Social Anxiety on People's Ability to Interpret Facial Expressions

People with social anxiety often have trouble in social situations, and with the majority of interpersonal communication consisting of nonverbal behaviors, misinterpretation of facial expressions may result in lost confidence and an increase in future avoidance. This study tests the hypothesis that as the level of anxiety according to the Liebowitz Social Anxiety Scale increases, the accuracy at interpreting facial expressions decreases. First, consenting students from Yorktown High School were sorted into one of six increasing levels of social anxiety (none, mild, moderate, marked, severe, and very severe social anxiety). Then participants were given a test with pictures of 28 faces taken from the Karolinska Directed Emotional Faces database, and asked to circle the emotion they thought was being expressed by each face. Each participant's level of social anxiety was then compared to their percentage of expressions correctly identified and the scores were averaged for each level. Accuracy appeared to decrease with increasing anxiety level up until severe social anxiety, where it began to increase again. Statistical analysis, however, did not show significance in the overall data, but it did with two pairwise comparisons and a third was found being close to significance. This could be evidence that more significance may be found with a larger sample size. Additionally, other factors may be influencing the ability to accurately interpret expressions. Overall, the study still achieved its goal to bring attention to the intricacies of interpersonal communication and how different factors can affect the way someone thinks others perceive them.

7 BI 300

Cavanaugh, Samantha

Hammond Middle School

Teacher: Chapman

Do Your Teeth Love Your Sugary Drink as Much as You Do?

Dentists always tell you sugar has bad effects on your teeth but to what extent? This project observes the effects of sugar on teeth by recording what would happen if I put white eggs into different sugary drinks. Eggshells have a composition almost identical to tooth enamel, so eggs would react the same to the drinks. My hypothesis was that color and physical features would change. I had five white eggs and five different drinks (water, Gatorade, Coca-Cola, orange juice, and cranberry juice) The results of my experiment showed major developments on the eggs. The color did change and there was visible decay on a few of the eggs. I was surprised to see how much the eggs had changed. In one of the cups, decay from the eggshell was floating on the surface of the drink, which was cranberry juice.

8 BI 301

Christino, Ruth

George Washington Middle School

Teacher: Straube

The Release Rates of Medication in Over-the-Counter Painkillers

People are constantly trying to outsmart pain. Hundreds of companies and scientific groups have been trying for years to formulate the perfect miracle drug to quickly and effectively relieve pain. This experiment delves into determining which popular over the counter (OTC) painkiller can distribute its medication the fastest. As the Opioid Crisis spreads across America, it is especially important to develop effective, affordable, and fast-acting OTC pain relievers. This experiment investigates if three different OTC painkillers are put in a stomach simulation, how long does it take for the medication in each pill to be released? To do this, white distilled vinegar is heated to human body temperature, then it is syringed into a test tube with one dose of either Advil/Ibuprofen, Tylenol/Acetaminophen, or Bayer Aspirin/Acetylsalicylic Acid, a stopwatch is started and then it is stopped when the medication is released from the pill. Of the three painkillers tested (listed above) Aspirin was the fastest to release medicine by far with an average time of 9.01 seconds while the other two OTC drugs had average times of 7 minutes 12 seconds (Tylenol), and 9 minutes 24 seconds (Advil). In conclusion, Bayer Aspirin releases medication the fastest, however it can have some adverse side effects which can make it not as safe to use as Advil or Tylenol.

9 BI 302

Arlett Estrada, Sara

Arlington Tech and Career Center

Teacher: Reese

The Effect of Antibiotic Frequency on the Resistance of E. coli

The purpose of the experiment was to determine the effect of the misuse of antibiotics on the E.coli bacteria. The hypothesis stated, If the antibiotic is given less frequently, then bacteria will be more likely to become resistant. The E.coli bacteria were given a course of Ampicillin while changing the frequency in which the antibiotics were prescribed. The bacteria were given 3 drops of Ampicillin per dose and left to continue growing until the experiment was completed. The result showed that the group with the highest frequency of antibiotic given had the most resistance. In conclusion, when the antibiotics were prescribed it was better to finish the course of the treatment and to make sure to remember to take the medication.

9 BI 303

Docena, Elise

Washington-Liberty High School

Teacher: Brodowski

Effect of the Method of Food Storage on Speed of the Enzymatic Browning Process of Apples

The purpose of this project was to figure out which method of food storage has the best properties for keeping produce fresh for the longest. This is a small step in preventing a problem present in our society today—food wastage. The properties and ability of different types of food storage to keep fruits and such fresh were tested through using apple slices. Apple slices brown at a rapid rate, due to the enzymes in the apple being exposed to the air. A noticeable change in color on the apple slice will appear within hours of the apple being sliced, so apples were chosen to conduct this experiment, as results would be easy to measure (using a enzymatic browning color chart), and the experimentation could be run over a shorter amount of time. My project tested which food packaging will best help prevent or delay the process of enzymatic browning in apples.

This experiment was tested out by putting apple slices of roughly the same size into three different food storage bags. My hypothesis was, that out of the three different types of bagging the apples were stored in (Ziploc bags, paper bags, and specialized “green bags”,) the green bags would perform the best because they are said to have a chemical property which keeps fruits fresh for longer than a normal type of bagging. Every single day for a week, every single apple slice was measured against a browning scale, which depicts many different shades of brown. Browning scales are

9 BI 304

Milton, Emily

T.C. Williams High School

Teacher: Paul

Leggo My Jello

In my science fair experiment, I am trying to find out if putting raw or cooked fruit with protease into a gelatin mix will make the gelatin more solid. In my experimental process, I will be testing many different mixtures including raw fruit in gelatin, cooked fruit in gelatin, cooked fruit with enzymes, and others. By having many types of experimental groups I will truly be able to see the best ingredients to put in your homemade desserts. Some enzymes, such as protease, can split the proteins in the fruit causing the whole gelatin mixture not set. When the enzymes are cooked, the enzymes will denature, or change shape, because of the extreme temperature and stop working. This is why the cooked fruit and gelatin in my experiment worked well because the enzymes could not affect the solidity of the gelatin. The raw fruit and gelatin samples did not solidify as the others did because the enzymes split up proteins in the fruit. The world relevance of my project is that many people like to enjoy gelatin desserts (specifically Jell-O products) because they are easy to make and are sold at local grocery stores.

10 BI 305

Ackleson, Thomas

Washington-Liberty High School

Teacher: Singh

Oil Sorbents and their Impact on Oil Collection and Dugesia tigrina Survivability

Oil spills are an ever-increasingly relevant subject in our current and future society. The way contained freshwater oil spills are often cleaned is by the use of oil sorbents. This experiment was conducted to identify an oil sorbent type that not only cleaned a simulated oil spill, but excelled at protecting the environment it was deployed in. The common oil sorbents of straw, clay, and polypropylene were tested on their ability to absorb oil in freshwater. In addition, each sorbent was tested on the morbidity rate of Dugesia tigrina that it produced. After a period of two weeks (14 days), measurements were taken for the oil and water remaining in each trial for each sorbent, as well as the survival rate of Dugesia tigrina for each sorbent type. It was predicted that the straw sorbent (natural and organic) would yield the highest survivability and lowest oil collection. It was also predicted that polypropylene would produce the highest morbidity for Dugesia tigrina and the highest rate of oil collection. Data was collected and converted into graphs and charts for analysis. Results showed that straw produced the highest survivability and oil collection rate but also collected a high amount of water. Clay and polypropylene faired similarly to each other in terms of morbidity and oil/water collection. The initial hypotheses were both partially rejected; some aspects of each were accurate. Potential implementation of formulae and computer/theoretical modeling was discussed, as well as the use of software to identify ideal sorbent types.

10 BI 306

Koury, Kelly

T.C. Williams High School

Teacher: Kazanciyan

Bioplastics: Decomposing Plastics

The focus of this project is to show how bioplastics are better for the environment and to test the biodegradability of agar based bioplastics using three methods. The hypothesis is that the rate of decomposition of an agar based bioplastic would be greatest under composting as compared to two other methods, buried in the ground and exposed to air in an enclosed structure. The I.V. is the different types of decomposition and the D.V. is the rate of decomposition.

The experiment had two phases: making the bioplastic and decomposition of the bioplastic. Trial 7 from last year's bioplastic project was used to make the bioplastic . This trial was used as it made the best decoration in the project. The ingredients are agar, water and glycerine . After the bioplastic was made the methods of decomposition were set up: composting, burying in the ground, and open to air in an enclosed structure. The bioplastic was placed in each of these areas and left in place for 82 days.

The results were that the bioplastic in an open air enclosed structure decomposed the most (28%) out of the three methods. However, the bioplastic in the other two methods (burying in the ground and composting) decomposed a little bit (3% to 9%).

In conclusion my hypothesis was not proven. The bioplastic in the composter did not compost faster than the other two methods. The bioplastic in the open air enclosed structure had a 28% decomposition rate which was higher than the other two methods.

10 BI 307

Zheng, Charles

Episcopal High School

Teacher: Olsen

Genomic Biomarker Discovery in Lung Cancer

The purpose of this project is to find differentially expressed genes and their biological functions between normal and Lung Squamous Cell Carcinoma tissues. Data were obtained from the largest public cancer genomic database – The Cancer Genome Atlas(TCGA). I used a machine learning approach - Principle Component Analysis (PCA) to explore the high dimensional data and a statistical test approach - Student's t-test to examine the likely true differences between tumor and normal tissues in the gene expression from RNA-seq data. Various visualizations emphasize their differences in the form of PCA plot, volcano plot and heatmap. Then, I ranked by their p-values to identify the top genes to further explore their functions in relation to Lung Squamous Cell Carcinoma. First, from PCA analysis, I confirmed the clear separation between normal and tumor samples using the expression values of all genes, as each type of tissues formed its own cluster. I also identified an outlier sample. I then removed the outlier sample and extracted all the normal samples and their matching tumors samples for downstream analyses. Next, through t-test and volcano plot, I identified genes with the smallest p-values and explored their biological functions. Genes that are known to be involved in general cancer formation or particularly lung cancer formation were identified. Genes that are not yet reported to be involved in cancer were also among the top gene list. These findings will help us to better understand the etiology and diagnosis of lung cancer.

10 BI 308

Arango-Rojas, Sara; Leahy, Meaghan; McCarthy, Maya

Wakefield High School

Teacher: Muñoz-Gonzalez

The Effect of Moisturizing Ingredients On Skin

The skin is the largest organ in the body and performs many important processes and functions. A problem that prevents these essential skin functions is dry skin. Dry skin can be resolved easily but with so many moisturizers offered on the market, it can be difficult to know which is best or even choose one. This project examined four popular ingredients in moisturizers to see what works best to solve dry skin. The hypothesis was that Glycerin would work best because Glycerin is the most common ingredient in moisturizers. To test the ingredients Jello was used as a skin substitute because they both contain collagen. The Jello was divided into cups and then covered with different moisturizers. The results found that hyaluronic acid worked best to hydrate the skin. The hypothesis was incorrect because glycerin was the second to last best. In conclusion, moisturizers that contain hyaluronic acid work best to hydrate the skin.

10 BI 309

Berasu, Effriata; Bautista, Alyssa

T.C. Williams High School

Teacher: Strimple-Barker

Denaturing Proteins

The purpose of this experiment was to determine whether or not keratin, albumen, and casein denature at the same temperature. In order to do this, an extensive amount of heat was applied to each variation of the proteins, in this case, hair, egg whites, and powdered milk. To confirm that they had been denatured, each protein was observed for changes such as skin forming on milk, hair becoming damaged, or egg whites becoming a solid white color. It was concluded that the proteins did not denature at the same temperature and they all did not denature faster when heated at 90 degrees Celsius.

11 BI 310

von Eckartsberg, Rose

Yorktown High School

Teacher: Wright

The Effect of pH on the Growth Rate of Pyrocystis fusiformis

Global warming is causing the acidity levels to rise in the ocean due to increased CO2 levels in the atmosphere. The purpose of this experiment was to observe how Pyrocystis fusiformis (dinoflagellates) will react to an acidic pH in the future. The hypothesis for this experiment was if the water is more acidic, then the growth rate of Pyrocystis fusiformis will decrease. The dependent variable was the number of organisms and the independent variable was pH (7, 6.5, 6, 5.5). Twelve beakers were used for testing, each had 50ml of dinoflagellates. Before the experiment began a count of organisms in each beaker was taken as a baseline. Distilled white vinegar was used to change the pH. After five days another count was taken. The hypothesis was correct. The pH of 7 had an average loss of 4.7, 6.5 had an average of 18.3, 6 had an average of 27.3, and 5.5 had an average of 43.3. The P-value was 0.007 meaning that the null hypothesis was rejected and the data was significant. Even though some of the organisms survived five days at 5.5 pH, they might not be able to last longer. It was observed that in the more acidic beakers the dinoflagellates had a lighter glow. This could have been caused by a decreasing number of scintillons. Scintillons are the organelles that emit light, the more acidic the water the less amount, causing a lighter glow.

11 BI 311

Gazic, Dzenita; Rizkallah, Rita

Wakefield High School

Teacher: Tran

The Correlation Between Catalase Concentration in Organisms and Their Lifespan

In this experiment, the correlation of catalase to the longevity of organisms was studied. The hypothesis was rejected; If the potato has the highest amount of catalase, then its lifespan will be longer that other organisms'. First a standard curve using multiple test tubes with known concentration of catalase (powder) was created. Then, the decomposition of hydrogen peroxide by catalase was used to determine the percentage of O2 gas produced using Vernier lab equipment after 15 minutes have passed. Once the standard curve was graphed, the catalase concentration of various sources/organisms such as liver, yeast, potatoes, and apples was tested to determine the extent of reaction. Finally, the lifespan of each organism was researched and correlated with the concentration of catalase inferred.

The amount of O2 was the most in the solution of potato which produced a more O2 bubbles than the rest (22.59%), followed by chicken liver solution which had 21.09%, then yeast solution which had 20.75% and finally apple solution with 15.16% of O2. Using the standard curve and the O2 concentrations, the amount of catalase in each organism was found. Apple had -4.65% of catalase, yeast had 23.02%, liver had 25.20% and the potato had 32.13% of catalase. The lifespan of each organism was researched and it was found that the lifespan of an apple is 1 month, potatoes was 4 months, compared to chicken with a lifespan of 84 months. Our results showed that catalase is not a good predictor of cellular health, as the correlation between

7 CH 400

Cozette, Olivia

Williamsburg Middle School

Teacher: Willet

The Effect of Different Desalination Processes on the Amount of Salt Left in the Water

The project was testing the effect of different processes of desalination on the amount of salt. The purpose of this experiment was to show which desalination process was the most effective to clean water. Many places around the world have limited drinkable water. The point of desalination is to be able to drink unsalted water safely. The levels of the independent variable were solar energy distillation, gas energy distillation, and reverse osmosis. The hypothesis for the experiment stated that if the water is run through the gas energy distillation process, then there will be the least amount of salt in the water because when water evaporates, the salt is left behind." Each level of the experiment was conducted 3 times; starting with 900 mL of water to 35g of salt. The results of the experiment were that the gas energy distillation process was the most effective with a mean of 0.333% salinity and the reverse osmosis process was the least effective with a mean of 63% salinity. The major trends identified in the results were that compared to the solar and gas energy distillation processes the salinity in the reverse osmosis process had a significantly higher mean. The results showed that the hypothesis was supported. In the future some great additions to this experiment would be more levels of the independent variable like sequential freezing, using materials like a real reverse osmosis membrane, and adding more trials to receive even more accurate data.

7 CH 401

O'Neill, Sean

Hammond Middle School

Teacher: Chapman

Which Type of Wood Burns for a Longer Period of Time?

I enjoy making campfires; so I wondered about the different types of wood, and which ones burn slower.

When a tree is cut or falls down in the forest, you can see the tree rings and the inside of the tree. The sapwood is the growing part of the tree, closer to the bark. It is usually lighter in color. The heartwood is in the center of the trunk; it is darker than the sapwood. In some trees, the heartwood is more resistant to decay and rot.

I wondered if I burned ash, oak, pine, and cherry wood, would cherry wood burn for a longer period of time because it is a hardwood tree?

I asked my neighbor for oak and ash wood. He gave me two big pieces of each type of wood.

I found some pine and cherry wood in my backyard. Then, my Dad and I cut each type of wood (oak, ash, pine, and cherry) into smaller pieces. We used the machete to cut them into smaller pieces (length: 10 in and width: ½ to 1 in.).

Later, I conducted three trials for each type of wood. I used my Dad's iphone to time how long each wood burned. I learned that ash wood burns for a longer period of time than all the other woods in my experiments. My hypothesis was incorrect, cherry wood did not burn the longest. However, two of the three hardwoods DID burn slower than the softwood, which was pine.

7 CH 402

Rami, Rayyan

George Washington Middle School

Teacher: Haisfield

Mineral Crystallization in Pipes

The point of this experiment is to figure out what materials will help and hurt crystallization in your pipes. This is important because if minerals crystallize in pipes, it can cause many bad things to happen, and even though people are trying to fix it, sometimes they're making it worse. I hypothesize that if there are cotton products in your drain, then crystals will grow bigger and harder because cotton swabs and cotton balls have many fibers that crystals can grow on. In order to perform this experiment you have to first prepare, then set up your experiment, watch the crystals grow, and finally record your data. The data showed that crystals grew on all the materials. There were some surprises, like some crystals turning orange after a while, and a few crystals being weaker, thinner, and more rectangular than others. The data supports my hypothesis and proves that minerals can crystallize on a variety of materials, making it all more important to reduce water hardness and remove unwanted things like hair from pipes quickly.

7 CH 403

Reed, Jack

Dorothy Hamm Middle School

Teacher: Azzara

What is the Effect of the Type of Leavening Agent on How High a Cupcake Rises?

The purpose of the experiment was to test what type of leavening agent would make a cupcake rise the most. If yeast is used, then a cupcake will rise more because it releases carbon dioxide and alcohol when heated. This creates air bubbles causing the cupcake to rise. Three batches of cupcakes were prepared with three separate leavening agents: baking powder, baking soda, and yeast. The height of samples from each group were measured in millimeters. Using baking soda resulted in the highest mean height, using baking powder resulted in the medium mean height, and using yeast resulted in the lowest mean height. The results did not support the hypothesis. The results from this experiment can help bakers know which leavening agent to use to make their cakes rise more.

7 CH 404

Sharif, Amina

Patrick Henry School

Teacher: Cummins

What a Reaction!

How does the particle size of Alka-Seltzer affect the time it takes for it to completely dissolve in water? Alka-Seltzer is a medicine dissolved to help relieve stomach pain and heartburn. It comes in packs of tablets that have 325 mg of Aspirin, 1000 mg of citric acid (which helps the tablet fizz and its reaction in water) and 1916 mg of sodium bicarbonate. To do my research, I conducted 3 separate trials where I broke Alka-Seltzer into different sizes, (whole, halves, quarters, powder), then measured how long it took to finish fizzing in 250mL of water. As a result, the average time for a whole tablet to react was 51 seconds, while the powdered tablet only took 13 seconds. This was a 38-second difference, with a gradual decrease in the amount of time as the sizes also got smaller. In conclusion, I found out that the smaller the sizes of each individual piece of Alka-Seltzer, the faster it finished fizzing underwater. However, next time, I will find a better way to split the Seltzer into equal pieces and use different liquids to determine the best conditions for medicine and/or Alka- Seltzer to deliver the fastest and most effective results. This information will help medical companies to determine whether they should make a larger pill and only require a person to take one pill or split the same pill into smaller sizes but require one to take more doses to deliver the fastest results.

7 CH 405

Steedman, Hannah

Jefferson-Houston School

Teacher: Paladin

How Does Water Quality Affect Crystal Growth?

In this experiment, I tested the effects of water impurities on crystal growth. I did this experiment so I could see what water was best when growing salt crystals. The data shows that crystal growth is not solely dependent on water quality. There are likely many other factors of the water I have not thought of but that is not my project.

7 CH 406

Mazariegos, Estefany; Rodriguez, Hilary

Hammond Middle School

Teacher: Claude

Bubble Pop

What supports our Research problem and hypothesis is surface and texture because the surface tension of the bubble is affected by the texture and surface of other materials than water. This is important scientifically because if surface effects others surface tension like how the bubble would pop on the cotton and satin and not on the polyester this shows that it will affect how things can be compatible with each other or not. We chose this topic because we were curios about how one's surface would affect others. This is important in real life because if you go out and the weather suddenly changes you would know what kind of material to where so that you don't get that wet.

8 CH 407

Baasansukh, Haley

Swanson Middle School

Teacher: Seliskar

Not So Crystal Clear: Do Different Sugars Affect the Mass of Rock Candy?

Sucrose is something we are all familiar with, from it being in our hard candy to our delicious fruits. The purpose of this experiment was to see if different sugar crystal sizes found in different types of sugar would affect the mass of the product. This experiment consisted of testing the different types of sugar on the mass of the rock candy produced by creating a supersaturated solution and a seed crystal for the sugar crystals to grow onto during crystallization. The hypothesis that was tested was, “If the Demerara sugar is crystallized, then it will have the highest mean.” The four levels that were tested were granulated sugar, light brown sugar, cane sugar, and Demerara sugar. The crystal sizes for each level were as listed, granulated sugar 450 to 650 µm, light brown sugar 270 to 420 µm, cane sugar 500 to 750 µm, and Demerara sugar 800 to 1,200 µm. The hypothesis was tested by producing ten different rock candy samples for each different sugar type. The motivation for this project was fueled by the interest in how crystallization works from a supersaturated solution. From the data collected, I could conclude Demerara sugar had the lowest mean with 8 grams and that cane sugar had the highest mean with 33 grams. The Demerara sugar and cane sugar were the levels that had the least variability among all of the levels, meaning that the data was consistent throughout all ten trials. The data does not support my hypothesis.

8 CH 408

Bartrum, Olivia

Thomas Jefferson Middle School

Teacher: Von Elmendorf

The Effect of Water Temperature on pH

The purpose of this experiment was to test the effect of water temperature on pH. It was hypothesized that if the temperature of water increased, then the pH would decrease. The hypothesis was chosen, because an increase in water temperature increases the ionization of water, which produces more H+ ions and decreases the pH. The independent variable was the temperature of water (8°C, 22°C, 70°C), and the dependent variable was pH. The experiment was conducted by placing three test tubes that contained the water of different temperatures on a test tube rack, and measuring the pH of the water contained in each test tube. Throughout the experiment, three trials were conducted to increase validity. The experiment showed that 8°C water had the “strongest” alkalinity (measuring an average of 8.584 on the pH scale), the 22°C water had the “weakest” alkalinity (measuring an average of 7.76 on the pH scale), and the 70°C water had a “moderate” alkalinity (compared to the other two levels, measuring an average of 7.85 on the pH scale). Overall, the data did not support the original hypothesis, as it was hypothesized that if the temperature of water increased, then the pH would decrease (or become more acidic). The data suggested that the temperature of water only slightly affected its pH, as the pH only slightly changed in different water temperatures.

8 CH 409

Johnson, Amanda

Jefferson-Houston School

Teacher: Calderara

The Future of Cupcakes

In my experiment, I baked cupcakes in the microwave and the oven to test their density. I found the density by dividing their mass by volume. I found the mass using a triple beam balance; I used a water displacement test to find the density. I found that when averaged, the cupcakes made in the oven (blue, labeled O) were denser, and the cupcakes made in the microwave (green, labeled M) were less dense.

8 CH 410

Omar, Najma

Hammond Middle School

Teacher: Scott

Breaking Chemical Bonds

In this experiment, I found out how to split atoms using a process called electrolysis. My purpose was to pass an electric current through water and successfully separate the hydrogen and oxygen atoms in half. I found out how the process works and what it does to hydrogen and oxygen atoms. My variables are my independent variable being the different water mixtures. (water + baking soda, saltwater, and distilled water) My dependent variable is the hydrogen and oxygen atoms because the loose covalent bonds are being separated.

8 CH 411

Simolunas, Luke

Swanson Middle School

Teacher: Swanson

The Liter of the Pack: What Brand of Soda Corrodes Aluminum the Most?

The purpose of my project, “The Liter of the Pack: Which Brand of Soda Corrodes Aluminum the Most,” is to explore and inform people about the effects of different sodas on aluminum. I tested water (control), Coca-cola, Sprite, Diet Coke, Dr. Pepper, and Fanta. I completed the project by measuring 100 mL of liquid into an airtight plastic container. I then weighed a 2x2 cm square of aluminum, placed it into the liquid, gently submerged it with my finger, and placed the lid on the container. From there I started a three-day timer and let the aluminum soak. At the end of the three days, I dried my samples, weighed them again, and recorded the amount of mass lost. I did ten trials for each of the six liquids. My data originally showed that Sprite corroded aluminum the most. But when you take a closer look at the dot plot, you can see that I had an outlier that made the means of the data unreliable. So I kept on looking at the dot plot, where I found that Coca-cola has the most concentrated data, higher up on the plot. So, I concluded that Coca-cola shows the most corrosive effect on aluminum.

8 CH 412

Walker, Natalie

Dorothy Hamm Middle School

Teacher: Japec

The Effect of the Chosen Liquid on the Dissolving Times of Alka-Seltzer Tablets

Background:

The experimental question is “Which liquid substance will dissolve the medication Alka-Seltzer tablets the quickest?” It is important because if a new liquid can dissolve an Alka-Seltzer tablet faster than water can, then the consumer would have quicker pain relief. Prior to this experiment, the author conducted other experiments and studies, but the results were not definitive. Further studies and experiments could lead to a discovery for quicker pain relief.

Hypothesis: Liquids with more acidity, like lemonade, will help Alka-Seltzer tablets dissolve faster.

Methods:

The time for the tablet to completely dissolve in various liquids was recorded. The data collection/experiment lasted around two days. The sample size of the data was 10 conducted trials of each liquid. The conducted experiment dealt with no human interaction. The setting of the experiment was the kitchen of the house.

Conclusion:

The scientific explanation for the results is the Alka-Seltzer tablets were made to dissolve in water. When the tablet is in water, it dissolves quicker than any other drinks because the tablet is scientifically created for that particular liquid. Therefore, lemonade has way more acidity, causing the results to be slower and showing that the hypothesis was incorrect. That would explain why it is best dissolved in water.

8 CH 413

Chavez, Alexa; Orozco, Victoria

Gunston Middle School

Teacher: Robles

The Effect of Substances on Ice Melting

Our project was The Effect of different substances on ice melting. We decided to conduct this experiment as ice on roads becomes an issue during the winter time in many areas. To do this we put twenty grams of all substances onto a tray and wait twenty five mins to then see ice height in cm. We used salt as the control then sugar,coffee grinds,sand and baking soda. What we found out is that sugar is the best alternative to salt due to the fact that it can be dissolved into water it lowers the ice's freezing point causing it to melt.

8 CH 414

Knisely, Calvin; Holladay, Philip

Swanson Middle School

Teacher: Seliskar

Electrolyte Experiment

In our experiment, we wanted to find out the number of electrolytes there are in well known sports drinks and juices. This is because we are both active athletes and wanted to know which drink would help us perform to the best of our ability. Our hypothesis' were, for sports drinks - Gatorade will have the most amount of electrolytes (per 100 mL) when compared to powerade and tap water. Whereas for juices - orange juice will contain the greatest amount of electrolytes (per 100 mL) when compared to apple juice, tap water, and lemonade. In order to find the number of electrolytes each drink contained, we used an electrolyte testing kit. The kit worked by measuring the amount of electrolytes due to the fact that sports drinks and juices contain voltage. In which the multimeter then measured through its leads, or contact points by being placed into the designated drink. The multimeter would then show a number in milliamps (our choice for unit of measurement). As a result, on average Powerade had the most number of electrolytes compared to tap Gatorade and tap water (by about ten milliamps). On the other hand the mean of orange juice had the most electrolytes compared to apple juice, water, and lemonade (by about twenty milliamps). In conclusion, Gatorade and orange juice are good conductors of electrolytes along with other nutrients which helps keep our bodies up and running, and healthy for years to come.

8 CH 415

Rivera Escalante, Camila; Marsh, Casey

George Washington Middle School

Teacher: Straube

Homemade vs. Brand-Name Shampoo: Effectiveness for Grease Removal

We chose to compare effectiveness of homemade shampoo vs. store bought shampoo to learn safer, chemical free ways to remove grease from hair. Our Hypothesis is, If we compare the effectiveness of homemade shampoo vs. store bought shampoo at removing grease, then the homemade shampoo will remove grease better. To compare the shampoo effectively we submerged .5 grams of wool yarn in grease (olive oil) for 10 seconds. We then removed it from the grease and placed it on the kitchen scale. After this we soaked the yarn in a mixture of water and one of the three shampoos, we massaged it for 20 seconds and then let it sit in the mixture for one more minute. Finally, we dried the yarn using a hairdryer until the piece of yarn was completely dry and then we placed it on the kitchen scale. To find the amount of grease removed, we subtracted the weight of the yarn after soaked in grease by the weight of the yarn after washed and dried. In the experiment, we discovered that the homemade coconut milk shampoo was the most effective at removing grease by .5 grams more than the store bought shampoo and .2 more grams more than the Castile Soap Herbal Shampoo. From our project, we learned that the toxic and harmful chemicals in store-bought shampoo are not necessary for removing grease. Homemade shampoo without the toxic chemicals can do the same job or even better than the shampoos with toxic chemicals.

9 CH 416

Koller, Sean

Washington-Liberty High School

Teacher: Brodowski

The Effect of the Salinity of Water on its Heat Capacity

In this experiment, my goal was aimed to find the effect of the salinity of water on its measured heat capacity. I created this experiment in order to assist my rational, this included my idea that there might be a more effective way to create the necessary heat for one's home using a hydronic heating system. Through a set-up that included a 6-volt battery connected to a calorimeter, thermometer, and a multimeter. This allowed me to take all the necessary measurements to calculate the heat capacity of each solution. This coupled with my extensive background research on the properties of saltwater, I was able to conclude that yes, more heat is contained in the water when it involves a salinity high solution. This could mean that heating ones home in such a fashion might prove to be effective, but future experiments would have to be conducted to show that the energy required to heat the water would be better than the current system.

9 CH 417

Licato, Anne

Washington-Liberty High School

Teacher: Averette

The Effect of the Concentration of the Bromelain Enzyme from Pineapple on the Concentration of Bromelain

In synchronized swimming athletes paint a thick layer of hot, liquid Knox gelatin on to their hair. The removal of Knox gelatin is time consuming and very tedious. Bromelain is an enzyme found in pineapple that may aid in dissolving gelatin. The purpose of this experiment was to determine which part of the pineapple contains the highest concentration of bromelain. The hypothesis was if bromelain is extracted from the pineapple core, then the bromelain extracted will hold the highest concentration of bromelain, because the core of the pineapple is closest to the stem, which holds the most bromelain. The three pineapple sections tested were the fruit, core, and skin. The sections were each blended and centrifuged to separate the juice from the pineapple solids. To find the bromelain wavelengths, each sample was mixed with a Bradford protein assay dye reagent and measured using a UV photospectrometer. The wavelengths were then converted to concentrations using a calibration curve. The calibration curve was necessary to convert wavelengths to concentrations and compare the data within ranges for known concentrations. The pineapple skin had the highest concentration of bromelain with an average of 0.527 micrograms/ml. The core averaged 0.510 micrograms/ml and the fruit averaged 0.491 micrograms/ml. However, both Anova tests that were run proved the data to be not statistically significant. Therefore, the null hypothesis, if bromelain is extracted from the pineapple core, then there will be no higher bromelain concentration as compared to the other sources, is accepted.

9 CH 418

Wayman, Elizabeth

Yorktown High School

Teacher: Dorman

The Effect of Pill Design on Time it Takes to Dissolve in Water

The purpose of this experiment was to test the marketing claim that Tylenol Rapid Release Gels dissolve faster than other acetaminophen pills. This experiment also helps consumers make wiser decisions about which acetaminophen pills they buy as Tylenol costs more. The hypothesis for this experiment was if acetaminophen pills, Tylenol Extra Strength Caplets, Tylenol Rapid Release Gels, and Tylenol Extra Strength Coated Capsules are compared, then Tylenol Rapid Release Gels will dissolve the fastest. To conduct the experiment Aluminum Sulfate was added to 1600mL of water until a pH between 1.5 and 3.5 was achieved. Then 50mL of the water was placed in a beaker with a stir bar and acetaminophen pill. The time the pill took to dissolve was observed and recorded in a data table. The process was repeated eight times at each level of the IV. Then the mean, median, mode, range, and standard deviation was calculated. The data showed that Tylenol Extra Strength Caplets dissolved the slowest, followed by Tylenol Rapid Release Gels, Tylenol Extra Strength Coated Tablets, and the control acetaminophen caplets. Therefore, the hypothesis was not supported. An ANOVA test was performed and the resulting p-value from was less than 0.0001 thus, the IV had a significant impact on the DV. A potential reason for these results is the non-active ingredients in the coating or inside the pills themselves. In summary, Tylenol Rapid Release Gels did not dissolve the fastest, contrary to the marketing claim used on Tylenol's packaging.

10 CH 419

Ardaiz, Alexander

Wakefield High School

Teacher: Gaither

The Effect of Paper Type on Burn Time

The experiment, The Effect of Paper Type on Burn time, was done to increase knowledge about fire hazards and safety in an office setting. The different structures of different forms of paper were tested to see if the changes in structure and makeup would affect burn time.

The position of the paper was a at a diagonal, where the corners of the paper were the lowest and highest points, this way the fire could burn from bottom to top without missing any paper.

To test burn time, 15 pieces of paper of each type (printer, toilet, towel, construction, and tissue) were cut to the size of one square of toilet paper. They were hung vertically from a clamp and ignited at the bottom corner, and time was recorded from ignition until the flame went out.

My hypothesis was that if toilet paper was tested, it would have the fastest burn time because of the pockets of air between its layers. After analyzing the data, my hypothesis was not supported. The results showed tissues had the fastest mean burn time (7.02466667 seconds), followed by toilet paper (7.469 seconds). The control, printer paper, had the slowest burn time (13.668667 seconds).

Recommendations for an office based upon this experiment would be to store tissues in the area least likely to be involved in a fire, but also to store all of their paper in a safe storage area since all types of paper are highly flammable.

10 CH 420

Bright, Christopher

T.C. Williams High School

Teacher: Briestansky

Can We Trust Advertised Fat Content?

The purpose of this experiment was to discover if the fat content represented in a Popchips advertisement is accurate, compared to other chip types presented in the ad. I used acetone, a nonpolar solvent, to extract fat from each of five chip brands (Popchips, Utz, Lays, Cape Cod and Kettle Brand). I mixed 28g of each product with 56ml of acetone for two minutes before removing the chip debris. When the acetone evaporated, I measured and recorded the fat weight in grams. After completing three trials, the data showed that the measured fat content in Utz, Lays, Cape Cod, and Popchips exceeded the advertised fat content by a range of 1.9g to 2.6g. In contrast, Kettle Brand yielded almost 3.9 grams less fat than the advertised amount, a percent error of 43.33%, the highest percent error of all brands. Popchips had the second highest percent error at 42.22% The lowest was Lays, with a percent error of 20%, followed by Cape Cod with 23.75% and Utz with 26%. This means that Kettle Brand had the least accurate nutrition label, closely followed by Popchips. Utz, Cape Cod, and Lays had the most accurate nutrition labels. This data led me to conclude that food advertisements are not always an accurate source of comparative nutritional information. Nutrition labels offer better guides for consumers regarding fat content, but the experiment showed that actual fat content will always differ by a percent error from the label.

10 CH 421

Galazin, Catherine

Wakefield High School

Teacher: Gaither

The Effect of Storage Temperature on the pH of Aspirin

The purpose of this experiment was to study the effect of temperature on the pH of Aspirin. The independent variable was temperature (cold, room temperature, and hot). The control was room temperature. The dependent variable was the pH of Aspirin, measured using a pH probe/meter. The hypothesis was that the pH of the Aspirin stored at a hot temperature would be furthest away from the normal pH of Aspirin. There were 10 trials for each level of the experiment. The pH of the room temperature samples was measured by dissolving each tablet in 3 mL of water and testing the pH with a pH probe. The process was repeated for both the cold and hot temperature samples. The data showed that room temperature had a normal pH, the hot was slightly basic but still within the range of the normal pH, and cold was much more basic than the normal pH range. Both an ANOVA test and a t-Test were performed, showing the results that there was a statistically significant difference between all levels. In conclusion, the results suggest that storing Aspirin at room temperature as recommended is the best way to keep a normal pH, but also that it should not get too much colder than room temperature.

10 CH 422

Abdelaziz, Nedim; Abdu, Nadim; Alhadj, Mahamat

Wakefield High School

Teacher: Gaither

How Does the Type of Salt Bridge Being Used Affect the Change in Voltage?

A salt oscillator is a device that undergoes repeated oscillations that can also illustrate some of the principles essential to the oscillators driven by chemical reactions. Salt bridges allow for the flow of ions to move and even oscillate from one substance to another. It has two aligned containers that are filled in by a pair of different solutions, showing electrical oscillations when being released. These oscillations occur due to a difference of mass density presented by the fluids which cause different ions to flow, leading to electrical potential variations between both containers. For this experiment, the salt oscillator is being tested using copper sulfate, or a suitable alternative, and sodium chloride solutions, changing as the diameter and length of the capillary increase and/or decrease.

For this experiment, the material the salt bridges were made out of was changed to test whether or not it would affect the diffusion of ions between the two solutions. Each salt bridge was placed between two 50 mL beakers filled with different solutions, one filled with copper sulfate and another filled with zinc chloride. The voltage was recorded over a 5 hour time period due to the time-consuming process of reaching equilibrium. Ten trials were conducted using 3 different types of material, sponge, filter paper, and paper towels. Each material was placed in the same concentration of saltwater in order to prevent any other variables from affecting our experiment.

10 CH 423

Clark, Zoe; Sweeney, Nolan

Wakefield High School

Teacher: El Gamal

How Temperature Affects Dissolution

The purpose of the experiment was to explore how temperature affects the rate at which a solute dissolves in a solvent. The hypothesis was if the water is at a higher temperature, then the solute will dissolve faster because of the fast-moving particles in the solvent. During the experiment procedure, a tablet of Alka-Seltzer was dropped into a cup filled with 200mL of water at four different temperatures and timed to see how fast it would dissolve. One water temperature was at freezing level (0°C), one was at a colder temperature (10°C), one was at room temperature (15°C), and the last one was at a hotter temperature (30°C). Five trials were done at each temperature to reduce the effect of outliers. The results showed that there was definitely a difference in the time to dissolve based on the temperature of the water. As the temperature increased, the rate of dissolution decreased. This data supported our hypothesis and our background research into the topic.

10 CH 424

Esquierdo, Hailey; Wiangkham, Gavarin

Wakefield High School

Teacher: El Gamal

The Effect of Solubility of Carbon Dioxide at Various Water Temperatures

The purpose of this experiment is to determine the solubility of carbon dioxide in the water at various temperatures. Without this knowledge, products like sodas may turn out flat instead of carbonated. The independent variable is the water at different temperatures; the dependent variable is the solubility of CO2 in water. To test this experiment, samples of carbonated water were placed in different locations based on the temperature they were assigned to. The temperatures consisted of cold, room temperature, and warm water. After each sample was placed in the assigned location for thirty minutes, 50 mL of carbonated water was transferred to an Erlenmeyer flask. Three drops of phenolphthalein were added and were swirled around for one minute to remove any trapped carbon dioxide bubbles. Then, using a pipette the NaOH solution was titrated counting the number of drops until the pink color persisted. The procedure was repeated with the other samples. The hypothesis that was tested was that if the water contains a higher temperature, then the solubility of carbon dioxide will increase because when solid solutes are dissolved in warmer water they disappear faster than using colder water. The constants in this experiment are the brand of seltzer water, the number of phenolphthalein drops and 50mL of carbonated water was used for all the samples. The control was the room temperature water. As a result, the hypothesis was rejected because it stated that with a higher temperature of the carbonated water, the solubility of carbon dioxide would increase.

10 CH 425

Farhod, Shodi; Newman, Elliot; Shagimuratov, Timur

Wakefield High School

Teacher: El Gamal

Supercooling/Snap-Freezing Water

In the lab, we used our equipment along with heated water and ice to determine the heat of fusion of ice. We began by heating 125 mL of water to 60 degrees Celsius we then poured 100 grams of this heated water into a styrofoam cup. Before doing this we had received and weighted the mass of 4 ice cubes. We then put the ice cubes into the heated water and covered the cup until all of the ice melted. We then measured the temp of the water. We used this new temperature and the final temperature to determine the change in temperature of the water. Using this information we were then able to determine the heat of fusion of ice. We were able to calculate the heat of fusion of ice therefore our hypothesis was supported. My understanding is that the change in the temperature of the water was the missing information needed and because we found that information we were able to calculate the heat of fusion of ice. The heat of fusion determines the amount of energy needed to melt a substance, it makes sense that the melting of ice was a part of our experiment. I think this experiment can be improved by completing more trials. My group only completed one trial and our percentage error was rather high, being at 13 percent, therefore if we had more trials we could have been closer to the accepted value and could have been more accurate.

10 CH 426

Fried, Olivia; Rozario, Ramy

Wakefield High School

Teacher: El Gamal

Gassed up Paint! The Difference of VOCs in Paint

Many people tend to overlook the dangers of the amount of VOCs (Volatile Organic Compound) in the cleaning supplements, coatings, and most importantly, the paints used for the walls of a home. However, there are some paints that are labeled as “Low-VOCs”, yet when the pigment is added, it can increase the volume of VOCs. This leads to the hypothesis of the experiment which is, If a PID is used to determine the amount of VOCs in regular paint and “low” VOC paint, then the regular paint will contain more VOCs. The materials needed for this experiment are 6 different types of paint, varying in the amount of VOCs as it is advertised in its label. Along with a PID (Photo Ionization Detector) to measure the amount of VOCs in paints. As well as, a plastic container and a sponge brush and paper towel. The constants of the experiment would be the time given to measure the VOCs in each paint and the vacuum the wood chips are placed into. Additional materials would be paper towels to clean the vacuum after each trial. Each paint will be tested three times which will help to see a range of results in the end. Throughout the experiment, all the materials will be used together to see whether it agrees with or rejects the hypothesis.

However, just like any experiment, there are risks. Which would include inhaling too many fumes which may result in dizziness, fatigue, throat irritation, etc. In addition to VOCs

10 CH 427

Rahman, Md Nabil; Fuqua, Stewart; Merritt, Songkran

Wakefield High School

Teacher: Gaither

The Effect of pH of Substances on the Oxidation of Fruit

The premise of this project was to find out if the pH value of various substances/solutions would affect the browning in fruits when applied. The independent variable chosen was the type of substance applied to the fruit (apples in our case) with the levels including no substance (control), vinegar, a baking soda solution, and distilled water. The dependent variable within the experiment was the change in color depth in the apples. The hypothesis was that if the pH of the substance applied was more acidic, then the fruit would oxidize less because the enzymes present within the fruit would be restricted from catalyzing the oxidation reaction.

Within the experiment, the apples were cut into slices with there being twenty slices for each level of the independent variable. Photos were then taken of the original apple slices without any substance applied and after 3 hours to compare the difference. Each slice was sprayed with the same amount of a substance. Once all the images of the apples were obtained, the percent change in overall color darkness was computed using an Image Analysis method developed by the students.

It was found that the application of vinegar incited the least increase and baking soda with the highest increase in overall color darkness within the apple slices on average. Some improvements could've been made to the experiment such as using a greater amount of apple slices to represent more trials and using more substances that hold a wider range of pH values.

11 CH 428

Bell, Sydney

T.C. Williams High School

Teacher: Lowe

A Study of Various Electrodeposition Methods for Common Metal Sulfates Without the Use of Cyanides

Electroplating encompasses a wide range of techniques used in many areas of design and research and is broadly defined as the process of coating an object with a metal in order to achieve desired characteristics. While large corporations have developed complex plating baths that use wide varieties of toxic chemicals, there is a lack of information about electroplating that is achievable for student interested in exploring chemistry. Some accessible methods of electroplating come from online forums such as YouTube videos and websites. This experiment aims to compare these common methods, such as anode to copper electrolyte solution and acetic acid experimentation, to simple electroplating with pure metal sulfate salts with hydrated compounds of copper, zinc, nickel, and silver. These compounds were plated onto iron electrodes and weighed before and after plating in order to determine the thickness of the plate. Plating thickness was used to evaluate the ease of plate as plating baths that are more temperamental produce a thinner plate. Metals that plated quickly with a simple bath composition are easier for students to plate with. Copper sulfate showed the largest plating thickness with an increase in mass of .691g, compared to the other metals which had thicknesses between averages of .392, for silver, and .607, for nickel. Zinc had an average mass increase of .542g. Next, these plated electrodes will be tested for the adhesion of the metal to the cathode to further identify which metal is easiest for students to plate with.

11 CH 429

Stutzman, George

Washington-Liberty High School

Teacher: Bohn

The Effect of Purifiers on Unsanitized Water

The project was designed to determine the correlation between sediment concentrations and time needed to dissociate. The purpose was to use P&G purifier packets to dissociate different concentrations, and measure the time until the sediment had fully dissociated. The hypothesis was, if the amount of sediment was changed in a water solution, then the time need to have the reaction occur, will be effective (successful reaction) at all concentrations of sediment in water, as long as the solution isn't supersaturated.

The data didn't support the hypothesis, since the purifiers worked at all levels of saturation. The final results showed that the 250 mL concentration of sediment had the quickest reaction time, while zero mL had the slowest reaction time. The purifier powder chemicals worked by attaching to the dirt particles in suspension and upon obtaining enough weight the clumps dropped out of solution to the bottom. The clumps of chemical and particles became denser then the water. But, with the zero mL trial, the lack of suspended particles made the reaction harder to attract enough dirt particles to clump together, which lead to a longer reaction time. Also, for supersaturated solution, the time needed to dissociate was very similar for each supersaturated concentration. This was because the concentration in the water was the same, and the only difference would've been the extra sediment which didn't dissolve, already dropped to the bottom. The quickest reaction time, 250 mL solution, had a low concentration of sediment, but still enough to react.

7 EN 500

Cobb, Emmeline

H-B Woodlawn Secondary Program

Teacher: Taggart

How Does Saturation Effect the Stiffness of Wood?

This research was developed to determine the effect of water saturation on the stiffness of wood. This is significant because it would help builders and architects predict the behavior of different types of wood, so they can determine which is most appropriate for its planned use. The hypothesis for this experiment was that a wood sample's stiffness would become less stiff when it is saturated with water. This hypothesis was used because our wood deck sags more than the interior floor does when it rains. The hypothesis was tested by measuring the stiffness of five unique wood samples. This experiment tested the stiffness of the five species of woods by applying a load to the plank's center on a test platform, using a luggage scale. The load required to bend the plank until the center touched the test platform was recorded. The load for each species of wood was tested three times and averaged for a single value. The experiment demonstrated wood stiffness when the samples were dry vs wet. Some major findings in this experiment were that woods with lower densities decreased in stiffness when they were saturated, and the woods with higher densities either stayed essentially the same stiffness or increased in stiffness.

7 EN 501

Reyes, Noel

Mary Ellen Henderson Middle School

Teacher: Johnson

Milk Protein Adhesives

There are currently hundreds of industrial and commercial glues on the market right now from Elmer's to Gorilla Glue. Most of the strong glues are very expensive ad contain chemicals that are harmful to the environment. The project's main objective was to see how the protein concentration in a homemade and eco-friendly glue affected the overall shear strength of said adhesive. Two different glues were made, one with powdered skim milk and the other with liquid skim milk. The powdered skim milk was about 70% casein protein while the liquid skim milk was about 30% casein. The two different glues were applied onto Jenga blocks and left to cure for 5 days. The shear strength was measured by exerting the maximum amount of horizontal pressure until the blocks were broken.

This experiment resulted in the powdered skim milk adhesive reaching the desired glue consistency while the liquid milk adhesive was watery and failed structurally. The adhesive that succeeded was very difficult to break. The original design to measure shear strength using a spring scale failed because the glue was too strong. Additional modifications were made to have quantitative measurements of the glue's strength. A test was designed to measure how much mass the block could withstand before breaking. After 15 trials, the wood broke after an average of 9.08N. 10 of the tests resulted in glue failures, two tests were substrate (wood) failures, and three were mixed results (glue and substrate) failures. According to the results, the higher the protein

7 EN 502

Vogel, Henry

H-B Woodlawn Secondary Program

Teacher: Taggart

The Effect of Surface Area on Paper Airplane Glide Distance: Is Bigger Better?

The purpose of this experiment was to test the effect of throwing different sized airplanes to see how far they would go compared to each other. The results from this experiment are important because these findings will help engineers make better planes that could glide farther and use less fuel. There are several forces that contribute to how well a paper airplane flies. Drag slows down aircrafts due to air pushing against a plane. Thrust is forward force provided by a plane's engine or another source. Lift is the upward force due to a different amount of pressure above the wing and below the wing. Gravity is a force against lift. Viscosity is how easily air flows. The hypothesis for this experiment was that bigger paper airplanes would fly farther because there would be much more surface area for lift. The hypothesis was tested by throwing different size paper airplanes of the same type from the same point multiple times and measuring their flight distance. The major findings were: (1) bigger paper airplanes do fly farther and (2) bigger paper airplanes' flight distance varies more than smaller planes. The hypothesis was supported by the data because the largest plane flew an average of 3.9 meters farther than the smallest plane. The results from this experiment are important because they will help engineers make better airplanes which can glide farther and use less fuel.

7 EN 503

Anjum, Anisa; Bisrat, Mieraf

Hammond Middle School

Teacher: Kochis

How Does the Brand of Trash Bags Affect the Time It Will Take to Rip?

After conducting our experiment for a total of three times and recording our data we found that our hypothesis was incorrect because we hypothesized that GLAD would be the best. We were testing what brand of trash bag is the strongest when using 3 bricks each weighing 13 pounds. Our data shows that Kirkland, the off-brand trash bag, was able to withstand the weight of the bricks the longest instead of GLAD.

7 EN 504

Griffin, Samuel; Andrious, Aiden

H-B Woodlawn Secondary Program

Teacher: Taggart

Plane Power

The rationale for this experiment was, the purpose of this experiment was to study the effect of the angle of an airplanes take off on how far it flies. The research question is what is the best takeoff angle to launch a plane at. The hypothesis is distance is a function of the angle the airplane is launched at. Because the distance will be affected by the angle the plane is launched at. We tested the hypothesis by launching the airplane at different angles to see which was the best, and if the hypothesis was correct or not. The result was that ten to fifteen degrees was the best angle to launch a plane at, and get a good distance. Ten degrees got an average of 520 cm. And fifteen with 504 cm. The conclusion was that the hypothesis was correct. Distance was a function of the angle the airplane was launched at. The major findings was that 10 degrees was the best angle to launch a plane at. With an outstanding distance of 520 cm. Our hypothesis was supported by the data because the results were similar to previous studies.

7 EN 505

Qerama Caton, Isabellle; Sbayti, Leah

Dorothy Hamm Middle School

Teacher: Araya

What is the Effect of the Design of Paper Airplane on How Far the Airplane Will Fly?

Our project studied how the shape of a plane can affect the distance it flies.

We chose this idea because we wanted to know how much aerodynamics actually help a paper plane fly. To test this we created 3 types of paper planes, Plane A had the most aerodynamics by being small and very pointy, Plane B had a little less amount of aerodynamics than Plane A because it was pointy but longer, and Plane C barely had any aerodynamics being short and not pointy. Each plane was launched using a paper launcher we made to keep the same force and avoid human error if throwing the paper planes by hand.

Our hypothesis was that Plane A would go the farthest because it had the most aerodynamics so it wouldn't slow down when we were launching it. We found that our hypothesis was correct and Plane A did fly the farthest. This project can apply to the real world because paper planes are subject to the same physics as any jet you see in the sky. We now know that jets in order to fly longer flights need to have more aerodynamics.

8 EN 506

Berhanu, Eyuel

Thomas Jefferson Middle School

Teacher: Von Elmendorf

The Effect of MSE Reinforcement Type on How Much Weight MSE Was Able to Withstand

The purpose of this study was to investigate the effect of different types of Mechanically Stabilized Earth (MSE) reinforcement on how much weight MSE can withstand. The independent variable was the type of MSE reinforcement. The experimental group included: ladder reinforcement, metal strip reinforcement, metal mesh reinforcement, and plastic mesh reinforcement. The control group was no reinforcement. The dependent variable was the amount of weight the MSE is able to withstand. The constants are soil type (sand), amount of soil used, testing conditions, and weight increments. The hypothesis was: If metal strip reinforcement is used, then it will hold the most weight. The experiment began by constructing a block of sand 45.72 x 45.72 x 20.32 with two levels of reinforcement on the inside. Then weight was applied by standing on the block of MSE and the sides of the MSE were no longer level and or the reinforcement was visible through the MSE block. Finally the process was repeated until all reinforcement types and control were tested at least 3 times each. The results showed that plastic mesh reinforcement was able to withstand the most weight. These results rejected the hypothesis. In conclusion, the study suggested that plastic mesh or geogrid reinforcement is preferable to metal strip reinforcement when building with MSE.

8 EN 507

Chu, Elaine

Thomas Jefferson Middle School

Teacher: Faqih

Only Rain in the Storm Drain

This study determined the most effective storm drain grate by measuring each grate's ability to screen plastic out and drain water. The IV was the design of grates, which included C grate: rounded rectangular openings, Circle grate: 5mm wide holes, and V grate: sloped bars. The control was no grate. The DV were the number of plastic pieces kept out and the time it took 5L of water to drain through each grate. The constants were the storm drains, containers, and total pieces of plastic. The hypothesis was: If the design of storm drain grates are tested, then the V grate will keep out the most plastic out and drain water the fastest. First, three grates were 3D designed and printed. Identical storm drains were built for each grate and the control out of styrofoam. Next, the baseline drainage time for each grate was measured. Then, 100 plastic pieces were added to storm drains. Finally, the drainage time with debris and the number of plastic pieces kept out by each grate was measured. The results showed the V Grate drained water the fastest with and without debris and the Circle Grate screened out the most plastic, blocking 98 out of 100 pieces. These results in part accepted the hypothesis. In conclusion, the study suggests grates significantly prevent plastic from entering storm drains and that standard grates in cities, like the C Grate, should be replaced with more effective designs such as the Circle and V Grates.

8 EN 508

Hogan, Wyatt

Kenmore Middle School

Teacher: Brown

The Effect of Bridge Type on Strength

It is important to know how much weight the bridge one is standing on or driving on can support. Do you want to walk across a river on a thin layer of cement with no supports? Maybe it could hold you but once more people join you it might not. So, on a model bridge made of popsicle sticks, how much weight could the each type of bridge hold? Four types of bridges were made for this simulation: girder bridge, truss bridge, arch bridge and a cable-stayed bridge. Three of each type of bridge were made and they were placed over a half-meter gap. A string was attached to the bottom of the bridge and weight was added to a bag hanging from the string. Once the bridge broke, the bag was placed on a scale and that weight was added to the weight of the bridge. The hypothesis was that the cable-stayed bridge would hold the most weight because it divides the load the most ways. The hypothesis was supported and the cable-stayed bridge's average weight carried was 12.9 kg (28.43 pounds) which is why the type of bridge that architects would use in crossing the river would be a cable-stayed bridge.

8 EN 509

Metzler, Grace

George Washington Middle School

Teacher: Straube

More Carbon, More Power? The Effect of Carbon Content on Stick Strength

This science fair project was about testing if the amount of carbon fiber content in a field hockey stick affects the speed of a shot ball. This was tested was by using three field hockey sticks, with varying amounts of carbon, and hitting a ball one hundred times toward a target. My hypothesis was if the ball is hit with the field hockey stick with 95% carbon, it will be the hardest. My hypothesis was correct, the stick with the most carbon hit the ball the hardest. Past research shows that carbon is heavy and a stiffer material that causes the ball to be hit the hardest. This science fair project relates and is in the category of engineering because it is focusing on the contents of a field hockey stick and if how it is engineered affects the ball.

8 EN 510

Savage, William

H-B Woodlawn Secondary Program

Teacher: Vanevera

The Mobile Air Quality Sensory Unit

The Mobile Air Quality Sensory Unit (MAQSU) is a handheld (and potentially drone-borne) system for measuring shifts in air pollution. Its purpose is to help people understand how the air they breathe changes as they move through their communities.

Most available air quality data comes from sensors that are costly and fixed in place. These systems measure the absolute amount of pollutants they encounter and are useful for comparing different cities or changes over time in one place.

But they do not empower individuals to understand how their own movements in daily life– like getting closer to major roads, industrial areas or construction sites, or taking a subway– alters the level of airborne pollutants they breathe in. That's where MAQSU comes in.

MAQSU is cheap, portable, and designed to calculate how air quality in one area changes relative to that of another. While this approach sacrifices precision, it is useful for understanding how certain features affect their surroundings.

The MAQSU system consists of two pieces of original hardware and three computer programs, two written in C and one in Python. The main device collects data from a variety of low-cost sensors, and transmits it via radio to a receiver device. Both are powered by Arduino microcontrollers. The receiver is in turn connected to a user's computer for graphing and display. The prototype has a range of up to 100 meters and a battery life of up to 30 minutes.

8 EN 511

Ward, Xaria

Hammond Middle School

Teacher: Maxwell

To Infinity And Beyond: The Drone!

“The glory of medicine is that it is constantly moving forward, there’s always more to learn. The ills of today don’t cloud the horizon of tomorrow but, act as a spur to a greater gift.”-William James Mayo. The quote signifies how medical technology is developing.I've conducted this experiment to aid in the transformation of societal norms by discovering ways to improve medical technology for future use. If we become open-minded to drones playing a role in medicinal fields of study, the likely hood of fatalities would decrease. For instance, imagine someone is miles outside the nearest hospital becomes involved in a severe car collision. In most cases, this type of emergency would require immediate medical attention. That’s when a drone comes into use, the drone would possibly deliver an organ, blood, or any other form of medical necessity for the situation in time to save someone’s life. So why can’t we take this big step right now? It can all begin by asking the question, how does the weight attach to a UAV/Drone affect the charge of its battery? In order to answer the big question, I used a DJI Phantom Standard drone to see how a 10g-20g knoch impacted the drone’s battery while being flown for 10 minutes. The UAV/Drone battery life lasted longer with no weight than when the drone had a knoch attached. However, more trials could have been added and the type of environment the drone was flown, could be more maintained.

8 EN 512

Osmanov, Lyla; Helms, Helena

Gunston Middle School

Teacher: Robles

The Effect of Shape of Wall on the Amount of Water from Waves That Passes Over

Natural disasters cause extreme destruction and many casualties. One of the most destructive types of environmental emergencies are tsunamis. They are incredibly destructive but nobody is doing anything about it. Alerting people of the danger is effective, but warning systems are faulty at best. Tsunamis are becoming more severe with climate change and rising oceans. The question that started the original experiment was: If a structure that could minimize the damage of tsunamis was built, what would be the best shape for that structure? A seawall is a structure built to protect the shore from tidal waves, but experts argue over which wall is the best for deflecting water. Hiroyasu Kawai, a researcher near Tokyo, said: “Even if the tsunami is bigger than the wall, the wall will delay flooding and guarantee more time for evacuation,” which answered an important question the project’s makers had. For the project, a wave tank was built out of a plastic container, and 5 walls with different shapes were attached to the end using secure methods. In order to measure the amount of water that passed over each wall, another container was placed behind each wall to catch the excess water. The levels of independent variable of this project were: vertical wall, inclined wall, reverse inclined wall, a concave wall and no wall (the control). After the experiment was conducted, it was concluded that the concave wall is the most effective shape for minimizing the damage caused by potentially fatal waves.

8 EN 513

Welker, Abby; Clarke, William

Swanson Middle School

Teacher: Seliskar

Structures Withstanding Wind Storms: Shape and Foundation of Structure

Our project is a partner project and we did two different projects. One was the shape of the structure and the other one was the foundation, they're both on how quickly the structure falls down. For the shape of structure experiment's hypothesis we predicted, if the structure of the building are rectangular prism, triangular prism, and a cylinder, then the triangular prism will stay up the longest because it has an angle and the wind will just get split by that angle and won't hit the building head-on. And for the foundation experiment's hypothesis, we predicted, if the material the building stands in is sand then the building will fall the quickest because sand is loose and light and won't support the building as well as potting soil or gravel. First, we made the buildings. We chose to test three buildings, the triangular prism, rectangular prism, and cylinder. We used straw, paper, and toothpicks to make the three buildings. For the shape of the structure experiment we tested each building 10 times in soil for a total of 30 trials. Then for the foundation of the structure experiment we used the triangular prism to test the three foundations, soil, sand, and gravel. After, we compared our results and concluded that for the shape of structure experiment, the data supported the hypothesis by the triangular prism standing the longest. And for the foundation experiment, the data didn't support the hypothesis by the structures standing in sand stood for the longest.

9 EN 514

Delgado, Abigail

T.C. Williams High School

Teacher: Paul

Will It Snap Under Pressure?

How will different shapes affect the amount of weight a bridge can hold?

The objective of my project was to determine what shapes would hold the most weight when made into a bridge. I thought that the Warren truss bridge (triangle) would hold the most weight, and the rectangle bridge would be the second strongest, and the square bridge the weakest. To do this experiment I constructed three different types of bridges and two of each, out of Popsicle sticks and wood glue. Then I tested the bridges by applying weight to each of them until they snapped. The square bridge was the weakest, only holding 48 lbs, and the rectangle bridge held 72 lbs. The warren truss bridge (triangle bridge) was the strongest, holding 86+ lbs because a triangle distributes weight onto two of its sides making it stronger than other shapes. My conclusion is that the warren truss bridge was the strongest because of the way triangles distribute weight, and the square bridge is the weakest because it does not distribute weight equally throughout the shape.

9 EN 515

Ipsen, Evelyn

T.C. Williams High School

Teacher: Matthews

Paper Prosthetics

The objective of this project is to build a non-motorized prosthetic that is cheap, effective, and efficient. The prosthetic doesn't have to be usable by an amputee, as the objective is to prove the function does not have to be complex and expensive; just effective. The prosthetic will be made of cheap materials and should be able to pick up several different objects with several different weights. The first prototype could pick up the primary object, a cup, when it was empty and when it was ¼ full. But no more than that. The second prototype could hold the cup when it was ½ full, but not for very long and no more than that. Even though the prototypes were unable to hold more than a half cup of water, The project was still successful, because a prosthetic was made with simple mechanics that could support weight and pick up common objects.

9 EN 516

Negussie, Yabsera

Wakefield High School

Teacher: Troiano

The Effect of Fabric Polyers on the Amount of C02 Filtered

The purpose of this study was to see the effect of different fabrics as filters for carbon dioxide. The independent variables were the fabrics used for filtration. The experimental group included wool, linen, and polyester. The control group was the amount of carbon dioxide produced by a match. The dependent variable was the difference in the amount of carbon dioxide before and after using the air filters. The constants were where the experiment is held, the time the experiment took place and where the air that was being filtered was contained. The hypothesis was: If wool, linen, and polyester are used as filters, then wool will filter the most carbon dioxide. The experiment was conducted in two separate ways, one included the testing of the control group and another which was for testing the fabrics. To test the control group a match was lit and then placed in a test tube then immediately concealed with a lid. After waiting 5 minutes a CO2 meter was put where the lid had been and kept there for 30 seconds. Then the results were recorded and repeated 4 more times. To test the fabrics two mason jars were used. One mason jar had the mouth covered with the fabric and was modified to have a 5cm diameter hole in the side of the jar. The hole was plugged with a cork. Next, a match was lit and placed into an unmodified jar. The modified jar was placed on top of the other jar

9 EN 517

Sartori, Colin

Yorktown High School

Teacher: McKowen

The Study of Linear Induction Motors and the Velocity of a Pinball

The purpose of this experiment was to determine if linear induction motors can be used in pinball machines to launch a pinball into play or to pull a pinball up a ramp. This experiment is important for pinball machine designers to determine if linear induction motors can be used to replace current technology. The conductor of this experiment had little to no knowledge of circuitry, coding, and linear induction motors before this experiment.

In this experiment, relays were programmed to control a series of electromagnets. These electromagnets propelled the pinball forward by turning on, attracting the pinball, and then turning off to prevent oscillation and capture. The process repeated for the next electromagnets. The velocity of the pinball was measured using an infrared gate implemented with two programmed infrared sensors.

This experiment consisted of three sequential testing phases to achieve the fastest pinball velocity possible: (1) determining the best voltage; (2) determining the best configuration of the electromagnets; and (3) determining the best pulse width and pulse delay of the electromagnets. Of the three voltages tested, the highest was the best, and this voltage was next used to test four configurations of the electromagnets. Using the highest voltage and the configuration yielding the fastest pinball velocity, the “on” time of each electromagnet and the delay time to turn on the next electromagnet were tested to determine the fastest pinball velocity. For comparison, the velocity of a pinball in a pinball machine was also measured. Over 430 experimental trials were conducted.

9 EN 518

Sharma, Ambica

Washington-Liberty High School

Teacher: Brodowski

Solar Friendly Surfaces

This experiment sought to determine whether a solar panel with a different shape and material could be constructed and tested to be as effective as a conventional flat galvanized steel based solar panel. Both the shape and material of the panel were varied in the experiment: flat was compared with corrugated surface, and the panel materials included aluminum, galvanized steel, and copper. Six solar panels were constructed: flat, aluminum; flat, galvanized steel; flat, copper; corrugated, aluminum; corrugated, galvanized steel; and a corrugated, copper solar panel. The hypothesis was that compared to the other five solar panels, corrugated, copper solar panel would show the most growth in thermal energy generated because of the presence of ridges in the corrugated surface allowing it to absorb more solar rays than a flat surface and that compared to aluminum and galvanized steel, copper is a better conductor of electricity and thermal energy.

Each solar panel was constructed and sealed on top of a bread pan filled with water to measure the thermal energy generated based on the change in water temperature after 15 minute time intervals for 30 minutes. Each solar panel was placed under desk lamp with a bright light bulb. All other experimental conditions were the same for all trials of each solar panel. The results supported the hypothesis: compared to other solar panels tested, the corrugated, copper solar panel generated the most thermal energy. The experiment showed that there are alternative designs that are more effective than the conventional design.

9 EN 519

McCormack, Maxwell; Winters, Rutger

T.C. Williams High School

Teacher: Matthews

Bug vs Machine: Creating a Dragonfly Ornithopter

This project focuses on the design, construction, and testing of an ornithopter using electric motors and four wings made from metal and paper. that is based off of the wing and body structure of a dragonfly. Traditionally, ornithopters are robots that flap like a bird; dragonflies are able to fly better than a bird can, for example they can hover and move in all directions . The ornithopter was created to be as light as possible while still having mechanisms that allow it to function. The frame was built out of balsa wood and a motor crank box was made to move struts that connects to the wings. Two crank boxes were connected on the front and the rear of the frame. 3v batteries and a Dr. Meter Power supply was used to test the motors. When the motors of the crank boxes had power flow through them, the motors did not have enough power to lift the wings. The motors may have been too weak to lift or the wings may have been too heavy to use. A future dragonfly ornithopter would need to have lighter wings and a more powerful motor to fly.

9 EN 520

Sanchez, Raphael; Brown, Liam

Arlington Tech and Career Center

Teacher: Le

The Effect of Different Types of Damping Systems on Buildings Affected by Vortex Shedding

The purpose of this study was to test different building dampers on how they reduce building sway from vortex shedding (an effect of wind). There were two independent variables tested. One independent variable compared difference building dampers on their ability to reduce sway. A Tuned Mass Damper (TMD) and Tuned Liquid Column Damper (TLCD) were tested and compared to a building's sway with no damper, which was the control. The second independent variable was the wind speed. Wind speeds of 7.5 m/s and 12 m/s were tested to understand the effectiveness of building dampers at different wind speeds. One hypothesis was that if the pendulum TMD would be most effective in reducing building oscillation. Another hypothesis was that the pendulum TMD would be most effective at both wind speeds. Results showed there was a significant difference in oscillation between a building with a damper and a building without one. However, the difference in the oscillation of a building with a TMD and a TLCD was insignificant. Thus, the hypothesis was rejected. The study suggests that a building will oscillate less if any passive damper is in place.

10 EN 521

Hixson, William

T.C. Williams High School

Teacher: Lowe

Better Lift with Bendy Wings

Airplane wings are constantly slowed by drag, a major factor in decreasing plane performance. Additionally, airplane flaps are limited by only bending at a single joint, inducing more drag and making a wing generate less lift. To combat this, wings have been designed that use experimental joint systems to make a wing that deforms naturally and curves to fit any scenario it encounters. These wings are currently in an experimental phase, and while prototypes are promising, there's a stark lack of data in the field. To combat this lack, an airfoil simulation program named xFoil was used to model the wings deforming and to predict the results of different patterns of deformation. The program was manipulated to produce results for different frequencies of deformations (which corresponds to how close the model is to a smooth curve) and for different severities of deformations (which corresponds to how curved the wing is). This data, when collected, was catalogued using a specially designed airfoil naming system which makes the experiment easy to repeat and apply across any type of airfoil for future experimentation. The data show that these wings performed better than conventional single-joint flaps in the areas assessed, creating higher lift and reducing drag over a wide range of situations. However, the experiment has a vast possibility of modifications to be attempted and catalogued, leaving the future wide open for even more discovery.

10 EN 522

Lakew, Yoseph

T.C. Williams High School

Teacher: Kazanciyan

Fuel Cell

There are many problems in our society, and one of the biggest is pollution. This project looked at how to decrease pollution at one of it's greatest sources, batteries. With the amount of battery waste produced in the U.S alone being equal to 1-2 tons and the effects of battery acid leakage on the environment, it makes batteries some of the most hazardous and dangerous types of waste. Since batteries aren't producers of energy but more like containers for it I wanted to find a reusable non-waste producing electrical mechanism which replicated the batteries' ability to store energy rather than produce it, and in my project, my chosen replacement for the battery was the fuel cell. In the project, a simple $40-60 fuel cell was bought and tested on its energy-storing abilities. The fuel cell, or more, in this case, the reversible fuel cell, was tested using the electrical unit voltage, by using voltage to proves the fuel cell's efficiency, the fuel proved it's reusability by having a similar voltages throughout the repeated trials, as well as proved usability by being able to store energy from several sources, and finally and most importantly the fuel cell proved it's ability to bring a solution to pollution, by producing no waste throughout all the trials, and is compatible with reusable energy (solar energy in this project). In all the fuel right now proved a cost-efficient replacer for the environmental harming batteries.

11 EN 523

Mukhtar, Zeinab

Wakefield High School

Teacher: Megargee

The Advancement of a Disposable Distillation Device

The goal of this project was to use skills from independent study/a summer internship to further advance the prototype of a disposable distillation apparatus designed to aid developing nations that lack access to clean drinking water. Taking into account the limitations/issues with production of the previous year's prototype (high vapor escape rate), this experiment tested to see which method of securing the aluminum foil condenser works the best during the distillation process. 6 oz of tea is placed in a soda can and connected via an aluminum foil condenser to an 8 oz water bottle submerged in a large bucket of ice water. After testing the original prototype, the use of regular tape, and the use of aluminum tape to secure the condenser, the aluminum tape was found to work most efficiently in limiting the amount of escaped vapor. It decreased the vapor escape rate by 25.39%, thus increasing the rate of production by 87.95%. Given the improvement in the rate of production, this prototype's method for securing the condenser shows that the use of disposable and accessible materials can provide adequate solutions to a crisis that affects millions.

11 EN 524

Stearns, Oliver

H-B Woodlawn Secondary Program

Teacher: Sensharma

Continuation of a Hydrogen-Powered Boat

This project is a continuation off of last years project. The goal of this project is to create a new and efficient form of powering a boat. The fuel source that we are using is the water that the boat is sitting in. The water is split into its component parts of hydrogen and oxygen by passing an electric current through ionized water. Once this has happened the gas is then into a combustion chamber where it is recombined to get a propulsive thrust. Last year the experimenter encountered hurdles in getting enough gas. So this year the experimenter focused on a more efficient method of gas generation. In order to do this we switched to a transformer which can amplify a current. This project will focus on the most efficient way of doing this.

7 EV 600

Austin, Cole

Hammond Middle School

Teacher: Claude

Color, Heat, and Light

Why do I get hotter when I wear a dark colored shirt than when I wear a light-colored shirt on a sunny day? I explored this question by looking at how colors affect the absorption of light energy from the sun. I took five different colored jars of room temperature water and put them in the same direct sunlight for one hour. I measured the temperature of the water in each jar at the beginning, middle, and the end to see how much warmer the water was after an hour. I repeated this experiment four times. The average change of water temperature in the lighter colored jars was only about 1-2 degrees centigrade, but the water in the darker jars warmed up a lot more (3-4 degrees centigrade). This experiment proves the hypothesis that if different colors are exposed to light, then their temperature changes will be different, because color affects the absorption of energy from light. This information now helps me make smarter choices about what color of clothes I should wear if I want to feel cooler or warmer outside.

7 EV 601

Brennan, Cecilia

Kenmore Middle School

Teacher: Schnappinger

The Effect of Acid Rain on Grass

The purpose of this experiment was to determine whether the amount of acid rain would affect the growth of grass. The grass was grown in disposable foil pans and each given a certain amount of vinegar, which is the substitute for acid rain. The control got 0 drops of vinegar, the first level got 5 drops of vinegar, the second level got 10 drops, the third got 15 drops and the fourth level got 20 drops. I mixed in this amount of vinegar with 220 milliliters of water and watered the grass with a spray bottle. At the end of 4 weeks, I took 3 measurements from each pan. The hypothesis for this project was that the more vinegar added, the less the grass would grow. The experimental results supported the hypothesis. The controls average height was 8.2 centimeters. The 1st levels height average was 5.5 centimeters. The 2nd levels height average was 6.2 centimeters, which is probably due to the one measurement of 10 centimeters. The 3rd levels average was 6.1 centimeters and the 4th levels average was 3.5 centimeters tall. The qualitative data showed that each level looked more sickly as the amount of vinegar grew. The experiment contributes to environmental science because acid rain is a form of pollution and is affecting the environment.

7 EV 602

DeMots, Avery

Dorothy Hamm Middle School

Teacher: Azzara

Quantitative Effect of Fish on Local Freshwater Ponds

The purpose of this experiment was to determine the quantitative change in the number of microorganisms in local freshwater ponds when fish are removed from the ecosystem, and to learn how fish impact the biodiversity of ponds. The hypothesis for this project is that a lack of fish will cause some of the microorganisms in the test pond to die or decrease from lack of nutrients provided by the fish's presence, namely waste. To design this experiment, an existing local fishpond with running water was used as the control pond, and a pump-aerated test pond was established using materials from the existing pond but without fish. On each of four testing days spaced evenly every two weeks over a forty-two day period, ten drops of water were taken from each pond and examined under magnification to quantify and identify microorganisms, which were then averaged and graphed. This project concluded that the presence of fish does impact both microorganism number and diversity. The largest difference in microorganisms occurred in the warmer months, with the numbers converging as the weather turned cold, either because the organisms were dying off or becoming dormant. This experiment models what could happen if all the fish in an ecosystem were to be killed off or if they relocated themselves.

7 EV 603

Kumar, Zachary

Williamsburg Middle School

Teacher: Bell

Microplastics in the Water Sources of the Arlington, Virginia Area

The use of plastics has become increasingly common. The degradation of these materials results in high levels of microplastics in the environment. Microplastics are identified as a piece of plastic under the size of 5 mm. The purpose of this experiment is to determine if microplastics are present in the Arlington waterways. The hypothesis for this experiment was, if the water source is the Potomac River, then the amount of microplastics will be greater, because the Potomac has the most direct route to the Atlantic Ocean, which consists of high amounts of microplastics. During the month of November water samples were collected at 4 separate sites: Potomac River, Gulf Branch Creek, Rock Creek and Four Mile Run Stream. Samples were collected a total of three times with 5 day intervals. Tap water was used as a negative control. Fifty mL of each sample were put into petri dishes with slides. Then, the petri dishes were baked to evaporate the water. Next, the slides were examined under a microscope. I used a reference to help me identify microplastics. Four Mile Run, trials 2 and 3, Potomac River, trial 1 and Rock Creek, trial 2 all tested positive for microplastics. Tap water and Gulf Branch Creek had no positive samples. The hypothesis was rejected because according to the data, Four Mile Run Stream had almost triple the mean of the Potomac River.

7 EV 604

Secrist, Elizabeth

Mary Ellen Henderson Middle School

Teacher: Johnson

Sediment and Turbidity in Tripps Run

The goal of this experiment is to discover which type of stream bed (armored or unarmored) has the greatest amount of turbidity and sediment. The type of stream bed affects the quality of water as decided by the turbidity and amount of sediment in the stream Data was collected from two different parts of the tributary Tripps Run. One section was armored meaning the stream bed was lined in concrete, while the other section of the stream was unarmored meaning it was not lined with human-made material. Each sector was tested for turbidity by using a turbidity tube and for sediment by measuring the mass of sediment in one square foot.

The results of the experiment supported the hypothesis that stated that the unarmored stream would have a higher amount of sediment and a lower amount of turbidity. When measured for the turbidity amount, the unarmored section had an average of 24.42cm, whereas the armored stream had 30.42cm less with an average of 54.84cm. Sediment was also as expected with the sediment amount in the unarmored stream being an average of 275.8g more sediment than the armored stream. Based on the experiment, armored streams have both clearer and cleaner water.

7 EV 605

Wiggins, Sasha

George Washington Middle School

Teacher: Owens

What's in the Water?

Water pollution is a common issue around the globe. By knowing what is inside it, we can see if we can have it fixed. If the tributary has more people living in the area, it will be polluted because there is more waste being dumped into the river. I used a water testing kit to see the number of materials found in each sample of water, with the Potomac being the dirtiest. After using the filter, I noticed that the levels in residual chlorine had gone up. In conclusion, the experiment worked in most fields but did not work with the residual chlorine.

7 EV 606

Edsall, Alba; Miller, Emmy

Swanson Middle School

Teacher: Ingersoll

Recycled Water and Plant Growth

Seventy percent of the Earth is covered in water, but only 0.4% of the Earth's freshwater is accessible. The purpose of this experiment is to see the effects of different types of recycled water on the height and growth rate of a bean plant. Greywater, rainwater, and tapwater were tested. Greywater is water that has been previously used from bathroom sinks, showers, bathwater. It was hypothesized that rainwater would result in the tallest plants and fastest growth rate because rainwater doesn't contain salts and treatment chemicals that may be found in other types of water. The experiment was performed over a six week period and used a light therapy lamp to mimic sunlight on 30 pole bean plants, ten per each independent variable group. At the end of the experiment, tap water had the highest height of 22.4 centimeters and the fastest growth rate of 4.1 centimeters per week. Rainwater came in second with a height of 22 centimeters and a growth rate of 3.9 centimeters per week. Greywater had the lowest height of 17.9 centimeters and the slowest growth rate of 2.9 centimeters per week. Our data did not support our hypothesis.The investigators believe greywater performed poorly because the greywater came from a shower and may have contained shampoo. Shampoo usually contains sodium, which overtime can stunt growth in plants. Overall, tapwater had the highest height and fastest growth rate, with rainwater closely behind.

8 EV 607

Adams, Elizabeth

Dorothy Hamm Middle School

Teacher: Kennedy

Toxic Turf? The Effect of Time in Saltwater Solution on Amount of Alkalinity, Lead, and Copper in Artificial Turf

This experiment searched for the difference in the chemical levels, specifically lead, of a water solution after crumb rubber soaks in it for differing lengths of time. The independent variable in this experiment was the length of time, and the dependent variable was the lead and chemical levels found. To complete the experiment, crumb rubber samples were collected from a nearby turf field and placed in a salt water solution. The water solution represents sweat, because the athletes who utilize the turf fields release bodily fluids during use. Over a two week period, the samples were tested at differing time intervals, the findings recorded and used in this experiment. Artificial turf has been known to contain carcinogens, so the research done in this project is important as it concerns the safety and wellness of patrons of artificial turf fields. The experiment found no traces of lead, though it did find a difference between the starting chemical levels of the water and the levels at the conclusion of the experiment, which lasted two weeks. Specifically, the alkalinity levels, or the ability of the water to neutralize acids and maintain a balanced pH level decreased significantly over the two week period. The levels of copper levels changed as well, increasing over the course of the experiment, thus demonstrating that the crumb rubber does indeed impact the chemical balance of the water solution.

8 EV 608

Belmont, Benjamin

George Washington Middle School

Teacher: Straube

Super Solar Sensor

Does making a solar cell follow the Sun affect its power output? If the cell follows the sun during the day, then the cell's power output would likely increase. In this experiment, I did five eight-hour trials with a trial being its own day. Using an external power source, the difference between two photoresistant sensors was found. Then, a servo motor moved the solar cell to the brighter sensor. Every six seconds, voltages were tested, producing 100 voltages after the eight hours. All 100 voltages were then averaged out, making a daily average voltage. After finishing the experiment, the hypothesis was revealed as supported. However, the energy used to move the solar cell and test the values may negate the voltage gained. Overall, the experiment went well and the hypothesis was supported.

8 EV 609

Dhakal, Richa

Thomas Jefferson Middle School

Teacher: Snell

The Effect of the Degradation of Microplastics on the Mortality Rate of Daphnia magna

This study was conducted to discover if microplastics, derived from tea bags, would have an effect on the health of Daphnia magna. The independent variable was the number of Tetley tea bags, minus the tea. The experimental group included: 1 bag, 2 bags, 3 bags, and 4 bags. The control group was water with no tea bags. The dependent variable was the number of Daphnia magna alive after an experimental period of 5 days. Lastly, the constants included the amount of water, number of Daphnia magna, containers, environment placed in, and the temperature of the water. The hypothesis was: If 3 Daphnia magna are placed in water boiled with 4 empty tea bags, their mortality rate will be 66% (2/3). 100 mL of spring water was boiled with the set number of tea bags according to trial number. The water was then allowed to cool and was placed into twenty 100 mL containers. The tip of the pipette was cut off by 4 millimeters, and 3 Daphnia magna were extracted and placed into the container. Lastly, Daphnia magna were stored in a dark, cool area to stimulate their natural habitat. After 5 days, the Daphnia were analysed and recorded. The data demonstrated that the Daphnia magna placed in water boiled with four tea bags produced the highest mortality rate; therefore, the hypothesis was accepted. In conclusion, this study suggests that although tea bags are efficient, the microplastics found in them can be lethal to aquatic organisms.

8 EV 610

Fado, Kaitlyn

Kenmore Middle School

Teacher: Price

The Effect of Fertilizer Type on Phosphate and Nitrate Levels

Phosphate and nitrate poisoning in a marine habitat is impacting hundreds of plants and animals all over the world. Excess phosphate and nitrate in a body of water causes the overgrowth of algae and other marine plants. This can cause dissolved oxygen poisoning and a lack of sunlight for developing marine plants. These deadly chemicals enter a marine habitat as soil runoff including phosphate and nitrate. The goal of this experiment was to find which fertilizer type produced the most phosphate and nitrate in its runoff. The fertilizers tested were Vigoro (least expensive non-organic), Scotts Turf Builder (best rated non-organic), Milorganite (least expensive organic) and Vermont Organic (best rated organic). The hypothesis states " If Scotts Turf Builder is used than it will produce the most phosphate and nitrate because it has the highest N-P-K ratio.". Results were collected by using a square foot of each type of fertilizer on soil and testing the runoff for nitrate and phosphate. The results rejected the hypothesis showing that Vigoro produced on average the most phosphate and nitrate with 0.333 ppm of phosphate and 66.6 ppm of nitrate. Runoff with more than 40.0 ppm of nitrate can be detrimental to marine life. This contributes to the issue of phosphate and nitrate poisoning by identifying which fertilizer can harm the environment.

8 EV 611

Harris, Nikolas

H-B Woodlawn Secondary Program

Teacher: Vanevera

Effect of Chemical De-icers on Plant Growth

Tests were conducted on plants planted with salt, sodium acetate, ammonium nitrate, or sodium ferrocyanide. Group 1 was planted with the chemical deicer in the soil, group 2 was allowed to germinate first, and group 3 was testing different concentrations of salt. The plants in group 1 never sprouted and the plants in group 2 all died (excluding controls). But in group 3 plants receiving the two lowest doses survived along with the controls but were always shorter concluding that plants are very fragile when it comes to over salting the roads. This suggests that local governments might consider using sand and gravel when they have snow on the roads because they provide traction without hurting plant life. Chemical deicers should still be used when there is ice on the roads because sand and gravel cannot provide traction on ice.

8 EV 612

Hassen, Zuha

Hammond Middle School

Teacher: Scott

Measuring Surface Tension: The Role Temperature Plays in Surface Tension

Using surface tension to their advantage, organisms like water striders use it to walk on water. Bodies of water throughout the world are beginning to be polluted by major pollutants such as oil and soda. To continue the adaptation of surface tension, the objective of this experiment is to find out if temperature affects surface tension and to determine if it differentiates by each liquid, which includes oil, water, and soda. The creation of a single-beam balance led to the measuring of surface tension, when each substance are in different environments such as the freezer, stove, and counter. It can be concluded that all of the substance's surface tension increased as the temperature decreased and decreased as the temperature increased, proving my hypothesis.

8 EV 613

Klapper, Cheyenne

Thomas Jefferson Middle School

Teacher: Snell

The Effect of Eco-Friendly Plastics on the pH of Water

The purpose of this study was to investigate which type of eco-friendly plastic affects the pH of water the most. The independent variable was the type of eco-friendly plastic. The experimental group included: Reusable, Recyclable, & Biodegradable Thank You Bags and ProGreen compostable bags. There was no control. The dependent variable was the pH of the water before and after exposure to water. The constants were the same temperature of water, the amount of water, wait time, and the size of the eco friendly plastics. The hypothesis was: If biodegradable plastics and bioplastics are exposed to water, then the pH of biodegradable plastics (Reusable, Recyclable, & Biodegradable Thank You Bags) will change the most. Five red solo cups were used to test the pH of each eco-friendly plastics. Water was boiled and poured into the cups, which contained the eco-friendly plastics. The pH of the water in each cup was measured and after 5 days the pH was measured again. The results showed that Reusable, Recyclable, and Biodegradable Thank you bags impacted the water's pH the most. These results accepted the hypothesis. In conclusion, the study suggests that biodegradable plastics change the pH of water the most and could cause potential harm to the environment.

8 EV 614

Pyke, Cassidy

George Washington Middle School

Teacher: Matthews

The Effect of Water Flow Rate and Temperature on the Mass of Compostable Bags

Microplastics are defined as plastics that are smaller than 5 millimeters. These tiny bits of plastic are everywhere. The most dominant threat they pose is to the marine environment. However, they can also pose a threat to humans, because microplastics can work their way up the food chain, to the food we eat. I was interested in finding out what made plastics break down the fastest in aquatic environments. I set up an experiment with four different simulated creek environments. They varied in temperature and water movement. The experimental design included four containers: cold, still; cold, moving; warm, still; and warm, moving. I added compostable bags and measured changes in weight over a two week period. The experiment assumed that mass lost from the bags turned into microplastics in the water. My original hypothesis was that the bags in the environment with a water pump and warmer temperature break down the fastest (i.e., lose the most weight). It turned out that the bags that lost the most weight (microplastics) were the ones that were outside with a water pump. Since I only did this project for two weeks I was not able to see the full range of the bag breakdown. However, if the rate of deterioration remained constant, the bags would still not have broken down fully after a year. I estimated that nearly 50% of material would remain intact after 6 months with more than 25% after 1 year.

8 EV 615

Shapiro, Harriet

Thomas Jefferson Middle School

Teacher: Leonberger

The Effects Of Mineral versus Chemical Sunscreens on the Hatching Viability of Brine Shrimp

The purpose of the study was to find the effects of mineral versus chemical sunscreens on the hatching viability of brine shrimp. The independent variable was the type of sunscreen. The experimental group included two mineral sunscreens (ThinkSport and Neutrogena) and two chemical sunscreens (Coppertone and Aveeno). The control group was no sunscreen. The dependent variable was the number of brine shrimp hatched. The constants were the amount of sunscreen, the amount of water, the Sun Protection Factor (SPF) of the sunscreens, the number of brine shrimp cysts, and the salinity of the water. The hypothesis was: The cysts not exposed to any sunscreen will be the most likely to hatch. The experiment was conducted by filling 5 glasses each with a solution of half a liter of water and .05 ml of the corresponding sunscreen. The glasses were centered under 3 incandescent bulbs and 50 brine shrimp cysts were placed in each. Every 12 hours for 72 hours, the number of hatched brine shrimp were recorded, and at the end of the three days, the water and brine shrimp were disposed of through the drain. The results showed that the control group (no sunscreen) allowed for the most cysts to hatch. The results supported the hypothesis. In conclusion, the study suggests that while all sunscreens are at least somewhat harmful to the environment, those containing oxybenzone are especially so.

8 EV 616

Srinivasan, Harper

H-B Woodlawn Secondary Program

Teacher: Vanevera

How Much Trash Can Humans Save?

The reason why I chose to do my experiment is because I am really interested in zero waste and saving the planet. I also think that if other people go zero waste, there might be less litter, and a lot less trash in landfills. My research question is “How Much Trash Can Humans Save?” My hypothesis is that the overall trash usage will be reduced by 25% because I believe that usage will be reduced by not a ton, but a bit. I tested this hypothesis by conducting my experiment and calculating my results. The results for this experiment were that week one had a higher average amount of trash used than week two. In conclusion the hypothesis was not supported and the overall trash usage was reduced by about 70%.

8 EV 617

Zambrano, Victoria

Hammond Middle School

Teacher: Scott

What is the Most Hazardous Chemical Found in Northern Virginia's Rainwater?

For my project, I wanted to test What is the most hazardous chemical found in Northern Virginia’s rainwater. My purpose in conducting my experiment was to observe and analyze if locations have an influence on how hazardous the rain is. After seeing children play out in the rain, I had to ask myself if it was actually safe for them to do it. I've been analyzing water for 7 years. I used my background knowledge of water to create my question. My experiment contained two procedures. One of the procedures was how to collect the water, and the second one was how to test the chemicals in the rainwater. The percentages of the rainwater were 36% was at the high level, 54% was at its low level, and 10% was at its ok level. My hypothesis turned out to be partially correct. The pH level was one of the hazardous chemicals found in the different rainwater locations, but it was not the only chemical that was not at the level it was supposed to be. The Total alkalinity, lead, copper, iron, chromium/cr, bromine, nitrite, fluorine, sulfide were also chemical/elements that were at high and low levels from what they were supposed to be. The only thing I would change would be is to ask permission to conduct my experiment in an actual laboratory.

8 EV 618

Coutlakis, Elina; Thomas, Sophie

Williamsburg Middle School

Teacher: Warden

The Effect of the Type of Material on the Amount of Water Percolated

Protecting the Chesapeake Bay watershed is important in this region. If contaminated runoff can be controlled, the Chesapeake Bay can stay cleaner. Rainfall can seep into aquifers over permeable surfaces, thereby reducing runoff, but not impervious ones. Local counties often require permeable driveways in new building projects as a way to protect the watershed. The results of this project can help people make choices during construction.The independent variables tested were sand, gravel, stone, and soil. The control was no material. The materials were tested dry and wet because often rain falls onto wet surfaces. Less water percolated through the dry material than the wet. This was attributed to pores being filled in the dry material, trapping the water instead of running through. The second application of water onto the material flowed through because the pores were already filled. The hypothesis was, if water is poured on the wet gravel then the second most amount of water (to the control, no material) will percolate through because it is the most porous of all of the materials. Larger particles of rock leave bigger pores between the material which will allow water to more easily pass through than stone, soil, sand, and gravel. Our hypothesis was proven to be correct, wet gravel had the most water percolation. Further experiments related to this topic could be to test the surface material at an angle, using coarser gravel types, or pouring more water onto the material.

8 EV 619

Galotto, David; Galotto, Naomi

H-B Woodlawn Secondary Program

Teacher: Vanevera

Which Straws are Better for the Environment and Consumers?

The objective of this experiment was to identify which disposable straw is most favorable to the environment and consumers. This experiment took three different types of disposable straws—paper, plastic, and biodegradable plastic— and subjected them to three tests. Test 1 was to determine whether the straws could biodegrade within two months. The hypothesis for Test 1 was that the paper and biodegradable plastic straws would biodegrade and the plastic straws would not. The paper straws fully biodegraded. The plastic and biodegradable plastic straws did not biodegrade. Test 2 assessed the negative effects on the quality of each type of straw after sitting in a glass of water for four hours. The hypothesis for Test 2 was that the paper straws would be negatively affected and that plastic and biodegradable plastic would be unaffected after sitting in water. The paper straws became flimsy and soggy after being in the water. The plastic and biodegradable plastic straws maintained the same quality as at the beginning of the test. Test 3 analyzed which type of straw people preferred to use in their drink. The hypothesis for Test 3 was that the paper straws would be unfavorable while the plastic and biodegradable plastic straws would be more favorable. Many people found the paper straws unfavorable to use. The plastic straws were somewhat favorable, and the biodegradable plastic straws were fairly favorable. Overall, paper straws were found to be the best for the environment and biodegradable plastic straws were the best for consumers.

8 EV 620

Schultz, Thomas; Klein, Erin

Swanson Middle School

Teacher: Seliskar

The Effect of Different Soil Amendments on the Amount of Water Drained Through the Soil

We tested how different types of soil amendments, (Old Compost, New Compost, Vermiculite, Peat Moss, and Nothing added (as a control)) affects the amount of water drained through an amount of soil, with Variegated Liriope Lilies planted in it. We would pour 100 Milliliters of water into a pot, and let it sit for five minutes, then we measured the amount of water that drained through and concluded which levels drained the most water, and which ones held on to the most water.

8 EV 621

Sokolove, Charles; Schmauder, Logan

Jefferson-Houston School

Teacher: Calderara

Water Quality Analysis in ACPS Drinking Water

Our experiment is to test some different characteristics of the drinking water in certain ACPS drinking water chosen by age, which included, George Washington Middle School (1935), James K. Polk Elementary School (1965), and Jefferson-Houston School (2014). Our test was compiled of a couple of things. We collected 5 samples of water (mL vary) from 3 different water fountains in those 3 schools. The things we tested for were: chlorine, hardness, iron, copper, and pH.

9 EV 622

Allen, Lily

Washington-Liberty High School

Teacher: Brodowski

The Effect of Different Fuels on the Growth of Elodea canadensis

The intention for this project was to show the effects of different fuels on the growth of Elodea canadensis, and therefore demonstrate why proper disposal of fuel and similar materials is so important. Today the world faces lots of environmental issues, but water pollution, although an extreme conflict, can be fixed with proper education and changing of disposal methods. The experiment's independent variable was type of fuel, and the levels were gasoline, diesel, ethanol based e85, and a control being regular water. The hypothesis was that if ethanol is tested on elodea, then it will grow longer than elodea tested on by diesel or gasoline, because ethanol based e85 is a biofuel made specifically to be more sustainable.

The results showed that there was no statistical difference between levels and the hypothesis was not supported, but there was lots of room for improvement within the experiment in order to make the data support the hypothesis. The results also showed negative growth on average with all the levels of the IV, which supports the research and the general idea that fuels are not beneficial for plants, and in order to protect aquatic plants like Elodea canadensis, fuels should be disposed of more properly.

9 EV 623

Bolejack, Anna

Washington-Liberty High School

Teacher: Sotomayor

The Effect of the Topography of the Slope on the Magnitude of the Landslide

This experiment was to alert others about the conditions that increase the risk of landslides. The purpose of the experiment was to see if the magnitude of the landslide would change based on the topography of the slope. The hypothesis is if the slope was cut at a ninety degree angle or if more clay was added, it would create a bigger landslide. For the first experimental group, clay was piled so that it was 2/3 of the slope with the rest of the dirt on top. This slope was at its repose angle. The second experimental group was the same as the first except it had a cut of ninety degrees. The third experimental group was the same as the second, but the clay was 1/3 of the slope. Then, water was sprinkled on the slope at a rate of eight mm per hour. The results showed that more dirt slid off the slope and therefore created a bigger landslide when the slope was cut. The results also showed that decreasing the amount of clay makes less of a landslide. It also showed how water can fill the gaps in between the dirt particles and cohere them. In the first experimental group, there was no landslide, but signs of movement were shown. Cracks along the side and peeling at the top showed how the dirt was kept from sliding by the water. In the end, changing different aspects of the slope's topography changed the amount of landslide.

9 EV 624

Estevao, Rebecca

Washington-Liberty High School

Teacher: Brodowski

The Effect of the Types of Detergent in Water on the Amount of Seeds that Germinate

This experiment was conducted to determine if water polluted with detergent had a negative effect on the germination of radish seeds, and to discover whether detergent alternatives were more beneficial to the environment. In the experiment, the seeds were tested with regular detergent, eco-friendly detergent, baking soda, and the control group of water. It was hypothesized that baking soda would have the smallest effect on the germination. The experiment was conducted by leaving the seeds in petri dishes soaked with a solution of detergent and water. After experimentation, it was concluded that all types of detergent had a negative effect on the germination of seeds because the control group had germinated significantly more seeds. Of the types of detergent, regular detergent germinated the greatest number of seeds followed by green detergent, then baking soda. This experiment proved that detergent alternatives are more harmful to the environment than regular detergent is.

9 EV 625

Felker, Kara

Washington-Liberty High School

Teacher: Brodowski

The Effect of Biodegradable Plastics on Amount of Degradation in a Given Time Period

The purpose of this study was to find the type of biodegradable plastic that degrades the fastest. The independent variable was the type of plastic the straws were made of (PP, rice-starch based plastic, PLA). The control group was non-biodegradable plastic straws. The constants were time for biodegradation (50 days), and conditions for biodegradation (type of soil, type of bucket, depth of bury). The dependent variable was the percent of mass loss that occurred over a 50-day period. The hypothesis was: if different types of bio-based plastics are tested for amount of degradation during a 50-day period, then rice-starch based plastics will degrade the most. Twenty straws of each kind were split into ten groups of two. Then the mass of each group was found, and they were then buried in soil and left to degrade for 50 days. After 50 days, the straws were dug up and a new mass was found from which the percent of mass loss was calculated. The data showed that rice-starch straws biodegrade the fastest. This supported the hypothesis. In conclusion, rice-starch plastics pose a promising solution to the plastic pollution problem. Future investment into the advancement of rice-starch plastics technology will help to keep the earth clean for generations.

9 EV 626

Flannery-Goodman, Lucy

Yorktown High School

Teacher: Dorman

The Effect of the Speed of Stream Water on the Number of Benthic Invertebrates in the Stream

The purpose of this experiment is to observe how more precipitation and faster runoff, due to climate change, would affect benthic invertebrates.

The data is collected from four different streams with different speeds of water. The number of benthic invertebrates in each stream is then collected.

The speed of the water (m/seconds) and the number of benthic invertebrates in each of the streams after 10 trials are collected. The ANOVA test concluded that the IV did have an effect on the DV, and it was not just natural selection. The p-value was 0.05, so the null was rejected.

The statistical tests also concluded that the stream with the highest water speed (0.45 m/sec) had the greatest number of benthic invertebrates in it, and the greatest median, mode, standard deviation, and range. The stream that had the lowest water speed (0.15 m/sec), had the least benthic invertebrates in the stream, and the lowest median, mode, standard deviation, and range.

This is supported by scientific research that stated that benthic invertebrates do best in waters that are mildly fast and consistently sped, which was shown in the data.

To expand on this experiment, I would do more research on where the water going into these streams were coming from.

9 EV 627

Goeke, Madi

Washington-Liberty High School

Teacher: Averette

The Effect of Algae Species Grown in a Photobioreactor on Algal Biomass for Biofuel Production

The overuse of petroleum-based products is one of the most prevalent environmental issues on Earth, and gasoline is one of the leading contributors. With known detrimental effects on the planet and various organisms, the presence of conventional fuels in the environment calls for a solution that can be implemented through an alternative source of energy known as algae. In this experiment, four algae species (Chlorella vulgaris, Nannochloropsis, Tetraselmis chuii, and Isochrysis galbana) were tested for their effectiveness at producing optimal biomass. These species were grown in a home-built, open-system photobioreactor to maximize CO2 intake, allowing for a larger biomass yield. A culture media consisting of sterilized water, salts, and nutrients was created and dispersed into various bottles, which were then filled with 50 mL of their given algae strain. After a three week growth period, the solutions were dewatered through a method known as flotation. In this process, the solutions were boiled and the algae cells adhered to the rising bubbles, producing a layer of algae on the surface of the water which could be skimmed off. T. chuii proved to be the most effective with an average of 162 mg of biomass, compared to the control's 101 mg of biomass. Nannochloropsis was significant with 144 mg, and I. galbana was insignificant with an average biomass of 68 mg. The diameter of the organisms appears to be the reason for T. chuii's high success, as T. chuii has the largest diameter out of the given algae species at approximately 10µm-14µm.

9 EV 628

Klug, Aaron

Wakefield High School

Teacher: Fuamenya

Shake It Up

The purpose of this project was to find out which type of soil would be best to build a building on and provide the most stability during an earthquake. It seems that earthquakes are in the news pretty regularly and for that reason has provided the drive for this experiment. The hypothesis states that if different soils; dirt, sand, and gravel are tested then the gravel would provide the most stability for a building during an earthquake because its parts won't move as dirt and sand.

Two items were built for this project. A Lego tower was built and represented the building. A shake table was also built with the top and bottom of a binder, rubber balls and rubber bands. The shake table was used to simulate an earthquake. All three of the soil types were tested twenty times. The results were very interesting and the expected outcome did not occur during the experiment.

9 EV 629

Krajicek, Caroline

Washington-Liberty High School

Teacher: Sotomayor

The Effect of Rising Sea Surface Temperature on the Intensity of Hurricanes in the Gulf of Mexico from 1996-2018

The purpose of this experiment was to discover if rising sea temperatures affect the intensity of hurricanes in the Gulf of Mexico from 1996-2018. Global warming is becoming more of a significant issue in our world and has many negative effects on the environment. For example, global warming increases the amount of heat in the atmosphere and surface temperature of the ocean, which may have a significant effects on hurricanes. Based on the data collected the null hypothesis (rising sea temperatures will have no effect on the intensity) will be accepted because there was no significant effect on the intensity. As a result, the hypothesis (rising sea temperatures will have an effect on the intensity) must be rejected.

9 EV 630

Leland, Erin

Washington-Liberty High School

Teacher: Sotomayor

The Effect of Proximity to Water on Soil Quality

The purpose of this study was to test the effect of proximity to a water source on the quality of soil. The hypothesis was: If soil at 5, 10, and 15 meters from water is tested for pH, nitrates, phosphates, and potassium, then the soil sampled from 15 meters from a water source will the highest water quality overall. This experiment was completed by taking soil samples from each level (pH, nitrates, phosphates, and potassium) at each location (Alcova Park, Glen Carlyn Park, and Bon Air Rose Garden). These samples were tested for each substance (pH, nitrates, phosphates, and potassium) and then the results of these tests were recorded.

Results suggested that there was not a high variance in the results and that there was no obvious correlation between the distance from water and soil quality. The null hypothesis was accepted based on the data shown in this study. In conclusion this study showed, based on numerous data points, that the proximity to a water source does not impact the soil quality parameters of pH, nitrates, phosphorus, and potassium.

9 EV 631

Papacosma, Charlotte

Wakefield High School

Teacher: Troiano

The Effect of the Urban Water Cycle on Microplastic Counts

The purpose of this experiment is to investigate whether the microplastic count in a sample fluctuates with key steps in Arlington's urban water cycle, as well as to conduct research regarding microplastic pollution and how individuals can reduce it. The urban water cycle, or the way water is sent from its source, through our societies, and back into the environment, is designed to remove many pollutants from our water. The researcher hypothesized that when samples were taken from key steps of the urban water cycle as well as a location that was not directly affected by the cycle, the tap water would have the fewest microplastics. This is because the portion of the cycle between when river water is filtered and when it exits our taps is a closed system, thus ensuring no outside pollution sources affect this water's composition.

Once two samples were collected from each location, a filter apparatus was constructed and each sample was filtered through a 0.45-micron filter paper. The papers were then viewed under a microscope and examined for microplastics. After the results were analyzed, the data was found to support the hypothesis, as the tap water had the lowest average microplastic count. The effluent was found to have the highest count, most likely due to dumping, laundering, and industry processes. Future repetitions of this experiment may be improved by collecting a larger, more varied set of samples, and by using a less subjective method when counting the microplastics, in order to prevent miscounting.

9 EV 632

Carlson, Isla; Vaughan, Kathleen

Wakefield High School

Teacher: Fuamenya

The Effect of E. coli on the Amount of Electricity Produced in a Microbial Fuel Cell

The purpose of this experiment is to provide information that can potentially improve living conditions in many large regions of Africa. According to Blimpo, “More than 600 million people in Africa live without electricity, including more than 80 percent of those residing in rural areas.” Microbial Fuel Cells (MFC) can be an efficient and powerful solution. A Microbial Fuel Cell converts natural chemical energy into electrical energy through the electron exchange between an anode chamber and a cathode chamber.

In this experiment, benthic mud, pasteurized mud, pasteurized mud with E. Coli, and lastly pasteurized mud with E. Coli are mixed with a sugar source were tested

The hypothesis of this experiment is, if E. Coli is added to pasteurized soil, a higher amount of electricity will be produced than the soil by itself because the E. Coli will eat, reproduce, and break down the soil efficiently, therefore producing the most electricity. The independent variable will be measured using a multimeter in mV.

In conclusion, the hypothesis was supported because adding E. Coli to a soil solution increases the voltage creation of a Microbial Fuel Cell. The Microbial Fuel Cell created was able to develop an average of 226.4 mV. So theoretically, if five of these Microbial Fuel Cells were placed in a series circuit the voltage capacity would be of a single AAA battery. This has large and potentially life-changing implications for those who need to create their own sustainable and cheap electricity.

9 EV 633

Dembosky, Alexa; Gordon, Alexandra

Washington-Liberty High School

Teacher: Brodowski

The Effect of Filter Material on the Amount of Bacteria Found in Filtered Water

Carbon, fabric, and sand were tested as filter mediums to see which was the most effective at removing bacteria from water collected from Four Mile Run. The filter systems were built out of out of 8.55 ounce plastic Coca-Cola bottles, rubber bands, and a layer of cheesecloth. Bacteria test strips were used to analyze the amount of bacteria from each of the samples after filtration. Our hypothesis was that the fabric filter would perform the best, because of the research that was done on Sari filters that have been commonly used by women and families in areas without access to clean drinking water.

The purpose of the experiment was to explore simple and accessible methods of individual water filtration to see which would be the most effective in removing bacteria. Large-scale water sanitation facilities and desalination plants are incredibly expensive, and take a lot of time and resources to put in place.

Through our experiment, it was discovered that the cloth filter was the most effective at removing bacteria compared to the carbon and the sand. This discovery supported our hypothesis, and our research on the Sari filters. This has created many questions and opportunities for future experiments relating to basic water filtration, including which kind of fabric can remove the most bacteria. This experiment and experiments built off of it can shed light on easy and effective ways to access clean water.

9 EV 634

Middleton, Sarah; Hay, Elizabeth; Watkins, Evelyn

Wakefield High School

Teacher: Muñoz-Gonzales

The Effect of Rain on the pH Level of Running Water in the DC Area

This experiment was conducted to test the effect of rain on the pH of different bodies of water. The reason behind this experiment was to know if the pH of each body of water is changed after an episode of rain. The hypothesis is "if it rains for more than 30 minutes, then the pH of the river or stream will be more acidic, because the rain is acidic." 225 ml of water were collected from each body of water and were measured using a pH meter and an electric thermometer. After measuring the pH the data was recorded and analyzed. The pure rain sample was a little acidic but the water samples from each body of water was a bit basic. This did not support the hypothesis because the hypothesis said that the bodies of water will be more acidic after the rain. One reason for this will be that not all rain flows directly to the river or lake, much water flows through cities, residences and perhaps farms. This means that all the things that are in those places are in the body of water, and those things are what make the water collected will be basic. The hypothesis was incorrect because the samples were more basic after the rain.

9 EV 635

Ruiz, Nicol; De Leon, Ester; Peterson, Kyra

Wakefield High School

Teacher: Tran

The Effect of Colored Dyes on Water Quality

The purpose of this investigation is to see if dyes that are thought to be safe and non-toxic are actually safe for the environment. The dyes in clothes may be washed out and once it enters the ecosystem, it can end up in grounds and rivers which can harm aquatic organisms. Different colored dyes were used in a simulated washing cycle and the resulting detergent water was then tested for toxicity by measuring the pH, alkalinity, nitrates, and total nitrates, as proxies for water quality.

A white shirt was cut into several pieces and soaked in different solutions of colored dye against undyed fabric serving as the control. After the cloth was dyed, the fabric was washed and the resulting detergent water was tested. Data was collected for each dye with three trials.

In conclusion, the purple and aquamarine dyes were more toxic than the control, but the scarlet was less toxic than the control. However, none of the dyes were considered to be toxic as per federal guidelines.

10 EV 636

Alcorn Rodrigue, Amelia

Wakefield High School

Teacher: El Gamal

The Effect of Rising Sea Levels on Native Virgina Plants

The purpose of this experiment was to determine the effect of saline soils on the growth of Virginia plants. The rising sea level does not just affect humanity but all of the natural world, mostly ecosystems found on coastal locations. Coastal habitats are put in danger as salt water contaminates fresh water resources. Not only does salt water contamination affect aquatic animals but plants found near coastal habitats as well. Plants can be exposed to salt through the soil. If different plants of Eupatorium perfoliatum (Boneset) are watered every day, and half of them are in soils with ⅛ a tsp of salt and the others are controls with normal soil, then the plants with no added salt will have a larger amount of root growth because plants that are not salt resistant are more likely to have stunted growth from environments that have a higher salinity than their natural habitat.

To test this theory, a control group of Boneset seeds were planted in natural potting soil. Boneset seeds in the experiment group were planted in potting soil with ⅛ tsp salt and each were watered daily. After three weeks of observing the growth of Eupatorium perfoliatum roots and recording the growth in millimeters, it was found that the control had a higher germination rate with a ratio of 3:1. The average growth of the constant was 11mm. Whereas the seeds planted in the saline soil only had one seed that germinated. The average for the experiment was 8.3mm.

10 EV 637

Ballantine, Lillian

T.C. Williams High School

Teacher: Briestansky

How Cool is Your Roof? The Effect of the Albedo of Roofing Materials on the Surrounding Temperature

How cool is your roof? Man-made materials, such as asphalt, affect the environment by absorbing and retaining heat. The purpose of this experiment was to see how different roofing materials had effects on the environment. In order to measure this, five materials were used, including Charcoal, Weathered Gray, and Slate Roval Sovereign 3-tab shingles; a mirror due to the absence of white shingles; and air (the control). These were all tested for their albedo (independent variable), or the fraction of incident radiation that is reflected by a surface or body. In this experiment, the Charcoal shingle was the lowest and lest reflective, followed by Weathered Gray, Slate, and finally, the mirror. The corresponding temperatures (dependent variable) of the materials were measured and proved the hypothesis wrong: if roofing materials with different albedos are placed in direct sunlight, then the roofing material with the lowest albedo will have the highest increase in temperature and retain heat for the longest amount of time. The data did not support the hypothesis, as the Weathered Gray Shingle proved to be consistently hotter than the Charcoal Shingle.

10 EV 638

Futrell, Sophia

Yorktown High School

Teacher: Hessler

Comparative Faunal Analysis on Four African American Sites in Easton, Maryland

Faunal remains (n=1400) excavated from four historical sites in Easton, MD, support our hypotheses about 18th- through 20th-century African American food ways. The Bethel and Asbury sites (18TA441 and 442) had a wide variety of butchered, domesticated remains, as social gatherings were common in these churches and schoolhouse. The high-income Freeman house and farm (445) had more remains of expensive meats (e.g., beef, pork); the middle-class Buffalo Soldier's house (440) had fewer.

10 EV 639

Houck, Summerson

T.C. Williams High School

Teacher: Briestansky

The Effect of Biomass on Biogas

What is the effect of different amounts of biomass on biogas?

This question is important to answer because biogas is a positive effect for the world, but what many people don't know is if different amounts of biomass create different amounts of biogas. With the conclusion to this question it can help others understand the biogas process and how much biogas is produced with different amounts of biomass. Currently right now many scientists are researching anaerobic digestion and how it plays a role in biogas production. Scientists are also trying to figure out how much biogas they can get from cow manure.Today global warming is becoming a bigger issue everyday because of fossil fuels and other harmful sources of energy. Scientists have been researching a lot more about an alternative way of energy called biogas. Biogas is created when animal waste, crops, and industrial residue is broken down. The renewable energy from the biogas is then used as a heating source. This experiment is important scientifically because we can learn if using more biomass is better than using less biomass. Biogas doesn't harm the environment at all, it actually helps it by capturing methane emissions and turning it into energy. This topic is relevant to the world because by knowing the conclusion, it can help us take care of our environment better and reduce methane emissions. My experiment tests this by seeing what different amounts of biomass does to biogas.

10 EV 640

Koumans, Elizabeth

Yorktown High School

Teacher: Lovrencic

The Effect of the Concentration of Oxybenzone on the pH of Chlorella Growth

As sea levels rise and trash contaminates Earth's bodies of water, it is more important than ever to protect marine environments. Oxybenzone, a chemical found in many cosmetic products because of its ability to block ultraviolet light, is a major pollutant to marine areas. The purpose of this experiment was to find the effect of oxybenzone on a common type of green algae, Chlorella vulgaris. This was tested by growing Chlorella with three different different types of sunscreen, with 0% oxybenzone, 4% oxybenzone, and 6% oxybenzone, as well as one control level with Chlorella growing with no sunscreen. The Chlorella was left to grow for seventeen days. Afterwards, the pH of the Chlorella growth was measured. The hypothesis was that increasing the concentration of oxybenzone in a solution with Chlorella would result in a lower pH due to higher levels of carbon dioxide in a solution with less algal growth. The data supported the hypothesis. With a p-value of 0, the data was shown to be statistically significant. These results were most likely found because oxybenzone has been found to directly inhibit mechanisms of photosynthetic electron transport and respiration electron transport, causing a smaller production of adenosine triphosphate (ATP), and restricting the energy supply for the algae's cells. Future studies could be done to find the effect of different active ingredients in cosmetic products on algae or the effect of oxybenzone on other types of algae and coral.

10 EV 641

Mathews, Katie

T.C. Williams High School

Teacher: Briestansky

What's in Your Water?

Water quality and pollution in local waterways is a significant problem that continues to get worse in many areas. When it rains, animal waste, pesticides, and fertilizers wash pathogens and nutrients into waterways. These often carry bacteria and viruses that can hurt the life in waterways and stimulate microorganism growth and reproduction, reducing the dissolved oxygen content. When oxygen levels in water decrease, fish and other animals can't get the oxygen needed to live. The dead fish and other aquatic species degrade the water quality. This project analyzed the effects different types of fertilizers had on the dissolved oxygen levels in local creek water. It was hypothesized that the phosphorus fertilizer would have the most damaging effects to the dissolved oxygen levels after 72 hours and the compost fertilizer would have the least damaging effects. (1) compost, (2) organic, (3) nitrogen based, and (4) phosphorus based fertilizer were added to samples of water and left for 72 hours before measuring the new level of dissolved oxygen. After 72 hours, the hypothesis was proven true; the phosphorus fertilizer caused the biggest drop in oxygen levels, while the compost fertilizer had the smallest drop in oxygen levels. This likely occurred because excess phosphorus causes nutrient pollution which leads to lower levels of oxygen. Excess nitrogen also has similar effects which is likely why the nitrogen based fertilizer had the second most damaging effects after the phosphorus based fertilizer.

10 EV 642

Mukhtar, Suheila

Wakefield High School

Teacher: El Gamal

Renewable vs Nonrenewable Fuels

My experiment is designed to show a small-scale comparison between renewable and nonrenewable fuels, and if renewable fuels can realistically live up to the energy production of nonrenewable fuels to support our world. And so, with the growing popularity of this topic, I asked the question: Can a biofuel produce an equivalent amount of energy as the same amount of a nonrenewable fuel? I conducted my experiment using vegetable oil and motor oil #30. I hypothesized that the vegetable oil would not be able to produce the same amount of energy as the motor oil because renewable fuels require more maintenance, land, and quantity to produce at that level. In order to find energy produced from both fuels, I soaked cotton cordage in a fuel and burned it, then watched its effect on the temperature of water in a can. This experiment also tested my creativity, as I had to create thicker cotton cordage using thinner cords and shape my Styrofoam cups to fit my can. At the end of my experiment, I was shocked at how realistic my trials were, where the motor oil inflicted greater harm and damage to the cordage compared to the vegetable oil, imitating the real effects of nonrenewable fuels on the environment. And even though my hypothesis was supported, because of how close the vegetable oils' energy production was to that of the motor oil, I still believe that renewable fuels have a shot at replacing nonrenewable fuels.

10 EV 643

Odenwelder, Lily

Washington-Liberty High School

Teacher: Bohn

The Effect of the Concentration of Nitrogen in Fertilizer on the Average Length of Leaves and Number of Leaves per Plant

The purpose of this experiment was to find an effective fertilizer that is a practical option for suburban use, with a lower nitrogen concentration because nitrogen is a prevalent nutrient pollutant. The project tested fertilizers with a high nitrogen concentration (30-0-0 NPK solution), a medium concentration (12-0-0 NPK mixture), a low concentration (2% nitrogen), and a no nitrogen concentration (water). The hypothesis was if the highest nitrogen concentration fertilizer is given to the plants then they will have the longest leaves and the most leaves will grow because nitrogen is a nutrient that aids in plant photosynthesis. The data did not support the hypothesis since the plants fertilized with this solution grew the second smallest leaves and the second smallest amounts of leaves, with averages of 9.20 mm long and 1.64 leaves per plant. The 2% nitrogen fertilizer's plants had the most leaves, averaging 2.48 leaves per plant, and the 12% nitrogen fertilizer grew the plants with the largest leaves, averaging 13.04 mm long. The water level grew the fewest number of leaves and the smallest leaves, with averages of 1.56 and 7.48 mm, respectively. Trends in plant growth were attributed to the fertilizers' nitrogen concentrations since the two levels whose plants grew the most had the most reasonable nitrogen concentrations. These two fertilizers with low and medium nitrogen concentrations are therefore effective and practical for suburban use because the plants treated with them grew well and they pollute less nitrogen into the environment.

10 EV 644

Quinn, Sam

Yorktown High School

Teacher: Lovrencic

Nutrient Runoff: The Effect of Soil Type

The use of fertilizers contributes to pollution in streams and other water bodies. The purpose of this experiment was to find a solution to reduce nutrient runoff. In my experiment, I tested what effect different types of soil had on reducing nutrient runoff. For my experiment, I made a fertilizer mixture and poured the mix into cups filled with different types of soil. The cups had holes in the bottom so that the fertilizer mixture drained through the soil and into empty cups beneath. I measured and compared the total dissolved solids (TDS) of the fertilizer mix before and after being filtered through the soil. Each soil tested increased the TDS measurement of the fertilizer mix except for peaty soil. The testing of peaty soil resulted in the only reduction. It reduced the TDS measurement of the fertilizer mix from 1430 ppm to an average of 1110.1 ppm, a 319.9 reduction. I assume peaty soil did the best because it had an appropriate amount of porosity for absorbing nutrients. All of my data was quantitative. I performed an ANOVA statistical test on my data. The p-value was greater than .05, which means that the results of my data were insignificant. To improve on my experiment, I could obtain pure scientific grade soils and use a device that ensures uniform holes in each cup.

10 EV 645

Taylor, Mason

Wakefield High School

Teacher: El Gamal

The Effect of Nanosilver on Water Quality

Silver nanoparticles, also called nanosilver is a submicroscopic unit that can be found in over 400 consumer products. Nanosilver is typically used for its antimicrobial effects and characteristics. Nanosilver does eventually get washed off, meaning it ends up in aquatic ecosystems. The purpose of this experiment is to see if there is an effect of nanosilver on water quality. The hypothesis, which states that if a higher amount of colloidal silver is added to the pond water, then the parts per million (ppm) will decrease, because of nanosilver's antimicrobial effects, was tested.

In this experiment, 100mL of pond water were placed into 4 groups of 5 cups, and a different amount of colloidal silver were added into each group of cups. The initial parts per million (ppm) was measured before the addition of colloidal silver, and the parts per million after 5 minutes after the addition. The results showed that there was an effect of nanosilver on water quality, as the parts per million decreased after the addition, meaning the quality was getting better.

10 EV 646

Glanz, Madeline; Cohen, Alana

T.C. Williams High School

Teacher: Breistansky

The Effects of Glycerin on Biodegradable Plastics

It was hypothesized that if three separate recipes of biodegradable plastic are created, then recipe number two (which contains the highest amount of glycerine) will create the most usable and durable plastic. The results supported the hypothesis because the recipe with the most glycerin (recipe number 2) was able to stay in the most usable form compared to the other plastics and durable and difficult to break. Even though recipe number two was durable, it was also very flexible, and it was found that the more glycerine incorporated in the solution, the easier to bend the plastic was. All the plastics were able to support the same amount of weight before breaking, but the plastics with less glycerine were more likely to split apart or form large cracks. There was 4.9 ml of glycerine in Recipe #1, 14.4 ml of glycerine in Recipe #2, and 0 ml of glycerine in Recipe #3. Recipe #2 also saw the highest Average Tensile Level because it was the easiest to tear because it had the most glycerin in it. The controlled variable included the location, time and place they were made, expirimentors, and materials such as a spatula and a pot for all the plastics. In order to improve this experiment, there should be a greater number of recipes incorporated with varying glycerine levels and an increased number of trials to eliminate human error in the project.

11 EV 647

Licato, James

Washington-Liberty High School

Teacher: Hedderly

Developing a Method for Simultaneous Removal of Pharmaceuticals and PFAS in Water Treatment

Perfluoroalkyl substances (PFAS) are a class of chemicals used extensively in consumer products for their stain, heat, and liquid resistant properties. Current water treatment methods are not effective at removing PFAS and pharmaceuticals (PPCPs), and these low concentrations released by water & wastewater treatment plants (WWTPs) can have serious health impacts on humans and the environment. Final effluent from three WWTPs in the DMV area were tested for 115 different compounds. On average, 51 PPCPs and 12 PFAS were detected. This experiment sought to develop an efficient, cost-effective method for the simultaneous removal of PFAS and PPCPs in water treatment using a composite zeolite material. Zeolites are aluminosilicate adsorbents with highly variable pore size. A composite material was created using a sodium silicate dehydration process for the six zeolites tested. The experiment was designed to test composite material effectiveness in both a controlled environment and on WWTP effluent. 18 PPCPs and 3 PFAS were selected for removal testing under controlled conditions. An LC-MS/MS was used to quantify samples in accordance with EPA Methods 537 and 1694. Zeolite 13X performed most effectively under controlled conditions with average PPCP and PFAS removals of 45% and 47%, respectively. Congruent particle to pore diameter was the most likely cause for 13X's superior performance. The composite material yielded PPCP and PFAS removals of 73% and 90% when tested on WWTP effluent. This outcome demonstrates that the designed material was effective at removing PFAS and PPCPs simultaneously and could be implemented in water treatment.

11 EV 648

Mazel, Megan

Wakefield High School

Teacher: Megargee

The Effect of Chemical Runoff (Winter Roads) of the Growth of Grass

The project that was performed was to see what happens to plants in the wintertime with all the salt that is drained on your lawns. It was also to see if there is any other mixture that could help the plants not die when early spring comes. The data showed that the salt mixture and the high beet juice have close results. They had physical differences like the salt plant mixture was dry and crispy on top and the high beet juice plant was red on top but not dry. The low beet juice mixture did not grow as tall, but it did not have as much reddish color on top as the high beet juice. Some problems during the experiment, the first trial of the experiment there were some problems, which were that the grass would not grow even though the plants had proper sunlight and the proper amount of solution. In the second trial, everything went a lot better because pre-grown grass was used. Which help see the results and was easier to write down the observation. In conclusion, the beet juice mixture is a good alternative for salt.

11 EV 649

Visek, Alexandra

Bishop O'Connell High School

Teacher: Pell

Carbon Dioxide Clouds

Due to an increased burning of fossil fuels, Carbon dioxide is being released in great amounts into the atmosphere. Carbon dioxide then becomes trapped in the Earth's atmosphere along with other greenhouse gases. Cloud formation occurs when evaporated water droplets form around particulate matter in the air, condensing to form clouds. Clouds, forming in the atmosphere are affected by the gases, and the elevation of gases in the atmosphere. This experiment is testing the effect of elevated Carbon dioxide levels on cloud formation. To simulate a cloud in this experiment a humidifier is used, in a chamber that simulates the conditions present when clouds form. The chamber includes sensors such as Carbon dioxide, humidity, and temperature sensors. To measure the cloud formation the light transmittance from one side of the chamber to the other is used, similar to using calorimetry. This method allows for the approximate density of the cloud to be calculated. Carbon dioxide was obtained by subliming dry ice. The trials conducted include a trial of ambient air, 600 ppm, and 1000 ppm. These values were retrieved from the sensors, and are an ideal value, but deviations from those values occur. The data from this experiment is very important in determining potential effects of climate change and global warming on cloud formation.

11 EV 650

Bernhardt, Will; Feist, Haylee

Yorktown High School

Teacher: Mower

Storm Simulations: A Solution to Stormwater Pollution

The purpose of this study is to propose and test different possible setups for stormwater runoff. Four different model properties were tested, with each model receiving 75 mL of water to simulate an average rainstorm. The amount of runoff from the property was measured (mL). Each property had a different “setup” to reduce stormwater runoff. Setup 1, the control, and had gutters leading directly into the street and a non-permeable driveway. Setup 2 had a rain barrel and a non-permeable driveway. Setup 3 had a rain barrel and a permeable driveway. Setup 4 had two rain boxes (a complex system distributing stormwater into the ground) and a permeable driveway.

It was hypothesized that the amount of stormwater runoff would be highest for setup 1, second-highest for setup 2, second-lowest for setup 3 and lowest for setup 4.

The results of this study confirm that the stormwater management system used has an immediate effect on the amount of runoff during a storm. Setup 2 reduced the amount of stormwater runoff by 46.2%, setup 3 by 96.4% and setup 4 by 99.61%. Although it was the most effective solution, setup 4 is cost-prohibitive, requiring an investment of $50,000-$60,000, and isn’t required by law for houses built prior to 2014 in Arlington (Arlington Stormwater Management, 9). Furthermore, setup 2, which can cost less than $300, can also be considered an effective and practical solution for reducing stormwater runoff in a cost-effective way.

11 EV 651

Stowers, Kareena; Reecer, Sofia

Wakefield High School

Teacher: Megargee

The Effect of Different Materials on the Visibility of Background Radiation Tracks Through a Cloud Chamber

Background radiation, a term used to describe all of earth's ionizing radiation, is always present in the environment. Using a Wilson Cloud Chamber (WCC), tracks are forged by background radiation particles. This experiment tested the effect of different materials on the visibility of background radiation tracks through a WCC. A WCC was constructed and used to observe these tracks. There are four different types of these tracks. Alpha and beta particle tracks are common, while muon and particle decay tracks are rare. Four different materials were used to cover the WCC and were tested for their effectiveness at blocking background radiation from the WCC. It was hypothesized that the more dense the material, the more effective it would be at keeping background radiation from entering the WCC.

The WCC was constructed using common household items. After constructing the chamber, the room harboring the WCC was darkened and a flashlight was shone into the chamber in order to observe tracks resulting from background radiation. Each of the four materials were wrapped around the WCC while tracks were located and recorded.

The results of the experiment confirmed the initial hypothesis. Aluminum foil, the densest of the materials tested, was most effective at blocking background radiation from entering the cloud chamber while felt, the least dense of the materials, was the least effective. It did not come as a surprise that muons and particle decay were never observed, seeing as how they are rare, especially without the help of high end equipment.

9 MC 700

Apsel, Max

Yorktown High School

Teacher: Dorman

The Effect of Data Given to a Machine Learning Python Program on How Accurately It Can Predict the Outcomes of National Football League Games

The scientist made a computer program with Python that used machine learning to predict the outcomes of National Football League games over an entire season. It can also give another point of view for people watching football, trying to predict which team will win based on the known statistics. How a computer weighs the importance of statistics could also impact sports betting. First, the scientist wrote a program that would both pull data from Pro-football-reference.com from each team between 1993 and 2018 and use the data from the years 1993 to 2016 to make a method for predicting the outcomes. The program then used that and tested it against the 2017 data to find the best approach to be the most accurate. Then, he tested that process on the 2018 data for accuracy and recorded the decimal that is given.

The scientist repeated this using only offensive data, only defensive data, and the offensive data of the home team and defensive data of the away team. The data recorded was quantitative and did not require any means of searching, the program printed the results. Once the data was collected, an ANOVA test was done. The p-value was less than .0001, meaning the independent variable had a very significant effect on the dependent variable. The f-value also told the same thing, being in the hundred-trillions. As a result, the program that used the offensive data from the home team and defensive data from the away team, was the least accurate.

10 MC 701

Berry, Colin

Yorktown High School

Teacher: Lovrencic

The Diffusion of Information: The Impact of Sentiment and Topic on Retweets

Although there are several studies that have examined the spread of information based on the positive or negative content of the information, there are many human emotions that are difficult to categorize into simple positive or negative categories. This study examines the diffusion of information that has been categorized into six sentiment categories (including happiness, sadness, anger, fear, surprise and disgust). I hypothesized that there will be differences in the diffusion rates of tweets considering six different sentiments and four different topics (including climate change, 2020 elections, gun control and crowdfunding). Although the results for all four topics combined together show that angry tweets are more likely to be retweeted than happy tweets, the results by topic reveal the importance of examining differences across topics. For both the 2020 election and gun control topics, angry tweets are significantly more likely to be retweeted than all other sentiments. However, for both the crowdfunding and climate change topics, both happy and angry tweets are equally likely to be retweeted. These results are robust to dropping outliers and to dropping retweets by bot accounts. Overall, the results suggest that the broad categories of positive and negative sentiment are too aggregate to really explain when information is likely to be diffused through retweets. Equally important, because so many people get their news from social media, it is important for both the sender and receiver to understand that some information may diffuse faster and wider than other information, depending on the topic under consideration.

10 MC 702

Gordon, Max

T.C. Williams High School

Teacher: Lowe

Using AI to Detect and Deter Telemarketing

Telemarketers and phone scams have been the biggest source of complaints to the FCC, swindling away nearly 40 billion dollars from phone users. While much of this is illegal, it is impossible to enforce American laws, such as the Do Not Call Registry, when telemarketers are based in India and China. This project explores the possibility of using a recurrent neural network (RNN) to identify telemarketers. The goal is an 80% success rate at identifying telemarketers, without any false positives. In addition, the program will be computationally simple enough to run on a Raspberry Pi. It will answer calls going to the user's smartphone (unless the caller's number is white-listed, e.g. on a list of known non-telemarketers) and determine if the caller is a telemarketer. If they are, the program will continue to talk and waste their time, and if they are not a telemarketer, the program will "forward" the call to the user. To determine the identity of the caller, the RNN will classify their sentences into one of the following categories: information, question, command, formality (hello, goodbye, etc.), conditional (if … then …), general exchange (banter), and persuasion. If enough of their sentences are classified as persuasion, then they get flagged as a telemarketer. During the first iteration of training, the model overfitted; this was due to the lack of training data, the dataset had 300 pieces total. But only 240 were used to train, as 20% gets set aside for validation.

10 MC 703

Wang, Susan

Episcopal High School

Teacher: Olsen

Automated Sleep-Stage Classification Using EEG Recordings: A Comparative Study of Multiple Deep Learning Models

Sleep-stage classification using Electroencephalogram (EEG) recordings is essential to the diagnosis of sleep disorders. To replace the highly technical and time-consuming process of manual sleep-stage analysis, our project employed and compared multiple deep learning models to classify EEG signals. The main goals of our studies were threefold: 1) to build individualized deep learning models with over 90% accuracy score for each individual subject; 2) to study the impact of hyperparameters on the models' performance; 3) to propose a unified deep learning model for multiple subjects.

We used EEG data from two public databases (National Sleep Research Resource and Physionet) to classify six stages of sleep (including wakefulness). We visualized and analyzed EEG signals through discrete Fourier transform. After signal standardization, the generated EEG samples were fed to multiple deep learning models: CNN, RNN, ConvLSTM, and other hybrid models. Due to data imbalance, metrics such as precision, recall, and F-scores were used to quantify the models' performance in different aspects.

Our experiments demonstrated: 1) CNN beat other deep learning models and reached accuracy score of 97% in training and 95% in testing; 2) a sliding window with size 200 and stride 100 achieved the best performance; 3) the ensemble technique improved the prediction accuracy score; 4) signal standardization techniques improved model generalization. In conclusion, our proposed methods can help diagnose sleep disorders by efficiently classifying sleep stages.

11 MC 704

Rahman, Mahia

Washington-Liberty High School

Teacher: Cook

Single-Cell Analysis of Megakaryoblasts by Laser Ablation Electrospray Ionization Mass Spectrometry and Automated Image Processing with Object Recognition

Chronic myelogenous leukemia is a type of bone marrow cancer that is challenging to treat due to metabolic reprogramming. Targeting metabolic activities offers a wide range of therapeutic possibilities. Identifying the metabolites in each individual leukemia cell allows for a better understanding of metabolic reprogramming, potentially leading to the detection of control points that helps in diagnosis and improving therapeutic strategies. The purpose was to establish the necessary preliminary steps for single-cell analysis of Megakaryoblasts (meg-01) cells: bulk analysis and recognition of single-cells by image processing. The hypothesis was that the image processing and cell recognition program would successfully segment the images, identify objects, and color the cells based on metabolite intensities from a mass spectra.

Bulk analysis was conducted using laser ablation electrospray ionization mass spectrometry (LAESI-MS). Cells were washed with phosphate-buffered saline (PBS). Eight common peaks were found in the PBS and meg-01 cell spectra, assumed to originate from the PBS. An image processing software was developed through Matlab. This program automatically segments the image, identifies the cells, and associates a false-color scale to the cells based on metabolite intensities from a mass spectra. When using the newly developed automated single-cell recognition software in tandem with the previously developed fiber LAESI-MS, there is potential to selectively analyze and associate entire mass spectra with identified cells. An automated image processing method for single-cell analysis was established. The performed bulk analysis allowed for collection of spectra from large cell populations to be used as a reference for single-cell analysis.

12 MC 705

Foster, Alisha

Yorktown High School

Teacher: Mower

The Effect of Type of Fractal Rule on Surface-Area-to-Volume Ratio of a 3D Solid

This research project seeks to determine which fractal rule applied to a regular tetrahedron produces the fractal with the highest surface-area/volume ratio. Three fractal rules were modeled as recursive functions that take an imput of the number of rule applications, and output each rule's resulting SA/V ratio when applied to the tetrahedron. Of the three fractal rules, one that subtracts volume, one that adds volume, and one that keeps it the same, the replacer rule (the one that keeps volume the same) was found to approach the highest SA/V ratio, because it gained double the surface area per rule application as compared to the subtractive and additive rules, without increasing volume. This conclusion may have applications for designing faster and more complete reactions, by shaping a solid reactant in the form of the fractal with the highest SA/V ratio.

7 ME 800

Haffey, Emma-Leigh

Gunston Middle School

Teacher: Rosendi

The Bioavailability of Different Supplements

This study endeavors to answer the question: Are all supplements bioavailable? The researcher tested 22 different supplements, some synthetic and some whole food, for bioavailability. These supplements were placed in a solution of hot water and vinegar to simulate stomach acids. The reactions of supplements were observed over a 2-hour period (the time it takes for the body to digest before supplements would be flushed out). Water was heated to 35 degrees Celsius, human internal body temperature. The researcher found synthetic vitamins to be far less bioavailable than whole food supplements. Soft gel supplements appeared to be completely non-bioavailable. To conclude, this study found whole food, plant-based supplements to be the most bioavailable as these were the only ones to be completely dissolved in the required time. This study addresses a real-world problem. According to the CDC (CDC's Morbidity and Mortality Weekly Report – MMWR, 2015) just 1 in 10 adults meet the federal fruit and vegetable recommendations. These statistics combined with increasing health issues such as diabetes, heart disease and obesity on the rise, it is important to supplement the human diet. It is imperative that supplements being consumed are bioavailable and thus, effective in the human body.

7 ME 801

Martah, Sara

Dorothy Hamm Middle School

Teacher: Azzara

Better Healthy Than Sorry

The purpose of this experiment was to find a modified recipe for peach cobbler that was based on nutritional and health purposes. This topic was studied because of the big numbers of people affected by unhealthy or unbalanced diets. In this experiment a peach cobbler recipe was used to create three new nutritionally improved peach cobbler recipes. The three recipes were baked and compared to the original, based on taste, color, texture, and health. It was hypothesized that of the three modified recipes created recipe number three would have the highest overall average based on the categories. To test the hypothesis, a chart containing the four categories was filled. Each category would be filled as a rating out of ten and the four categories were added together for a grand total out of 40. The results of the experiment rejected the hypothesis. The data that was taken from the chart showed that recipe #1 had the best overall score of 32 out of 40 while recipe 2 had 27.6 out of 40 and number 3 had 24.1. In conclusion recipe number one got the highest score which meant it was the chosen recipe that would be used when wanting a healthier substitution for peach cobbler.

7 ME 802

Shoji, Maeve; Gillette, Sidonie

H-B Woodlawn Secondary Program

Teacher: Taggart

Why So Salty?

Salt can make or break a dish. An important factor that we have to take into perspective is how much salt a human can taste and how much they can differentiate between two concentrations of salt. Salt can enhance the taste of a dish but if you add too much salt, it's as if you blinded your taste buds. The research question for our experiment is how does the percentage of salt concentration affect humans ability to taste? Our hypothesis is that we think they will not be able to taste a one percent but they can taste a 3% difference.The first step to test our hypothesis is to identify the salt percentages that will be used. Next, label the cups in a way that you will remember what percentage is in each cup. Then add water, for this experiment we used 50g of water. Designate a greatest and least side and ask the subjects to order the different salt percentages from greatest to least amount of salt, and then record their answers. 20 subjects participated in this experiment.The results for this experiment were that most humans cannot taste a percent difference under 5% of salt, but there will be some exceptions. For the conclusion, it was difficult to determine if the hypothesis was supported since the data collected is hard to compare, however most people averaged 50% correct.

8 ME 803

Hossain, Sameen

Swanson Middle School

Teacher: Swanson

Bioengineering a Kidney Using Stem Cells

Around the world, there is an issue with organ transplantation. The number of organ donors available is smaller than the amount of patients that need transplants. Even if the transplant is undergone successfully, there is still a risk of the patient's body rejecting it. Human Induced Pluripotent Stem Cells (HiPSCs) are adult cells that have been reprogrammed to be able to transform into any type of cell in the body. They can help to create organs using the patient's own cells, and therefore, not needing a donor and reducing the risk of immune rejection. This experiment intends to find the best microenvironment in which to grow an organ, such as the kidney. Previous scientific papers that have transformed HiPSCs into kidney cells were needed for this experiment. The soluble factors that were used in the papers were researched for their functions related to kidney development. Next, the best ECM proteins needed for kidney development were determined. This was done by searching up the embryonic expression in kidneys of the proteins and their subunits. After that, a combination of soluble factors and ECM proteins was decided based on all the research that was done. I did not have access to a lab during my experiment. Although there is no way to prove that my research is correct, this helps understand why the scientific papers I used were successful previously, and suggests some new possibilities. I hope that someday, this experiment can be beneficial in the world of medicine.

8 ME 804

Patterson, Rory

George Washington Middle School

Teacher: Matthews

Don't Flake Out: Measuring the Effectiveness of Skin Moisturizers

The purpose of this project is to determine which of several popular skin moisturizers does the best job of keeping skin from drying out. The experimental procedure for answering this question has two simple steps. First, make the skin models (using Jello because it is made of water and gelatin, a substance that is made of collagen. Collagen is also found in human skin) and coat them with moisturizers. Second, observe the skin models and measure how much weight they lose over a two-week period, record the data, and make conclusions. At the conclusion of this experiment, the data collected shows that, overall, Vaseline's Petroleum Jelly did the best job at keeping the skin models from drying out.

9 ME 805

Newman, Sarah

Yorktown High School

Teacher: Paz-Soldan

The Effect of Chemicals on Eroded Tooth Enamels

The purpose of the experiment was to discover which chemical improves enamel density in teeth. Tooth decay is the second most common disorder other than the common cold (The National Institute of Dental and Craniofacial Research, 2018). 10 wisdom teeth were cut in half. The mass was found. The teeth were placed on a tray. 15 ml of lemon juice was poured over. This sat for 4 minutes. The teeth were removed from the juice. The control (no chemicals) was placed in Petri dishes. Next, 8 grams of calcium nitrate was mixed with one milliliter of water and brushed onto the corresponding teeth for 2 minutes. These steps were repeated for zinc nitrate and potassium phosphate and then repeated every 3 days for 4 weeks. The teeth were rinsed off, to remove the build-up of chemicals and reweighed. Data collected during the trials was the increase in tooth mass. Descriptive statistics were found and a One Way ANOVA test was conducted, this found a P-value greater than .05. This shows that there isn't a significant difference between data between treatments. The null hypothesis that chemicals do not have an effect on eroded enamel is accepted. This could be because the chemicals had different textures that reacted differently when combined with water. It was observed, the thinner powders were more cohesive. In future experimentation, chemicals of the same consistency could be used. If to be expanded upon foods or substances could be used to determine what erodes or remineralizes the enamels.

9 ME 806

Rai, Kritika

Washington-Liberty High School

Teacher: Sotomayor

The Effect of s-Adenosyl-Methionine on the Growth of Eisenia fetida

The purpose of the experiment was to test the effects of s-Adenosyl-Methionine on the growth of Eisenia Fetida. The hypothesis was: If 30 mg and 45 mg of s-Adenosyl-Methionine are added to the diet of two Eisenia Fetida worm groups, then the worms receiving 45 mg of acid will have the least amount of growth. 30 different worms, 10 per group, were observed. Each group was given 50 grams of worm food and appropriate s-Adenosyl-Methionine amounts every two days for 17 days. The IV was the different levels of s-Adenosyl-Methionine, and the IV was the growth of worms. Group 1 received 30 mg of s-Adenosyl-Methionine. Group 2 received 45 mg of s-Adenosyl-Methionine. The Control Group did not receive acid. The constants were the temperature, duration of growth per worm, food given, amounts and times of s-Adenosyl-Methionine fed to each group, light exposure, and amount of water to keep soil damp. The length of the worms was recorded every night. The control had an overall growth mean of 4.95 cm; Group 1 had a mean of 1.87 cm; and group 2 had a mean of 1.66 cm. Group 2 had the least amount of growth. A T-test was conducted between Group 2 and the control, concluding this experiment with p-value of 0.000000000119. Based on the results, the hypothesis was accepted, and the null was rejected. In conclusion, this study suggests that s-Adenosyl-Methionine acid does reduce the growth of Eisenia fetida.

9 ME 807

Blackburn, Isabel; Archie, Patrice

T.C. Williams High School

Teacher: Matthews

Just Breathe...

The purpose of this project is to answer the question, “Which gene therapy is most beneficial for cystic fibrosis (CF) patients with the F508del mutation?” and to help further research in regards to finding a way to help patients who suffer from the most common CF mutation, F508del. After we gathered background knowledge on the disease, we worked to see which combination of drug therapies, as well as proposed new generation therapies, would be most effective in improving lung function. The proposed outcomes can be modeled by two methods: in vitro and in silico. We chose to model the possible outcomes through the in silico method, which required three computer programs that would model the procedure and allow multiple outcomes to be projected. Many possible outcomes were projected when using the Patchdock software. The top outcome projected from Patchdock was used to model the molecule in the Polyview software and then again in Pymol software. The results show that each ligand molecule can successfully bind tightly to the receptor molecule. All four ligand molecules bind to different sections of the Cystic Fibrosis Trans-membrane Conductance Regulator (CFTR) protein, suggesting that there is an additive effect to combining all four drugs.

9 ME 808

Dechant, Sophie; Dawson, Anibel

T.C. Williams High School

Teacher: Matthews

Developing an Artificial Pancreas

Diabetes is one of the world's fastest-growing diseases in the world. Currently, diabetics are having to take shots to get the proper amount of insulin in their bodies. The tragic part of this is that there are multiple more efficient ways of helping diabetics that are not currently in process. With an artificial pancreas, diabetics could be able to monitor blood sugar and receive the proper amount of insulin in their blood. For our experiment, we developed a working artificial pancreas that regulates blood sugar until the proper amount of blood sugar is obtained. The outcome of the project concluded that an artificial pancreas monumental step in giving diabetics a regular lifestyle.

10 ME 809

Narang, Vivek

Washington-Liberty High School

Teacher: Singh

The Effect of The Number of Screws and the Time to Weightbearing on the Healing of Femoral Fractures

The main objective of this project is to answer the question: Do the number of screws and the weeks to weight-bearing affect the healing of a femoral fracture? The hypothesis is that the number of screws and the time to bear weight does affect the healing of the femur. The femur is the longest and strongest bone in the human body and is roughly ¼ of one's overall height. However, as one gets older, bones become more fragile and eventually break. Over the course of approximately two months, I worked with Dr. Robert Hymes, the director of Clinical Research of the Department of Orthopedic Surgery at Inova Fairfax Medical Campus, in order to analyze data of patients with femoral fractures. Using the program EPIC, patient files and x-rays were examined in order to view approximately 130 x-rays. However, of those 130 solely 94 were eligible for the project due to insufficient information. After months of data collection and graph analysis, it was found that while there was no relationship specifically between the number of screws and healing, there was a relationship between all three variables. As the number of screws increased, the weeks to weight-bearing decreased, and moreover, all healed patients had a decreased time to weight-bearing than unhealed patients. In conclusion, it was interesting to observe the relationship between the totality of the variables detailed in the project. Furthermore, while the individual sections of the hypothesis were rejected, when incorporating all variables together, the hypothesis was proven correct.

10 ME 810

Modlin-Unger, Ellie; Marchese, Andrea; Villado, Isabella

Arlington Tech and Career Center

Teacher: Neal

The Effect of Glasses and Age on the Blind Spot Activation Distance

The experiment was to better understand the relationship between the size of an individual's blindspot and the condition of their eyes. The hypothesis is that young individuals without glasses will have smaller blindpots than people who are older, or have glasses. Subjects were shown a white bar with a black circle on the right side and a plus sign on the left. Participants were asked to cover one of their eyes and then look at the symbol on the opposite side of the bar. They would move the device back and forth until the symbol in front of the opened eye disappeared from their vision; the distance from the corner of the eye to the back edge of the phone would be taken. Second measurements would come from moving the device closer until the symbol reappears; both eyes were tested.

The procedure was conducted on four groups, students without glasses (the control group), students with glasses, adults without glasses, and adults with glasses.The distances for individuals without orthotics were smaller compared to those who did need some sort of visual aide. The largest difference between the corresponding adult and student group(with glasses and without glasses), for mean or median, was 1.23cm. A strong correlation between age and a larger blind spot could not be found when looking at the data in the adult group without glasses when compared to the control group. For adults with glasses the data showed a larger blind spot than the control group.

11 ME 811

Lee, Jake

Episcopal High School

Teacher: Olsen

Development of Artificial Epidermis Using Collagen Film and Keratinocyte Cell Line for Personalized Allergy Tester

Tissue engineering is a research field for regenerating damaged biological tissue by substituting human cells on an appropriate scaffolds, one of them collagen as a biodegradable polymer.has been widely used. Artificial skin is primarily used for regenerate damaged skin caused by severe burns, skin damage and dermatology, but has rarely been used for allergic testing.

In this study, we suggested an alternate way for allergy testing via cultivating the patient's epidermal cell on top of an artificial collagen film, ultimately reducing the effort and the danger over direct in vivo testing on the patient. By cultivating Human Keratinocyte Cell Line on an artificial collagen film and applying allergens, PBS and ethanol extracts of peanut and peach-hair, to draw out an allergic reaction, then was observed for any reactions in the allergic reaction-related genes, such as TNF-α, IL-1α, IL-1β. After applying the allergens on the artificial epidermis for 24 hours, the Keratinocyte cells and the monocyte cells were harvested to be observed. For the peach hair, both TNF-α and IL-1β were observed having a strong expression in both extracts of each cells. On the other hand, for the peanut extract, only the PBS extract elicited an increase of the reaction in the TNF-α, IL-1β. Therefore, as discerning an allergic reaction from a cultivated epidermal cell on top of a collagen film was possible, an allergic reaction for a patient using his or her epidermal cell was also possible.

12 ME 812

Costle-Tyler, Alexander

T.C. Williams High School

Teacher: Lowe

Beyond Mold: Formaldehyde and Volatile Organic Compound Off-Gassing in Damp Building Materials

Dampness is a widespread issue that affects a large portion of the population. Currently research has been done on the mold which dampness causes and its varying health effects; however, little research has been done on building materials expelling chemicals when exposed to dampness. It is believed that these building materials could expel chemicals, such as formaldehyde and TVOCs (Total Volatile Organic Compounds), at levels detrimental to health during long term exposure. To test this theory building materials were exposed to dampness in an enclosed airtight container and the resulting airborne chemical concentrations were recorded. The goal of this study is to prove a correlation between building materials being exposed to dampness and the expulsion of chemicals, as short term exposure to such low levels has no discernable health effects and little research has been done on true long term exposure. Through sets of three trials for each material a vast increase in both formaldehyde and TVOCs was recorded. The highest concentrations were more than three times higher than the mean concentrations with many of the other trials being approximately double the mean. This suggests a strong link between building material dampness and the expulsion of chemicals.

In conclusion, there is a likely link between damp building materials and the expulsion of chemicals suggesting it is a major health concern. The next steps for this project would be searching for a solution and expanding testing by including more materials and creating more quantitatively accurate tests.

7 MI 900

Levin, Nate

Williamsburg Middle School

Teacher: Zarro

The Effect of Different Essential Oils on the Zone of Inhibition

The purpose of this experiment was to see if essential oils are viable as an alternative to alcohol-based hand sanitizers for people with skin conditions. Many people with skin conditions such as eczema cannot use alcohol-based hand sanitizers as it burns their skin. The hypothesis said that the oregano essential oil would show the greatest zone of inhibition. The reason for the hypothesis was that oregano essential oil contains carvacrol, which causes eventual cell death. The K-12 strand of E. coli was plated, then the essential oil infused discs were placed onto Mueller-Hinton agar, as is standard for zone of inhibition studies. The plates were subsequently put into the incubator for 22.5 hours. The plates were taken out and the zone of inhibition was measured. The lemongrass essential oil had a significantly higher zone of inhibition than all others tested, with over a 300 percent increase compared to the next highest tested, the oregano essential oil. This is evidence that large amounts of inhibition of growth can be obtained with certain essential oils, though the results were not as hypothesized. One reason this could have happened is due to lemongrass essential oil containing citral, which can also cause eventual cell death. The results of this experiment indicate citral is more effective than carvacrol at killing E. coli. Further research on this topic could determine the lowest concentration of lemongrass needed to show a meaningful effect. This research could be used for improving personal care and household cleaning products.

7 MI 901

Shah, Jaya

Williamsburg Middle School

Teacher: Willet

The Effect of Environmental Conditions on Bacterial Growth

The purpose of this experiment was to inform others on how environmental conditions can affect a household sponge. A sponge can hold a lot of bacteria (Doucleff, 2017, September). Environment can significantly influence the bacterial growth on a sponge. This data could provide people with information on the importance of taking care of their sponges and could result in an improvement of people's health.

This experiment was done by placing four Petri dishes into four different environmental conditions: 27º Celsius with 50% humidity (warm and humid environment) in an incubator; 27º Celsius with 25% humidity (hot and dry environment) in an incubator; 17º Celsius with 50% humidity (cold and humid environment) in the classroom and 17º Celsius with 25% humidity (cold and dry environment) in the classroom. A wet bulb was used to create 50% humidity. The bacterial growth was measured after 72 hours (three days).

The key results of this experiment were as follows: the hot and humid environment produced the most amount of bacteria with approximately 10.7% of bacteria covering a section of a Petri Dish. The cold and dry environment produced the least amount of bacteria at approximately 4.2% of the given surface area.

The data in this experiment shows that hot and humid environments created more bacteria on sponges than the other conditions. Therefore, it is recommended to keep sponges in cold and dry environments. This will keep people safer and less prone to illness.

7 MI 902

Wilson, Darya

Dorothy Hamm Middle School

Teacher: Azzara

Bacteria or Not? The Effect of Different Surfaces on the Amount of Bacteria Found on Them

The purpose of this experiment was to test the amount of bacteria on different surfaces. The hypothesis being studied was that a shoe bottom would have the most bacteria out of all the variables. This investigation was conducted by rubbing swabs of different surfaces on agar and waiting one week. Then, each coccus was counted and it was found that a shoe bottom had the most bacteria out of each variable tested. This experiment models the importance of proper hygiene and cleanliness in people's lives.

8 MI 903

Bergmann, Carly

Swanson Middle School

Teacher: Swanson

What's the Best Way to Prevent Cheese Mold?

The purpose of this experiment was to test the best way for a consumer to prevent mold from forming on cheese. The use of FreshPaper, foam savers, and beeswax were tested. My hypothesis was that cheese wrapped in beeswax paper would last the longest because it would be best at protecting the cheese from humidity. The control of the experiment was a slice of cheese with no mold prevention. Each method was tested using ten slices of Swiss cheese. After exposing the cheese to the ambient environment of a house, each cheese slice was prepared in accordance with the products' descriptions. The number of days until mold appeared on a given slice was recorded. As expected, the control had the lowest average number of days before the first sign of mold, followed by foam savers, and beeswax paper. The mold prevention method with the highest average number of days before the first sign of mold, and therefore the best method of mold prevention, was FreshPaper with an average of 19.1 days. According to the manufacturer, FreshPaper uses herbs to prevent cheese mold by eliminating the mold spores before they can attach to food. To make the experiment more robust, different types of cheeses could be tested and the cost of the mold prevention procedure could be taken into account. This experiment can be used to help eliminate food waste by pushing the expiration date further back.

8 MI 904

Do, Tracy

Hammond Middle School

Teacher: Scott

How Does Temperature Affect Yeast Rising?

My project was how the temperature of the water has an effect on yeast. The information that may be received from this experiment is significant for those who bake. The independent variable is the temperature of the water, the dependent variable was the height of the yeast, and the constants consist of the size of the cup, amounts of each material, the room temperature, and the location the experiment took place. My approach to this experiment was to increase the heat of the water to a specific temperature, dissolve additives, add yeast, and then measure the height it rises every two minutes. From the data collected, the higher the temperature, and the higher the results were with the lowest temperature of 75° F giving an average of 72 centimeters while the highest temperature of 125° F displaying an average of 117.5 centimeters. Overall, the temperature does display a difference in heights at different rates.

8 MI 905

Stewart, Samantha

Thomas Jefferson Middle School

Teacher: Snell

The Effect of a UV Clarifier on the Hue and Saturation of Water Containing Chlorella vulgaris

The purpose of this study was to discover if the presence of a UV clarifier adversely affected the color saturation and hue of water with Chlorella Vulgaris, a type of green algae . The independent variable was the presence of the UV clarifier. The control group was no UV clarifier. The dependent variables were the hue and saturation of the water. The constants were the starting amounts of water and algae, water temperature, location, type of algae, and time when the data were gathered. The hypothesis was: If the UV clarifier is put into the water, then the saturation and hue will decrease. Fifty milliliters of Chlorella Vulgaris was poured into each of two bins containing six liters of water, and were left for two days. The UV Clarifier was built during this time. The color of the water from each bin was recorded in RGB. The Clarifier was placed in one bin, and the other one remained untouched. Two more bins were setup, and the two day process repeated. The clarifier was moved to a new bin and the RGB was measured again. This process was repeated once more. The data were converted from RGB to HSV and graphed. The results showed that if a UV Clarifier is used, then the hue and saturation of water with Chlorella Vulgaris will increase. These results rejected the hypothesis. In conclusion, the study suggests that a homemade UV Clarifier does not adversely affect the hue and saturation of water containing Chlorella Vulgaris.

9 MI 906

Carlson, Margaret

T.C. Williams High School

Teacher: Holmes

Effect of Colored Light on Yeast

The purpose of this experiment is to determine if the color of the light affects the time it takes for yeast to bubble in water. I placed samples of yeast under different colored lights (blue, red, and white) and one in darkness for three hours. Next, I placed each yeast sample in warm water and timed how long it took for each sample to bubble. I repeated this process 5 times and recorded the data. In my original hypothesis, I predicted that the yeast exposed to red light would take the longest bubble. My data did not support this hypothesis but rather indicated that the yeast incubated under dark conditions took the longest to bubble.

9 MI 907

Chahil, Natalia

Washington-Liberty High School

Teacher: Brodowski

The Effect of Different Types of Water Treatments on Concentration of E. coli

The purpose of this experiment was to find the effect of different types of water treatments on the concentration of E. coli. The hypothesis, if ultraviolet light is most effective then the concentration of bacteria in water will decrease by damaging their DNA. The hypothesis was not supported by the data. The ultraviolet light had a decrease range of 100-100,000 bacteria per mL of 4 out of the 8 trials, 3 trials had an increase in the range of 100 bacteria per mL, and 1 had no change. Chlorine tablets had a decrease range of 100-100,000 bacteria per mL of 6 out of the 8 trials and 2 trials saw an increase of 100 bacteria per mL. The carbon filter had a decrease range of 100-100,000 of bacteria per mL of 7 out of 8 trials and 1 had an increase of 100 bacteria per mL. Chlorine tablets were most effective treatment compared to the others.

Because each trial was significant, the null hypothesis was rejected. The major experimental error introduced by incubating the trials of the contaminated water for a longer time resulted in less effective treatments due to high toxicity of bacteria concentrations. This shows how ineffective current ways of treating water are. If global warming continues, there will be higher concentration of bacteria impacting the effect of water treatments. This study is significant because it shows that treating contaminated water with chlorine tablets can kill bacteria and prevent people in undeveloped countries from getting water borne diseases.

9 MI 908

Rynes, Katherine

Washington-Liberty High School

Teacher: Brodowski

The Effect of Different Types of Minerals on Escherichia coli K-12 Growth

Escherichia coli K-12 was tested against iron, sulfur, copper and a constant variable of nothing to see which would impede growth the most. The experiment was performed as a Zone of Inhibition experiment in a Petri dish. The hypothesis for this experiment concluded that iron would perform the best because it is a metal and could be overdosed easily and kill the bacteria. Levels of the IV were administered through a thin paper disc into the inoculated Petri dishes. After 96 hours, the Petri dishes were measured and recorded by growth, looking for the least amount of growth. Sulfur had the lowest mean of 708.44 mm2, and aside from the full growth of the control group, iron had the most bacteria growth of 1261.58 mm2. Copper preformed between the two, with a mean of 1140.23 mm2.

A null hypothesis is rejected because of the ANOVA p-value of 0.0012, which supports statistical significance. As well, the data rejects the asserted hypothesis, because against copper and sulfur, it repels bacteria growth the least. However, it cannot easily be said sulfur is the most effective in killing Escherichia coli K-12, because it has a high standard deviation of 670.16 mm2, which suggests bad data. Copper, the second-best preforming, has a standard deviation of about half: 341.91 mm2. However, a significant difference exists between the two, as sulfur preforms much better than copper, by about 400 mm2.

9 MI 909

Sellgren, Margot

Washington-Liberty High School

Teacher: Brodowski

The Effect of Spices on Microbial Activity

This project is about the effect of spices on antimicrobial activities to see whether at home remedies actually aid in curing infectious diseases. The independent variables are cinnamon, clove, and cumin. They were testing on a sample of Staphylococcus Epidermidis which is found on human skin. There were 16 trials for each independent variable and one trial for the control. All testing was done with googles and gloves. They were left for five days, observed, and then the zone of inhibition was measured.

Five days later, some of the spices had been effective and some had been disastrous. Cinnamon had done nothing and there was zero inhibition of the bacteria, nor growth. The zone of inhibition of the cinnamon trials was 0 mm. Cumin had spurred the growth of the bacteria and seemed to support its life. The average diameter of the cumin spores was 32.09 mm. Clove had almost completely inhibited the bacteria. The average zone of inhibition of the clove trials was 39.14 mm. This data could be used to further antibiotics and medical research for practical, natural ways to cure illnesses.

9 MI 910

Tewelde, Luliya

Wakefield High School

Teacher: Thacker

The Effect of the Different Types of Electromagnetic Radiation on the Growth of the E. coli Bacteria

The purpose of this project is to see if different waves of Electromagnetic radiation affect the growth of living things. The question was What is the effect of different waves of Electromagnetic radiation on the growth of E-coli bacteria? Based on the research I have done I guessed to see negative effect on the group that were put under the UV rays. Before starting the procedure I cleaned my hands and the environment that I was going to work at and wore goggles and Gloves for safety reasons after that I started by using aseptic technique to sterilize the inoculating loop I did this technique every time I use the rope to interact with the bacteria and I have three IV groups the UV(Ultra-violet), Visible light and NV group(no light) the bacteria are drew on a petri dish and put under these environment and I checked each one every 24 hours. The results showed that each group showed growth. The results proved the hypothesis wrong since the group under UV rays showed growth too.

9 MI 911

Thomas, Lauren

Washington-Liberty High School

Teacher: Brodowski

Antibacterial Properties of Household Teas on Staphylococcus epidermidis

The purpose of this experiment was to study the zone of inhibition (cm) caused by antibacterial teas on Streptococcus Bacterium. Staphylococcus Epidermidis replaced Streptococcus Bacterium for increased safety. The hypothesis was if three different common household teas are tested on Staphylococcus Epidermidis bacteria, then green tea will be the most effective in killing the Staphylococcus Epidermidis bacteria because green tea contains catechins which may inhibit the growth of bacteria. Pomegranate, mint, and green tea were the three independent variables with the control being sterilized distilled water. The data rejected the hypothesis with pomegranate tea inhibiting the most bacteria growth at an average of 2.2 cm. Mint tea inhibited bacteria growth at an average of 2.0 cm, green tea inhibited bacteria growth at an average of 1.5 cm, and the control inhibited bacteria growth at an average of 1.1 cm.

An ANOVA test was conducted in order to determine if the averages were significantly different. The calculated p value was 0.927, which is over the critical value of 0.05, and therefore the null hypothesis was accepted. Additionally, seven T-tests were conducted, all seven groups were above the critical value of 0.05 and therefore each test was insignificant. The results show that antibiotics, body products, or body scrubs which use forms of pomegranate, green tea, or mint ingredients are ineffective. Especially, in natural or organic body cleansing products which primarily do not use chemicals to aid in the cleansing process.

9 MI 912

Long, Amanda; Ashley, Caroline

Washington-Liberty High School

Teacher: McCoart

What is the Effect of the Brand of Water on the Number of Bacteria Grown?

The purpose of this experiment was to study the number of bacteria grown from different samples of bottled water (cm2). Throughout the experiment aseptic technique was used to prevent the spread of bacteria. The hypothesis was stated that, if the growth of bacteria from different brands of water is tested then Fiji will have the highest level of bacteria growth because it is filtered through volcanic rock. This research hypothesis was supported by the data with the tap water averaging 0.00 cm2 growth, the Dasani water averaging 0.00 cm2 growth, the Deer Park water averaging 0.00 cm2 growth and the Fiji water averaging 6.61 cm2 growth. An ANOVA test was done to determine if a statistically significant difference existed among the means for the groups. The calculated P-value was 0.971, which is more than the critical value of 0.05, meaning the data was statistically insignificant. This confirms the null hypothesis: if the growth of bacteria from different types of drinking water is tested then there will be no difference from the brands. This data showed a trend, the brands with the most thorough filtration grew the least number of bacteria. Further experimentation including a focus on the filtration system with both commercial and home systems tested along with repeated trails should also be performed to further improve this filtration theory. This study was significant because it showed the method of filtration used to clean water can greatly impact the cleanliness of the water.

9 MI 913

Mann, Edwin; Maldonado, Katherine

Wakefield High School

Teacher: Troiano

Effect of Antibacterial Treatments

Recently, antibiotic resistant bacteria has been becoming an increasing problem in the world, causing worse and worse infections that need new treatments. One of these treatments is Phage therapy, a procedure in which the patient is injected with bacteriophages that target specific types of bacteria. However, there is already existing antibiotic treatment. The purpose of this study was to determine the effect of both antibiotics and bacteriophages on e. Coli Growth. The independent variables were amoxicillin and T4 virus (a type of bacteriophage). The dependent variable was the zone of inhibition around the micro agents. In all groups, the agar plate (one for each group) was swabbed with e. Coli and divided into four quadrants, one for each quadrant. In the control group, nothing was applied to the agar plate. In group two, only T4 was applied. In group three, only amoxicillin was applied, and in group four, both T4 and amoxicillin were applied. Then, the agar plates were left to sit at room temperature for one week. The results showed that Group 4, the group with both amoxicillin and T4 was the most effective, which supported the hypothesis. In conclusion, the study suggests that antibiotics and phages combat bacteria more effectively together rather than apart.

9 MI 914

Messman, Reid; Carome, Abby

Washington-Liberty High School

Teacher: Sotomayor

What is the Effect of the Type of Wrigley Gum on the Amount of Mouth Microbes?

The purpose of the experiment was questioning if gum reduced the number of mouth microbes in a subject's mouth and if the type of gum had any effect on the results. The results showed different types of gum have different effects on the number of mouth microbes. Wrigley's Big Red gum (cinnamon gum) had the greatest decrease in the number of microbes in the subjects' mouths, while Wrigley's Juicy Fruit was the only type of gum tested that increased the number of mouth microbes. Wrigley's Extra gum decreased the number of microbes in a person's mouth but not by a significant amount compared to Wrigley's Big Red. The data supported the hypothesis: If a subject is swabbed before and after chewing one type of Wrigley's gum for two minutes, then the biggest difference in the number of microbes will be with the subject who chewed Wrigley's Big Red cinnamon gum because Wrigley's Big Red contains cinnamon oil which is naturally antibacterial and antifungal. To further understand this experiment a null hypothesis was created: If you swab a subject's mouth before and after they chew one stick of Wrigley's gum for two minutes, then you will have no difference between the number of mouth microbes as prior because Wrigley's gum does not reduce or increase the number of microbes in your mouth. The data supported the hypothesis because at the end of the experiment Wrigley's Big Red gum had the least amount of mouth microbes; the null hypothesis was rejected.

10 MI 915

Stievater, Adam

Washington-Liberty High School

Teacher: Singh

The Effect of Light on Biofilm Growth

The purpose of this experiment was to find the effect of light on biofilm growth. The research hypothesis was that biofilm would grow better under a grow light, because biofilm is photosynthetic. The null hypothesis was that light would have no effect on biofilm growth. Biofilm was sampled from the Thomas Jefferson Memorial and inoculated onto 40 petri dishes. Half were grown under a grow light and half were grown inside an opaque box. The petri dishes were inoculated for 8 days and then the growth was calculated using ImageJ image processing software. When biofilm was grown under no light, the mean growth was 2.298 cm2, the range was 6.319 cm2, and the standard deviation was 1.004 cm2. When biofilm was grown under a grow light, the mean growth was 4.714 cm2, the range was 2.743 cm2, and the standard deviation was 0.990 cm2. On the summative graph, the error bars do not overlap, and a T-test performed on the data returned a p-value of 5.2611 x 10-18. These imply statistical significance in the results, which rejects the null hypothesis and accepts the research hypothesis. Therefore, it can be concluded that biofilm grows better under a grow light compared to in a dark box.

10 MI 916

Tripathi, Anika

Washington-Liberty High School

Teacher: Singh

The Effect of Plant Extracts on the Colony Growth of E.coli

The purpose of the experiment was to observe commonly found plant extracts on their ability to prohibit the growth of E. coli colonies. The three extracts chosen were Garlic, Clove and Oregano which have shown antimicrobial properties in previous studies. It was hypothesized that Clove extract would result in the least number E. coli colonies because in a study done in 2006 by Seenivasan Prabuseenivasan, Clove extract showed strong antimicrobial properties against multiple bacterial strands. The aim was to find natural antimicrobial agents that can be used in the future topically on produce and eventually in medications using plant metabolites.

The agar was sterilized and poured into plates. After they were set and refrigerated, quadrants were drawn onto the plates and they were labelled with IV levels. The plates were inoculated with bacteria using sterile swabs. During all procedures gloves, goggles, and aprons were worn. The extracts were added to the plates using a micropipette onto the sterile disks. After 2 days in the incubator the colonies were counted and the data was tabulated.

There was no bacterial colony growth on the Clove and Oregano plates. Garlic extract had an average of 9.125 colonies and a large standard deviation of 14.62 due to the outlier trials. The control plate had a mean of 9.25 colonies. There was no significant difference between the control and Garlic extract, confirmed by the t-test and error bars. The a-nova test indicated that there was significant difference overall between experimental groups.

10 MI 917

Lewis, Spencer; Foster, Jacob

Washington-Liberty High School

Teacher: Singh

The Effect of the Strain of Competent E. coli K-12 on the Genetic Retention and Growth of a Recombinant Plasmid

This experiment's purpose was to investigate which strains of E. coli would affect the pX330 plasmid's ability to grow and maintain genetic integrity. The hypothesis of this experiment was if the NEB Stable strain of E. coli were used to carry the pX330 plasmid, it would be the most effective at retaining genetic integrity. We chose this hypothesis because NEB Stable E. coli has a genotype that allows higher genetic retention than other strains of K-12 E. coli. We tested the hypothesis by combining various strains of the K-12 E. coli with the pX330 plasmid incubating them, in petri dishes, and counting the resulting CFUs as well as testing genetic integrity through a gel-electrophoresis machine.

11 MI 918

McDonald, Alexandra

Yorktown High School

Teacher: Mower

Optimization of Microbial Fuel Cell Technology to Maximize Power and Nitrate Removal

The unsustainability and environmental pollution caused by primary energy sources along with issues on the purification of wastewater act as a major impetus for research into alternative bio-renewable technologies. Microbial Fuel Cells (MFC) are bio-electrochemical devices that are able to reduce the cost of the purification process while simultaneously generating renewable energy that is good for the environment. MFC's harness the power of respiring microbes to generate electric energy and remove pollutants directly from organic matter present naturally in the environment. Electrons generated at the anode from the oxidation-reduction reactions are used to reduce nitrates at the cathode and produce electrons. Four different types of fuel cells were constructed using household materials and the power production along with the nitrate removal was measured and compared. The results show that the double chamber MFC had both the highest power output and reduced nitrates the fastest compared to the others. Future experimentation could focus on scalability to fully explore the potential of MFCs functioning as mobile waste-processing units. Fuel Cells can dramatically lower energy bills which can be beneficial to lower class families and places with low access to electricity. There has also been raised interest in incorporating Microbial Fuel Cells to provide longer-lasting power for implantable medical devices (IMDs). We have only scratched the surface on the limitless possibilities of MFC technology. These revolutionary fuel cells have the potential to reshape how wastewater is treated through energy production and the removal of pollutants.

7 PH 1000

Beaumont, Nicola

H-B Woodlawn Secondary Program

Teacher: Taggart

Staring at the Sky: Following the Paths of the Moon and Sun

This study explores how closely the Moon's daily path in the sky tracks the Sun's daily path. While the Sun and the Moon always rise in the East and set in the West, the Sun's daily path changes with the seasons; it rises higher in the sky and is visible longer in the summer than in the winter. The hypothesis was that the Moon would follow the same seasonal pattern. Stellarium planetarium software was utilized to study the paths of the Sun and the Moon during 2019. Data was recorded for the Sun's and the Moon's altitude (height in the sky), azimuth (position on the horizon), and rise and set times. The data showed that the Moon's daily path does not have a smooth seasonal pattern like the Sun's but instead varies during each month with the change in moon phase. This led to large differences in the Moon's and the Sun's daily path, particularly during the Full Moon phase. Thus, overall, the hypothesis was not supported by the data. However, there were some interesting exceptions: the Moon and the Sun had similar daily paths at the equinoxes and the New Moon closely followed the Sun's path. These results can help people understand the logic behind why the Moon and the Sun take separate paths across the sky, and how to locate them (mainly the moon) at different times with a telescope or the naked eye.

7 PH 1001

Buckley, Grant

Williamsburg Middle School

Teacher: Zarro

The Effect of the Type of Insulation Inside of a Lunchbox on the Change of Temperature of an Ice Pack After 6 Hours

The purpose of this experiment was to determine which lunchbox insulation would keep an ice pack coldest for the longest.This is important because by the time a typical person would eat a packed lunch, up to 6 hours may pass by. An overly warm lunch can ruin food taste and eventually food safety. It was hypothesized that when compared to other types of lunchbox insulation, the lunchbox made from vinyl with polyester fill would keep the ice pack coolest for the longest because the polyester fill is able to trap the most air, and cool air is what actually keeps the ice pack/food cold, not the surrounding material itself. Frozen ice packs were placed into lunchboxes with four different types of insulation: vinyl with polyester fill, foil lining, neoprene and non-insulated vinyl/cloth. After six hours, the change in temperature was measured inside each lunchbox. These procedures were repeated for 10 trials. Vinyl with polyester fill was found to keep the ice packs cool the longest. The data collected in this experiment supported the hypothesis that vinyl with polyester fill provides the best lunchbox insulation. Extensions of this experiment might include testing various brands of ice packs to determine which ice pack stays cool the longest within the vinyl with polyester fill lunchbox.

7 PH 1002

Cozier, Malia

George Washington Middle School

Teacher: Haisfield

Trampoline Effect: Wood or Metal

In baseball, aluminum bats are used for amateurs and wooden bats are used for pros. There have been many accidents as a result of aluminum bats. The reasoning for this is that the aluminum bats have something called a trampoline effect, this happens because an aluminum bat is a hollow metal rod which is why wood bats don't have as much of it. There are many reasons for switching bats, or just using them in the first place. The main reasons are usability and safety. When players reach the pros they are a lot stronger and there is a greater risk of hurting someone. In ballparks, you don't hear the ping that comes along with the speed of the ball plus the swing and exit velocity; and that's a good thing.

7 PH 1003

Witmer, Skye

Jefferson-Houston School

Teacher: Paladin

The Effect of Air Pressure on Soccer Ball Distance When Kicked

In my experiment, I tested how air pressure affects the distance a soccer ball travels. To make sure the experiment/data is accurate, I made a wooden contraption that simulates a foot kicking a soccer ball. I decided to do this experiment because I'm a soccer player myself and I am curious to know why FIFA chose those specific psi numbers for playing soccer. This experiment can also easily be applied to anything that can be inflated. So what I want to get out of this experiment is to let people know that choosing the right air pressure for your ball WILL impact how you play.

8 PH 1004

Brennan, Emily

Jefferson-Houston School

Teacher: Calderara

Slip Sliding Away

In this experiment the speed of a block going down a slide when covered by different fabrics. I used five fabrics that represented running pants, jeans, basketball shorts, and leggings. I did the tests with three different angles and then averaged them to get a better representation of all the slides that could be on a playground. In the end, I found that the running pants went the fastest and sweatpants went the slowest.

8 PH 1005

Cooper, Alena

George Washington Middle School

Teacher: Goodman

Cooking with Color: The Effect of Different Colored Solar Ovens on the Amount of Thermal Energy Absorbed

This science fair experiment will test what color of a solar oven will absorb the most thermal energy. It is proven that different wavelengths of light have different amounts of energy and darker colors can absorb all wavelengths. Black can absorb all wavelengths of light and can convert it into heat while white reflects all wavelengths. This energy can then be used for our everyday lives. Just last year, solar energy capacity has increased by 24%! It is arguably the cleanest and renewable form of energy but there is still room for improvement. Most solar panels are blue, but if they were black, they might be able to absorb more energy than regular blue ones could. I will make 5 different colored solar ovens and place them next to a window on a sunny day with a cup of water inside. I will then wait 5 minutes to take the temperature of the water and the colored paper and convert it into thermal energy. It is expected that black will absorb the most energy since it is the darkest color, but there is a chance that this experiment will surprise me with an unexpected outcome.

8 PH 1006

Eshete, Blen

Kenmore Middle School

Teacher: Brown

The Effect of the Type of Container on Ultraviolet Light

Ultraviolet light is a big part of our lives. The purpose of this experiment is to learn which container keeps out the most UV ray exposure. Knowing the effects of ultraviolet light and how to minimize the exposure could help with further expansion in the medical field. Or anything that is disrupted by ultraviolet radiation in general. The goal of the project was to find which container kept out the most UV rays. Several beads were placed in different containers (water bottle, glass cup, blue tinted water bottle, and a prescription bottle). There was also a group of beads placed outside without a container. After some time the beads started to react to ultraviolet light. The amount of beads that had started to glow in each container was then recorded. The seven beads in the water bottle, glass cup and, the ones with no container had all showed color. The materials that the containers were made of was not able to stop the ultraviolet light. However the prescription bottle was able to keep out all ultraviolet light from entering and the beads stayed their default white color. An interesting thing which the researcher has come to find out was that not all the beads in the tinted blue water bottle started to show color but some did. An average of 3.6 beads in the blue tinted water bottle had color change shown. This experiment supported the hypothesis by showing that the prescription bottle kept out all ultraviolet light.

8 PH 1007

Fall, Leo

Swanson Middle School

Teacher: Seliskar

Beat the Heat

Solar panels, a technology that converts the light from the sun into usable energy, are becoming increasingly efficient due to development in technology. What people aren't accounting for is the diminishing effect of heat on the voltage output and lifespan of the solar panel. Scientists have developed a wide array of solar panel cooling methods to use when optimizing the efficiency of a solar panel. This experiment was created to test different types of cooling methods on a heated solar panel to find the most effective method for improving the efficiency of the solar panel as measured in surface temperature and voltage output. I hypothesized that of the three cooling methods used (water, air and glycerin gel), the water cooling condition will have the best effect on the efficiency of the solar panel. The results showed that the water cooling condition was the most effective at cooling the solar panel with an average decrease of only 0.18v (Volts) and an increase of only 45 C over 3 minutes of heating. The next most effective method, the air cooling method, had an average decrease of 0.22v and an increase of 57 C per minute, while gel cooling, the least consistent cooling device, had an average decrease in 0.38v and an increase of 67 C. All three methods were more efficient than the control condition.

8 PH 1008

Frank, Spencer

Kenmore Middle School

Teacher: Michelson

The Effect of Different Textures on Radar Visibility

The purpose of this experiment was to determine the effect of texture on light reflection out of five textures: Paper, aluminum, 80, 120, and 180 grit sandpaper. In this experiment, light represented radar, a form of electromagnetic microwaves. The experiment helped to further back up paint colors on vehicles. The experiment's hypothesis was that aluminum foil would have the highest light reflection followed by paper, 180 grit, 120 grit, and 80 grit sandpaper.

A box was covered with black paper on the inside, and a flashlight and light meter were inserted. Textures were cut out, and changed each set of trials on a template. The shape was placed in the box and the light was turned on for 5 seconds. Light is similar to radar because it is on the EM spectrum and travels straight.The results of this experiment were as follows: The paper had an average light reflection of 30.8 Lx, the 80 grit 11.6 Lx, the 180 grit 10.5 Lx, the 120 grit 8.25 Lx, and the aluminum 7.65 Lx. When the results were observed, a connection was made between the 12 grit sandpaper and the aluminum foil. Based on further research, the researcher found that all the sandpaper was made of aluminum oxide resulting in similar data. The researcher also concluded that the paper was very reflective because it was white, a color that contains all colors.

8 PH 1009

Huddle, Maya

Patrick Henry School

Teacher: Geddes

Catching Asteroids... Is It Possible?

Orbiting altitude, velocity, and gravitational pull are influential factors going into satellite movement, and even theoretically catching an asteroid. This experiment tested how increasing the speed of an object would affect the orbiting altitude. It simulated different gravitational pulls of Mars, Earth, and Earth's Moon using information adapted from NASA's database. In the experiment, the height of a tube was changed to see how increasing or decreasing the speed of a marble "asteroid" would deviate from zero. This was measured on a cookie sheet, which was tilted at different angles to simulate the gravitational pull of these three locations. The results consistently showed a direct correlation between speed and the deviation from zero; the higher speed created a straighter line (less of a deviation from zero gravity) whereas the lower speed created more of a curve. In conclusion, this project showed that gravitational pull has a greater effect on objects orbiting at a lower speed rather than objects moving at higher speeds.

8 PH 1010

Kaminski, Maya

Kenmore Middle School

Teacher: Brown

The Effect of Arlington Lights on the Visibility of the Night Sky

The purpose of this experiment is to determine the amount of light pollution in Arlington and its effect on the ability to see the night sky. This experiment is important because light pollution is harming the ecosystem, wasting energy, and affecting the ability to research the night sky. The hypothesis is the brighter the lights are in the location where the experiment is being done, then the fewer stars will be visible. The procedure entailed going to six different Arlington locations each night for sixteen nights. At each location, the constellation Perseus was found in the sky and compared to star charts (ranked 0-8 and provided by Globe at Night, a citizen science program used for this project). Additionally, a light meter was used in each location to record how much light was each area. The experimental results supported the hypothesis by showing that the brightest location, 352.9 lux (measurement of light), was an average of zero on the star charts, with no stars seen, while the location with the least amount of light, 0.0 lux, was an average of two-point-one on the star charts, had an average amount of stars seen. This science project contributes to astronomy in Arlington because it was found that the different types of lights in Arlington are affecting the amount of light pollution that is emitted into the atmosphere. If all of the lights were changed to LED lights, the atmosphere could have significantly less light pollution in it.

8 PH 1011

Lux, Akira

Swanson Middle School

Teacher: Swanson

The Effect of the HB Scale on the Electrical Resistance of Mechanical Pencil Lead

The purpose of this experiment addresses the electrical resistivity of mechanical pencil lead: the effect of the HB scale on the pencil lead's electrical resistance in a circuit. The experiment's results would allow engineers to consider the aspects of a certain material when applying it to an electrical circuit. It was hypothesized that if five different degrees of pencil lead are tested as resistors (4B, 2B, HB, 2H, and 4H) in a circuit, then the 4B pencil lead would produce the least electrical resistance, because it was the IV level inferred to consist of the most graphite and the least polymer compounds compared to the other levels. To test this hypothesis, individual sticks of mechanical pencil lead were attached to a multimeter that measures electrical resistance. After ten trials per level, 4B lead had the highest average resistance (2.82 ohms), while 4H lead had the lowest average resistance (0.64 ohms). The results refuted the hypothesis of the experiment, but further research showed that the electrical resistance also depends on how tightly-bound a material's particles are; this justifies why 4H lead's tightly-bound particles allowed it to have minimal electrical resistance. This experiment contributes to the field of engineering and technology because it emphasizes the importance of experimentation and the scientific method; it proves that more than one factor of a material has to be put into consideration before fully applying it as an electrical conductor or resistor.

8 PH 1012

Galindo, Isabela; Busigo, Mariella

Gunston Middle School

Teacher: Pentland

The Effect of Different Liquids on the Mass of a Cracker

The purpose of the experiment is to have a better understanding of what happens inside the human body with the food that we consume using examples and equivalents that exist outside the human body. It was also looking to comprehend why different things are recommended for different situations and the effect they have when they are followed. For the experiment, the setup was 5 trials with 5 cups each, and 5 liquids behind each group. There was an electric balance and a sheet of paper with a pencil to write the results down. There were also five different timers to make everything easier and a strainer to release the water. The team was surprised to find that the fizz in the liquids did not affect the crackers more than the acid, and neither did the sugar. It seemed that the sugar strengthened the crackers instead of destroying them, which led to slightly less mass loss. This lead us to the conclusion that the acid from the lemon affects crackers more than other materials.

8 PH 1013

Shipley, Alexander; Blaha, Mitchell

H-B Woodlawn Secondary Program

Teacher: Vanevera

Forehand vs Backhand: Speed Battle

The reason we did this experiment was that we have played frisbee for a long time, and were both curious which method of frisbee throwing was fastest. We thought that this information would be interesting and helpful to more people than just ourselves. Our research question was: Among different skill groups, which frisbee throw travels faster, forehand or backhand? Our hypothesis was that backhand would go faster for all skill groups. We thought this because most people learn to throw the backhand before any other throw, and practice it more. We tested this hypothesis by gathering a group of twenty participants, and having them each self-evaluate their skill level. We then had them each throw three backhand throws, and three forehands. We measured the speed of each throw, and averaged out the throws, separating them by type of throw, and the skill group. Our results concluded that the lowest skill group threw backhands faster, and the highest skill group threw backhands faster. Interestingly, the two middle skill groups threw the forehand faster than the backhand. We think this was because the forehand is more similar to throwing a ball, and that since these skill groups practiced each throw equivalently, they threw forehands faster. We were not surprised by the fact that the high skill group threw the fastest on average, or that the low skill group threw the slowest. In conclusion, our hypothesis was incorrect. We hypothesized that all skill groups would throw backhand faster, while only two did.

9 PH 1014

Bain, Angelica

Washington-Liberty High School

Teacher: Sotomayor

The Effect of App Color Scheme on LED Blue Light Irradiance

The purpose of this experiment was to investigate how different applications' color schemes, such as dim and dark modes, affected the amount of blue light energy emitted from the LED screens of smartphones. It is known that there are negative health effects (ocular, cognitive, and immunological) from overexposure to LED light, specifically in the blue wavelengths, so factors that affect the dosage of LED light are important. The hypothesis stated that if different color schemes of smartphone applications were tested for the amount of blue light relative irradiance using an Ocean Optics 4000USB spectrometer, then the unaltered versions of the applications would emit the most relative irradiance (w/m^2) at the blue light wavelengths.

Based on the results of this experiment, the null hypothesis stating that different color schemes of smartphone applications have no statistically significant differences in the amount of blue light relative irradiance was rejected. This was proven by conducting an ANOVA test which resulted in a p-value of 2.64^-36, which falls far below the needed 0.05 to prove the independent variables had an effect on the dependent variable. The data strongly supported the conclusion that the hypothesis was accepted because the unaltered application screens emitted over 360% more light in the targeted blue wavelengths as measured by relative irradiance. According to these findings, dark modes do have a significant impact and should, therefore, be a part of blue light mitigation best practices. Dark modes do matter!

9 PH 1015

Hubbard, Marie

T.C. Williams High School

Teacher: Matthews

Energy in the Sky

The goal of this experiment is to build and test an object that can get energy (volts) from the atmosphere. There is a lot of energy in the atmosphere from the sun and ground, and theoretically you can measure that energy and harness it to use it as a source of renewable energy. It was stated in the past by multiple scientists, notably Feynman, that if you increase the height of the object (in this case a balloon) you can increase the voltage significantly. In the experiment it was found that this statement is correct, but I found through a lot of testing that the wind is a variable but it can also increase the voltage. Which is one reason why storms create so many volts.

9 PH 1016

McNally, Ella

Washington-Liberty High School

Teacher: Brodowski

The Effect of Different Speeds on the Orbiting Altitude of Different Planets

The purpose of this study is to determine if the orbiting altitude of different planets is affected by different speeds. The independent variable is gravity and speed of the satellite. The experimental group includes Earth and Jupiter. The control group is no planets. The dependent variable is the orbiting altitude of Earth and Jupiter (cm). The constants are the size of the marble which replicates Earth or Jupiter and the cookie sheet which represents space. The hypothesis is: If a planet has more gravity than another, then satellite's trajectory will deflect or deviate more. If the satellite speed is increased, then trajectory will deflect or deviate less. To conduct this study, a trajectory panel was constructed and 6 different scenarios were set up. Each of the scenarios contained different levels of gravity of a planet and different satellite speeds. A colored marble was rolled down a tube and marked a trajectory panel on a piece of paper. Then, the deflections were measured by a zero deflection line. The results showed that more gravity of a planet meant the trajectory had a greater deflection and the more speed of a satellite meant a lesser deflection. These results accepted the hypothesis. In conclusion, the gravity of a planet and the speed of a satellite had great effects on the trajectory of the satellite.

9 PH 1017

Sherlick, Maya

Arlington Tech and Career Center

Teacher: Le

The Effect of House Shapes on the Ability to Withstand Hurricanes

The purpose of this study was to test the effect of different shapes of houses on the destruction caused by hurricanes. The independent variable is different house shapes (tall; short; flat roof; and raised house). There is no control group. The dependent variable is how much force in Newtons is required to counterbalance the fan, the wind source. The force was divided by the surface area for each house. The constants are the material used (popsicle sticks), the fan used, the location and the force gauge used. The hypothesis was: If the house is short then it will be the least destroyed because the structure is located below the high-speed wind source. The results of my experiment showed that the house with stilts experienced the least amount of force. One reason for this outcome was that the experiment was done using a small model and the wind could not have been at the correct angle. The hypothesis was rejected because the stilts house with roof withstood the least force and it would withstand the best in a hurricane.The hypothesis accepted was not accepted because the stilts house has a gap on the bottom and on the top. The gap allowed wind to flow through and not directly on the house, so the force on the house was less. The house had a roof so the wind had a turbulent flow, meaning the wind went around the house, so it affected the amount of force on the house.

9 PH 1018

Yacobucci, Margaret

Yorktown High School

Teacher: Dorman

Discovering the Effect of Solar RFI on 20-Meter Radio Telescope Accuracy

In this project, the 20-Meter radio telescope at Green Bank Observatory, which is used by astronomers at a variety of professional levels, was utilized to observe two radio objects, 3c 153.1, an emission nebula, and 3c 397, a supernova remnant. They are visible at night and during the day, respectively. These objects have the same recorded apparent brightness in Janskys (10−26 W/m2/Hz). Both objects appear to be the same brightness from Earth, so it follows that the objects would be the same brightness when observed. However, it was hypothesized that radio frequency interference (RFI) from the Sun would skew the data causing the data collected during the day to be less accurate with a greater brightness than the data collected at night. In the experiment, the telescope was tasked to observe both objects 10 times in a 4 petaled, 100 arcminute, low-resolution daisy scan. The data was recorded in antenna temperature and converted to Janskys. The average brightness for 3C 153.1 was brighter and less accurate than 3c 397. A T-test found that the difference was statistically significant. The hypothesis was not supported because the observations of 3c 153.1 were less accurate than those of 3c 397. Possible explanations for this data include RFI from the sun reflecting off the moon (waxing gibbous at the time of observation), inaccuracy in the published data, or inaccuracies with the telescope.

10 PH 1019

Bernstein, Amelia

T.C. Williams High School

Teacher: Strimple-Barker

The Race to Zero!

The Mpemba effect, which is when hot water freezes faster than cold water, is a controversial topic that was originally observed in the 1960's by Erasto Bartholomeo Mpemba who claimed to have seen it making ice cream. This effect is controversial because it is counterintuitive that hot water would freeze faster than cold water. The purpose of this experiment was to see if boiling water freezes faster than fridge temperature water. The hypothesis stated that the boiling water would freeze exactly 10 minutes faster than the fridge temperature water. One 125mL cup of boiling water and one of fridge temperature water were placed in the freezer and every 10 minutes the temperature was checked until both reached 0. The hypothesis was proved wrong. Boiling water does not freeze faster than fridge temperature, although it is interesting that the boiling water's temperature went down a lot faster in the beginning as compared to the fridge temperature water. Within the first 10 minutes the boiling water had gone down about 30 degrees Celsius while fridge temperature water had only gone down about 4 degrees Celsius. If the experiment was repeated a more varied range of water starting temperature could be used to see if it affects the results.

10 PH 1020

Haan, MeiLi; Ley, Thi; Smith, Lauren

Wakefield High School

Teacher: El Gamal

The Effect of Weight on the Battery Life of a Drone

The purpose of this experiment was to find the effect of weight on the battery life of a drone. In this experiment, the hypothesis was if weight is added to a drone, then the battery life of the drone will decrease because the propellers of the drone will have to work harder to support the weight of the drone, making the energy drain faster. The independent variable was the amount of weight added and the dependent variable was the amount of time the drone lasted.

The procedure was to add pennies to the drone using tape, two pennies were added every trial. For trial one there were two pennies attached to the drone, the drone weighed 128 grams. The amount of battery lasted for four minutes, 21 seconds, and 28 milliseconds. In trial six, there were 12 pennies attached and the drone then weighed 153 grams. In this trial, the battery of the drone stayed on for one minute, 13 seconds, and 57 milliseconds. This trial had the most pennies attached in the experiment. For this experiment, the hypothesis was accepted. As more weight was added to the drone, the battery life decreased, which made this an indirect relationship.

11 PH 1021

Bass, Dillon

Yorktown High School

Teacher: Hessler

An Exploration of Amateur Astronomy: Astrophotography and Spectroscopy

This project is an investigation of the limits of amateur astronomy in two specific fields: astrophotography and spectroscopy. The project was performed with an amateur telescope, a camera and some other basic equipment. In the astrophotography half of the project the goal was to take clear pictures of the night sky, specifically the Orion Nebula, but also a few other objects like planets and star clusters. Techniques including a hydrogen alpha filter were used to capture maximum detail and combat light pollution. The photos were stacked edited in Photoshop to increase total exposure time, contrast, and color. The second half of the project used spectroscopy and stellar spectra to attempt to determine the type and temperature of various stars. A diffraction grating was added to the camera in order to split starlight into the component wavelengths that make up a star's spectra. A software was used to analyse the captured spectra by comparing them to a professional database and Wien's law was used to determine an approximate temperature for each star.

11 PH 1022

Gamboa, Sophie

Wakefield High School

Teacher: Megargee

Impact Forces In Gymnastics Tumbling

The purpose of the experiment was to discover the impact forces present during gymnastic floor tumbling. Athletes in the sport of gymnastics face huge injury risk and incidence, the goal was to find out to what extent do those forces test the resilience of the human body. To further investigate, were there any ways to diminish those forces and the threat they pose to the human body's resiliency. Using a video analysis program called Kinovea and videos of elite gymnasts, the forces present upon impact were analyzed. The results were remarkable, the impact forces present are near the limits of the human body. The average of the impact forces fell around 3,500J and the amount of force it takes to break a femur is about 4,000J (from a direct perpendicular hit). To further contextualize, the impact force was up to 55 times higher than the impact forces of walking. While these forces are huge, there is a way to diminish their impact. By increasing the deceleration time, the force becomes significantly decreased. This can be done with the use of something called a sting mat. Sting mats are soft 4" thick pieces of foam that can be landed on during gymnastics, this increases deceleration time and absorbs some of the impact force. This project allows athletes in the sport of gymnastics to gain a simplistic understanding of the level of force they are subject to. By being aware of the solution, athletes can act preemptively to prevent injury.

7 PS 1100

Allen, Peter

Williamsburg Middle School

Teacher: Zarro

The Effect of the Amount of Fertilizer on the Height of a Bean Plant

The purpose of this experiment was to determine what the best amount of fertilizer is without causing eutrophication. The hypothesis stated, if the amount of fertilizer applied to the bean plant is 1 gram per every 2.24 centimeters of soil, then the height of the plant will be higher than if no fertilizer is present because the low amount of fertilizer given to the plant will not cause the plant to burn, but still show an obvious improvement from no fertilizer. The independent variable was the amount of fertilizer per centimeters of soil, and the dependent variable was the height of the bean plant. Thirty-six bean plants were divided into four groups of nine plants. The first group had 1 gram of fertilizer per every 0.74 cm of soil applied to the plant. The second group had 1 gram per 1.49 cm while the third group had 2.24 cm of soil. The extra nine were planted with no fertilizer added. The average height of a plant with 1 gram per every 2.24 cm reached only 11.11 cm while the plants with no fertilizer reached 17.16 cm, therefore disproving the hypothesis. This experiment can help inform people of the best way to maintain their yard while minimizing the harmful effects. This project could be further experimented by testing the effect of the amount of time the plant spends germinating. That could lead to the knowledge of the most efficient way to grow a plant.

7 PS 1101

Ayscue, Sarah

Kenmore Middle School

Teacher: Haile

The Effect of Different Types of Animal Feces on Plant Growth

Growing plants in animal manure is a commonly known method used for growing plants all over the world for hundreds of years. Manure is packed with a wide variety of nutrients such as nitrogen, phosphorus, and potassium, which are all beneficial for growing plants. Animal manure can help reduce runoff and nitrates in the soil. Manure can help loosen and increase carbon in the soil, as well as keep plants healthy and green. The purpose of this experiment was to determine which animal feces would have the best effect on plant growth. The hypothesis was that the plant growing in containers with herbivore feces would grow tallest within fourteen days. Eight containers were filled with animal manure, potting soil, and eight lentil seeds. Every day the tallest, shortest, and the average of all the sprouts per container were recorded. Pictures were taken of all the plants daily and watered every third day. The final results indicated that plants fertilized with herbivore feces grew the tallest with an average height of 22.8cm, the plant container with omnivore feces grew the second tallest with an average height of 15.1cm, and finally the plant container with carnivore feces grew the third tallest with an average height of 14.4cm. Results indicate that herbivore feces are more effective in plant growth than carnivore and omnivore feces. However, sprouts growing in the control container grew the tallest out of all four, with an average height of 23.4cm.

7 PS 1102

Azmi, Samia

Hammond Middle School

Teacher: Chapman

How Does a Different Type of Light Effect Plant Growth

Household lights were proven to be better than the grow light.

The hypothesis was that the plants with the grow light would grow taller and healthier, but the hypothesis turned out to be incorrect. The plants with the regular light turned out to grow healthier and taller than the plants with the grow light. The plants with the grow light grew at an average rate of 11.716 while the plants with the regular light grew at the average rate of 16.066. Five plants were grown with the grow light when I had planted six, one of the plants hadn't grown at all while all six of the plants planted with the regular light had grown, therefore my hypothesis had been incorrect.

7 PS 1103

Burch, Max

H-B Woodlawn Secondary Program

Teacher: Taggart

How Does the Salinity of Water Affect Plants' Growth?

I chose this experiment because I really like plant science, and I had already done another plant science experiment, so I thought I might as well. My research question for this experiment is: "How do salt levels in water affect plants' growth. My hypothesis was that the plants watered with water with a high amount of salt would die a lot quicker than the plants watered with water with 0 percent salt, because many studies show that most plants are not salinity-resistant, or that are plants that are "resistant" to high amounts of salt in the water that they are watered with or in their habitat. I tested my hypothesis by watering twelve different plants with 0 percent salinity water, 6.25 percent salinity water, or 12.5 percent salinity water everyday for about 45 days, there were four different types of bean plants. All in all, my results were that my hypothesis was correct and the plants watered with water with a high salt content died quickly, even if one of them survived for 15 days and that plants watered with normal water did almost completely fine.

7 PS 1104

Flom, Allyna

H-B Woodlawn Secondary Program

Teacher: Taggart

The Effect of Different Colored Lights on Plant Growth

I was interested in seeing whether our plants could grow anywhere else in the house if they were provided with a light other than sunlight. This led me to question, “how do different colored lights affect plants?” My hypothesis was that LED lights would work just as well as sunlight because they are bright and could possibly provide a plant with everything sunlight provides. I tested this hypothesis by setting up the experiment in a dark space so that each set of plants would only be exposed to one type of light. I also had a set of plants exposed to sunlight. The results of my experiment showed that in the first week the plants under the black light were the tallest. In the second week, plants under the LED light and plants under the amber light were the same height. By the third week, plants under the LED light were the tallest, even taller than the plants growing in sunlight. In conclusion, my hypothesis was correct as my experiment showed that LED lights allowed the plants to grow better than they did in sunlight.

7 PS 1105

Goco, Grant

H-B Woodlawn Secondary Program

Teacher: Taggart

Don't Take This Too Lightly

I decided to do this experiment because I've always found plants very interesting and wanted to find out how to grow them as well as possible.

I decided to figure out "what is the effect of different types of light on plant growth?"

My hypothesis was that plants exposed to both sunlight and artificial light would grow the tallest.

I tested this by planting nine pumpkin seeds (leftover from Halloween), split evenly between three pots. After letting them grow I placed them in positions within my house that would give them access to only sunlight, artificial light only, or both depending on the pot. I then measured and allowed them to grow for one week.

After removing outliers, I found that the plants exposed to sunlight only were tallest, but those exposed to sunlight and artificial light had grown the most. Since the plants exposed to sunlight only had started tallest, I concluded that my hypothesis was supported.

7 PS 1106

Hemsch, Emma

Dorothy Hamm Middle School

Teacher: Azzara

The Effect of the Acidic or Basic Substance Added to the Soil on the Height of the Plant

The purpose of this experiment was to determine the effects of an acidic or basic substance added to the soil on the growth of pea plants. Pea plants usually must have a soil pH in a range from 5.8 to 7.0 in order to grow. In this experiment, it was hypothesized that the farther away from neutral the soil pH was, the less the plant would grow. To test this hypothesis, nine pea plants were planted. Vinegar was added to the soil of three plants, and baking soda was added to the soil of three plants. Three pots remained without an acid or base. All of the pea plants were then watered regularly. The pH of the soil was taken ten minutes after the substances had been added. The pots with vinegar had a soil pH of approximately 5.5, while the pots with baking soda had a soil pH of approximately 9.0. The pots with only water added to them had a soil pH of approximately 6.0. The height of the plants was measured every seven days. After three weeks, the plants with two substances added to them did not show any evidence of germination, while the plants with only water added to them grew an average of 50.8 centimeters. This could indicate that pea plants must always have a soil pH in the optimal range for them to germinate.

7 PS 1107

Rickard, Elise

Thomas Jefferson Middle School

Teacher: Holland-Shuford

The Effect of Growing Methods on Brix Levels

The purpose of the study was to determine the effect of different growing methods on the Brix levels of romaine lettuce. The independent variable was the growing method. The experimental group was the hydroponics group, and the control group was the soil group. The dependent variable was the Brix levels. The constants were the plant type, seeds, light and sun exposure, temperature, and refractometer. The hypothesis was: If different methods of growing romaine lettuce are tested for Brix levels, then the plants grown hydroponically will have higher Brix levels. First, a bin was used to grow eleven soil seeds and eleven hydroponics seeds. Eleven days later, another setup was constructed using seed plugs. Then, four of the tallest seedlings from the soil group were transplanted to larger containers and then placed under a T5 grow light; four hydroponics group seedlings were transferred to a larger bucket, surrounded by growing pebbles, and placed under the same grow light. A refractometer was used to find the Brix levels. The results showed that the hydroponics group had higher Brix levels, and supported the hypothesis. One reason for these results may be that the nutrient solutions used in hydroponics give hydroponic plants more nutrients than soil plants. Another reason may be because the hydroponics group always had access to water, while the soil group only received water once a day, causing water and nutrient deficient plants. In conclusion, the study suggests that hydroponically grown plants are more beneficial because they contain more nutrients.

7 PS 1108

Stinson, Elena

George Washington Middle School

Teacher: Haisfield

Saving the Turtles, One Worm at a Time: The Effect of Worms and Inorganic Fertilizer on Plant Growth

This project tested the effects of worms and inorganic fertilizer on plant growth. Worms are better for the environment, but people might not want to use them if inorganic fertilizer makes their plants grow better. Inorganic fertilizer is bad for the environment because the nitrogen in it can cause algae blooms, which are harmful to marine life. The hypothesis states that if worms are used instead of inorganic fertilizer, then the plants will grow better, because worms make the soil ten times as nutrient-rich, and they aerate and drain it. This experiment tested whether worms are better for plants than inorganic fertilizer by planting green beans in pots. Ten of the pots had five worms each, ten of the pots had 1.2 mL of inorganic fertilizer and ten of the pots with no independent variable. The plants were watered every other day and their growth was recorded over a three-week span.

The results showed that the worms were better for plants. The average worm plant height was 22.15 cm, 5 cm taller than the control group average, and 7.35 cm taller than the inorganic fertilizer plants. Some errors were breaking off plant stems, which happened while measuring the plants. On day 10, a significant amount of IF1A broke off, causing the daily average for inorganic fertilizer to not increase as much as it would have. Next time, there will be precautions so it will not happen again, which will make the project more successful.

7 PS 1109

Waldman, Amelia

Williamsburg Middle School

Teacher: Willet

The Effect of the Type of Plant on the pH at Plant Death

The objective of this experiment was to find an alternative for harmful chemicals that prevented invasive species and weeds from growing in gardens, farms, and lawns. The method used was to control the pH of the water that plants are watered with to see if it affected the growth of the plants. It was hypothesized that the change in the pH of the water would have a differing impact on invasive versus native species of plants. The approach to this experiment was to have a native plant species and an invasive plant species, and see what pH range the native species could survive that the invasive species could not. This was tested by watering both the native and invasive plants with water getting gradually more acidic, and certain plants getting watered with water getting gradually more basic. This would show what type of plant could survive a certain pH range. The point was to identify if there is a pH range that would kill off an invasive species without killing the native species, that could be used to water plants instead of harmful chemicals. There were no results obtained from this experiment, as none of the plants grew, despite the change in the pH of the water they were watered with. Conclusions drawn from this experiment were that the plants' lack of growth may have been caused by overwatering and use of the wrong cold stratification technique.

7 PS 1110

Beauvais, Cyrus

Gunston Middle School

Teacher: Pentland

The Effect of Fertilizer Quantity on the Germination Rate and Growth of Radish Plants

This research can be very helpful because agriculture is a very important part to the economy of many countries. Fertilizer quantity is very important to how well the crops will grow. The scientist found the adequate amount of fertilizer for radish growth. The design of the experiment was six groups of forty-eight radish plants. Each group was given three mL of water with a certain amount (no fertilizer, one tablespoon, two tablespoons, three tablespoons, four tablespoons, and five tablespoons) of fertilizer mixed in with one gallon of water whenever the soil was dry. The germination of all the plants was measured every day, and the height was measured after seven days and after fifteen days. The results showed that one tablespoon of fertilizer per gallon of water was best for the growth and development of the plants. The plants given water with no fertilizer were only slightly behind in the development, and after that there was a steep decline in growth for the radishes given more fertilizer. However, the fertilizer quantity didn't have an impact on the germination rate of the plants. Almost all of the radishes germinated at the same time, with a small number of seeds that sprouted much later than the majority. This project verified that the generally advised amount of fertilizer as advertised on the plant food bottle used is accurate for radish plants. Overall, this experiment met its objectives.

8 PS 1111

Boerckel, Kathryn

Kenmore Middle School

Teacher: Price

The Effect of Dish Detergent on Plant Growth

Everyday cleaning products are frequently advertised as environmentally-friendly, but which products really are safer for the environment? The goal of this project was to find the effect of dish soap on plant growth. This experiment tests three types of dish detergents; Seventh Generation, Dawn (environmentally-friendly) and Ajax (non-environmentally-friendly). Three bean plants were watered with a dish soap and water solution every three days for four weeks. One plant (the control) was watered with only plain tap water. Each plant's height was measured each week. Measuring started when each plant reached a height of approximately 15 cm. My hypothesis was that the plants watered with environmentally-friendly dish soaps would have a higher growth rate than the plant watered with dish soap not marketed as environmentally friendly. The results of this experiment did not support the hypothesis: the two plants watered with environmentally-friendly detergents reflected a smaller growth rate than the plant watered with the soap that was not marketed as environmentally-friendly. The plant watered with Seventh Generation grew to 16.4cm, Dawn to 17cm, Ajax to 20cm, and the Control to 24.1cm. This science fair project reflects the need of consumers to be aware of ingredients in everyday cleaning products and how the chemicals contained in them may adversely affect the environment.

8 PS 1112

Fern, Caroline

Kenmore Middle School

Teacher: Price

The Effect Of Chemicals On Seed Germination Rates

The purpose of this experiment is to see if radish seeds are pre-soaked in different chemicals, will their germination rate be increased compared to their normal germination rate. This experiment is important for many reasons. A quote from CBS News States, “Food production will need to increase by at least 70 percent to meet the demands of this growing population by 2050..." Another reason is this experiment could suggest new ways to accelerate botanical life therefore, an increased amount of food. The hypothesis of this project was, if different seeds are pre soaked, then the seeds germination rate that will increase the most would be the seeds pre soaked in hydrogen peroxide. For the procedure three trials of six seeds to each chemical were recorded for growth in a span of twenty days. In advance, all the seeds had been soaked in their specific chemical for four hours. The chemicals included hydrogen peroxide, dilute isopropyl alcohol solution, dilute hydrochloric acid solution, and lemon juice. The outcome entailed unexpected results, in detail the control totaled with a germination rate of 94.4% and the predicted three percent hydrogen peroxide yielded a rate of 88.8%. To conclude this project contributed to local farmers and scientists who previously speculated that hydrogen peroxide increased normal germination rates. This was considered beforehand resulting from multiple statements from the NCBI affirming that hydrogen peroxide sped up growth rates, while this experiment contracted those results.

8 PS 1113

Hogan, Abigail

Kenmore Middle School

Teacher: Brown

The Effect of Detergent on Mint Plant Growth

In recent years, it has become increasingly common for people to wash things outside. Most times, people use more detergent than necessary so it gets into the roots of native plant life. This project investigates whether different detergents have a positive or negative affect on native plants. To measure this, sixteen mint plants were planted in exactly the same way. Each day their growth was charted, and they were watered with a mixture of a specific detergent and water. Four plants were watered with Dawn dish soap, four with Tide laundry detergent, four with Adam's car shampoo, and four with just water. The hypothesis was the dish soap would have the most negative effect on the plants because it is made to be harsh and scrape dirt and oils off of dishes, which means it also has a high pH level. The results did not support the hypothesis. The dish soap plants had the highest average growth of 11.125 cm, which was even higher than the control (water) with an average growth of 10.25 cm. The plants watered with the car shampoo mixture had an average growth of 5.875 cm and laundry detergent plants had the lowest average growth with 2.75 cm. This experiment showed that dish soap helps grow plants because of its high phosphorus concentration, while laundry detergent and car shampoo harm plants.

8 PS 1114

Mukhtar, Yasmeen

Hammond Middle School

Teacher: Scott

How Magnetism Affects Plant Growth

I conducted this experiment to see at what position you could place a magnet for a seed to grow best. My findings were that using a magnet can enhance plant growth and strengthen the stem. The positioning of the magnet was the independent variable and the amount of time it took the plant to grow as the dependent variable. The plant was able to reach optimal growth when exposed to a magnet, this was because the protein increased. This caused the plant to germinate faster and it was much healthier.

8 PS 1115

Planey, Violet

George Washington Middle School

Teacher: Matthews

Galactic Greenhouses: The Effect of Light Filtration on Plant Growth

Over the past few decades, climate change has become a prevalent and dangerous issue. Scientists have been working to solve climate issues, but also have been planning for the future in case there is no way to save the Earth. An idea that scientists are experimenting and researching is the possibility of living on Mars. Mars does not have the same conditions as Earth, as it has a minimal atmosphere, no oxygen, and extreme cold, and this poses complications for stable life. One major concern of scientists about life on Mars is food supply. It is impossible to bring a supply that will last forever, but Mars does not have the farming ability that earth does, one reason being that there are extreme amounts of UV light hitting the surface of the planet. The purpose of this experiment is to investigate how UV light can be filtered to create an environment that can support plant-life.

On November 6, three seed starters were filled with potting soil and fertilizer, and three different seed starters were filled with martian soil regolith and fertilizer. Then small holes were dug, and one bean seed was planted in each individual unit. For over a month, data was collected on the plants, and the results were unexpected. It was found that the tallest plant was in tray three, which had a polarized cover. Then, the control, or the plants without a filter grew second tallest, and the plants with a UV filter grew the least.

8 PS 1116

Rougle, Eliana

Hammond Middle School

Teacher: Scott

How Added CO2 Affects the Growth of Plants

Climate change is real and it's affecting us now. This project's purpose was to learn how added CO2 affects the growth of plants. I hypothesized that adding CO2 would increase the plants' growth. To test this hypothesis, I decided to plant four terrariums for a closed, controlled environment. Once the seedlings began to sprout, I measured the growth and added 40 ml of CO2 to two of the terrariums, keeping track of the plants with sticker labels. The independent variable was which plants received extra CO2. The dependent variable was the growth of each plant. The constants were the amount of water received, the amount of CO2 received by the CO2 plants, and the type of soil. They mostly received the same amount of sunlight, but it was not consistent, which could have affected the results. The measurements were not completely consistent as well, and in another trial, I would have measured each plant several times to fix this issue. In the end, my hypothesis was proven incorrect, as the plants that did not receive extra CO2 grew taller, had a lower death rate, and looked and behaved healthier overall. Although there were a few outliers, the averages show a significant difference. The average height of the non-CO2 terrariums was 6.4 while the average of the CO2 terrariums was only 4.4. In conclusion, my project shows the negative effects that climate change will have on plants.

8 PS 1117

Scally, Evelyn

Dorothy Hamm Middle School

Teacher: Kennedy

The Effect of Sunscreen Compositions on Radish Plant Growth

This experiment was conducted to examine how different compositions of sunscreens will affect the growth of daikon radishes. Some sunscreens are now banned from beaches due to containing certain chemicals that cause negative side effects in marine life, such as Oxybenzone. The hypothesis was if there was no sunscreen dissolved in the water, then the radish plants would have the highest average growth because if any sunscreen was added to the water, the experimental plants would still experience an effect from the added chemicals. After following the procedures, data was collected by finding the total growth that occurred in each plant during the 16-day period. The control group, the group with no sunscreen added into the water, had the highest average growth, proving the hypothesis correct. Every other group experienced less growth due to the sunscreens added. According to the data, reef-safe sunscreens are better for now, but alternatives for sunscreens will still be better for marine life over time.

8 PS 1118

Syed, Tanween; Rowley, Travis

Hammond Middle School

Teacher: Larson

Plants and pH: How the pH of Water Affects the Growth Rate and Crop Output of Royal Burgundy Bush Beans

In our experiment we have three independent variables: water with the pH of acid rain, water with the pH of normal rain and tap water. The answer to this question may seem obvious as the plants with acid being dumped on them clearly won't do as well as those who got tap water. Given the pH's that we were working with it seemed obvious that, at least for royal burgundy bush beans that the plants treated with tap water would have the best crop output. We also thought that the plants treated with our acid rain solution would grow the worst and have the smallest yield. Our hypothesis was correct, acid rain grew the least and tap water will have the best crop output. We figured this out by planting royal burgundy bush bean seeds and watered them with tap water every 3 days for 9 days so that they could germinate. We mixed water and sulfuric acid to create a stand in for normal rain, acid rain, tap water then we used those to water our plants every three days. We also measured the plants' growth every three days. After 15 days of watering with acid rain, normal rain and tap water we re-potted the six largest plants from each category. After 66 days of growth we harvest, measure and weigh the beans. Then we average out our data and make our verdict.

9 PS 1119

Huson, Teo

Washington-Liberty High School

Teacher: Brodowksi

"Kill or Get Killed" A Study on the Allelopathic Properties of Nut Trees Local to Northern Viriginia

Kill or get killed. In the wild, this is the law of the land, for animals and even for plants. Allelopathic trees and plants, are defined as a biological phenomenon by which an organism produces one or more biochemicals that influence the germination and growth of another organism.

The purpose of this study is to show how allelopathy can kill other plants in an ecosystem, and even destroy an ecosystem. For instance, many of the most dangerous invasive species are slightly allelopathic, explaining how they can easily overrun an ecosystem. This experiment shows how allelopathic trees and plants pose as a threat towards natural ecosystems, and how it can affect crop growth in the US. On the other hand, Allelopathy can also lead to good things in the world. For example, if a crop was made allelopathic it could naturally kill weeds and then pesticides would not be needed as much in agriculture. This idea shows the gravity and the importance of allelopathic plants, and how if properly mitigated these plants can be an extreme plus factor in the agricultural world. In fact, if allelopathic traits were transferred over to crops, then not only would the climate benefit (as less pesticides would be used) , but farmers would benefit, as their crops would be easier to grow, and they could sustain more plants with the same amount of land. Allelopathic bio-engineering can change the world, and this research is just the beginning.

9 PS 1120

Makonnen, Nathan

Wakefield High School

Teacher: El Gamal

What Is The Effect of the Amount of Elodea on the Amount of Oxygen Produced?

The purpose of this experiment was to determine the effect of elodea on the amount of dissolved oxygen in a closed environment. The hypothesis stated that if 6 elodea were used, then it would produce the most oxygen. The first step that was taken to start this experiment was to gather all the materials. Then, the invetigator set up the Erylenmyer flasks and filled all of the flasks with 450 mL of water, then placed the different amounts of elodea in them. Each week, the levels of dissolved oxygen measured each week for three weeks. After the three weeks, all of the data was gathered. The average oxygen level without any elodea in the tank was 6.46. The average oxygen level with 2 elodea in the tank was 2.78. The average oxygen level with 4 elodea in the tank was 1.33. The average oxygen level with 6 elodea in the tank was 1.76. The results were shocking because that was not what was expected. Usually the more elodea the more oxygen gets produced overall, but in the experiment it turned out to be the complete opposite.

9 PS 1121

Tsai, Benjamin

Washington-Liberty High School

Teacher: Brodowski

The Effect of Microplastics on Soybean Growth

The purpose of this study was to find the effect of microplastics on soybean growth. The independent variable was the water that the soybeans were watered with (Nestle Pure Life, Aquafina, Evian, Dasani, and tap water). The control group was tap water. The dependent variable was the length of the soybean roots. The constants were the environment, the amount of water, and the soybean source. The hypothesis was: If soybeans are watered with water containing different amounts of microplastics, the ones watered with the least microplastics will grow the most. 30 mL of water from each independent variable was poured into a plastic bag containing a paper towel and five soybean seeds. This process was repeated, then each bag was placed in a heated area composed of a large cooler, a cardboard box and a heated pad which maintained an average temperature of around 23°C. The roots of each soybean were measured daily for three days. The results suggested that microplastics have no effect on soybean growth. These results reject the hypothesis. In conclusion, the study suggests that soybean growth is not affected by microplastics present in water.

10 PS 1122

Dramstad, Brent

Wakefield High School

Teacher: El Gamal

Radiation and Its Effect on Farming

The purpose of the experiment was to see what the effect of radiation on plant germination. The information collected is important because radiation will have a bigger impact on farming due to global warming. The hypothesis was that if bean plants are subjected to microwave radiation then the rate of germination will decrease. This hypothesis was tested through three trials of experimentation on the control and the four levels of the independent variable. First the beans were put in groups for each level of the independent variable. Then they were put into the microwave for a set time (15 seconds, 30 seconds, 45 seconds or 60 seconds), this mimics intensified exposure to radiation from the sun. In order to give the bean plants a suitable habitat, they were wrapped in a wet paper towel with soil inside. Once the data on the dependent variable was recorded, it was concluded that the radiation did decrease the rate of germination which supports the hypothesis. If this experiment was done again, it would be best to try lower levels of the independent variable/less exposure to radiation or a different type of plant.

10 PS 1123

Parker IV, William

Wakefield High School

Teacher: Gaither

Which Type of Music Increases the Rate of Plant Growth for Chia Plants?

Humans rely on plants for numerous reasons. By experimenting, discovering sounds and/or vibrations that work as the best catalyst for plant growth could act as a substitute for widely used growth-inducing formulas. This will greatly reduce the use of pesticides and fertilizers which contain chemicals that damage the Earth. First, the question must be answered; Which type of music increases the rate of plant growth for chia plants?

Three containers of the same volume were collected and filled with Miracle Grow Potting Soil. Each pot was watered with the same volume of water when needed. Every plant received equal amounts of sunlight and 60 minutes of music being tested (if tested) each day. At the end of the experiment, heights were recorded, compared, and analyzed.

Two different types of music were put to the test in this experiment. 432 Hertz music, traditionally used for Yoga meditation, Classical music, and a control group experimented. Tested on Chia plants, the same type of soil, the same amount of sunlight, equal amounts of water, as well as volume of music stayed constant to eliminate inefficiencies during this project. Each independent variable was tested 20 different times (every individual plant sprouted in their respective pots).

At the end of the experiment, it is recorded that Classical music increased the growth of Chia plants the most. The takeaway from this project is that farmers, gardeners, or those who grow plants don’t always have to turn to pesticides and fertilizers to produce healthier plants.

10 PS 1124

Coggins, Kathryn; Carlson, Rhys

Wakefield High School

Teacher: El Gamal

The Effect of Different Probiotics on Plant Growth

It is well known that probiotics (which are composed of healthy bacteria) are very beneficial for human health. The purpose of this experiment, is to see if they have similar effects on plant growth and health, like they do on human health. The probiotics used are probiotic yogurt, organic kombucha, and apple cider vinegar. The control is water, and these are all used on the same bean seeds. This experiment was conducted for two weeks, everyday, measurements and pictures were taken of the plant growth. This experiment resulted in probiotic yogurt having the most precise and accurate results, while the control, water, had the highest average because of the third trial which grew to be about 32 centimeters which is a major outlier compared to all the other trials. The reason why there was little to no growth in the plants that were watered with kombucha and apple cider vinegar, was because of the acidity in these products. The hypothesis was proven incorrect stating that probiotic yogurt would result in the most growth, because water resulted in the most growth, however probiotic yogurt had the most precise and accurate results. Therefore, if you wanted to use some type of probiotic for watering plants, you can use probiotic yogurt concluding from these results.

10 PS 1125

Zarraf, Fatima Zahra; Darko, Isabella

Wakefield High School

Teacher: El Gamal

The Effect of the Amount of Salinity on Plant Growth

Freshwater is the primary way to water plants, but what if saltwater could be a way to water plants? This project was chosen because the researchers wanted to find another way to water plants, and that if saltwater could be used. The hypothesis for this project was if 12g of salt and 100 mL of water were stirred together and added to the plant, then the plant will not grow because the amount of salt added will stress the plant's ability to grow. The hypothesis was supported by the data because none of the plants that were watered with saltwater grew. The experiment was conducted by putting 5 radish seeds in each of the red cups which were filled with 2 cups of soil. Cup one was the control so that certain cup was only watered with fresh water. The others were watered with saltwater, but each cup had a different amount of salinity. Cup 2 had 3 grams of salt, cup 3 had 6 grams of salt, cup 4 had 9 grams of salt, and cup 5 had 12 grams of salt. Every cup also had 100 mL of water added. Plants that were watered with saltwater didn't grow. 3 plants did however grow and which were watered with fresh water. 1 plant grew 2 cm, and the other 2 grew 1 cm. The experiment did not turn out as expected, but the researchers did find out that if plants are watered with saltwater they wouldn't grow.

11 PS 1126

Alavi, Zahra

Wakefield High School

Teacher: Megargee

The Effect of Doogh (Yogurt Drink) on Plants

The purpose of this project was to determine the effect of Doogh (a yogurt drink) on plant growth. It was hypothesized that the addition of Doogh on plants would inhibit plant growth, as it would cause the plant to dry out. The hypothesis was rejected, as Doogh on plants aided plant growth by acting as a fertilizer. Plants without Doogh and only water served as the control. The dependent variable was the height of the plant as well as the color of the plant. Initial measurements were taken daily for 10 days. In the end, the plants had more growth with slight color changes towards the sides, which were browning. This project provided evidence that the plant with more concentration of yogurt is better than the one with a lower amount of yogurt. In addition, if there is no salt in Doogh it will have a better effect on plants. Future experiments would need to be conducted on other plant types or species of plants, such as outdoor plants, trees, animals or with varying concentrations of yogurt.

11 PS 1127

Portner, Noah

Washington-Liberty High School

Teacher: Hedderly

The Effect of Chitinase From Various Sources on Mycorrhizal Growth in Plants

The purpose of this research was to determine if chitinase originating from plant and bacterial cells would ultimately affect mycorrhizal quantity on root samples and whether the effect of the plant and bacterial chitinases would differ. Plant cells interact with mycorrhizae to form symbiotic links, and so the hypothesis stated that if the added chitinase is plant in origin, then mycorrhizal plant coverage will be greater because plants form symbiotic relationships with fungi while bacteria do not. The dependent variable was the percent of the root covered by fungi while the independent variable was the type of chitinase. The quantity of chitinase was also varied to better detect a correlation. A control containing no chitinase was compared with concentrated bacterial chitinase diluted in water in the magnitudes .2 □g/ml, .02 □g/ml, and .002 □g/ml. Banana peel was added to water in the quantities 5g and 10g. The hypothesis was rejected. Though increased amounts of bacterial chitinase correlated with poorer mycorrhizal growth, increased banana chitinase revealed the same trend. The data indicates that plants containing an abundance of chitinase will have a harder time forming symbiotic relationships with mycorrhizae. Furthermore, while chitinase producing bacteria are abundant, gardening with chitinase producing plants may harm the growth of the other plants.

11 PS 1128

Sokol, Josh

Yorktown High School

Teacher: Mower

The Effect of the Initial Quantity of Arbuscular Mycorrhizal Fungal Propagules on the Growth of Plants in Soil With a Reduced pH

Increased soil acidification due to climate change is a subject that currently lacks sufficient research. This experiment aims to remedy the adverse agricultural effects of soil acidification by utilizing the symbiotic relationship between plants and arbuscular mycorrhizal fungi (AMF). AMF can take up to two months to fully associate with plants, but the process can be accelerated when more AMF propagules are present in the soil. In preferable pH soils, association speed is generally negligible. However, the experiment will investigate how plant growth in reduced pH soil is affected by increased initial AMF propagule quantities. The hypothesis is that more rapid colonization will facilitate earlier access to more nutrients, leading to significantly healthier plants. Five groups of twelve bean plants were grown with increasing quantities of initial AMF propagules in the soil. After fifty days of growth, root mass, leaf mass, stem mass, and stem length were recorded. The majority of the data suggested a positive correlation between increased initial propagule quantities and plant health. However, the null hypothesis was accepted. Naturally, slight health variation existed between plants of the same group, but the group with the highest quantity of initial propagules resulted in plants with extreme variance in health, significantly influencing statistical relevance. The likely explanation is that some plants in this group were overwhelmed by excess mycorrhizal associations. To more accurately assess the question, additional experimentation must be conducted with more trials, more exact propagule quantification methods, and reduced AMF propagule quantities to avoid harming any plants.

12 PS 1129

Amponsah, Keirstyn

T.C. Williams High School

Teacher: Lowe

Seagem Project

With the decreasing availability of arable land and the need for nutrient dense produce, the macroalgae Ulva Lactuca yields the potential to serve alongside staples such as wheat or corn in grocery stores. However, in a world that is gradually becoming more environmentally conscious with its allocation of resources, the transport of such an algae as a live specimen would not be feasible. To overcome this obstacle, this experiment was centered around the modification of U.Lactuca with consideration of nutritional content, perishability, and transportability. After quarantining and cultivating samples of U.Lactuca, data was collected on the macroalgaes mold growth, structural fragility, and cell loss. The results of these tests would then go on to set the specifications for the structural modification of the macroalga. Through trials of dehydration storage in varying temperatures, water reabsorption, compression, and simulated transportation , samples of U. Lactuca were accordingly refined. The results of the experiment displayed that the dehydration of U.Lactuca effectively reduced the rate at which it produced mold during transport and remained safe to consume. In addition, the dehydrated samples were also found to be efficient in the reabsorption of water, which is required to sustain both water soluble nutrients and cells within U.Lactuca's composition. Form compression trials displayed that the compression of U.Lactuca pre-transport allowed it to be more durable for longer periods of time. With these modifications in mind, U.Lactuca may indeed have the possibility to become a dietary staple.