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Wakefield High School

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TABLE OF CONTENTS

(AS) Animal Sciences 2
(BE) Behavioral and Social Sciences 10
(BI) Biochemistry 36
(CH) Chemistry 47
(EN) Engineering 93
(EV) Environmental and Earth Sciences 132
(MC) Mathematics and Computer Sciences 183
(ME) Medical and Health Sciences 197
(MI) Microbiology 205
(PH) Physics and Astronomy 222
(PS) Plant Sciences 250

7 AS 100

Hanna, Andrew

Mary Ellen Henderson Middle School

How Musical Vibrations Affect Hermit Crabs?

The purpose of the experiment was to find if crabs have similar logistical systems compared to humans. This was tested by exposing the crabs to different levels of music (Heavy Metal, Hip-Hop, and Classical) Then, it would be seen if they would react like most normal humans. The crabs were then put about 6 inches away from the Oontz speaker (connected via Bluetooth to a phone) and played each song, waiting for the crabs to hide in their shell or move away from the sound. This was done to each crab every day.

The major findings were exactly as expected. At the heavy metal level the average time it took each hermit crab to hide was a short 8 seconds. It was the level that made the crabs hide the fastest. For the Hip-Hop level. It took an average of 48.3 seconds to make each crab hide. As I expected, this was the one that didn't make the crabs hide much faster or much slower. It was just in the middle. Finally, for the classical level, the crabs hid at a slow 94 seconds. This was the slowest and most likely, compared to crab standards, the least threatening, Heavy Metal being the most threatening, and Hip-Hop being in between them.

7 AS 101

Pick, Casey

H-B Woodlawn Secondary Program

Do Slugs Understand Incentive?

The experiment was conducted to see if slugs can control their speeds when they want to reach a reward. The research question for the experiment was whether slugs understand incentive. The hypothesis was that when slugs have food at the end of a tube, they will go through the tube faster than without food. This is because food is a positive stimulus. A slug was put at one end of the tube and was timed on how long it took to get to the other end. The procedure was repeated with food at the other end. The tube was a standard paper towel roll and the food was a cucumber. The results were that the food did nothing to incentivize the slugs. This may be because they were well fed at the time, or preferred to explore their surroundings.

7 AS 102

Albaugh, Tucker; Green, Felix

Mary Ellen Henderson Middle School

Salt Affecting Brine Shrimp

Our experiment that we were testing is how does the concentration of salt in water affect how many brine shrimp eggs hatch and live for a day. We had 4 different independent variables. They were 3.5%, 2%, 5% and 6%. The purpose of this experiment was to find how the rising salt levels of the ocean will affect brine shrimp and its population. We measured how many brine shrimp survived by taking them out of the hatchery and hand counting. We conducted the experiment by weighing the water and then weighing the salt to find the salinity.

In the first 3 levels of salt the number of Brine Shrimp increased but when the shrimps were placed in 6% they decreased. Something that we realized from studying our graphs was that our data was not scattered. Another thing we realized was that in trial 4 the 5% salinity the most amount of shrimps hatched (with 69.3% hatched) . We also realized that the 2% (which had a hatch rate of 65%) and the 3.5% (which had a hatch rate of 66.4%) the amount of shrimps that hatched in the 4 trials were very similar. Our data supported our hypothesis was supported until we reached 6% salt (only 61% hatched) . Our experiment can relate to the information we already knew because brine Shrimp are exceptionally tolerant to high levels of salt in the water.

7 AS 103

Howard, Emilia; Rodgriguez, Mia

Mary Ellen Henderson Middle School

Does Temperature Affect Development of Mealworms?

Have you ever wondered how temperature affects development? Well, we wondered this and studied the development of mealworms. The purpose of our experiment was to see how the temperature played a role in the development of mealworms. We tested this by placing three sets of 33 mealworms in three different temperatures (1.6 C, 20 C, 28 C). After we observed them each day and wrote down when each set became a pupa, then the adult (beetle); we created a graph to help understand the different rates they developed at.

The overall conclusion of this experiment was that the increase in temperature makes development happen faster. The graphs showed that the heater and regular room were ahead of the normal amount of time it takes for the larva to become pupa (12 days). The heater set developed on day 6 and the regular room set developed on day 9. This data leads to conclude that development isn't always one day, development is over time. Day 6 and day 9 were both days that the larva fully developed into pupa but before they were already progressing into this stage. The graphs also showed that the refrigerated mealworms were behind the normal speed. This set of mealworms developed at a much slower rate over time and leads to conclude that in colder environments mealworms develop slower.

7 AS 104

Kappler, Rachel; Gehrke, Kathryn

H-B Woodlawn Secondary Program

Are Mixed Breed Dogs Smarter than Purebred Dogs?

Are Mixed Breed dogs smarter than Purebred dogs? The hypothesis of the experiment was that mixed breed dogs would be smarter than purebred dogs, because they have both of their parents talents. For example a mix between a sheepdog and a golden retriever would be able to swim well and herd well, in other words receive the best of both parents' talents. The hypothesis was tested by sending three purebred dogs and three mixed breed dogs through a series of IQ tests, from calling out "movies", "refrigerator", and the dog's name, to setting up a series of obstacles or puzzles for the dog to solve in order to get the treat. The motivation for this project was both of the researchers' love for dogs. Many people believe purebred dogs or mixed breed dogs are smarter, and this experiment attempted to figure out which of these theories are accurate. All in all, on average purebred dogs performed better (or were "smarter") than mixed breed dogs. The hypothesis was not supported by the data.

8 AS 105

Porter, Sarah

George Washington Middle School

Fruit Flies on a Sugar High: The Effect of Sugar and Alternative Sweeteners on Fruit Flies's Lifespan and Reproductive Rate

Fruit flies, or Drosophila melanogaster, are useful organisms when it comes to assisting scientists with research on reproduction, genetics and nervous system development due to their short lifespan, rapid reproduction rates, and ability to show genetic mutations over a short number of generations. Studying the impact of a fruit fly's diet on its lifespan and reproduction has allowed scientists to better understand hunger, cravings and, ultimately, weight gain and obesity in humans. The fruit flies' reaction to artificial sweeteners could provide insight into similar impacts on the human population, especially considering that human fertility has declined over the last 50 years.

This experiment sought determine how long fruit flies would live on a diet of sugar and yeast in comparison to sugar alternatives, such as high fructose corn syrup or aspartame. The experiment used three mason jars of soda mixed with yeast, and 10 fruit flies, equally divided among male and female, were placed into each jar. Each jar was secured with paper to allow for oxygen, and they were examined daily to determine whether the fruit fly population increased or decreased. This data was then recorded and analyzed for trends.

This experiment found that pure cane sugar soda led to a longer lifespan and a higher reproductive rate than soda containing high fructose corn syrup and aspartame. From this data, I concluded that fruit flies are likely to live longer and produce more offspring on a diet of sugar and yeast than a diet of sugar alternatives.

10 AS 106

Bell, Sydney

T.C. Williams High School

Oyster's Filtration Rate of Nitrogen and Ammonium Sulfate

Oysters are integral to both the Chesapeake Bay watershed ecosystem and to the people who live around it. While the water quality in the Chesapeake Bay has been improving due to the efforts of conservationists, more work still needs be done. My project, which tests which species of oyster, out of Blue Point, Kumamoto, and Royal Amethyst, is most effective at filtering out contaminants from the water, will help researchers conserve the type of oyster that is most beneficial to the bay. I tested these species of oysters by placing them in cups filled with either nitrogen or ammonium sulfate. Then, every 10 minutes for an hour, I tested the amount of the contaminate left in the cup. I found that while both Kumamoto and Royal Amethyst oysters were able to reduce the amount of nitrogen from 2 ppm to .5 ppm, Royal Amethyst oysters were more effective at filtering out contaminants because they filtered ammonium sulfate from 7 ppm to 4 ppm, instead of 7 ppm to 4.75, like the Kumamoto. I concluded that Blue Point oysters were the least effective because they were not fully submerged in the water, and they were perhaps not as fresh or even alive compared to the other two species, because two Blue Point oysters failed to filter out any contaminate. I hypothesis that the Royal Amethyst oysters were the most effective because they were smaller, and therefore in the shipping and transportation process had most ice surrounding them, hence staying healthier.

12 AS 107

Naughton-Rockwell, Tessa

T.C. Williams High School

Saving the Bees: The Correlation of Internal Beehive Temperature and Neonicotinoid Residues

The purpose of this investigation is to assess the possible relationship between internal brood temperature in Apis mellifera (honey bees) and exposure to neonicotinoids in the field. Honey bees maintain the brood comb at a constant temperature of 35℃; a suboptimal temperature results in bee death. Neonicotinoids have been linked to a decreased function in the nicotinic acetylcholine receptors which is connected to the thorax of honey bees, the thermoregulatory center for bees. I predicted that beehives exposed to neonicotinoids would have internal brood temperatures below the optimal. Based on the surrounding agriculture, the hives found at Hivetool.net were categorized into high and low pesticide risk exposure groups. To verify the assumptions made, all participating beekeepers were given a survey asking about local pesticide risk. 100% of the beekeepers made estimates of pesticide use that matched the predicted risk evaluated in this experiment. Results suggest that the low pesticide risk group had higher temperatures with a mean temperature for the months of August and September 2018 of 34.9℃, +/- .548. The high risk group had a lower overall temperature with a mean of 32.9℃, +/- 2.17. The difference between the low and high risk reveals the low risk group has significantly higher temperatures with a t-statistic of 2.77 and p-value of .00979. In order to quantitatively confirm the presence of pesticides, wax and honey samples have been collected in order to complete Liquid Chromatography (LC) and analyze the composition of the samples for common pesticides.

7 BE 200

Savarie, Lucy

George Washington Middle School

Slam Dunk the Junk: The Effect of Clean or Dirty Trash on Behavior

The purpose of this experiment is to find out if the cleanliness of trash affects whether or not people pick it up. This project could change people's minds about littering by seeing how many other people pick up litter or leave it. If there are dirty pieces of trash near a trash can people will be less likely to pick it up because it is dirty and they don't want to touch it with their hands. I collected the trash I would use and I picked a location with a trash can, near me. I set up the trash 2 feet from the trash can and recorded my data in a notebook for 50 people for each of 5 trials. For each trial I made sure to replace the trash whenever someone threw it away. The results I collected were surprising but also not, because I didn't realize that so many people don't pick up litter. I recorded 250 people in total for each type of trash and for the chip bags only 6 people picked it up. 6 people picked up the red solo cup and 0 people picked up the dirty paper towel. I hope that the results of my project will bring awareness to the reality that people don't pick up litter. Hopefully in the future these results will encourage people to pick up litter.

7 BE 201

Snyder, Kathryn

Mary Ellen Henderson Middle School

The Effects of Multitasking

Multitasking is something that many people do every day. But is it really multitasking? The purpose of the experiment was to discern whether multitasking is productive, or rather it was splitting the multitasker's concentration. The experiment was conducted by giving the test subject a number of tasks to perform until they messed up. The Independent Variable in the experiment was the tasks being performed. The first level was writing 'the' continuously on a sheet of paper. The second was the first task and pressing a button in the pattern one, one-two. The third was tasks one and two and reciting the pledge of allegiance. The dependent variable was the number of seconds it took for the test subject to mess up. They were timed until they messed up.

The results were quite interesting. The test subjects with three tasks messed up sooner. The graphs show that when one task is being performed, the productivity and preciseness of the tasks increases compared to when multiple tasks are being performed. For instance, the average amount of time for someone performing one task was 98.78 seconds, whereas the average for someone performing two tasks at a time is 76.38 seconds. And the average while doing three tasks at a time, was 47.65, drawing even more of a gap between the levels of the experiment. The experiment shows that multitasking decreases the productivity and preciseness of the tasks being done.

7 BE 202

Teague, James

Mary Ellen Henderson Middle School

The Effect of Time On The Reliability of Eyewitnesses

The purpose of the experiment was to determine how the reliability of eyewitnesses in criminal court cases change after the passage time. The Independent variable was the passage of time in days, and the dependent variable was the participant's ability to remember the photo displayed to them and the distinct features of the man in the photo. This was conducted by asking participants to view a photo closely for 2 minutes and remember the skin, hair and eye color of the participant and 2 other distinct features. Then return in 2, 4, 8, 16 or 32 days later (depending on participant group) and remember the skin, hair and eye color of the participant and the 2 other previously stated distinct features. After that, they identify the photo in a lineup of 8 other photos and they would identify the photo they originally saw. The decision to represesent the results in a graph was made to clearly display information. For the graph, the decided to create a scatter plot graph was made. The decision was made because a Linear Regression equation could predict at what point in time the participants would forget these features. The Linear Regression equation ended up being y= -0.9879032258x + 106.25. According to this trend, the participant would not be able to remember any feature of the man in the photo after 108 days.

7 BE 203

Anderson, Katherine; Way, Phoebe

Mary Ellen Henderson Middle School

Major versus Minor

Most western music is divided into two keys, major and minor.. The goal of the project was to discover whether a major or a minor key song was more popular. In the experiment ten participants were given two sets of songs in each set there were two songs, one major and one minor. They were then instructed to pick one of the songs that they preferred more. The participants were not informed about the goal of the experiment so they had no idea they were picking major versus minor. The participants were also asked if they had heard the songs before to make sure they had no previous association or preference for the song. The data we gathered shows a strong preference for major key songs. In the first set of songs, the major key was preferred by 60%. In the second set of songs, the major key was preferred by 90%.

7 BE 204

Cheek, Lily; Cheek, Owen

H-B Woodlawn Secondary Program

Color Perception: How Does Sight Affect Taste?

The rationale for this experiment was to test if color can affect your taste. This is also known as color perception. The research question for this experiment was “How Does Sight Affect Taste?”. Our hypothesis for this experiment was that the participants would think that each color of yogurt had its own flavor. To test this experiment, we got four containers of vanilla yogurt and dyed three out of the four a color ; red, blue and yellow. We tested two trials of twelve participants. We gave each participant a spoonful of each color, and asked them what flavor they thought it was. Our results were that most of the participants thought that the yogurt colored blue was blueberry flavored. The majority thought that the red yogurt was strawberry, the yellow yogurt was vanilla, and the white yogurt was vanilla. The conclude this experiment, our hypothesis was supported by our results. This experiment could contribute to society by changing the color of a food to appeal to a picky eater. We could improve this experiment by testing more colors, testing in a different environment, testing more people, and different age groups.

7 BE 205

Gil-Reynolds, Lucia; Sirois, Evelyn

George Washington Middle School

Toxic Air

The project is on the type of potentially harmful molds in George Washington middle school. We used a ¨tape lift¨ to sample some of the mold in different locations around the school, sent those samples off to a lab where they observe the samples and identify the mold for us.

7 BE 206

Keelen, Madison; Lindly, Abby

Mary Ellen Henderson Middle School

How Does Scent Effect Short Term Memory?

The purpose of this experiment was to find a effective and useful study habit for seventh graders. The research question for this experiment was how different scents affect the short term memory of a seventh grade student. In the experiment the subjects read a small paragh for five minutes and depending on the group, then would diffuse the certain scent into the air. The subjects sat in a chair next to the diffuser. then, the subject got a memory test, How this test was measured was that the percentages (out of 100) were averaged with all other three trials that had the same scent. After this test was done, the test was graded put in a data table.the objective in this project is to, try and find a easier way to memorize certain contents, this reduces the amount of stress, and amount of time spend studying.

What was noticed with the results were that all of the results were very consistent, for example, there was an 72% average or 8 questions right, the no scent or control diffused in the air, this group average was 61% or 7 questions right. And the citrus scent, the average test score was 50% of 6 questions right.The results tell that if someone was studying for a test, or helping someone study they would use or recommend having peppermint diffused in the air when studding and not to use the citrus scent.

7 BE 207

Rotherham, Susan; Baroody, Marin

Mary Ellen Henderson Middle School

Can YouTube Outeach Teachers?

Have you ever wondered if online instructional videos could replace teachers? The purpose of this experiment was to find out if instructional videos, live instructors or written instructions were the best method of learning a new skill. The experiment was conducted by testing 15 human subjects. The test subjects were all taught to make an origami swan. The subjects were broken into three different groups that each had a different type of learning. The first group had YouTube video instruction that allowed review. The second group had written instructions and the final group had a live instructor who was able to talk to the subjects freely. At the end of each instruction period, the subject's final origami product was graded using a rubric.

The YouTube group had an origami scoring average of 5. The paper instruction group also had a scoring average of 5. The instructor group did the best in scoring with an average of 8.6. These results show that the live instructor had the best results showing that even though online videos are a good source of information and learning, teachers are superior in instruction and should not be replaced.

8 BE 208

Alexander, Helen

H-B Woodlawn Secondary Program

What Makes A Pretty Face?

For my experiment I tested the accuracy of the golden ratio. The golden ratio maps out the ideal distance between our eyes, length of our chin, and the position and length of our mouth and nose. I asked twelve volunteers to rate a series of famous faces on a scale of 1-10. I then calculated their facial ratio and compared it to the ideal to see if more “perfect” faces would be viewed as more attractive. My hypothesis was that faces with ratios closer to the ideal would be given higher ratings because symmetrical faces are easier for the brain to process, making them more pleasing to gaze at.

The results proved my hypothesis incorrect. Celebrities with better ratios did not always get better ratings. This is most likely because there are many more factors that weigh into someone’s overall beauty. Our relationship with the person, our personal preferences, and even the way we view ourselves make a difference. In doing this experiment, I learned that beauty truly is in the eye of the beholder.

8 BE 209

Anderson, Maddie

George Washington Middle School

A Twist on the Turing Test

The purpose of my experiment was to determine whether people respond better to tests of general knowledge created by artificial intelligence or by humans.

Because my research showed that AI may soon surpass humans in cognitive abilities, I hypothesized that humans would respond better to tests created by AI.

I made two tests - the first with questions coded in Google Script, and the second based around my own questions - which I then passed around to people to collect my data.

According to my results, the AI-generated test gave better results: an average score if 78.6%, versus 61.2% for the human test.

In conclusion, my hypothesis was supported. The AI test resulted in a higher average score over the human test.

8 BE 210

Ermovick, Ryan

Kenmore Middle School

The Effect of Vehicle Type and Color on Vehicle Speed

This experiment was conducted to see if vehicle type or vehicle color has an effect on how fast the vehicle, on average, is travelling. This experiment was conducted on a specific street in Arlington County, Virginia. On nine separate occasions, data on vehicle speed, vehicle type, and vehicle color were collected. In total, data on 1,194 vehicles was recorded. The results show that the vehicle type with the highest average speed was the sedan category, and the vehicle color with the highest average speed was the blue/purple category. The hypothesis was not fully accepted or rejected.

8 BE 211

Funk, Alexandra

Mary Ellen Henderson Middle School

Praising Children on their Intelligence: Constructive or Destructive?

The goal of the experiment was to find how different levels of praise affect how children perceive setbacks. The data was collected through two tests that were given to 12 test subjects. The data was analyzed by comparing the time taken on each test and score improvements. Test subjects that were given praise on the first test on effort were more likely to see a set back on a second test as a lack of effort. Those praised for their intelligence saw that their lower score on the second test was because they weren't smart enough. Everyone who was praised for effort chose to take home a copy of the second test. These results could be interpreted to mean that those who are praised for effort attribute success to effort, thus will try harder on assignments in the future. Other studies have shown the same results.

8 BE 212

Lucier, Maxwell

H-B Woodlawn Secondary Program

What Is the Most Common Demographic for Video Gamers?

This experiment was originally intended to find out if the stereotype that boys play video games more than girls was true or not. I began researching about the topic and I quickly realized that there is a lot more than just gender that affects whether someone plays video games or not. So I changed my research question to: “What’s the most common demographic for video gamers?”. Because while I did want to see if the stereotype about boys playing more than girls was true or not, I also wanted to also get a general demographic of the kind of person that would enjoy playing video games. I researched further, and I actually discovered some pretty interesting things. I found that boys enjoy playing more than girls because of the quantity of pleasure chemicals released in a boy’s brain compared to girls. Boys had a lot more of this chemical released than girls, thus enjoyed playing more. I also believed that Extroverted people played online video games a lot, do to them having a lot of social interaction, and Introverted people would pay more single player games. I tested my hypothesis by releasing a survey to some of my 8th grade classmates, with their consent of course. My hypothesis was proven correct by the survey that I released. Boys played more than girls, and Extroverted people played more than Introverted people. So this “stereotype” is actually quite true and is backed up by science, maybe people can now realize that too.

8 BE 213

Yang, Nina

Hammond Middle School

Got Stuck? Get Gum! : Does Gum Improve Concentration?

Do you think teachers would allow students to chew gum in class if they know that gum actually helps students concentrate more? My purpose for this project is to determine whether gum improves concentration. If the gum is confirmed to improve concentration through my experimentation, it would be beneficial for people who find it hard to concentrate and for people with disabilities. My hypothesis stated if people chew gum while doing math problems, then they will have better concentration (in speed and accuracy) than those who don't chew gum because chewing gum increases blood flow which delivers oxygen to regions of the brain in charge of attention. In my procedure, all participants will get a worksheet and complete it under a minute and 15 seconds while half will chew gum. My results show that participants who didn't chew gum and participants who did chew gum have the same amount of correct answers, but participants who didn't chew gum completed more worksheets than those who does chew gum. Despite the fact that my results didn't support my hypothesis, my hypothesis was actually correct due to errors in the type of math problem and time limit I set for my participants. Finally, I conclude that gum does improve concentration because scientists hypothesized that chewing gum increases blood flow that delivers oxygen to regions of the brain in charged with attention. Furthermore, chewing gum also dull out distracting background noises by activating the Eustachian tube [in the ear] which all supports concentration.

8 BE 214

Crum, Grace; Niemi, Alexis

Mary Ellen Henderson Middle School

Fidget Toys

The purpose of the experiment was to find out whether using a fidget toy or no fidget toy would allow students to memorize the most pictures. The groups consisted of fidget toys and no fidget toys. We conducted our experiment by having 20 pictures that students could look at for 5 seconds each. They then had to wait quietly for 40 seconds while trying to remember the images. For half of our students, we allowed them to use a fidget toy for the duration of the experiment. The students then wrote down all the pictures that they remembered.

The major findings of the experiment were that the overall amount of pictures memorized were higher for the group that did not have a fidget toy and that the overall stress level was lower for the group that did have a fidget toy. In the graphs, the group that did not have a fidget toy(Group A) memorized an average of 10 pictures, and the group that did not have a fidget toy(Group B) memorized an average of 9 pictures. The Likert scale, however, showed different results of which group did better. In the graphs, Group A had an average Likert scale level of 3, and Group B had an average Likert scale level of 4. This data shows that Group B, the group with the fidget toy was less stressed than the group without a fidget toy.

8 BE 215

Tenorio Guzman, Jhon Kevin; Lynn, Daniel; Siles, Mark

Gunston Middle School

The Effect of Activity Over BPM

The purpose for our experiment was to compare the human heart rate after physical and virtual activity. What motivated the researchers to do the experiment was the debate of whether video games can qualify as a sport. The goal of the experiment was to find the effect of activities over BPM(beats per minutes). The procedure for our experiment was that for each activity they will be given 5 minutes and the BPM will be taken at the end of each activity. The data shows that the average greatest BPM was basketball in real life in its category and ping-pong in real life. When looking for the greatest BPM per category with control and if the BPM where the same for the participant then one tally would be marked on both. For basketball, the control came out the greatest only 1/21 (5%), for physical it was 15/21(71%), and for virtual 6/21 (29%). When looking for the greatest BPM per category for ping pong the control was only the greatest 2/21(10%), virtual it was 4/21 (19%), and physical 15/21 (71%). In the end our hypothesis was correct that physical activities came out greatest in ping pong and basketball.

8 BE 216

Winston, Erik; Hughes, Elijah; Thomas, Kaeden

Gunston Middle School

The Effect of Amount of Time Playing a Video Game on the Ability to Concentrate

The purpose of this experiment was to see if video games really do have a negative impact on the ability to concentrate as society tells us.

The goal of this experiment was to find the effect of the amount of time playing a video game on the ability to concentrate.

Thirty test subjects took a simple math test with 50 questions. Subjects were then asked to play 2 minutes of video games, take another test and so on until eight minutes of video games.

From zero to four minutes of video games one's average correct answers decreases. The average amount of correct answers for the control was 22.63 and was 20 after two minutes. From four to six minutes of video games one's concentration increases, shown by the average amount of correct answers after four minutes of video games was 24.5 and after six minutes of video games it increased to 28.5. However, after eight minutes of video games concentration decreases, the average amount of correct answers was 14.97.

The accuracy and concentration decrease until 4 minutes of video games and then the level of concentration rises until reaching eight minutes of video games. Where the participants had their best score was also analyzed. No one had their best score for the control test. One person had theirs after two minutes of video games. Nineteen people had theirs after four minutes, six people had theirs after six minutes, and 11 people had theirs after eight minutes.

9 BE 217

Berry, Colin

Yorktown High School

The Impact of Financial Experiences and the VA EPF Course on Financial Literacy Among Teenagers

The goal of this experiment was to test how different factors affect the financial literacy of high school students. Financial literacy is a very important part of education because it prepares students for college and living on their own. The hypotheses were that the Virginia state required Economics and Personal Finance (EPF) course, a credit card, and a paying job would all have a positive impact on financial literacy. It was also predicted that personal experiences with credit cards and jobs would increase the positive effect of the EPF course. The results were not what was expected - the data show statistically significant differences in the opposite direction of what was hypothesized for the EPF course and the credit card moderator. While not hypothesized, the data revealed similar differences across gender that have been found in prior studies on questions on inflation and risk diversification, with females scoring significantly worse on those questions. Although the sample size is too small to make reliable conclusions (with a sample size of 30 students and a response rate of 6%), the lack of significant positive effects from the Economics and Personal Finance course across the three financial literacy questions on interest rates, inflation and risk diversification suggest that a larger Yorktown-sponsored survey might be a useful activity. The results also suggest that attention to gender differences is necessary, with a focus on reversing this difference.

9 BE 218

Boston, Ava

Yorktown High School

The Effect of Age on Perception of Time

The purpose of the experiment is to determine how individuals' experiences with time perception differ due to age. My hypothesis states, as age increases, people will perceive time as passing faster. I created a survey with four questions: How quickly do you think the past week, month, year, and decade have gone by on a scale of 1-5 with 5 being fastest? I timed the interview and asked participants how long they thought it was in seconds. My hypothesis was accepted; participants in the 60+ age group perceived time as passing the fastest compared to all other age groups. The 18 under age group perceived time as passing the slowest. According to this experiment, there is no statistical correlation between age and short term time perception. Participants in the 20's and 30's age group on average got the lowest difference between perceived time and actual time; they guessed durations of short term time periods most accurately. A scientific explanation for the results is how the brain processes information. When the brain collects familiar information, it takes less time to organize it. New information requires more processing, which makes it feel longer. Therefore, new experiences seem longer than routine ones. Since younger individuals have more new experiences, they perceive time as passing slower than older individuals who have had those experiences and have more routine schedules. The results are relevant because it contributes to our knowledge of the human brain and how individuals experience different perceptions of time due to age.

9 BE 219

Singer, Jacob

H-B Woodlawn Secondary Program

How Do 1:1 Devices Affect Learning?

Many schools, in recent years, have adopted a 1:1 device program. A 1:1 device program is when each student has their own personalized device. Arlington Public Schools implemented a 1:1 device policy in 2014. However, these devices are expensive and have unknown and possibly negative effects, such as distracting students. HB-Woodlawn has ~$1204.12 of technology per person, since Arlington Public Schools provides each middle school student with a iPad and each high school student with a MacBook. Is this technology being used most effectively to promote student success? The purpose of this project is to analyze how providing students with 1:1 devices affects learning. To collect data, the HB-Woodlawn college profiles from the past 10 years were gathered. These profiles included mean SAT scores, mean ACT scores, number of AP tests taken, and other measurements of academic success. Over time, the mean SAT scores at HB-Woodlawn have been decreasing. However, HB-Woodlawn scores are decreasing faster that the state average although they started higher. In contrast, mean ACT scores have been increasing and are in the 90th percentile, and the mean score on AP tests is also increasing. Continuing this trend, the number of AP tests taken and college admissions rates are increasing. Because of this conflicting data, my project is inconclusive. Many different factors affect test scores, especially the average of a entire grade, such as many colleges stopped requiring SAT scores in recent years, leading the the number of SATs taken decreasing.

10 BE 220

Dhakal, Abby

Arlington Tech and Career Center

The Effect of Social Orientation on Short-Term Memory

Teenagers often complain about not remembering something that happened moments before. Is there a correlation between different parts of their personality on their memory? This project looks at the effect of being an introvert or extrovert on short-term memory. The participants were given a sample Myers Briggs personality test to determine their social orientation. Then, they were given a memory test with forty-two questions. It was hypothesized that extroverts would do better on the memory test than introverts. The experimental results rejected the hypothesis since introverts actually scored better on average than extroverts. The experiment also led to the discussion that other factors from the Myers Briggs personality type indicator might be helpful in discovering the relationship of human personalities on short-term memory.

10 BE 221

Gaylord, Charlie

Yorktown High School

The Effect of a Time Limit on Accuracy of Test Answers

The rationale behind this experiment is to determine whether the accuracy of test scores are impacted negatively when a time limit is enforced. Time limits can be a trigger for many stress induced symptoms, including forgetfulness and feelings of loss of control; both of which can lead to lower test scores. The hypothesis is, if the test is timed, then accuracy of test scores will decrease. This is expected, because when one is put under stress, the body releases adrenaline, a natural stimulant of cognitive processes. This experiment contained two independent variables: Time to complete the given test, and gender of the subject. Due to the length of the test, (10 math questions) a time limit of two minutes was enforced on the first trial. The second trial had no time limit enforced. Two different tests, yet identical in difficulty, were presented to each subject, in order to prevent any “memorized answers”. The dependent variable for this experiment was the accuracy of test answers. After testing concluded, the data was analyzed and it showed, despite a few outliers, that accuracy was significantly increased during the untimed test, as opposed to the timed test. The average score for test one was 84.6%, and the average for test two was 94.6%. As the data in this experiment implies, time limits and accuracy of test answers are interdependent, and in order to ameliorate poor test scores, extra time can, and should be given.

10 BE 222

McCormack, Michaela

T.C. Williams High School

Sleep's Affect on Cognitive Capability in Fruit Flies

This project explores how varying amounts of sleep affect reaction time and memory retention in Drosophila Melanogaster subjects. The research question is how are cognitive abilities, more specifically learning and memory, affected by sleep? The hypothesis states that the learning index percentage for both the Spatial Orientational and Olfactory tests will decrease if sleep becomes irregular. To test the hypothesis, a DAM (Drosophila Activity Monitor) machine was constructed to monitor and align fruit flies on certain sleep schedules. The fruit fly wings were individually clipped, and two cognitive tests were administered, the spatial orientational learning test and the olfactory test. The olfactory test classically conditioned the flies to go into a tube with a certain scent (CS-) and avoid a different scent (CS+). The flies were trained using electric shocks and tested to see how sleep affects the olfactory cortex. During the spatial orientational learning test, the flies were put into a petri dish and were presented distractor stripes to measure how sleep affected their vestibular senses. Currently, the experiment is stalled, as the DAM machine is under construction, and experimentation is starting in February. There are currently 250 flies in the colony with another 100 flies with clipped wings. The next steps is the completion of the DAM machine.

10 BE 223

Terry, Claire

Yorktown High School

The Effect of Color on Perceived Gender

The purpose of the experiment was to determine what effect color has on how high schoolers perceive the gender of a picture of a face, and what the effect of childhood exposure to the assignment of colors to genders has on high schoolers, and how it affects how they perceive colors and genders. It was hypothesized that the faces overlaid with the colors red, green, blue, and no color would be perceived as male, the faces overlaid with the colors yellow, pink, and purple would be perceived as female, and the face overlaid with the color orange would be perceived as male and female equally. A survey with eight pictures of an androgynous face, each picture overlaid with a different color, was given to 30 participants, who were asked to say what gender they thought the face was. About two-thirds of people perceived the red, orange, yellow, blue, and no color faces as male. About two-thirds of people perceived the purple face as female and about three-fourths of people perceived the pink face as female. The orange face was seen as male and female about equally. The hypotheses were partially supported and the null hypothesis was rejected, showing that color has an effect on the perceived gender of a picture of a face by high schoolers. This shows that childhood exposure to the assignment of colors to genders continues to resonate in high schoolers and affects how they perceive colors and genders.

10 BE 224

Vaughan, Abigail

Arlington Tech and Career Center

The Effect of Age on Opinion

The purpose of this experiment was to understand the views of different generations on the HPV vaccine. Even though this vaccine could prevent HPV cancer, most do not get the vaccine. In order to collect different opinions, a survey was conducted. The results show that teenagers believe that the vaccines are a good thing to get, matching the adults' views for the most part. However, most teens felt as if they did not know a whole lot about HPV.

10 BE 225

Rivero, Alissa; Finkelstein, Sophie

Washington-Lee High School

Does the Self Reference Effect Extend to Handwriting?

The purpose of the experiment was to determine whether the principles of the self reference effect would extend to handwriting. This was tested by having participants read a passage in the font Times New Roman (Group 1), the font of a third party (Group 2), or a font derived from their own handwriting, (Group 3). They were given a test to measure how well they had retained the information. The experimental hypothesis stated that participants who read the passage in the font derived from their own handwriting would have higher test scores than those who read the passage in the other fonts, due to the self reference effect. It was supported by the results. Participants in Group 1 had an average score of 6.47 out of 10. Similarly, participants in Group 2 had an average score of 6.57 out of 10. On the other hand, Group 3 had an average score of 8.00 out of 10. In statistical tests, these results were used to determine that there was no significant difference between Group 1 and Group 2. However, the overall results were significant. This showed that there is little to no difference between reading a passage in Times New Roman and the third party's font, highlighting the influence of the self reference effect, which did to extend to handwriting. This can be seen as the participants in Group 3 generally had higher test scores than participants in the other groups.

7 BI 300

Christino, Ruth

George Washington Middle School

How Synthetic Grass Fibers Affect Water Quality

The purpose of this experiment was to determine whether or not different synthetic turf fibers altered water quality in order to determine whether or not it is a safe material to use on children's and adults' sports fields. I first gathered 4.92892 ml/1 teaspoon of turf fibers from the samples I received. Then, I put the grass fibers into containers with 250 ml of distilled water and allowed 90 minutes to elapse. I then tested the water for alkalinity, residual chlorine, calcium, iron, copper, lead, nitrate, nitrite, bromine, chlorine, cyanuric acid, chromium, and fluoride. I repeated this five times for each type of turf. For my control group, I allowed the distilled water to sit for 90 minutes. Few of the water quality indicators changed significantly or to an unsafe level. The indicators that remained at a safe level include hardness, iron, lead, nitrate, nitrite, cyanuric acid, and fluoride. The different types of turf showed unsafe levels of residual chlorine and unsafe pH levels. Diamond Pro Fescue turf left an average of 0.02 mg/L of residual chlorine, while Allplay XP turf left an average of 10 mg/L of residual chlorine. Safe drinking water contains from 0.2 mg/L to to 5 mg/L residual chlorine. The average pH after exposure to Diamond Pro Fescue was 3, and the average pH after exposure to Allplay XP turf was 5.1. Ideally, water should have a pH of 6.5 to 8.5.

7 BI 301

Silva, Leila

Williamsburg Middle School

The Effect of a Chicken's Living Conditions on the Quality of the Egg

This project explores the effect of a chicken's living conditions on the quality of the egg. The hypothesis was that the pasture raised chickens would have the darkest yolks and the shells with the most mass because their more diverse diet, which contains more grass, herbs, and insects, should contain more xanthophylls (which cause the color of the yolks). The pasture raised chickens should also have eggshells with a higher mass because the increased outdoor access and motor activity should lead to better mineral deposition in the shell. The darkness of the yolk was measured with an egg yolk ruler (a color gradient for eggs with a scale from 10-14) and the mass of the shell was measured in grams. The hypothesis was partially supported. Although the pasture raised eggs didn't have the deepest yolks and shells with the most mass, the level with the second highest amount of space did have the darkest yolks (free-range). As soon as the category of farming practice contained outdoors access, the results increased. This shows that there may be a correlation between the chicken's quality of life and the quality of the egg. Another observation was that the conventional and cage free eggs had the same yolk deepness, even though cage-free advertises as a more humane alternative to conventional eggs. This was most likely because they have the same feed and the conditions of cage-free eggs are still not ideal.

7 BI 302

Talka, Jon; Contessa, Gabe

Mary Ellen Henderson Middle School

Fermentation Nation

In this experiment, there were three independent variables. The first independent variable is Ribose sugar. The second is Honey, and the third is Sucrose sugar. These independent variables are all designed to affect how the rate of which, yeasts will release CO2. We measured the rate of which CO2 was released in PPM/S. Overall in the experiment, we mixed yeast, warm water, and our selected sugar together, then we measured the rate of which the yeasts released CO2, with a vernier CO2 gas probe.

The results of the experiment were surprising. The average rate of respiration for the yeasts in the honey was 28.57 ppm/s. The rate of respiration is how much CO2 the yeasts are releasing. The average for the yeasts in the sucrose sugar was. 11.0 ppm/s, and for ribose, the average was 3.61 ppm/s. This shows that honey causes yeasts to release the most CO2 in the process of ethanol fermentation. Sucrose causes yeasts to release the second most amount of CO2. Ribose released the least.

8 BI 303

Godwin, Nathan

Kenmore Middle School

Compost to power

Introduction:

I chose the topic of microbial fuel cell energy production mostly because I have done experiments with microbial fuel cells in the past and because I have an interest in microbiology. I also chose this topic because I thought the idea of recycling the United States 49 percent of produce thrown out into electricity was a good idea. Because I thought this technology could be used to recycle discarded produce, I decided to test the effect of compostables on microbial fuel cell power output. Hypothesis:

My hypothesis is that if bananas are present in a microbial fuel cell, then the highest power output achieved by said microbial fuel cell will be greater than 39 Microwatts. Written results:

It appears that compostables have a negative effect on microbial fuel cell power output. The highest reading from microbial fuel cells with compost was on average 17.7 less micro watts than microbial fuel cells without compost.

Conclusions:

My hypothesis, if bananas are present in a microbial fuel cell then the highest power output achieved by said microbial fuel cell will be greater than 39 Microwatts was rejected, it was rejected because the highest power output achieved by the banana fuel cell was 5 Microwatts. This experiment is important because it reflects on the potential for microbial fuel cells to be used for clean energy production and recycling.

9 BI 304

Carleton, Elizabeth

Yorktown High School

The Effect of Water Treatment Method On Bacteria

The purpose of the experiment was to find the most effective method for eliminating bacteria from water. Boiling water kills bacteria harmful to humans. Bleaching water causes the oxidation of certain organisms. When water is filtered, it passes through a mesh, removing certain minerals. The hypothesis tested was that if bleach is added to water, then the least amount of bacteria will be present because bleach kills most organisms through oxidation. Water was collected from a local stream and treated with one of the methods tested. Petri dishes were inoculated, sealed, and incubated at body temperature for 24 hours, after which the number of colonies was counted. On average, the control trials had 55.1 colonies, with a range of 0-133. Therefore there was a variation in the starting amount of bacteria. Filtered water, on average, had 27.2 colonies, with a range of 16-56. Therefore the filtered water didn't fully rid any samples of bacteria but decreased the range, most likely because the filter was designed for the purpose of making water taste better, not making it safe. Bleached water produced no colonies on Petri dishes because all bacteria were killed through oxidation. Boiled water produced no colonies on Petri dishes except an outlier with a single colony. Errors in the experiment were that a Petri dish may have remained uninoculated, and three Petri dishes had an organism other than bacteria. Improvements of the project are using additional tests or treating it using a UV light.

9 BI 305

Futrell, Sophia

Yorktown High School

The Effect of Different Fertilizers on Elodea canadensis

Among the many environmental issues the Chesapeake Bay area faces is Hydrilla verticillata, an invasive aquatic plant clogging up the water systems and blocking out sunlight for other native plant species. While this plant can usually be controlled with the use of some pesticides, fertilizer runoff has caused it to grow out of proportion. But which fertilizers are harming Hydrilla and other aquatic plants, and which are helping? What is the effect of different fertilizers on it?

The goal of this experiment was to find out which types of common agricultural fertilizers affect Elodea canadensis, a similar aquatic plant, in the water.

It was found that Urea, the most popularly-used, nitrogen-based fertilizer, is the most harmful to aquatic life, the Elodea specimen having died off in less than a week. Triple-Super Phosphate, being in very strong concentrations, also killed off its Elodea within the first four weeks. Other than the control (no fertilizer), the Elodea with potassium chloride survived the six weeks with a fluctuating average length. These results were the opposite of the original hypothesis.

With this information, farmers should learn that heavy concentrations of Urea and Triple-Super Phosphate fertilizers, when brought into local rivers by precipitation, can have negative effects on the aquatic flora of the area. Potassium chloride, on the other hand, may be the fertilizer causing Hydrilla's uncontrollable growth.

Further experimentation with other common fertilizers should be carried out, as the statistic data of this experiment wasn't conclusive.

9 BI 306

Koury, Kelly

T.C. Williams High School

Bioplastics : Bioplastics Made From the Sea

The focus of this project is to show how algae based bioplastics are better for the environment and make a bioplastic decoration at home that is made from agar which is algae based. The hypothesis is if the amount of each ingredient (agar, water, and glycerin) is varied then the attributes (strength, flexibility,etc.) will change. The more agar the stronger the more glycerin the softer. The I.V. is the ingredients (agar, glycerin,water and food coloring in some) and the D.V. is the attributes of the bioplastic (strength, flexibility, etc.).

The experiment has 3 ingredients: agar, glycerin, water and sometimes food coloring. The ingredients are stirred in a pot on the stove on medium high until it froths. Then the mixture is placed in a mold for three days. On day three remove the bioplastic from the mold and let it sit for four days. At day seven measure the attributes. Trial one consists of seven rounds where the ingredients are varied. Trial two is the same as trial one.

The results showed that method 7 made the best decoration because it had no cracks, no flaking, and was the prettiest. Method two (30% agar , 3% glycerin) with the most agar was the strongest while method seven (12% agar , 15% glycerin) with the most glycerin was the softest. The conclusion is that the hypothesis was proven. Finally bioplastics are better for the environment than conventional plastics because they have non toxic ingredients and decompose faster.

9 BI 307

Zurita, Persia

Wakefield High School

Using Genetic Engineering (CRISPR) to Turn Baking Yeast Fluorescent

Genetic engineering involves modifying an organism's DNA in this case using Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) to deliberately change an aspect of the organism for a particular purpose. This experiment demonstrates the power and simplicity of genetic engineering by adding plasmid DNA with a sequence of proteins from a jellyfish to the yeast Saccharomyces cerevisiae so that it turns a fluorescent green color from expression of the Green Fluorescent Protein (GFP).

10 BI 308

Baker-Rosenberg, Raynie

Washington-Lee High School

The Effect of Different Environments (Sand, Soil, and Rocks) on How Fast Cellular Decomposition Occurs in Raw Beef

This experiment relates to the forensic study of cadavers and the determination of time of death. The purpose of this experiment was to measure how fast cellular decomposition occurs in raw meat specimens in different terrains and conditions found in the state of Virginia. Raw beef was used because it is similar to tissue in a human body. The hypothesis was if raw beef specimens are placed on three terrains—sand, soil, and rocks—the specimens in the soil terrain will begin to decompose the fastest.

The experiment was conducted as follows: three trays each were individually filled with rocks, sand, and soil. Twenty meat specimens were placed on each terrain. Samples from each tray were observed by microscope over the course of 12 hours and the first signs of cellular decomposition such as change in color, breakdown of the cell membrane, or swelling of the cell were marked on a data table.

Surprisingly, the fastest rate of decomposition occurred in the sand terrain, with a mean rate of 7.95 hours. The slowest rate of decomposition occurred in the control group, which had a mean rate of 9.35 hours. The mean rate of decomposition for the specimens on the soil terrain was 9 hours. The hypothesis was rejected. The results were unexpected, but they are useful because they show that things such as soil composition can cause unpredictable results. This data can help pathologists learn about determining the time of death in Virginia terrains.

10 BI 309

Murray, Andrew

Yorktown High School

The Effect of pH on the Time It Takes for Amylase to Break Down Starch

This experiment is studying the effect of pH on the time it takes for amylase to break down starch. Amylase is an enzyme in the body that is found in saliva and pancreatic juice. Its main function is to break down starch. However, pH can change the efficiency of amylase. The hypothesis is that if the pH is changed, then amylase will break down the starch quickest in a pH of 7.0.

The results of this experiment were that amylase broke down the starch quickest in a pH of 7.0, with an average of 74 seconds. A trend was discovered between the independent variable and dependent variable. The closer the independent variable level got to 7.0, the lower the dependent variable value was. However, the further away the independent variable level got from 7.0, the higher the dependent variable value was.

Amylase works quickest in a pH of 7.0 because of the change of the shape of the active site on amylase. In amylase, there are amino acids that each have a charge. The attraction between the amino acids shapes the active site on the amylase. However, when pH changes, the charges of the amino acids change too. This can cause the attraction within the molecule to differ, which then results in a change of the active site's shape. When the shape of the active site changes, it can make it harder for the amylase to attach to a substrate, therefore making it less efficient.

12 BI 310

Ferguson, Garrett

Yorktown High School

The Effect of Temperature Variation on Percent Alcohol By Volume

The focus of this experiment was to determine the temperature at which yeast ferments the most quickly in a glucose and water solution to produce the highest percent alcohol (or ethanol) by volume in six days. In testing these temperatures I hoped to find the most time-efficient way to ferment yeast and use the ethanol produced to create products in the gasoline, pharmaceutical, and alcoholic beverage industries. The hypothesis for this experiment was “If the yeast is fermented at room temperature, that solution will yield the highest percent alcohol by volume.” Water and glucose were mixed together and dissolved in a flask, and then yeast was added to the solution and the flask was closed with a stopper. The flasks were placed in an incubator (35℃), at room temperature (23℃), and in the fridge (1.6℃) and were left for six days. After the experimentation period was over, each of the solution densities were measured using a hydrometer. After calculations were performed, the results showed that the room temperature sample had produced the highest percent alcohol by volume, comprising 4.33% of the 35 mL sample. From this experiment it can be concluded that the optimal starting temperature to ferment yeast to produce ethanol is approximately 23℃, likely because of the fact that the fermentation process is exothermic, and raises the temperature of the solution from 5-8℃ during the reaction, which brings the room temperature sample right into the optimal range of fermentation from 28-38℃.

7 CH 400

Ahmad, Kamran

Kenmore Middle School

The Effect of the Amount of Coins on the Voltage it Creates

Many people believe that batteries are a modern invention, but batteries started with the original design known as the voltaic pile and it was founded by Alexander Volta. The experiment was conducted to see if adding more coins each time would make more electricity. The purpose of this experiment was to see if the coins made more electricity each time when more coins were added. It was hypothesized that if more layers of coins are added then there would be a more powerful battery. The results were compared and graphed. At one point the amount of voltage generated was very few so the results on the graph didn't change that much. According to the results, one penny and one nickel had the least amount of voltage generated and ten pennies and ten nickels had the most amount of voltage generated. One explanation of this would be that there was more paper towel squares that were dipped in salt and vinegar so ten pennies and ten nickels made the most amount of voltage. The amount of voltage generated changed based on how many coins were added each time. It was possible that if different type of metals were used other than pennies and nickels then the results would have varied. It was possible that if I had used two paper towels dipped in salt and vinegar solution each time then, the amount of voltage generated would change. Thus the hypothesis was accepted.

7 CH 401

Beauvais, Cyrus

Gunston Middle School

Effect of Soap Concentration on the Surface Tension of Water

The purpose of this study was to determine the effects of soap concentration on the surface tension of water. Surface tension is related to hydrogen bonding, which is when two hydrogen atoms want another electron so they are attracted to an oxygen atom. This creates a water molecule that attracts other water molecules, forming a cluster, or water droplet. In a water droplet, all the water molecules are pulled inwards, toward the center of the cluster. When the surface of the cluster is stretched, more molecules are pulled outward, so that the cluster won't burst. This is how surface tension works. When soap is dissolved in water, it interferes with the hydrogen bonds so there is less surface tension.

It was hypothesized that if soap is added to water, then the penny will hold less water due to the soap's interference with hydrogen bonds. In this experiment, five different concentrations of soapy water were dropped onto a penny to measure the maximum amount of water the coin could hold.

The data showed that the higher the soap concentration, the less water could fit on the penny before the droplet burst. Improvements to the experiment could have been dropping the water onto the penny from a set height and keeping track of the humidity in the room where the experiment was conducted.

7 CH 402

Fern, Caroline

Kenmore Middle School

The Effect Of pH On Teeth

Exposing your teeth to products with a low pH can have devastating effects on your dental health. An example of these effects from the U.S. National library of medicine says that tooth erosion has been increasingly documented as an effect of these juices/sodas with a low pH. Another effect has been that enamel has been worn down at increasing rates exposing the bare tooth. This project is going to test effect of drinks on tooth decay. An egg will simulate teeth. The egg will be submerged in the various liquid for four hours, once the four hours are completed the eggs will be observed for decay/chipping. PH levels are dropping in popular drinks throughout the market. This project will demonstrate the negative effects of low pH levels products have on our teeth.

7 CH 403

Gallagher, Ketevan

Mary Ellen Henderson Middle School

How Snow Removal Salt Affects Duckweed

The purpose of How snow removal salt affects duckweed was to find out if generic snow removal salt (sodium chloride) had a different effect on duckweed than eco-friendly snow removal salt. The eco-friendly snow removal salt that was used for this experiment was Redmond Ice Slicer. Ice Slicer claims that they are environmentally and plant safe, and the GHS classification for Ice Slicer says it is not hazardous to the environment. In the experiment, there were two control jars, which were just water, and there were six treatment jars, three of which contained amounts of generic snow removal salt, and the other three contained amounts of eco-friendly snow removal salt. One jar contained 1% generic snow removal salt, one jar contained 2% generic snow removal salt, and one jar contained 3% generic snow removal salt. One jar contained 1% eco-friendly snow removal salt, one jar contained 2% eco-friendly snow removal salt, and one jar contained 3% eco-friendly snow removal salt.

This experiment had very interesting results. In control 1, (water) all forty duckweed except for three survived the 14 day study period, and all the duckweed in control 2 (water) survived except for six. The duckweed in control 1 lived an average of 13.65 days in the study period and in control 2, it lived an average of 13.9 days in the study period. None of the duckweed in any of the treatment groups survived all 14 days in the study period.

7 CH 404

Hogan, Abigail

Kenmore Middle School

The Effect of Dish Soap on Surface Tension

This experiment tested the effect of dish soap on the surface tension of water. This is important so you know which dish soap works the best. Rafts were made out of transparency film and a piece of kitchen sponge. A basin was filled with water and a raft was placed at one end after placing one milliliter of dish soap on the sponge. Both how long and how far the raft moved forward were measured. The independent variable was the three different kinds of dish soap. The dependent variable was how much the surface tension was broken down, how far and fast the raft went. The soap breaks the bond between the water molecules at the back of the raft but the molecules like to stay connected so they rush forward to meet the molecules at the front of the raft, moving the raft forward. It was hypothesized that Dawn would break down the surface tension the best because it is made of chemicals to do exactly that. Also, Dawn is known for getting the oil out of dishes so the soap would have to be able to break down the surface tension of oil. The results show that Dawn moved the raft forward the farthest, and Seventh Generation moved it forward the fastest, while Palmolive didn't excel at either. This disproves my hypothesis because the chemical based Dawn works just as well as the natural Seventh Generation.

7 CH 405

Moret, Zoe

Kenmore Middle School

The Effects of Sugary Drinks on the Color of Teeth

Sugary drinks can give you diseases like diabetes, for example. I tested the effects of sugary drinks on the color of teeth.

I gathered supplies including blue Gatorade, eggs, orange juice, hot chocolate, coke and grape Kool Aid. Then, I carefully place one egg in each cup. Next, pour 1 ½ cups of each drink into different cups, and I set a timer for 2 hours. Let the eggs sit in the cups for 2 hours. Finally, I measured the color of each egg using a color scale.

I discovered that while water did not change the color of the egg, coke darkened the egg the most. The water stayed white while the coke darkened to a dark brown. I noticed that the egg in orange juice had pulp along the side of the egg. The blue gatorade dyed the egg blue and the purple kool aid dyed the egg purple. I also noticed that the darker the drink, the darker the egg turned.

In conclusion, the more sugar in a drink, the darker your teeth will turn. The coke had the most sugar and it turned the darkest color and the water had no sugar and the egg stayed white. A further experiment could be brushing the eggs with a toothbrush to see how much of the color will come off.

7 CH 406

Olson, Freya

Williamsburg Middle School

The Effect of the pH of Water on the Hatching Rates of Brine Shrimp

The purpose of the experiment was to determine the level of pH, or the amount of acid or alkaline in the water, that brine shrimp eggs hatch the most in. If pollution were to cause brine shrimp populations to decrease then many fish and migrating birds going to the Great Salt Lake would be in peril. During the experiment different levels acids and alcalines were added to Petri dishes. The brine shrimp were given three days to hatch and grow before they were measured by the experimenter. The results were that the most brine shrimp hatched in a pH of 7.81 with a total of 123 brine shrimp. In conclusion the experimenters hypothesis, with a pH of 7.5 the most brine shrimp will hatch, was proven incorrect. The data shows that brine shrimp actually do better in a pH of 7.81 which is closer to the pH of the Great Salt Lakes.

7 CH 407

Roman, Vivian

Jefferson-Houston School

Got Mold?

My science fair project is deciding whether mold grows better on wet or dry bread. I will be using the same type of bread,lighting,environment and time. I know the struggle of finding out why your bread is moldy, so I want to help families by providing research on what they may be doing wrong that is causing their bread to mold. I will be placing bread in two containers one with 5 tsp of water one dry with a paper towel over both, I will then wait five days and see which has molded the most. I predict the wet bread will mold the most because of well known research.

7 CH 408

Roman, Zachary

Thomas Jefferson Middle School

Testing the Effect of Different Chemicals on Fire Prevention

Wildfires have been a problem that has increased severely over the decade. The purpose of this experiment was to find another possible fire retardant that could help with fire prevention in the homes as well as forests. The four chemicals tested in this experiment were: Water, Baking soda, fire extinguisher and ANSULITE AFC-3MS 3% AFFF concentrate (class b foam). The hypothesis was that the fire extinguisher would delay the ignition of the charcoal brick the longest out of all four of the chemicals. The experiment was conducted by putting three charcoal bricks in separate newspaper nests and applying the chemical being tested to the brick. Once the chemicals is applied, the newspaper is lit on fire and the time is recorded to see how long it takes the charcoal brick to catch on fire. The results of the experiment show that the baking soda delayed ignition the longest but the class b foam prevented fires in ⅔ bricks. In conclusion, the hypothesis was rejected. The data shows that the best fire retardant (of the chemicals tested) was the class b foam. This could lead to more experiments in the future.

7 CH 409

Zambrano-Argueta, Victoria

Hammond Middle School

Which Sport Drink Has The Most Electrolytes?

Sport drink industries need too incorporate the number of electrolytes in their nutrition facts. People who have been dehydrated, in physical activity, or in consequence of an illness want the best and quickest route to get energy back. On the other hand, people like me want to prevent a dehydration. The industries of sport drinks with electrolytes have an obstacle of offering customers with a mouthwatering beverage vs. a healthy drink. My research purpose was the find out which sport drink could give you the most energy. I build my circuit to connect to my multimeter to measure the level of electrolytes. In the replications of my testing I always made sure to clean my conductor (nail) with distilled water. Pedialyte was the beverage with the scale of 10.3 electrolytes vs. Gatorade, Powerade, Propel, Red Bull, and Vitamin Water with the number of 9.32 electrolytes. In the replications of testing all the numbers weren't precise, but I was able to identify which one was better or worse. With a margin of average of 0.98 electrolytes. In conclusion I discovered that if beverages have more sugar the less electrolytes they will have. If the level of sodium is high the presence of electrolytes is more accurate. The FDA must evaluate the number of electrolytes any drink has. Sport drink businesses would eliminate sugar in their drinks. And we would have the right energy to stay hydrated.

7 CH 410

Scheffel, Riley; McLaughlin, Anna

H-B Woodlawn Secondary Program

Moisturizer on Jello

This experiment tested the effect of various moisturizers on jello, acting as skin. This project was done to see which moisturizer is best to use, so it was done to help society. Neutrogena was the moisturizer that was thought to be the best one because of past experiences. The hypothesis was tested by measuring weight of jello (as skin) with moisturizer on top, There were 7 different moisturizers. Aquaphor, Aveeno, Burt's Bees, CeraVe, Johnson's, Neutrogena, and Vaseline. A total of 8 petri dishes were used including the 7 moisturizers, and one control group using no moisturizer. There was 1 ounce of jello and 1 ounce of moisturizer in each of 8 petri dishes. The moisturizer and jello petri dishes were weighed 10 times over three days. The first day, they were weighed 8 times. Once an hour, for eight hours. The second and third day, they were weighed once at 8:00 am. Vaseline was the moisturizer that changed the most with Burt's Bees very close behind it. Before all of the measurements, it was thought that every petri dish would be losing weight because of evaporation. Whichever moisturizer lost the least weight, would be the best one. However, some of the petri dishes were gaining weight, and losing weight. Therefore, the data was quite difficult to analyze.

7 CH 411

Sokolove, Charles; Schmauder, Logan

Jefferson-Houston School

Erase the Rainbow

Basically, in our experiment we are taking Skittles and seeing how they react to different substances over a certain period of time. We are doing this experiment because we think that Skittles will react differently in different substances and we want to see the difference. We will be performing this experiment at home. Do do it we will, pour the same amount of the different substances into a bowl or cup. We will then put a Skittle in each cup or bowl. After a certain period of time, we will record the difference between the skittles and see how they reacted differently. To do this experiment we will need, a cup, our substances, and Skittles. We think that all of the skittles will react differently because they are all in different substances.

8 CH 412

Al-Hadhrami, Sarah

Hammond Middle School

Juice Glucose Levels

Being diagnosed with type one diabetes, I have to make sure that I maintain my blood glucose levels. My experiment measures the glucose levels in different fruit juices to help me determine what fruit juice would be best to take if my blood glucose level goes low. Before starting, I researched some information about glucose and how it moves through the body by a hormone, insulin. I hypothesized that if I measured the three types of fruit juice, apple, orange, and lemon juice, then apple juice would have the most glucose. Before beginning my experiment, I had to make sure that the strips that were going to measure the glucose operated. I made different percentages of water with glucose powder, then dipped a strip in each of the seven percentages (2%, 1%, 0.5%, 0.25%, 0.125%, 0.0625%, and 0%). After getting the colors on the strips to match the colors on the back of the strips container, it was time to measure the glucose percentages on the samples. Since the strips that dipped in the juices converted to the color of the last percentage 2% before 30 seconds, I had to dilute the samples out of 1:10 to get the specific results. After three trials I averaged the results and got the following: apple juice glucose average was about 2.29%, orange glucose average was 4.17%, and lemons glucose average was 1.16%. Thus, my hypothesis was incorrect, and orange juice had the most glucose.

8 CH 413

Barua, Dhruva

Thomas Jefferson Middle School

The Effect Of Different Types of Rocks on the pH and Phosphate Levels of Water

The purpose of this study was to observe the effect of different types of rocks on the pH and phosphate levels of water. The independent variable was the different types of rocks. The experimental group included: quartz, sandstone, and shale. The control group was a set of trials with no rocks in the water to compare to the water with rocks. The dependent variable was the pH and phosphate levels of the water. The constants were the amount of water given in each trial, dissolving time, temperature the rocks were kept, and amount of rocks. The hypothesis was: If the rocks are tested for their effect on water quality, then shale will cause the greatest increase in the pH of water, and sandstone will cause the highest phosphate levels in the water. 60 grams of shale, quartz, and sandstone were gathered from Four Mile Run stream and crushed into dust. Then, 20 cups were set up in 4 rows and 5 columns, adding 500 mL of water into each cup. Equal amounts of rocks were distributed into each cup, each row representing different levels. The researcher sealed the cups, waited two weeks, and tested their pH and phosphate levels. The results of this study reject the hypothesis and suggest that quartz and shale may have an impact on the Four Mile Run stream's alkalinity. In conclusion, the study suggests that rocks increase the pH of water and, depending on the type, can affect the phosphate levels both negatively and positively.

8 CH 414

Bolles, Sarah

Gunston Middle School

The Effect of Brand of Sport Drink on Number of Electrolytes

The purpose of this experiment was to find the sport drink that contains the most electrolytes. Based on research, the main purpose of sport drinks is to replace electrolytes and fluids lost through sweat during exercise. Two examples of electrolytes are sodium and potassium. Sodium is important in the body because it holds water in body tissue, and potassium is necessary because it balances fluids and helps send nerve and muscle signals to each other. People who are healthy and exercise regularly for under an hour do not need to drink sport drinks. If desired, they can add a pinch of salt to their water. The hypothesis of this experiment was if a person consumes Honest Sport, then they will receive more electrolytes than other brands because Honest Sport contains more sodium and potassium based on the nutritional label. The experiment used a Logger-Pro conductivity meter to measure how fast the liquid conducts electricity. The four brands tested Gatorade, Powerade, Honest Sport, and Propel. The control was a sodium chloride solution (500 g/1L) and regular tap water. The conductivity was measured in µS/cm. At the end of the experiment it was found that Honest Sport had the highest amount of electrolytes with an average of 3079.43 µS/cm. This was significantly higher than the control (salt water) with an average of 2015.29 µS/cm and tap water with 381.29µS/cm. To further this experiment, brands of sport drink powder mixes could be tested as well.

8 CH 415

Bungar, Romeo

Gunston Middle School

The Effect OF Different Types of Salt On The Setting Time Of Plaster of Paris

The purpose of this experiment is to find what type of salt would accelerate the setting of plaster of paris most effectively. Plaster of paris is widely used in the medical, industrial, and artistic fields. Salt accelerates the setting of plaster of paris when water is added forming a white solid that doesn't fracture or contract. This chemical reaction of calcium sulfate hemihydrate is the only form of calcium sulfate that can behave this way with water. Due to this chemical reaction, plaster of paris is currently used in ceilings, sculptures, and molded casts. This experiment tested five forms of salts: Coarse Salt, Fine Plain Salt, Sea Salt, Iodized Salt, and Epsom Salt and measured the amount of time it took for for the plaster of paris to set. The amount of salt covered a surface area of 4mm by 4mm square paper and it was mixed with water The time was recorded. The solidification of the mixture was noticed by the change in luster and the consistency. At the end of the experiment it was found that palin salt accelerated the setting time of plaster of paris the the most effectively (242 sec). This occurred because of the small salt grains which dissolved quickly in the plaster of paris mixture and the good amount of sodium the plain salt grains distributed. This salt accelerator can be a reference to create new accelerators that can accelerate plaster of paris or even more substances efficiently.

8 CH 416

Cunningham, Charlotte

Swanson Middle School

The Effect of Dairy Milks on Thickness of Kefir

Kefir is a probiotic drink that contains active cultures and is growing in popularity. The bacteria in kefir culture feeds on the lactose in milk through a process called fermentation, and, as a result, can provide benefits to those with a lactose intolerance or digestive issues. The effect of dairy milks on thickness of kefir was studied to determine how the thickness changes for each milk after kefir culture was added.

Thickness was determined by recording the time in seconds it took 30mL of each liquid to drip out of a turkey baster into a cup. The two largest differences were found between whole milks and whole milk kefirs, with a mean difference in flow times of 8.68 seconds between whole cow milk and whole cow milk kefir and 13.86 seconds between goat milk and goat milk kefir. Nonfat milk and nonfat milk kefir had the lowest difference, with a mean difference in flow time of 0.5 seconds. Due mainly to the high starting milkfat, the whole milk kefirs were the thickest, and nonfat milk was the least thick due in part to its lack of milkfat.

Applications of this work may include aiding both patients with Dysphagia who have difficulty swallowing thin liquids and also people with thickness preferences. Future experiments involve work to determine the viscosity of dairy milks as there is a relationship to flow time, and investigating adding kefir grains to various dairy milks to make a homemade kefir and determining flow times.

8 CH 417

Gordon, Alexandra

Swanson Middle School

Dissolving Plastic

The purpose of my project was to find the effect of the proportion of acetone in an acetone/water solution on the mass of the not-dissolved plastic sheet. My hypothesis was that if the amount of acetone in the water increases, then the mass of the not-dissolved plastic will decrease. I think this because the more concentrated the chemical is, the stronger its likely effect will be. If the chemical is diluted, then it will be less potent, and will cause less of a reaction on the plastic. Essentially, I think that there will be a negative correlation between the amount of acetone in the water and the mass of the piece of plastic. I chose to do this experiment because I wanted to develop a way to safely dispose of polycarbonate (a type of plastic) so that it would not harm marine life if deposited in the ocean. I knew that acetone would dissolve polycarbonate but I wanted to see if it would still accomplish that when diluted. I found that my hypothesis was correct because the group with the highest amount of acetone in it dissolved the plastic more than the group with the highest amount of water in it.

8 CH 418

Haukedahl, Haley

George Washington Middle School

What's That Smell?

This project was conducted to see which types of oxidations could remove the bad smell, and most affect the chemical compounds of skunk spray. In this project, 5 different oxidations were used; lemon juice, tomato juice, vinegar, dish soap + water, and hydrogen peroxide + baking soda + dish soap. The hypothesis was that the hydrogen peroxide, baking soda, and dish soap combination would work the best. First you take 6 rags, and using the skunk spray put even amounts on each of them. Then you take 5 of the rags and put a different oxidation on each of them, leaving the sixth one alone. Next, four volunteers were asked to smell the rags and rate them on a scale of 1-10, 1 being not smelly at all and 10 being unbearably smelly. The sixth rag, the one without any solution, was given last so the skunk spray wouldn't warp their sense of smell. Lastly, put the data in a chart and calculate which oxidation had the best result.

8 CH 419

Hystad, Anna

H-B Woodlawn Secondary Program

How Much Baking Soda Is the Ideal Amount for a Bottle Rocket?

The experiment was done to test the ideal amount of baking soda in a bottle rocket, because it was thought that a simple, effective, science experiment involving the perfect ratio of baking soda and vinegar in a bottle rocket, had yet to exist. The hypothesis before doing any research, was that the smallest quantity, ½ teaspoon of baking soda(or 2.5 grams) for every one cup of white vinegar, would make the bottle rocket go the highest. The hypothesis was tested by testing three different quantities of baking soda, each to one cup of white vinegar, ½ tsp(3.5 grams), 2 ½ tsp(12.5 grams), and 2 tsb(30 grams). Data was then recorded showing the approximate height for each trial(3 trials were conducted for each ratio). The results of this experiment showed that the largest quantity, 2 tablespoons, made the bottle rocket go the highest, with an average height of almost 9 feet- 105 inches(266.7cm or 26.67m). While the other two ratios: 2 ½ tsp (33in height or 83.82cm) and ½ tsp (15in height or 38.1cm) came in with much lower heights.

8 CH 420

Licato, Anne

Swanson Middle School

The Effect of Different Bromelain Containing Substances on Removing Knox Gelatin

Synchronized swimming is an Olympic sport that requires the athletes to secure their hair by brushing on a thick layer of hot liquid Knox brand gelatin and allowing it to harden before competing. After the swimmers compete, they must then remove the hardened Knox gelatin from their hair. The hardened gelatin is difficult to remove.

For this experiment, substances containing one special ingredient, bromelain, were used. Bromelain is a protective enzyme found in pineapple that can break down the proteins in gelatin.

The purpose of this experiment was to determine the most effective way of dissolving Knox gelatin using four bromelain containing substances: bromelain extract, bromelain supplement pill, bromelain protein powder, and fresh pineapple. It was hypothesized that fresh pineapple would be the most effective because bromelain is derived from pineapple. Swimmers getting in and out of the pool for competition was simulated by saturating the gelatin with water before testing the different bromelain containing substances.

The bromelain extract removed the most gelatin with an average of 0.562 grams of gelatin removed. Next, the bromelain pill removed an average of 0.188 grams of gelatin. The fresh pineapple and bromelain protein powder did not remove any gelatin and they both increased the weight of the gelatin. The weight increase was possibly due to absorption of water or residual bromelain solution remaining on the gelatin. Bromelain extract appears to be a possible solution to removing Knox gelatin from synchronized swimmers' hair.

8 CH 421

Mason, Liam

Swanson Middle School

Flushable Wipes: Are They Really?

My experiment was done to test the difference in dissolvability between toilet paper, wet wipes, and flushable wipes. My hypothesis was that if toilet paper, flushable wipes, and non flushable wipes were tested, the toilet paper would dissolve the most, because it's the simplest and thinnest of the three, as wet wipes need to be strong in order to remain wet. I conducted this experiment in order to investigate the "flushable" title, as flushable wipes have been the cause for many, many problems for the sewage system, the leading issue being that of "fatbergs". Fatbergs are large clumps of all things not meant to be flushed, from oil, to paper towels, and of course, to so-called "flushable" wet wipes (Caron, 2018). These wipes are labeled as flushable, and thusly, flushed. In reality, however, it seems as these wipes cause many unseen problems (Wright, 2018). With my experiment, I set out to investigate the validity of the "flushable" claim, and how these wipes compared to their different, competing varieties (toilet paper, and non-flushable wipes).

8 CH 422

Negussie, Yabsera

Thomas Jefferson Middle School

The Effect of Different Fabrics on the Difference in CO2

The purpose of this study is the effect of different fabrics as filters for carbon dioxide. The independent variable was the fabrics. The experimental group included wool, linen, and polyester. The control group was CO2 produced by a match. The dependent variable was the difference of CO2 before and after using air filters. The constants were the experiment location, time of the experiment was conducted and containment used. The hypothesis was: If wool, linen, and polyester are used, then wool will filter the most carbon dioxide. The experiment was conducted in two ways, the control group and the testing of the fabrics. To test the control group a match was lit and then placed in a test tube and immediately concealed with a lid. After waiting 5 minutes a CO2 meter replaced the lid was and kept there for 30 seconds. The results were recorded and repeated 4 more times for a total of 5 trials. One mason jar ’s mouth covered with fabric and was modified to have a 5cm diameter hole in the side of the jar. The hole was covered with a cork. A match was lit and placed into an unmodified jar. The modified jar was on top of another jar and was in that position for 5 minutes. Then the containers were turned upside down in the same position. The cork was removed and replaced with a CO2 meter. After 30 seconds the CO2 meter was removed. Then repeated 4 more times for each fabric.

8 CH 423

Schimenti, Jenna

Williamsburg Middle School

The Effect of Different Brands of Spray Stain Remover on the Stain Leftover on a White T-Shirt

Eating food can be messy! Unfortunately, getting it on your clothes is inevitable. Because cash is limited, finding a way to save clothes is important. The purpose of my science project was to determine which brand of spray stain remover showed the best results at removing a stain from a white T-Shirt. I decided to use commonly found stain removers that everyone can purchase. I tested four brands – OxiClean MaxForce, Zout, Shout and Seventh Generation. A key constant in my experiment was several brand new white T-Shirts. My hypothesis was that if the spray stain remover used was OxiClean MaxForce, then the stain leftover on the white T-Shirt would decrease because it is chlorine-free and harnesses the power of oxygen to get tough stains out. Using marinara sauce, which is found in foods commonly eaten by teenagers, I stained 40 white T-Shirt pieces. Each of the spray stain removers was sprayed on ten marinara sauce stains. All T-Shirt pieces were washed using the same wash machine, wash cycle and laundry detergent. Via my Likert Scale, I scored all 40 trials. The result was that Seventh Generation won with a mean of 4.3. A close second was OxiClean MaxForce with a mean of 4.2. As such, my hypothesis was proven incorrect. But, now I know which stain remover is the best at removing tough stains from my favorite clothes.

8 CH 424

Snyders, Ella

Kenmore Middle School

The Effect Different Liquids Have on the Corrosion of Pennies

My hypothesis was that the penny sitting in the bleach would corrode the most while the penny sitting is the salt and vinegar mixture would corrode the least. My hypothesis proved to be partially correct. I let each 2018 penny sit in a different liquid (coca-cola, lemon juice, vinegar, vinegar and salt, and bleach) for exactly a month. I then took them out and measured the percent of the penny that the corrosion took up. The penny sitting in the lemon juice had the least corrosion with 0% while the penny sitting in the bleach had the most corrosion with 67%.

8 CH 425

Vaughan, Kathleen

Gunston Middle School

The Effect of Different Liquids on The Amount of Electrolytes

The entrepreneur's of sports drinks tend to spend tens to hundreds of millions of dollars advertising their products each year. Usually in the advertising, something is mentioned about the high level of electrolytes, which your body loses when you sweat (especially on a hot day). In this experiment, the amount of electrolytes in a sports drink (Dependent variable) will be compared to with healthier alternatives such as orange juice, tap water, coconut water, and distilled water (Independent variable). To test the different liquids, a multimeter is utilized. A multimeter is a scientific tool that is used to measure electrolytes in currency, which in this case is mA (milliamperes). The hypothesis was that the Powerade was superior to all of the other beverages, considering the amount of electrolytes that is constantly televised. The experimental results did not support the hypothesis due to the fact that coconut water had the highest amount of electrolytes out of all of the liquids tested. This experiment has shown that Powerade was not all it was supposed to be, and that a much healthier choice can be made through coconut water, or orange juice while exercising, rather than an unhealthy option.

8 CH 426

Bailey, Caroline; Wayman, Elizabeth

Williamsburg Middle School

The Effect of Type of Salt on Amount of Ice Melted

There were two main purposes of this experiment. The first purpose was to figure out if Sodium Chloride (rock salt) melts less ice than salt compounds such as Magnesium Sulfate. The second purpose was to test if Calcium Chloride will melt more ice than the other the salts tested. It was hypothesized that if the type of salt is Calcium Chloride, the amount of ice melted would be the greatest because it has 3 ions which lowers the freezing point of water more than the other salts(2). For this experiment, 10g of ice were placed into a graduated cylinder and then 10g of salt were placed on top of the ice. The graduated cylinder was left in a refrigerator at 38 °C for 10 minutes, then the amount of water in the graduated cylinder was measured as that was how much ice melted. This was repeated 10 times at each level of the independent variable. The hypothesis was supported by the results of this experiment. Calcium Chloride had a mean of 11.3mL, the highest of all the salt types tested. Sodium Chloride had a mean of 6.8mL of ice melted and the means for Magnesium Sulfate and Sodium Bisulfate were both 4.8mL of melted ice. The mean for all the salt types were close except for the mean of Calcium Chloride which was the greatest. In conclusion, according to this experiment, Calcium Chloride melts more ice than the other salts tested.

8 CH 427

Middleton, Sarah; Denton, Genevieve; Hay, Elizabeth

Gunston Middle School

The Effect of Different Buffers on the pH Level of Lemon Juice

This experiment was chosen to test different buffers on their ability to comfort an uneasy stomach. The goal of this project was to find the effect of different types of buffers on the pH level of lemon juice. The hypothesis was that if Pepto-Bismol is added to lemon juice it will bring the pH level to a 7, or a neutral level, because Pepto-Bismol is a one of the most commonly used buffers to alleviate stomach aches (usnews health). One dosage of each buffer, 30ml or two tablets, were added to lemon juice and measured using pH strips and two pH meters and the process was repeated a total of five times. Lemon juice without any added buffers had an average pH level of 3.17. TUMS raised it to an average of 4.55, Milk of Magnesia raised it to an average of 9.26, Pepto-Bismol raised it to an average of 4.26, and Ibuprofen raised it to an average of 3.26. While studying the buffers, it was discovered that Milk of Magnesia raised the pH level the most, which did not support the hypothesis.

8 CH 428

Moir, Libby; Dooley, Megan

Swanson Middle School

What Kills Ice Without Killing the Earth?

The purpose of our experiment was to find a more environmentally friendly solution to the salt used on roads to melt ice. We tested five environmentally friendly ice melters to see which of them would melt the ice the quickest and at the lowest temperature. We believed that if the table salt was used, then the ice would melt the fastest because it is closest to the road salt used by most cities, and it will lower the melting temperature. We completed fifty trials over two days of experimenting. After testing our data, we realized our hypothesis was proven correct. The table salt melted the quickest, at 2490 seconds, and had the lowest melting temperature. The beet juice came in second (3707.6 seconds), then the pickle juice (3846.3 seconds), then the control, with nothing added (3889.7 seconds), and lastly the sugar (4132.6 seconds). In terms of the temperature the pickle juice had the second lowest melting temperature, then the control, and lastly the beet juice and sugar had the same melting temperature. In conclusion, switching to table salt would put us a step closer to a more environmentally friendly ice melt, although it still isn't the best option. Another solution could be using beet juice, but we wouldn't be the first country to use it, since many provinces in Canada have already made the switch. We hope that in the future, our country could switch over to a healthier alternative for the Earth.

9 CH 429

Guthrie, Tyler

Arlington Tech and Career Center

Flammable Fashion

There was one main purpose of this project, and that was to educate people on what kinds of clothes are the most flammable/the most safe. This was done because there are many different types of cloths that are used for clothes, and some are more safe than others.

The hypothesis that was made was that “If wool is burned then it will take the longest to burn and it will burn for the shortest time because it is the hardest to ignite and it can be extinguished by its own natural fibers”. The data overall supported the conclusion. Although Polyester, Nylon, and Wool all had about the same results, Wool was still counted as the best because it didn't melt and it didn't leave behind a liquid byproduct that was harmful. However, the obvious winner is technically Kevlar. Kevlar didn't even ignite, however there were obvious burn spots when the fire was held to it. The burn spots were blacked out and warm to the touch.

9 CH 430

McArdle, Owen

Yorktown High School

The Effect of How Acidic a Fruit Is on How Much Voltage It Contains

The purpose of this experiment was to determine the voltage of different acidic fruits. Fruits are capable of generating electricity because the acids in them act as electrolytes, so if you place metal in the center of one, it creates an electrical current. This allowed me to measure the voltage of each fruit. I hypothesized that as the acidity of a fruit increased, its voltage would increase. First, I determined the pH of each fruit. Limes were the most acidic, with a pH of 1.9, followed by lemons (2.0), grapefruits (3.38) and mandarin oranges (3.9). Next, I measured the voltage of each fruit. The two most acidic fruits had the lowest voltage; specifically, limes had 0.19 volts and lemons had .28 volts. On the other hand, both grapefruits and Mandarin Oranges had 0.6 volts.

The data did not support the original hypothesis; instead, as the pH increased, the voltage increased, too. This suggests that voltage does not affect the acidity of a fruit. After performing an ANOVA, the p value was less than 0.05; therefore, the null hypothesis was rejected. This shows that there was a statistically significant difference in the data. Lastly, there was an experimental error that could have led to inaccurate data, which was that I did not use pH paper and instead researched the average pH. If I re-did the experiment, I would also have different nails and wires for each fruit, therefore the voltage would be more accurate.

9 CH 431

Taylor, Jamison

T.C. Williams High School

Melting Ice With De-Icers

The objectives of this project are to discover which de-icer could be used as an alternative to rock salt. I tested four different de-icers on four important qualities a de-icer should have: fastest at melting ice, how safe it is for the environment, how easy it is to clean up, and the amount of attraction it provides. I first tested how long it would take for ice to melt with the de-icers. After, I tested which ones provided great attraction by walking over it repeatedly. Lastly, I found out which were easiest to clean by attempting to sweep it up with a broom.

My experiment showed that rock salt provided great attraction, was easy to clean up, and melted ice the fastest. Urea melted ice the second fastest, was easy to clean but provided no attraction. Ground black beans melted ice the third fastest, provided some attraction, but was difficult to clean up. Lastly, Alfalfa meal was the slowest to melt ice, difficult to clean up, but provided great attraction. Overall, the type of de-icer you should use came down to where you live. If you live in rural areas like a farm, Alfalfa meal would be ideal because it is safe for plants and animals; it also provides attraction. On the contrary, if you live in urban areas like a city, urea would be ideal because it melts ice fast, safe for pets, and doesn't need to be cleaned because it dissolves in water.

9 CH 432

Tripathi, Anika

Washington-Lee High School

Neutralizing Power of Common Antacids

The purpose of the experiment was to observe which common antacid had the highest neutralizing power on stomach acid, which is comprised of hydrochloric acid, to inform consumers. The three antacids tested were Tums, Alka-Seltzer, and Rolaids. Antacids are often used for heartburn, which is stomach acid burning the esophageal lining. It was hypothesized that Alka-Seltzer would have the highest neutralizing power, because based on previous study over a 30-minute titration process, Alka-Seltzer brought the initial pH up the highest. Minimum dosage of each antacid was added to 30 mL of HCL and titrated till neutralization. It was compared to the control, no antacid added. Each antacid was weighed and the number of grams was recorded. The difference of the NaOH equivalence to the antacid divided by the control NaOH times 100 is the neutralizing power. Calculated as a percent, Tums neutralized 49.21% of acid, Alka-Seltzer neutralized <-488.24% and Rolaids neutralized 37.76%. The results showed Tums had the highest neutralizing power, and Rolaids had the second highest percent. Alka-Seltzer neutralized a negative percent, because the antacid added to the acidity, because of the citric acid ingredient. The results aligned with theoretical results, because the antacids lowered the pH of the acid, although Alka-Seltzer did not. The standard deviation showed little variability. The error bars did not overlap, so there was a significant difference between antacids tested. Therefore, the null hypothesis was rejected that stated there would be no difference in neutralization between antacids.

9 CH 433

Williams, Robert

T.C. Williams High School

Neoprene Wetsuit In Argon

I am researching if soaking a neoprene wetsuit in argon gas will improve the time that it insulates. The research objective was to find out the optimum time to soak the wetsuit in argon. To test this I used wetsuit boots, a thermometer and a cooler. I tested the time to cool down after zero, six, twelve, twenty-four, and thirty-six hours in argon. I found that the argon improved the time to cool off significantly and there was a small trend in the data. I concluded that when you soak a wetsuit in argon gas it will improve the time that it insulates.

9 CH 434

Zymowski, Tyler

Arlington Tech and Career Center

The Effect of Anodization on Titanium

My experiment was the effect of anodization on titanium. I strived to discover if the anodization process was measurable and consistent. Anodization is the process of rusting a piece of metal by using electricity and a hard base bath. However, this rust will end up being vibrant colors. I tested 8cm pieces of titanium, each at variable levels of voltage. I used a power supply that plugs into the wall, wires, a plastic bin, and a water mixture to test my experiment. The water mixture was 80% water and 20% borax. Starting from 0 volts (control), to 10 volts, to 30 volts, to 50 volts, and then 70 volts. I had 10 trials for each level of voltage leading to a total of 50 tests overall. With this sample size, I was able to get conclusive results with no variation between samples whatsoever. My control kept the original silver color of the metal. 10 volts gave back a golden brown. 30 volts yielded a light baby blue. 50 volts made the metal turn dark indigo. 70 volts lead to the metal being a rose goldish pink. All of my tests for each level yielded the same colors, with no variation whatsoever. This leads me to conclude that anodization is a measurable and consistent process that will yield the same results every time.

9 CH 435

Jones, Jill; Peters, Kaitlin

T.C. Williams High School

The Effect of the Process of Making Biodiesel on Its Efficiency

We are researching how the manufacturing process of diesel fuel affects its potency. From this experiment, we hope to learn about the sustainability of homemade biodiesel. Some universities are putting research into this topic because it is good to know the more sustainable options. We are going to be testing our homemade biodiesel against commercial diesel to find out which is more efficient. We are measuring the efficiency using the heat combustion equation to determine the energy produced by the diesel. This project is important because fossil fuels are depleting so we need a new sustainable resource that can be used to make fuel. More research into clean, sustainable, fuel sources will result in a cleaner planet for everyone. By testing which method of making biodiesel is more efficient, we will then know which one is the most reliable to use in the future.

10 CH 436

Beckles, Kayla

H-B Woodlawn Secondary Program

Which Color is "Cool"?

My project is on how different colors absorb light. The colors I used were red, orange, yellow, green, blue, purple and black. My hypothesis was that light colors like yellow would absorb the least amount of light. I tested by using a box, a lamp with a 60-watt bulb in it, and colored construction paper. The temperature was measured from a thermometer borrowed from the chemistry lab. My findings were that lighter colors do absorb less light than darker colors. In the experiment, the data that surprised me the most was that green, blue and, purple all absorbed the same amount of light.

10 CH 437

Olcott, Kyle

Yorktown High School

Acids and Aggregates

In our era, we've managed to construct towering skyscrapers and magnificent structures with the use of concrete as our base. However, with pollution becoming an increasingly alarming problem, acid rain could render these structures unstable as corrosion plagues the concrete. The goal of the experiment was to see which aggregate prevented corrosion the best.

In the experiment, three types of aggregates, sand, pea, and ¾", were used. Bricks of concrete made from 65% aggregate, 20% cement, and 15% water were given a week to dry. Each brick was then weighed and submerged in a container containing a solution of water and muriatic acid with a pH of 1 for six weeks. They were then let to dry for three days, then weighed again to see the percent of mass each brick lost.

The results show that ¾" concrete is best at preventing corrosion with 0.39% mass being lost on average, while sand performed the worst with 2.55% mass being lost. This can explained by looking at the grading and size of the void area in each concrete. While there is little void area in sand, it is hard for cement to fill the small cracks. ¾" aggregate, however, is well graded and allows for cement to easily flow into the void area. The results show that using ¾" aggregate is preferable when making a structure that will be used over long periods of time, where acid rain may affect its durability.

10 CH 438

Penn, Talia

Arlington Tech and Career Center

Sugar, Spice, and Everything Nice

The purpose of this project is to help find other ways to naturally preserve food by using eco-friendly techniques. The problem was finding a way to naturally preserve the apple slices while also obtaining accurate data and canning with white and brown sugar, chili powder, and salt was the most efficient option. The method of canning that was used involved small glass canning jars and small apple slices being put into the jars and being sealed. The results showed that the spices performed best. In conclusion the initial hypothesis which was that chili powder would preserve the apples the longest was proved and the null hypothesis that stated the opposite was also disproved. The spice that was most effective in preserving the apple slice was, chili powder.

10 CH 439

Sartori, Lauren

Yorktown High School

The Effect of the Brand of Acrylic Paint on the Quality of Acrylic Paint

The purpose of this experiment was to find the highest quality acrylic paint. The different brands of paint used were Liquitex Basics, Winsor and Newton, and Liquitex Heavy Body. The most expensive paint was Liquitex Heavy Body (~$5.67 per ounce), then Winsor and Newton ($2.50 per ounce). The inexpensive paint was Liquitex Basics (~$1.25 per ounce). The different colors used were Titanium White, Ultramarine Blue, and Cadmium Yellow. The hypothesis for this experiment was, if the brand of paint is Liquitex Heavy Body then the quality of paint will be higher than the other paints.

Three different tests were conducted to determine the highest quality paint. The first test was a quantitative opacity test. This test involved a spectrophotometer to measure the amount of light penetrated through the paint. The lower the light (lux) penetration, the higher quality the paint. The second test was a qualitative opacity test. This test required a printed smiley-face, on which the paint was painted on. The fewer layers of paint, the higher the quality. The main ingredients in acrylic paint are water, glycerin, and pigment. A higher quality acrylic brand will have a greater percentage of pigment when compared to the other brands. To measure this, the third test dried out and burned the paint. The change in mass was then transformed into percentages.

In conclusion, for Titanium White and Cadmium Yellow the highest quality paint was Liquitex Heavy Body. For Ultramarine Blue the highest quality paint was Winsor and Newton.

10 CH 440

Youkeles, Samuel

Yorktown High School

Tracking the Rate of pH Change Due to Electrolysis

The purpose of this experiment was to find a correlation between the initial pH of a solution and the rate of its dissociation through electrolysis. This study is applicable to chemists today because it provides information about which chemicals dissociate most readily and what important or harmful chemicals may be released.

In order to conduct this experiment, three solutions were made from a base of sodium sulfate and water. HCl was added to create an acidic solution, NaOH was added to create a basic solution, and a normal sodium sulfate solution was kept as a control. An electric current was then sent through each solution for about 40 minutes, and the pH changes were graphed by a pH meter. These tests generally resulted in all solutions going through positive change, with solutions of lower pH going through a faster rate of pH change.

The reason for these results could have been because the H+ ions from the water picked up electrons at the cathode, forming hydrogen gas in reduction and releasing into the air. At the same time, the oxygen from the water was released as a gas through oxidation, but the production of oxygen from sulfate, or of chlorine gas, was often favored by the reaction. This meant that there was more OH- left in the solution to make it basic. To improve this experiment, a different base solution could be used to test if the same results occur.

11 CH 441

Ambellu, Galilee

Yorktown High School

The Effect of the Concentration of Hydrogen Peroxide on the Rate of the Reaction

Patients must be ensured clean rooms, while they are being treated, because their weak immune system prevents them from having the strength to fight off diseases, such as influenza (the flu) and pneumonia, making them more severe than expected. One-fourth of American deaths each year comes from this poor disinfecting of beds, floors, and counters. In an attempt to help combat this medical concern, an experiment was conducted, which tested the effect of differing concentrations of hydrogen peroxide (H2O2) on the time taken for the reaction to begin. The power of H2O2 can be well illustrated through the iodine clock reaction, which turns two solutions, A and B, a blue color when mixed together. Solution A is made from many substances, including 0.05M potassium iodide (KI), 0.1M hydrochloric acid (HCl), starch solution 1%, 0.01M sodium thiosulfate (Na2S2O3), and distilled water (H2O), while Solution B consists of only one substance, H2O2. Knowing the impact increased concentrations of hydrogen peroxide have on the reaction rate will help hospitals, using the H2O2 vaporization process, realize the amount of H2O2 used has the ability to alter their cleaning methods for patient rooms. This will prove that H2O2 is not only a safe gas to use, but one that will clean rooms at faster rates.

11 CH 442

Chen, Yiming

Yorktown High School

Effects of Various Types and Concentrations of Solutes on Passive Daytime Radiative Cooling in Paint

Overheating of buildings has long been a global problem. It poses severe health threats in developing countries and induces ozone depletion where air conditioning is prevalent. Passive daytime radiative cooling (PDRC) in paint serves to combat this problem by spontaneously reflecting light and emitting heat off the surface. White paint is the simplest PDRC material. My project serves to test the effects of acetone, ethanol, and ethyl acetate on the PDRC qualities of white household acrylic paint when they are added in higher and lower concentrations along with water. I performed six trials with concentrations of approximately 6% and 25% of each solute by mass. A pure white paint sample serves as the control. Setting up a light bulb to mimic sunlight while keeping the distance of exposure and area of data collection constant, I used a surface temperature sensor to collect data over time. Statistical analysis with a Z score test proved all trials to be significant, though increasing concentration did not show a trend of increasing PDRC effectiveness. Using Lewis structures for all species involved and applying knowledge of van der Waals forces, I analyzed the differences in PDRC effectiveness for each trial. The findings in this experiment are impactful as they provide an approachable and affordable method to reduce surface temperatures of white paint by a maximum of 3.4°C. Determining an optimal low concentration of solute can allow for large scale implementation, resulting in an adequate solution to the aforementioned problems.

11 CH 443

Ege, Tyler

Yorktown High School

The Effect of Battery Overcharging on Battery Life

Batteries have been infamous recently for making the news due to explosions caused by overcharging. It is common to leave all forms of batteries charging overnight and this has been shown to be damaging in their long term health. In my project, the severity of the damage in relation to the length of battery overcharging was measured. The batteries were charged until the battery recharged showed they were fully charged. This served as the control. A second set of batteries were then charged an additional 4 hours to serve as the first level of the independent variable and a third set was charged an additional 24 hours to serve as the second level of the independent variable. 10 nickel metal hydride batteries were used for each level. I used a vernier light sensor to record the light output of a flashlight that used 2 AA batteries. The flashlight was kept 1 foot from the light sensor on a table in a dark room. Length of the battery life was determined from the start of the trial till when the light sensor no longer recorded light output above 50 lux. The data showed minimal correlation between overcharging and battery life. Between the control and the first level the average battery life decreased by 8 minutes 24 seconds. Between the control and the second level the average battery life decreased by 7 minutes 12 seconds.

11 CH 444

Ishaq, Ishaq

Wakefield High School

Electrolyte Challenge

The experiment determines the effects of different types of liquids on their electrolyte amount. The different liquids tested were tap water, distilled water, Deer Park Spring water, orange juice, coffee, Gatorade, and Powerade. Electrolytes are minerals and substances in the human body that are essential in helping balance the amount of water in your body along with balancing the pH level of the human body. Sodium, calcium, and magnesium are all examples of electrolytes and are regularly obtained through foods that contain these minerals. Electrolytes conduct electricity and give off ions when mixed with water. Foods and drinks with more electrolytes give off more energy to the consumer. The most prominent use of electrolytes is in sports and energy drinks, in which it is often advertised that its electrolytes replenish the salts lost from sweat from exercise. The amount of electrolytes was reflected by the conductance of the liquid since electrolytes conduct electricity. In order to do this experiment, a conductance probe was connected to a laptop with an application that displayed the levels of conductance of each liquid. The probe was dipped into a sample of each liquid and the conductivity, measured in siemens per centimeter, was determined when it stopped changing and became a stable value.

12 CH 445

Lytle, Leslie

T.C. Williams High School

Developing a Biodegradable Bioplastic for Consumer Safety and Commercial Applications

Plastic has led to major advances in the fields of medicine, food production, and consumer goods, but due to almost 40% of plastics being single use, plastic waste is now at the center of a global environmental crisis. While biodegradable plastics are available, they require industrial composting facilities, rare in the US, to break down. Also, they are often made out of edible products, using up cropland that could be used for growing food. Last year, I began addressing this problem by creating a cellulose based biodegradable plastic that could break down in a home composting system. This year, I'm expanding the results to focus on improving the physical properties and consumer safety of the material, in addition to testing biodegradability in a simulated landfill and marine environment. The physical properties being tested are solubility, melting temperature, and tensile strength. DSC analysis will be performed to determine thermal properties like glass transition temperature. So far, four new iterations have been made with improved consumer safety due to the replacement or neutralization of sodium hydroxide. These are biodegradable in a simulated landfill and in compost in 21 days. This rate of biodegradation is 7826 times faster than commercial plastics. However, the physical properties, especially tensile strength, still need to be improved. The next steps are to complete a microplastics analysis to determine if the plastics are actually biodegrading or just disintegrating and to experiment with neutralization methods and other plasticizers to improve physical properties.

7 EN 500

Ellinwood, John

Kenmore Middle School

The Effect of Different Materials on WiFi Signal Strength

My project is on the effect of different materials on WiFi signal strength. I tested each material by placing it over a phone that stayed at a consistent distance from my router. I then measured the signal strength in decimal mili watts (dbm). My experiment is important because it can help people increase their WiFi signal strength in their homes. It can help them choose better place for their routers which will increase speed and effectiveness.

7 EN 501

Frank, Spencer

Kenmore Middle School

The Effect of Different Shapes on Radar Visibility

Radar is used everywhere. It is used in everyday objects, but also in aircraft. Stealth aircraft have irregular shapes. My experiment tested what shapes—a “W” shape, a “V” shape, a cylinder, and a crumpled cylinder— are most stealthy. My hypothesis was, of those shapes, the effectiveness of their radar avoidance would be V, W, cylinder, and crumpled cylinder.

I covered a box with black construction paper on the inside. Then I placed my lux meter and flashlight in it. I used light to represent radar due to the similarities between light and radar. I placed each shape in the box one at a time, turned on the flashlight, took measurements, and repeated five times for each shape. I then averaged my measurements in lx.

The average lx reading of the W was 18.4 lx. The average lx reading of the V was 15.6 lx. The average lx reading of the crumpled cylinder was 26.8 lx. The average lx reading of the cylinder was 32 lx.

My experiment shows that the V was the stealthiest shape because it had the lowest lx reading, which means there was the least amount of reflected light. The W was the second, the penultimate stealthiest shape was the crumpled cylinder, and the least stealthy shape was the cylinder. This shows that geometric designs with angles that don’t reflect towards the source will be the best at being undetected by radar. Shapes with dull, flat, straight on heads will be the least effective at avoiding radar.

7 EN 502

Hernandez, Lester

George Washington Middle School

The Little Magnetic Train That Could

This investigation examines how magnets and power sources push and pull a “train” through an electromagnetic field. The investigation tested magnets of different sizes and strengths and different brands of batteries to find the fastest and longest lasting propulsion systems. The investigation concluded that the largest magnets and “store brand” batteries were the best propulsion system for this experiment.

7 EN 503

Kalhoro, Marium

Hammond Middle School

How Do Different Seawalls Effect the Height of the Tsunami

My project concludes in many different topics, but I have narrowed it down to one “How different seawalls affect the height of the tsunami”

I did this project because to show how using a better seawall will save lives, homes, buildings and other property near the coastline. Another reason I choose this topic is to inform people about how tsunamis are dangerous and how we can help. So I conducted this project to see which seawall is best to use when a tsunami occurs.

7 EN 504

Sao, Lamine

Swanson Middle School

Motorized Magnets

The purpose of the experiment was to build a motorized magnet with different magnet diameters to find out which had the highest rotations per minute (rpm). If the magnet sizes are 10 mm, 12 mm, and 15 mm in diameter, then the 15 mm diameter magnets will make the battery spin the fastest. Three batteries were labeled 3-5 and 1 cm of reflective tape was attached to each one. The 10 mm magnets were put on battery 3, one on the positive, four on the negative side. The magnet on the positive side of the battery was attached to the tip of a metal screwdriver, which had a copper wire wound around it that touched the magnets on the negative side of the screwdriver. The contact made the battery spin. A laser tachometer was used to measure the rpm. This process was repeated for each diameter magnet. The 15 mm magnets had the highest average at 638.82 rpm. The hypothesis was supported by the data. The 15 mm diameter magnet had the highest average rpm because it created the most tangential force. The 10 mm magnets had a top speed of 648.00 rpm. The 12 mm magnets had a top speed of 959.00 rpm. The 15 mm magnets had a top speed of 950.00 rpm. While the 12 mm magnets had the highest rpm, it did not have the highest average rpm.

7 EN 505

Savage, William

H-B Woodlawn Secondary Program

Backdoor

I have a dog who doesn't bark. Initially this may seem like a blessing, but the problem is that we never know when she needs to go out, which means that we usually end up with a lot of accidents inside our house. I wanted to see if there was any way to stop this from happening and alert us when she needs to go out, so I decided to build my project, which I've named "Backdoor." I wanted to see if there was an effective and consistent way to know when she wanted to go out. I believed that I would be able to build a device that could alert everyone in my house when she needed to go out by using motion sensors and a sound system to act as her barks, almost like the Trumpet of the Swan. I built the device using a single board computer and various electronic parts cobbled together, which included a Passive Infrared Radiation detecting motion sensor. I spent a long time testing and fine-tuning the motion sensor to get the perfect range and sensitivity. When finished, the device worked the way I wanted it to. It would consistently detect my dog, and play its alert noise at a volume that I could hear from two floors up. When the device was in use, our dog did not have a single accident in the house, which showed that the device completed its task.

7 EN 506

Smialowicz, Henry

Kenmore Middle School

Rocket Science

My experiment was to figure out which type of nose cone material would result in a rocket going the highest. I used three different types of nose cone materials: paper, wood, and plastic. My hypothesis predicted the plastic nose cone would help the rocket go the highest because the plastic seemed stable enough to not collapse and yet light enough to not drag the rocket down. My procedure was making the rocket body from a model rocket kit and then carving, cutting, and gluing the three nose cones using the different materials.

After the rocket was ready, my Dad drove me to an open field to launch the rocket. I performed nine trials, three launches for each of the three nose cone materials using the same rocket body. I measured the height of the rockets at their highest altitude by using angles, and recorded the heights after each launch. Finally, I averaged the data from the nine trials and the end result was that the paper nose cone materials resulted in the rocket going the highest. The data proved my original hypothesis wrong and I concluded, if you want your rockets to go the highest, it is best to use the lighter weight material over stability.

8 EN 507

Andersen, Caroline

George Washington Middle School

The Effect of Drone Weight on Flight Time

Today, most of the drones that can be purchased by the public run on battery power, which can be recharged or replaced once it runs low. But because of this, drones can only fly for an extended period of time, on average about ten minutes. However, military-use drones can go for about twenty, although they cannot be purchased by civilians. Drones are made to be lightweight and nimble, and companies like Amazon have showed interest in using them for delivery. But there are concerns regarding the ability to keep them in the air. In my experiment, I will be testing how weight can affect a normal drones flight time in order to see what companies can do to improve flight time. If more weight is added to the drone, then the flight time will vary inversely with the percentage of weight added. I taped weights of 65g to the drone and let it hover in the air until the battery ran low. The decrease in flight time however, was not inversely proportional with the weight added. Instead, as the weight increased, the relative reduction in flight time accelerated. In other words, the decrease in average flight time was accelerated as weight was added.

8 EN 508

Bah, Alhaji

Hammond Middle School

Cardboard = Arm?! Can a Bionic Cardboard Arm Perform the Tasks of a Human Arm?

The Science Fair project is about a bionic cardboard arm that was made. The cardboard arm had three goals it had to reach: it had to be at least 70% water resistant, wind resistant, be able to hold 54.43g (strength test) and be able to throw those 54.43g at least 1 meter (distance test). Three cardboard arms were made. The first arm failed the water resistance test, failed the strength test, failed the distance test, but passed the wind resistance test. The second arm passed the water resistance test, passed the wind resistance test, passed the strength test, but failed the distance test. The final arm passed the water and wind resistance tests, passed the strength test, and passed the distance test.

8 EN 509

Bradley, Lauren

H-B Woodlawn Secondary Program

What is the Effect of Different Bracing on Model Buildings?

In recent years, more geographic areas have been affected by seismic activity by new and different causes, for example fracking. This experiment was conducted to help when constructing buildings in areas not previously impacted by seismic activity. The research question was what is the effect of different structural bracing on model buildings? The hypothesis of this experiment was that structural bracing improves the building stability of single-story residential construction during seismic events because structural bracing minimizes the damage caused by shock waves through a building. To test this hypothesis, model building with different structural bracing were constructed and then subjected to consistent force via a shake table on a consistent level of power. The types of structural bracing tested were diagonal bracing, cross bracing and the control of no bracing. Each kind of bracing had five trials timed from when the shake table started until the structure collapsed, specifically when one complete corner or wall collapsed. The time of how long the structure stood would be recorded in seconds. As the hypothesis expected, cross bracing excelled in comparison to the other two types. The structure with cross bracing was the only type that stood for longer than 60 seconds and over all shook much less. Surprisingly, the structure with diagonal bracing did not meet the expectation of being a middle point between the other types; instead it was almost as unstable as the control. This experiment proved that buildings using cross bracing are more stable during seismic activity.

8 EN 510

Brown, Tenagne

Hammond Middle School

Juicing 4 Power

The purpose of this project was to examine the behavior of certain juices when used as a power source for solar cells. I chose to do this experiment because of my concern and interest in environmental science. I considered that if I could spread the word for unrecognized natural resources I could possibly help influence a better future for humanity. Sustainability is one of the key factors of renewable resources and fruits are one of the most available products in the world. Also, their seeds allow us to continuously rely on fruits for clean and safe energy. Using blueberry, blackberry, and lemon juices, I compared the amount of electricity they each produced. The three juices, mixed with titanium dioxide, graphite powder and iodine solution, which are then placed in between two copper-coated glasses, created 3 differently powered solar cells. The solar cells were then measured using a multi-meter to see the amount of energy generated.

After conducting this experiment, the data shows that blueberry produces 25 volts, blackberry produces 19 volts and lemon produces 11 volts of electricity. When the juices are combined with the other ingredients the characteristics of the juices are altered. For example, lemon juice which has the most acidity, surprisingly produced the least amount of energy in a solar cell. When analyzing the end results, I came to the conclusion that berry juices work best.

Everything starts at home, so it's important that everyone contributes!

8 EN 511

Buckley, Ford

Williamsburg Middle School

The Effect of Tower Design on Time Tower Survives Intense Wind

The purpose of “The Effect of Tower Design on Time Tower Survives Intense Wind” was to find the most durable, stable, and efficient building design. As background research, engineering disasters such as the Tacoma Narrows Bridge were studied. The goal of the experiment was to see what would happen to different tower designs when they were exposed to intense winds. The Tacoma Narrows Bridge collapse provided inspiration in the topic of structural engineering and the experiment was born. Triangular, square, rectangular and circular towers were built and tested against a box fan wind source in 10 repeated trials each. The hypothesis was that the triangular building design would withstand winds the longest. The hypothesis was disproved. The structure able to withstand the winds the longest was the rectangular design, with a 14.47 second mean resistance time. The circular base was next most resistant at 8.69 seconds, the square base third at 7.12 seconds and the triangular design was least resistant at 4.35 seconds. It is believed that slight flaws in design construction and material selection in the triangle design (strips of poster board with three sides of tape vs. a more solid poster board folded to minimize taping to one side) likely contributed to the hypothesis being disproved, as most background research asserts triangle to be the the strongest design shape.

8 EN 512

Chenoweth, William

Williamsburg Middle School

The Effect of Snare Drum Head Tension on Length of Sustain

The effect of snare drum head tension on length of sustain was investigated to learn if sustain can be shortened by tuning up or down a snare drum head. This experiment is relevant because dampening a drum is important during recordings and performances, so tuning could be a viable way to achieve desired results. The experiment was conducted by tuning the drum head, dropping a ball onto it from a certain height, and recording the length of the sustain. Tests were repeated 15 times for each level of IV. There was a definite trend in the data showing that as the drum head tension increased, the sustain shortened. This data supported the hypothesis of the experiment, which had theorized that a higher tension would have a shorter sustain.

The experiment went very well with no known errors. Possibilities for extensions include testing different drum heads or testing the bottom drum head instead of the top.

8 EN 513

Jones, Amelia Rose

George Washington Middle School

Building a Circuit to Detect Ripeness

In this project, the goal was to make a circuit that could identify ripe produce. Spoilage wastes ten percent of produce in the United States. My first science fair project focused on a new way to grow food faster and more efficiently, but what good is technology to make an abundance of food, if we lose ten percent each year? We often identify whether a fruit is ripe based on its color using our sense of sight. I created a circuit that detects color, in an attempt to replicate the process a human eye uses.

The main purpose of this project was to build a circuit that can recognize ripe produce. The project created two circuits. The first circuit was used to measure the resistance of different colors in kΩ. This allowed me to find the number that determines ripeness for red produce. The second circuit replaced the multimeter with a diffused red LED that lights up when the resistance level is adjusted to meet the resistance level of ripe red produce.

It is possible to determine the ripeness of produce based on the level of resistance through a photoresistor. There is potential for the use of this method to increase the productivity of selecting produce during harvesting. Technology can be utilized to pick produce at a level of ripeness in relation to how long it takes to get to market. This can provide the farming community with a more efficient way to harvest produce and ultimately decrease waste.

8 EN 514

Lawrence, Jake

Swanson Middle School

Rabbit Ears No More

In recent times, television has become an increasingly old-fashioned way to consume content, yet the price of a basic cable plan still remains astronomical. Satellite television antennas have come a long way from their formative days atop TV sets and now offer a very appealing way for an individual to continue viewing television without a monthly fee. This experiment was created with the express goal of determining what effect shape has on the number of channels the antenna could receive.

Three antennas of various shapes were chosen for testing, all within a similar price bracket and from common seller. It was hypothesized that the rectangular antenna would be able to receive the most channels, due to it having the greatest surface area. That theory was tested by way of a digital television, to which each of the antennas was connected and underwent several manual channel searches. Of the antennas tested, the hourglass-shaped one performed the best, receiving 47 channels through each and every trial. The circular and rectangular antennas received 44 and 33 channels, respectively.

This research shows that, though consumer antennas are extremely viable options for viewing television, especially when the cost is compared to other options, there's a noticeable difference between antennas, even when they are advertised as functionally the same thing. This experiment serves to help streamline a potential buyer's search for one such device.

8 EN 515

Marquis, Sofia

Gunston Middle School

The Effect of Bridge Structure on Tensile Strength

Many people cross bridges every single day, not knowing how much that bridge can handle and at what time they will break. This project is used to test which bridge structure has the best tensile strength. Since there were many bridges the most commonly seen ones were built. The most common bridges were the Beam Bridge, Suspension Bridge, Cable-Stay Bridge, Truss Bridge, and the Cantilever Bridge. The control was the beam bridge because each bridge had the beam bridge as the base design. The most used material was the popsicle sticks, which every bridge was built out of. Each design had to be built three times each, with everything the same. The beam bridge was tested first, by hanging more than 100 lb of sand off of the middle of the bridge. The same testing procedure was used throughout the bridges. Due to research it seemed that the Truss bridge would be able to hold the most weight, yet the Beam held the most at an average of one hundred twenty three pounds. The Cable-Stay, Cantilever, and Suspension were all close, for they were all similar in build. This project shows the strongest bridge to go with on places that have a large population. Objectives were not met for the hypothesis was not correct, but there was potential to learn a lot of new things, especially that even a project that was done many times can still surprise people.

8 EN 516

Ramaswamy, Harini

Swanson Middle School

The Effect of Gear Ratio On Torque In Arduino Based Robots

The basis of this experiment was the effect of the mechanical advantage of the Arduino based robot in speed, power, and torque. I wanted to study the results of various challenges the robot had to face and how the specific small to large gear ratio could handle three different mechanical advantage tests. I hypothesized that if the robot has a small to large gear ratio, then the robot will perform the best when it has to climb up the ramp which was the torque test. I wanted to test the reliability of that gear ratio and how it could perform using the base structure for the robot that I had constructed, although I knew the gear ratio might not perform to its full potential utilizing that style of a gearbox.

The result was the robot performed its best during the speed test. This is a surprising finding since the gear ratio for speed robots consists of a large gear to small gear. These results may have occured from a faulty robot chassis structure that did not support better torque and might have altered the strength it was able to apply. In the future, I could test out various robot structures that may benefit other gear ratios and I could extend the horizons of my experiment to include a newer, more durable design. I could also develop my array of tests that I performed for the experiment and could increase the number of trials so I could collect more reliable results.

8 EN 517

Sanchez, Raphael

Thomas Jefferson Middle School

The Effect of Tuned Mass Dampers on Buildings Affected by Vortex Shedding

The purpose of this study was to test how much the building sway from vortex shedding was reduced when a pendulum Tuned Mass Damper (TMD) was being used. The independent variable was the amount of damping. The experimental group was the building with a pendulum TMD. The control group was the building without the pendulum TMD. The dependent variable was the building sway, as measured by an accelerometer. The constants were the building, the accelerometer, and the pendulum. The hypothesis was: The trials with building's TMD unlocked will oscillate less than the trials that will have the building's TMD locked. A model building with a TMD that was set to the natural frequency of the building was treated with different wind speeds. Along with changing the wind speed, the TMD was locked and unlocked (active) to test how effective a TMD would be against vortex shedding. Results showed that the TMD was most effective at reducing building sway at moderate speeds; however, the TMD was not very effective when treated with low and extremely high wind speeds. Thus, the results supported the hypothesis in technicality. In conclusion, the study suggested that TMDs could make a difference when a building oscillates as a result of vortex shedding, but TMDs only make a significant impact on building sway at moderate wind speeds.

8 EN 518

Suliman, Fatima

Hammond Middle School

Trap the Dye

The purpose of this engineering project is to prevent fading in dark-colored clothing by creating a solution that can be applied to those clothing items. Fading in dark-colored clothing occurs quite frequently and often leads to an increase in the amount of clothing present in our landfills. A solution that helps prevent fading would decrease the likelihood of that occurring. I decided to carry out this project because I wanted to create something that could positively impact the average person while helping benefit the environment over time.

Over the period of this engineering project, I created three different solutions that consisted of a water base as well as varying amounts of distilled white vinegar, washing soda, and salt. The first solution was made and tested on one black cotton shirt and underwent three complete wash cycles. The second and third prototypes were applied to different shirts and underwent the same process. A numbered color scale was used to see the impacts of these solutions. Each shirt shade was recorded before and after each wash cycle.

Each of the three shirts that had a solution applied to it received a one on the color scale before and after each wash including a fourth shirt that did not have any solution applied to it. Based on the data that I have collected the solutions are able to maintain color as much as a shirt without solution applied to it can, longer-term impacts on the fading of dark-colored clothing are not yet known.

8 EN 519

Black, Kyle; Behrens, Aleksander

H-B Woodlawn Secondary Program

Paper Airplane Launcher

For our Engineering project we built a motorized paper airplane launcher. We seeked to create a more effective and efficient way to fly a paper airplane and more consistently demonstrate the physics of flight. We wanted to eliminate as many inconsistencies and human errors when throwing a paper airplane as possible, by instead launching it from a machine that would guide it to a steady and smooth flight.

Our paper airplane launcher lived up to our expectations as it did indeed shoot out a constant plane that traveled farther than it would have by throwing it. With the exception of a few adjustments like raising the wheels so that a wider variety of paper planes could be used and limiting the friction of the wood used to guide the paper airplane, our machine was indeed effective and efficient.

8 EN 520

Connor, Asher; Andress, Oliver

H-B Woodlawn Secondary Program

What's the Catch?

Our expirement is tested which non-recreational gloves worked the most efficiently to catch a football. The reason why we did this expirement was because my partner and I both like football and thought this expirement would be fun to do. The main question for the expirement was which non-recreational glove worked the most efficiently to catch a football. Our hypothesis was that the dishwashing gloves would work the best because of the grip it showed when we first looked at it and because of our research. We tested our expirement by gather 16 people (8 boys, 8 girls) of all different ages and threw them the football 5 times for each glove and control. So we had 7 gloves and 2 controls so nine times five is 45 so each contestant attempted to catch 45 passes. Our results were that the dishwashing globes worked the best posting a 91% catch rate and the worst catching rate was the wool gloves.

8 EN 521

Kuhse, Finnegan; Buehlmann, Patrick

Williamsburg Middle School

The Effect of Type of Wood-Based Material on Durability of Pykrete

For the experiment, it was decided that various wood based materials would be frozen in water to create the pykrete and then drop a weight upon pykrete to discover how much mass was lost. The reason it was chosen was to do the experiment that was missing in the limited research that other scientists have done. It was missing the different durabilities of the different wood based materials in pykrete. This spurred the lust for finding the answer to this unknown mystery. The mass of the pykrete was measured before and after dropping a five pound weight on it three times. Then, those two numbers were subtracted to find how much mass was lost. This was repeated three times per wood based material. It was discovered that the most commonly used material, sawdust, is far surpassed by common household items such as paper and paper towels. In the results sawdust. had the least amount of durability. Therefore the hypothesis, being if the wood based material is sawdust it will create the least durable pykrete, was proven correct. In future projects that might be done, would be to include a wider variety of wood based materials. Another variable that could be changed in future research might be to have the different type of liquids be the independent variable. That possibility would not be about pykrete however, because pykrete is only made with water and a wood based material.

8 EN 522

Safi, Sabrina; Kruse, Olivia

Hammond Middle School

Will It Break?

Our Objective/goal was to see if the design of a bridge affected how much weight a bridge held. The methods/materials that we used were Popsicle sticks, wood glue, sand, buckets, a small luggage scale, newspaper, bungee cords, and small plastic bowls. We set up a bridge across two flat surfaces and tied the bungee cord to the bridge and hooked the bucket to the bungee cord, then we slowly added sand until the bridge broke and measured the amount of sand in the bucket using the luggage scale. The Results of our project showed us that the design of the bridge does matter and that the triangle bridge held the least where the arch bridge held the most concluding that our hypothesis was correct. The Conclusion is that based on the results of the experiment, our hypothesis was correct: The rectangle weighed an average of 14.25 Lbs, the triangle bridge weighed an average of 10.45 Lbs.and the arch bridge was strong weighed an average of 42.1 Lbs.

8 EN 523

Souders, Elle; Lawler, Greta

Williamsburg Middle School

The Effect of Roofing Components on Magnitude of Water Damage and Number of Shingles Lost in Hurricane Conditions

In 2018, Hurricane Michael devastated much of Florida's coast. Maps show that almost all of the infrastructure was destroyed - except for a couple recently built houses. Why did these houses remain standing? What ensured their survival? This project explores the effect of roofing components on magnitude of water damage and number of shingles lost in hurricane conditions. The experiment tested different roofing components (weather guard, roofing felt) against hurricane force winds and water damage. Just like how homes built with more precautions put in place against wind and water survive better in difficult conditions, so did the houses in our experiment which were prepped against water or high winds. Roofing tiles that were well prepared lost only 1-2 shingles, while ones that had already suffered damage lost up to 5. The experiment concluded that roofs that had been previously fortified against hurricane conditions sustained less damage. This was due to the weather guard's impermeability and the fact that the integrity of the wood was not previously comprised. Overall the results stood up to what was previously hypothesised, that if roofs were prepared correctly in the face of extreme weather they could better withstand it.

9 EN 524

Smalls, Amari

T.C. Williams High School

Hydropower Generator

The problem in my past community (Kinshasa, Congo) that I'm trying to solve is the electricity blackouts happening at times when electricity is crucial. Through these experiences I came up with the idea to create a model which could be dependent on itself for energy; that model, if successful, could then be applied in real-life.

My hypothesis is, if the amount of spoons increases then it won't have any effect on the voltage produced as long as the speed of the water was consistent.

I built the generator out of wood and electric motor and spoons. There were four generators and each had a different amount of spoons. FOr each generator I used an ohm meter to measure the voltage needed to light up the LED.

I hypothesized the amount of spoons I used for my generator wouldn't matter as long as the speed of the water was consistent, but I was proven wrong. Although my hypothesis was incorrect, I created a new one that if you increase the number of spoons, the amount of electricity will increase along with it. Through testing I learned its best to hold the generator at a downward angle so the water will hit the turbine correctly.

9 EN 525

Torg, Will

H-B Woodlawn Secondary Program

Water Desalination

A readily available supply of drinking water is a necessity for human life, and the explosion of human population as well as the lack of new sources of fresh water being discovered demands new solutions.The purpose of this project was to design and test an apparatus that would be efficient in cost and desalination performance. The water was evaporated as a means of purifying it. Numerous trials were run, using different amounts of water and different methods for retaining more heat to maximize evaporation and condensation. The desalination prototype used an incandescent bulb, plastic container, plastic wrap and funnel. It worked as follows: The heat emitted from the bulb evaporated the water, which then condensed on the plastic wrap and dripped into the funnel, to a storage area underneath where all the desalinated water was collected. After a period of about 10 hours, the desalinated water was measured in a graduated cylinder.

9 EN 526

Williams, Dilin

Washington-Lee High School

Flexural Strength of Beam Structures

The experiment investigated the flexural strength of balsa wood sheets with cut-outs of different shapes to find the most effective method of reducing the weight of a structural piece. A total of 4 different designs were tested. Ten trials were conducted for each design. When conducting a trial, the sheet being tested was placed in a testing apparatus that used a bucket of sand hung on the end of a lever to apply downwards force. The different designs tested were square cut-outs, circular cut-outs, triangular cut-outs, and no cut-outs. The sheets with no cut-outs were cut thinner to match the mass of the other designs. It was hypothesized that the circular cut-outs would have the highest breaking force of all of the tested designs. The results of the experiment showed that the circular cut-outs had the highest mean flexural strength, confirming the hypothesis. However, the design with circular cut-outs was wildly variable, meaning that the design with the next highest mean, the design with no cut-outs, was the most effective. This result was likely caused because the cut-outs created points of stress, making them easier to break. The experiment confirmed that the most effective way to reduce the weight of a structural member is to reduce the overall size of the part, rather than cut pieces out of it.

9 EN 527

Gascon, Neil; Gonzalez, Alan

T.C. Williams High School

The Solar Powered Gauntlet

In our project, we are creating a circuit that would charge a USB fan through a solar panel, attaching it to an aluminum cardboard platform to make our product look like an arm and to test the lifespan of the fan once charged at different amounts of charging time for each test. The purpose of our project is to create a product that would cool people but be environmentally friendly, is lightweight and can be transported efficiently. Our procedures were divided into four phases, the first three relate to the construction of the cardboard arm, with the last phase relating to testing the fan's lifespan after being charged by the solar panel. Each step that was taken in each phase was taken in order to satisfy the goals we laid out to determine the success of our product. We created six goals to determine the effectiveness of our product. Our first design utilized a car charger in order to connect the USB fan and the panel. Upon the completion of all four phases, our product was able to satisfy ⅚ of the goals we had created but failed one: the fan's lifespan. This was due to us acquiring a weak solar panel; subsequently, when this solar panel was charging the fan, it only absorbed small amounts of sunlight. We will continue this project by making modifications to the product. Complete success will be determined when the optimal charge time of the fan is equal to its lifespan after being charged.

9 EN 528

Kiser, Luke; Jones, Amirah; Muir, Maddie

Arlington Tech and Career Center

How Does the Ratio of Sand to Cement Affect the Strength of Concrete?

This project was chosen, the effect of the ratio of sand on the strength of concrete because everyday people walk on concrete in suburban areas, and they live in buildings that use concrete. The purpose of this experiment was to find out how the ratio of sand to cement changes the strength of concrete. The hypothesis was if more cement is added to the concrete then the concrete will be stronger because as found in Robert A. Carstens' project titled "Concrete Breakers", it was found that "the more cement you add, the stronger the concrete gets." In this project it was concluded that the concrete with more cement than sand was stronger. Compared to the concrete with more sand than cement. However, one of the strongest combinations tested was the control, which was fifty percent cement and fifty percent sand.

10 EN 529

Andersen, Annabelle

T.C. Williams High School

Drone Performance versus Weight

Typical, battery-operated drones can only fly for approximately ten minutes, while higher-end, military-use drones can fly for approximately 20 minutes. However, higher-end, military-use drones are not available for purchase to the public. A typical drone is made of lightweight materials in order to reduce weight and improve mobility. However, the composite material used to build higher-end, military-use drones allows them to fly at extreme altitudes. Drones have many advanced features, including, but not limited to, vision sensors, gyro stabilization, and even, in some, radar positioning. With the possibility of drones making trips and carrying loads faster than humans, many shipping companies are looking to drones for the future of their companies. However, typical drones do not have a long enough battery life to deliver packages, which is a hindrance to the progression of these companies. In this experiment I will see how much of an effect weight has on drone battery life in order to determine what companies can do to improve the ability of drones to deliver items.

10 EN 530

Dugan, Anna

T.C. Williams High School

Toxically Hypoxic: The Effectiveness of Various Aeration Devices on Dissolved Oxygen Levels

The problem I chose to combat is the eutrophication of coastal waters and the hypoxic dead zone areas that it produces. Dead zones can be studied through biodiversity tests, studies of dissolved oxygen levels in different areas, and by tracking the formation of algal blooms (Duarte and Vaquer-Sunyer 15453). Since dead zones affect many kinds of industries, from aquaculture to tourism, both professional and amatuer scientists are attempting to put a stop to the problems dead zones pose. The main approach scientists are taking is to simply prevent the formation of dead zones by urging farmers to “decrease inputs of nutrients, especially nitrogen and phosphorus” (Carpenter 11039). However, instead of attempting a method of prevention, I will go for a head-on approach meant to preserve the biodiversity of areas already ravaged by dead zones. In this project, I will attempt to design, build, and test a water-churning device that will speed up the bacteria’s metabolisms and eventually cause them to die faster from lack of sustenance. In addition, the added dissolved oxygen will help to keep the natural biodiversity alive throughout the whole process.

10 EN 531

Lunati, Mia

T.C. Williams High School

Rocket Performance

Fins are built to stabilize and control the direction in which the rocket is going. Changing the angle of the fins may affect the height of the rocket, since there will be a change in the amount of yaw and spin. The greater the angle of the fins, the more the rocket will spin when launched. This project is relevant to everyday life because individuals who design and create rockets have to take in account the many factors that are involved in keeping the rocket stable with a minimal amount of air resistance.

10 EN 532

Mukhtar, Zeinab

Wakefield High School

Distillation of Water Using Disposable Appliances

The struggle to obtain clean drinking water causes one million people to die from water-related diseases every year. This is why the purpose of this project is to create a home-made distillation device using disposable materials that are both affordable and accessible. Room-temperature tea boils in a soda can. It's vapor then passes through an aluminum foil condenser and into a water bottle submerged in ice, condensing into distilled water. The distillation device produced an average of 9.54 tbsp (140.474 mL) of distilled water from the original 12 tablespoons (2/3 of a cup) of room temperature tea in sixty minutes (three trials done). The results also proved that the rate of distillation increased. This contradicted the hypothesis which predicted a consistent rate of distillation.

10 EN 533

Stearns, Oliver

H-B Woodlawn Secondary Program

Hydrogen Powered Boat

The purpose of this research is to design a new form of a propulsion system for a boat. The current form or system of propolision for a boat, involves an inboard and or outboard motor that has an onboard stored fuel system, meaning that the boat run out of fuel. However what I am proposing is using a system that will take its fuel from the water itself and thus will require no onboard fuel system. The system will get its fuel through a process of electrolysis, or the system of passing a current of electricity with salt in the water in order to facilitate the reaction. Salt is necessary for the reaction to occur because it is an ionic compound which conducts electricity (NASA). The current is formed by passing electricity between an anode and cathode connected to a battery. This will generate oxygen gas on the positive cathode and hydrogen gas on the negative anode (ISBU). The hydrogen and oxygen gas will then be recombined in the combustion chamber to recombine the two gases that will produce the propulsion. Hydrogen and oxygen is actually a popular form of rocket fuel, it is one of the most popular type of cryogenic rocket fuel. Or gaseous fuel stored at very low temperatures. Hydrogen/Oxygen combination produces 30-40% better specific impulse rate than other fuels (BRAUNIEG). This means that it is a very efficient fuel and generates a lot of force, making it optimal for this experiment.

11 EN 534

Cambridge, Gavriel

T.C. Williams High School

Developing an Unmanned Solution for Wetland Observation

The observation of wetland environments is challenging due to the complex shorelines and shallow water that characterize a wetland. Conventional methods of observation damage the environment, using boats and wading researchers, which disturbs the water column and startles organisms that can serve as indicators of wetland health. Criteria for non-invasive operation in a wetland were used to evaluate the performance of three existing unmanned solutions. The selected design was then optimized through a series of hardware tests. Next, network tests established network latency and packet loss for different network configurations between the onboard computer and a topside computer tested at different distances. Tests for CPU usage by the onboard computer across different video output methods on different cameras were performed in order to improve video FPS and reduce CPU usage. The most recent development with this project was to test the accuracy of three different methods of species detection and identification. Identification based on shape and color combinations, using a Haar Cascade, and using a pre-trained neural network based on the Tensorflow python libraries were tested, with the Tensorflow neural network having the highest accuracy. Although a fully functioning design was not developed, the tests performed at this point in the experiment serve to optimize aspects of the design for operation in a wetland, and meet the future goals of the project, which are to implement and test a fully functioning design.

11 EN 535

Fried, Ellie

H-B Woodlawn Secondary Program

The Effect of Blade Design on Oar Drag

The experiment studied the effect of blade design on oar drag. I chose this topic, because, as a rower, I was interested in the engineering behind rowing. The hypothesis is that the Fat Smoothie blade design will create the most drag, therefore deemed the most effective oar in this experiment, because of its vortex edge, which is supposed to help reduce drag, and its larger surface area. Five 3D oar designs, loosely based on previously tested Concept 2 blades: Macon; Smoothie; Big Blade; Vortex Edge; and Fat Smoothie were designed and printed. The experiment used two containers filled with the same amount of water set parallel to each other. A toy bus was positioned in in between the containers. Two connected clamps were positioned on a structure added to the bus on each side and set at a specific angle. Two matching blades were inserted into clamps on either side of the bus; each blade corresponded with the right or left side. The bus was dragged using a pulley system, thereby draggin the oars through the water. This was performed three times for each blade. The average time of the Macon blade was 1.63 seconds; the Smoothie was 1.497 seconds; the Big Blade was 1.5 seconds; the Vortex Edge was 1.723 seconds; and the Fat Smoothie was 1.73 seconds. The hypothesis was supported, because the Fat Smoothie blade had the highest average time with 1.73 seconds, which means it had the most oar drag.

11 EN 536

Stocks, Allison

Yorktown High School

The Effect of Architectural Design on Supertall Building Flutter Acceleration

Prior studies have shown varying architectural designs can be implemented to positively impact a supertall building's flutter acceleration during wind events. To explore the impact of different architectural designs, an experiment was conducted. The purpose was to determine the effect of architectural design on flutter acceleration. Four buildings with Circular, Corrugated, Octagonal, or Spiral Fins architectural design were constructed using aluminum flashing and wood. Ten trials were conducted for each architectural design. To determine the flutter acceleration, an accelerometer was attached to the building. A wind tunnel was constructed using a leaf blower to induce building flutter. The flutter acceleration was lowest with the Spiral Fins architectural design. This can be explained because a horizontally and vertically non-uniform architectural design like Spiral Fins resulted in the greatest vortex shedding and disruption which effectively reduces flutter acceleration. From best to worst flutter acceleration, the architectural designs were Spiral Fins, Octagonal, Corrugated, and Circular, respectively. Data analysis using a t-test showed the p-value was <.0001. The results indicate that as vortices created by wind are disrupted by effective architectural design, flutter acceleration decreases. The experiment confirmed that an effective architectural design can help to lower the flutter acceleration of a building during extreme wind events. A future experiment could be to determine the optimal spiral fin slope and orientation that maximizes vortex shedding and limits flutter acceleration.

11 EN 537

Doney, Brendan; Cardwell, Owen

T.C. Williams High School

An Autonomous Quadcopter for Urban Search and Rescue

In recent years, the human fatalities and financial loss associated with urban search and rescue missions have increased; however, the complex terrain and faulty connection that characterise such environments make it difficult for robots to supplant humans. In this project, an autonomous system for a LiDAR-equipped quadcopter was developed for high mobility and awareness to have repeatable autonomous flight that progressively increases in speed. The Betaflight control software and firmware were used to test the hardware on the quadcopter initially, with a subsequent shift to the ArduPilot firmware for autonomous control. Ubuntu MATE 16.04 and Robot Operating System were installed on a Raspberry Pi to act as a coprocessor. After setting up the basic systems, three test flights were performed to test the accuracy of the ArduPilot feature set. In the three flights, the quadcopter moved progressively closer to a successful altitude hold, but a crash in the third flight snapped an arm on the quadcopter. To then subvert the need for a physical rig, an environment was simulated using the model quadcopter and indoor flight environment of the ROS package hector_quadroter. General functionality was verified using manual control and waypoints were selected for the development and testing of autonomous code. In the end, the project did not meet its goals, but it was successful in limited autonomous flight. The primary limitation was simply the inconsistency of the physical drone, as it resulted in damage that forced the switch to simulated testing late in the development cycle.

12 EN 538

Lustig, Matthew

T.C. Williams High School

The Other Side of Solar: Harnessing Solar-thermal Energy for Urban Lighting

Due to an exponentially increasing reliance on electricity, non-renewable energy resources are having dramatic effects on our environment, causing global warming. An alternative to nonrenewable energy sources are solar and thermal energy, which are among the most abundant, readily available sources of energy. Thermal energy produced by our sun is conducted by impermeable surfaces such as sidewalks and roadways that are largely present in our urban and suburban communities. Using the Seebeck effect (a difference in temperature to create voltage) and the Peltier effect (heat is absorbed when an electric current passes across a junction between two materials), urban sidewalks could be enhanced with implanted Seebeck plates in order to produce enough electrical potential energy to power urban street lights and cut that form of electrical usage out of the power grid. A circuit was designed that could be implemented in urban sidewalks to utilize the Seebeck and Peltier effects to produce electric energy. Mathematical and virtual simulations were conducted on this circuitry to test the effectiveness of this energy production method and its ability to power a streetlight. It was concluded that the voltage produced by this method is insufficient for use in urban lighting. Regardless, there are multiple other ways this energy production method could be implemented into a power grid that would cut down on overall carbon emissions and improvements can be made to the circuitry to increase its ability to power streetlights, such as introducing a hybrid of AC and Seebeck power supply into the circuit.

7 EV 600

Chu, Elaine

Thomas Jefferson Middle School

Make a Difference With Conservation!

The purpose of this study was to determine if practicing active energy conservation of water, electricity, and natural gas in a home reduces a household's carbon footprint. The independent variable was the level of energy conservation practiced in the household: active energy conservation (truly trying to conserve as much as possible) and usual energy conservation (a level of conservation that occurs when not intentionally focusing on conservation). The dependent variable was the change in the household's carbon footprints. The constants included: the footprint calculator, the calculator's methodology, and consistency of each level of conservation. The hypothesis was: If the active energy conservation of water, electricity, and natural gas is practiced in a home, then the household's carbon footprint will be reduced. The household's water, electricity, and natural gas usages when practicing each level of conservation were calculated from meter readings, bills, water measurements, and estimations. From these usages, the household's carbon footprints were calculated using a footprint calculator. Finally, the household's carbon footprints were compared. The results showed that practicing active energy conservation reduces the household's carbon footprint because less water, electricity, and natural gas is consumed. These results support the hypothesis. In conclusion, the study suggests that making more simple and easy efforts to actively conserve energy every day is an effective way for individuals and households to reduce their carbon footprints. These efforts may only make a small change for one household's carbon footprint, but it will make a tremendous difference if everyone contributes.

7 EV 601

Dhakal, Richa

Thomas Jefferson Middle School

The Effect of Green verus Conventional Dish Detergents on Red Wiggler Worms.

The purpose of this study was to find out if eco-friendly or “green” dish detergents are truly less harmful to the environment. The independent variable was different brands of “green” or “conventional” dish detergents. The experimental group included: Dawn Dish Detergent, Palmolive eco-friendly Dish Detergent, Seventh Generation Dish Detergent, Palmolive Dish Detergent, Gain Dish Detergent, and AJAX Dish Detergent. The control was no detergent. The dependent variable was the amount of worms alive after five days. The constants included: the same species, age, starting number of the worms, amount of light given, bowls, spoons, number of holes in the aluminum foil, aluminum foil, type of soil, amount of dish detergent, and amount of soil. The hypothesis was: If four red wiggler worms are put into a mixture composed of 20 ml of Seventh Generation Dish Soap and 100g of potting soil, then they will have the most worms alive. Five large (177 ml) cups were prepared by mixing 236.59 g of potting soil and 20 ml of the first type of dish soap. Four worms were dropped into the cup then covered with tin foil. Then, 10-12 holes were evenly dispersed throughout the tin foil. The different IV variables were then tested. The amount of worms alive in each cup was recorded. The results suggested that Palmolive Eco-Friendly Dish Detergent kept the most worms alive after five days.These results rejected the hypothesis. In conclusion, the study suggests that Palmolive Eco-Friendly Dish Detergents is the least harmful to worms.

7 EV 602

Dickerson, Anastasia

Williamsburg Middle School

The Effect of the Amount of Rainfall on The pH Level of the Potomac River

The purpose of this experiment was to determine the effect of the amount of rainfall on the pH level of the Potomac River. If the pH level is affected by different amounts of rainfall, then it could be potentially dangerous to plant and animal life that interacts with the river. On an extreme level, if the pH is changed enough the natural cycles of the plant and animal life that live in or by the river could be interrupted. On a smaller scale, humans that interact with the river could receive skin and eye irritations. This shows that it is important to determine the effects of rainfall on the pH of the Potomac. To determine this, 4 samples of water affected by different amounts of rainfall were taken to be tested. The samples were tested by a digital pH meter, and the results were recorded. No Rain had a mean of 7.49 pH, Light Rain had a mean pH of 7.54, Medium Rain had a mean pH of 7.70, and Heavy Rain had a mean pH of 7.90. The results show that as the amount of rain increases, so does the pH level of the Potomac River. Although a trend was identified, the amount in which it increased was so subtle that it most likely does not have an impact on the environment.

7 EV 603

Fischer, Ava

Thomas Jefferson Middle School

The Effects of Different pH Increments on Population of Daphnia Magna

The intent of the study was to determine the effects of different pH increments on aquatic microorganisms, specifically Daphnia magna, in a controlled micro environment. The independent variable was the different pH levels of the spring water. The experimental group included water with a pH of 4, 5, and 9. The control group was the group with a pH of 7, since water with a pH level of 7 was the optimum pH for microorganisms. The dependent variable was the number of Daphnia magna out of five that survived in the different groups of spring water with separate pH increments. The constants included: the type of beaker, the temperature of the water, the number of Daphnia Magna, and the date tested. The hypothesis is: If spring water that has a pH level artificially changed and has five Daphnia Magna placed in the water, then the beaker with a pH of seven will have the most Daphnia Magna still alive. Four beakers were filled with water and had materials added to artificially change the pH. Daphnia Magna was placed in the water, and after 24 hours, was tested for population out of five. The results showed that all the beakers, with the exception of the control group, had similar survival rates, with no survival rate greater than 5%. Thus, the results accepted the hypothesis. In conclusion, though not all pollution changes the pH of water too drastically, it still has a lasting effect on the surrounding environment.

7 EV 604

Klapper, Cheyenne

Thomas Jefferson Middle School

Fertilizer Nitrogen Pollution in Water

The purpose of this study was to see which brand of fertilizer affects water the most. The independent variable was the different brands of fertilizer. The experimental group included these conditions: Virgo Lawn Fertilizer, Scotts Turf Builder, and Dr. Earth Root Zone. The control group was no fertilizer. The dependent variable was the amount of nitrogen in water. The constants included: the size of plastic bin, amount of fertilizer, nitrogen soil tester, amount of soil, size Lawn Seed Blanket, area where tested, number of tests, wait time when drained, and time and temperature when tested. The hypothesis was: If Virgo Lawn Fertilizer is tested for how much nitrogen is in it in water, then Virgo Lawn Fertilizer will contain the most nitrogen in water. Four bins were placed on a patio all containing soil and an equally cut Lawn Seed blanket. All the bins had either a certain brand of fertilizer and one bin contained no fertilizer. Water was poured into each bin and was tested for how much nitrogen were in them. The results showed that Scotts Turf Builder contained the most nitrogen in water. The results rejected the hypothesis. In conclusion, the study suggests that Scotts Turf Builder contains the most nitrogen and buyers who use fertilizer should limit themselves from Scotts Turf Builder, because of its potential impact on the environment.

7 EV 605

Vaile, Natalie

George Washington Middle School

Solar verusus Wind: Which Produces More Energy?

The world is changing. It's getting more technology and because of that the world are having a problem with global warming. The United States needs an alternative energy source, but which one, solar or wind. Society should care about this because if they don't do anything severe storms will happen more often, such as droughts and hurricanes. It's happening all over the world. Today most people get energy from fossil fuels. The problem is that by using fossil fuels we are causing pollution. With solar panels and wind turbines we can stop the pollution to the environment. This experiment is going to be testing which renewable energy source is better by comparing how much energy each one makes.

7 EV 606

Try, Lillian; Ballantine, Harriet

Jefferson-Houston School

How Does Rain Affect the pH Levels of a Creek?

The reasoning behind our project is that we see children and people playing in this creek during the spring and summertime and we wanted to see if the water they were playing in is harmful to them. We do know that other factors such as bacteria can play a part in whether the water is clean or not, but we decided to focus on pH to make sure we could have the most accurate data and pay the most attention to our findings. When we conducted our experiment we based our project around the hypothesis, “if it rains, then the creek, will be purified by the rainwater”. We collected water from a specific place along the creek before and after rainfall. Our variables consisted of the rain, which was the independent variable, the pH level in the creek, which was the dependent variable. Also, our constants were the equipment used and the place that we collected water from and our control was the creek water. The result that we found was that our hypothesis wasn’t proven, the data stayed consistent throughout the duration of our entire experiment. In conclusion, our findings have brought us one step closer to protecting our environment and community with this project and experiment.

8 EV 607

Aramendia, Caroline

Kenmore Middle School

Oh No Ozone

The purpose of the experiment is to determine the effect of location on ozone. Measuring the ozone concentration can help us better understand and avoid ozone in certain areas. Ozone is a health threat that can worsen asthma, bronchitis, and many other diseases related to breathing. Knowing where most of the ozone is created can help us limit the amount produced. Knowing this can help so many people along with the environment. Not only does ozone affect humans but also plants. Ozone contributes to acid rain which sucks up minerals in the soil. Plants need these minerals to grow tall and healthy. Measuring ozone can help us track and limit the amount so it will no longer be a risk to us.

8 EV 608

Argueta, Jocelyn

Kenmore Middle School

Shaking for Suds

Water hardness can affect us in our daily lives including water conservation and health. The hardness of water is the amount of dissolved calcium and magnesium in the water. Depending on the amount of minerals your water has you can receive the essential amount of minerals you need in your body but the negative effects are that the more hard your water is the more soap you feel the need to use since hard water doesn't produce much suds. This made me think about the amount of water you waste and health and I compared 3 different waters to see which one was the most hard by using soap and comparing the height of the suds. I did this project because I think everyone should know about water hardness because it can affect us all since it has positive and negative effects including health risks.

8 EV 609

Basloe, Aidan

Swanson Middle School

Combating Allergens Using Air Filters

My project used two different types of machines to measure the amount of contaminants in the air and measure if different types of air filters have an effect on those contaminants. I picked this project because I was allergic to my school's trailers in elementary school; the air in the trailers made me really sick and we've searched for a solution. For the project, I used both an optical dust sensor board made with the code Arduino,and a separate Temtop handheld dust sensor machine. Both sensors measured the difference in the amount of contaminants in the air, like dust and pollen. The different air filters were placed in three separate bedrooms: a HEPA air filtering machine in my room, an Ionic Breeze Air Purifier in another bedroom, and a ceiling fan going in my parent's room as the control. I also tracked differences like the weather outside and the temperature inside. My hypothesis was that using a HEPA air filter will make the air have less contaminants compared to using an ionizing air filter or a ceiling fan, because ionizing air filters and ceiling fans have no effect on the amount of contaminants in the air. The conclusion was that my hypothesis was not supported because the Ionic Breeze air filter actually showed the best results (least contaminants) when measuring with the Arduino device.

8 EV 610

Estevão, Rebecca

Swanson Middle School

Root Length of Soil Erosion Fighting Plants

Sedimentary pollution is a huge part of water pollution, it happens when running water picks up dirt and sediment, and then runs into the nearest body of water. My science fair experiment was testing the root lengths of different soil erosion fighting plants. The ultimate goal was to find the quickest growing plant to help prevent erosion and sedimentary pollution in flood prone areas. I experimented with three known types of soil erosion fighting plants, tall fescue, blue fescue, and periwinkle. Before experimentation, I predicted that tall fescue would have the longest roots over the month period they were given to grow. After a month the roots were measured by pulling the plants out of the soil, shaking off the dirt, and stretching out the roots. After experimentation, we concluded that tall fescue did grow the longest roots over the month period. People can use the results of this experiment to protect their topsoil and prevent further pollution to their watershed, especially if they live in flood prone areas.

8 EV 611

Felker, Kara

Thomas Jefferson Middle School

Trees verus Air Pollution

The purpose of this study was to find the relationship of the green view index (GVI) of a city on the air quality index (AQI) value of particulate matter with a diameter of <2.5 microns (PM2.5) during the year 2017. The independent variable was the GVI of a city. The experimental group included: Tampa, with a GVI of 36.1%; Sacramento: 23.6%; Seattle: 20%; Miami: 19.4%; Los Angeles: 15.2%; and New York City: 13.5%. There was no control group. The dependent variable was the mean AQI value of PM2.5 over the course of the year 2017. The constants were the source of data for the GVI, the source of data for the AQI value, and the dates of the AQI values for each city. The hypothesis was: If cities have a higher GVI, then those cities will have lower PM2.5 AQI values. Two google sheets files were created and set up with city names as headers. The data was then entered into one google sheet file, then 11 statistics of the data were found. The statistics were entered into the second google sheets file and two graphs were made. The results suggest that there might be a positive relationship between the GVI of the cities and mean PM2.5 AQI. This supports the hypothesis. In conclusion, this study suggests that the relationship between the GVI of a city and its mean PM2.5 AQI values is complex, but planting trees cannot hurt.

8 EV 612

Fireison, Abigail

George Washington Middle School

Experimental Study of Alternatives to Sand in Zeer Pot Refrigeration Technique

Zeer pots, or refrigerators that function without electricity, have changed lives in the rural, poorer parts of Africa, and are usually built with two different sized pots and a well-wetted sand insulation layer between the pots. But what happens if the sand insulation layer is replaced with a different material? Although similar experiments have been performed, previous work has failed to compare the effects of a soil insulation layer on zeer pot technique. In this experiment, the materials being tested are sand as a control, soil and crushed charcoal. During the experiment, there were three trials; in each, three small but sufficient zeer pots were constructed, and the inner and outer temperatures of the zeer pots were recorded for a time period of seven hours, every thirty minutes. This research is expected to inform others who need refrigeration but do not possess electricity of other options for a zeer pot insulation layer besides sand, perhaps better options.

8 EV 613

Goldstein, Catherine

George Washington Middle School

All That Glitters Is Not Gold: Testing the Biodegradability of Glitter in Freshwater

The amount of microplastics in our waterways is an increasing problem for our environment. Following a ban on microbeads in cosmetics, some scientists and politicians now want to enact a similar ban on glitter, also a microplastic. Glitter is washed down our drains after a single use, easily entering our waterways. However, some companies now sell “eco-friendly” glitter, which is made of plant cellulose instead of plastic. The purpose of this experiment is to test whether the mass of eco-friendly glitter will be reduced (biodegrade) after seven weeks in fresh river water. I hypothesized that if eco-friendly glitter samples were left in fresh water for a period of seven weeks, then the mass of the samples will be reduced (biodegrade) because they are composed of natural materials as opposed to microplastic. I purchased four brands of eco-friendly glitter as well as standard plastic glitter (control). I added five grams of each glitter sample to jars containing 24-oz of freshwater collected from the Potomac River, for four trials per sample. After seven weeks, I filtered the water from each jar and re-weighed remaining glitter. All brands of eco-friendly glitter showed significant reductions in mass as compared to minimal reduction in the standard plastic glitter. Minke Bio Cosmetics glitter showed the greatest biodegradability, with an average of 1.88 grams of mass reduced. The plastic glitter had an average of only 0.18 gram of mass reduced. The results support my hypothesis, and prove the need to address this environmental health issue.

8 EV 614

Gross, Miracle

Hammond Middle School

Which Amount of Water Makes the Best Pervious Concrete?

The purpose of this engineering project was to discover what amount of water makes the “best” pervious concrete. When something is pervious it allows water to flow through its voids. Therefore, the best pervious concrete was the batch that allowed water to flow through the voids of its rock. I decided to do this project because of massive flooding in different states; essentially in the past year. Over 35 people were killed in Hurricane Michael. Many homes were also destroyed. Through my research, I learned that pervious concrete absorbs a greater percentage of rainfall than the average concrete; which is why my project is connected to environmental engineering. Installing pervious concrete could save many people and homes, but the most important part is knowing how to make it.

In my experiment, I used various amounts of water to mix with pea gravel and Portland cement. I used the amounts of 0.3125 qt, 0.625 qt, and 1.25 qt. I let it shape in a circular bucket and dry for 12 hours. After drying I took each set of concrete out of the bucket and poured water over it. I did this to observe if the water flowed over, through, etc. the concrete. The batch that I added 0.3125 qt of water to was pervious. It had voids and the pea gravel/rock was visible. In the other batches, the water flowed over and the rock wasn’t visible.

8 EV 615

Haywood, Zoe

Williamsburg Middle School

The Effect of the Type of Wood on Its Burn Time

Although it is unlikely, one day you might find yourself in a survival situation and knowing the best type of wood to burn to keep warm would be important. The purpose of this experiment was to test if the category of wood and its destiny would effect the length of time it takes the wood to burn completely, the hypothesis was if a hardwood with a high density was burned it would have a faster burn time then a softwood with a lower density. Four species of wood, two softwoods and two hardwoods all with different densities and the same volume were burned until the wood was completely charred. The results of this experiment partly support the hypothesis, the wood with the highest density also had the longest average burn time while the wood with the lowest density had the lowest average burn time but whether a wood was categorized as hard or soft seemed to have no effect on the results, oak a hardwood had the longest average burn time of 11:31 and had the highest density of 9.39 cm3/g, and bass a softwood with the lowest density of 6.22 cm3/g had an the lowest average burn time of 4:68. With these results it is clear that the higher the density in wood the more the burn time of that wood will increase.

8 EV 616

King, Ellarose

Williamsburg Middle School

The Effect of Impervious Surfaces on The Urban Heat Island Effect

The Urban Heat Island Effect, or (UHI) is a theory that urban areas --densely packed cities -- have higher temperatures than their surrounding rural areas. This is because of the materials the area is built with, tall buildings that trap heat, and the amount of anthropogenic heat emissions in those areas. The more people in an area means more buildings, and more heat being generated by people using cars and other transportation, and heating up an area with their body heat. The more cities there are, the worse it gets. That's part of the reason climate change is happening. People are raising the global temperature by moving to cities.

The hypothesis for this experiment is: if the boxes are placed on asphalt, concrete, and grass, then asphalt will be the hottest because it has the lowest albedo and it is the darkest color, which absorbs heat. There are no risk factors in my experiment. The main goal for this experiment is to prove that certain surfaces make places hotter than they should be. The expected outcome was that asphalt would have the hottest temperatures, but concrete has experienced hotter temperatures. Grass is the coolest surface, as predicted. This is because grass has the highest albedo, the amount of sunlight reflected, of the three surfaces tested.

8 EV 617

Leland, Erin

Thomas Jefferson Middle School

The Effect of the Time of Year on Overall Water Quality

The purpose of this study was to test the effect of two different times of year on the overall water quality of a source. The independent variable of this experiment was the time of year the water samples were tested (Fall: 10/27/18, and Winter: 12/8/18). In this experiment there was no control group. The dependent variables of this experiment were the pH level, dissolved oxygen level (ppm), nitrate level (ppm), and turbidity (JTU) of the water. The hypothesis was: If water quality was tested in fall and winter, then in fall the water quality would be far better than in winter. This study is important because it could change people's approach to water related industries and activities. This experiment may help those who wish to find when the most opportune time is for water related activities. The parameters of the water were tested using test tabs that reacted with the chemicals in the water. This was done at five different sites along the Four Mile Run stream, once in fall and once in winter. Results suggested that water quality in fall is superior than in the winter due to perhaps biological reasons such as falling leaves and dying animals. These results supported my hypothesis that water quality in the fall would be overall better than in the winter. In conclusion, time and location seemed to have a great impact on the quality of water and there are still many things left to be discovered.

8 EV 618

Morrison, Aidan

Gunston Middle School

The Effect of Beach Erosion Prevention Methods on the Effect of the Amount of Beach Erosion

The purpose of my experiment was to contribute to other data that goes toward helping prevent beach erosion. This data is important because this is a real world problem and it will continue to grow rapidly if we don't do anything about it. The goal of this experiment was to find the most effective beach erosion prevention method. To conduct this experiment, a tank was used to replicate a beach. The beach erosion prevention methods tested were tetrapods placed in shallow water, tetrapods placed in deep water, a beach fence at the water line, a rock barrier, and no beach treatment as the control.

The experiment showed that the most effective beach erosion prevention method out of all the variables tested was tetrapods placed in shallow water. The average shoreline loss was 0.64 cm which is the least amount of shoreline loss. This was very surprising because the research supported that the rock barrier would perform the best.

This project applies to the real world because coastal erosion is an increasing problem especially with sea level rise. This project will be helpful if our planet keeps on heading into the direction of global warming. This will be beneficial for citizens in communities near the coast. If coastal erosion continues to happen, there will be more and more shoreline loss. This will lead to the loss of communities. Using these methods will help the government decide on coastal erosion prevention methods for these communities.

8 EV 619

Pinkowski, Shota

George Washington Middle School

Bio Filter

The focus of my project is to figure out what easily accessible, natural materials (charcoal, coconut fiber, shells, and rice) will work to remove pollutants from water. By testing and comparing the results of each natural filter, it becomes possible to see which filters can improve water quality in contaminated environments.

8 EV 620

Rai, Kritika

Thomas Jefferson Middle School

Is Climate Change Real?

The purpose of this study was to test the effects of carbon dioxide on ice. The independent variable was the amount of carbon dioxide. The experimental group was ice exposed to additional carbon dioxide. The control group was ice not exposed to additional carbon dioxide. The dependent variable was the mass of ice after being exposed to or not exposed to additional carbon dioxide after a certain period of time. The constants in this study were the temperature, the starting amount of ice, and the starting amount of carbon dioxide. The hypothesis was: If additional carbon dioxide is introduced into the atmosphere around ice, then the ice will have lower mass than ice not exposed to additional carbon dioxide. Ten blocks of ice were each observed; five were exposed to normal levels of carbon dioxide, the other five were exposed to additional carbon dioxide. They were kept in the freezer for three hours, at 3.33°c. The results show that the ice blocks in the experimental group (exposed to additional carbon dioxide) had a lower mass, with a mean of 0.65 kg. The ice blocks in the control (no additional carbon dioxide) had a higher mass than the experimental group, with a mean of 0.68 kg. These results support the hypothesis. In conclusion, the study suggests that carbon dioxide does have an effect on ice mass.

8 EV 621

Sherlick, Maya

Thomas Jefferson Middle School

The Effect of Location on Nitrogen and Phosphorus Amounts in Water

The purpose of this experiment was to see the effects of different locations within the Northern Virginia watershed on the amount of nitrogen and phosphate in the water. The independent variable was location; the Potomac River, Four Mile Run, Lubber Run, and Powhatan Spring. There was no control group in this study. The dependent variable was the amount of nitrogen and phosphate in the water. The constants were the size of the cup, type of nitrogen strip, and phosphate test kit. The hypothesis was: If measuring the nitrogen and phosphorus in the water, then the Potomac River will have the most. First the researcher collected water from each location. Then the researcher followed the instructions on the nitrogen and phosphorus kits. The researcher added the data to the data table. In conclusion, this study suggests that Arlington needs to improve the way water sources are handled, including the handling of nitrogen and phosphorus. The hypothesis was rejected because the Potomac River had the most phosphorus but not the most nitrogen.

8 EV 622

Anderson, Lucy; Chisholm, Anna; Thomasbeer, Skye

Gunston Middle School

The Effect of Substances Used to Melt Ice on the Growth and Health of a Bean Plant

The purpose of this experiment is to find out what effects some water pollutants have on plant life. This experiment was chosen because an observation was made that in the wintertime people use salt on the roads and sidewalks to melt ice. When the ice melts or it rains, all of the salt runs into the streams. It is important to know the effects of this on plant life so that we can make sure that we are not harming our wildlife. The goal for this project was to find the effect of substances used to melt ice on the growth and health of a bean plant. To execute this experiment, each substance was mixed with water and added to a different groups of bean plants every other day. The bean plants were measured every other day. After the experiment was conducted it was found that all the substances added to the water harmed the plant. The data supports the hypothesis, because the average growth of the plants watered with pure rainwater was 21.5 centimeters, 10.75 centimeters with beet juice added, and 0 centimeters with any Sodium or Calcium Chloride added. The results of this experiment may be beneficial to governments and organizations for the health of plants and the environment because it will provide more research. Plant life is declining, and human contamination plays a big role. After the experiment concluded, all objectives were met because a clear answer to the question asked was received.

8 EV 623

Honaker, Carolina; Jamison, Caroline; Solis, Maya

Gunston Middle School

The Effect of the Location on Water Quality

The purpose of this experiment was to test the quality of water around our neighborhoods. We chose this experiment because we wanted to know if our water had harmful chemicals for plants and animals. The goal of this experiment was to measure the total level of hardness, chlorine, alkalinity, nitrite and nitrate, pH, and average amount of iron and copper. The hypothesis was that if the Anacostia water is tested, then it will be the least treated water source because of its location and exposure to bridges, highways, boating traffic, yacht club, and current construction activity. The experiment consisted on collecting five samples of water from the Potomac River, Anacostia River, Four Mile Run, Tidal Basin, and Lake Barcroft. We tested 50 mL of water for total hardness, chlorine, alkalinity, pH, nitrite, nitrate, copper, and iron. After 3 trials with each water source, we found that Lake Barcroft has the best water quality because it had neutral pH (7), an alkalinity level of 106.7 ppm, an average of 0 for total chlorine, and 100 for total hardness. The Anacostia River was the least treated: it had an average pH of 5.3, 53.3ppm for alkalinity, total hardness of 66.67ppm, and 0.33 ppm for Chlorine. In conclusion, the objectives were met because we were able to see a difference in water quality for the 5 different water sources. However, if we were to do this again we would find different sources that are more susceptible to pollution.

8 EV 624

Kinzer, Allison; Critchfield, Whitney

Williamsburg Middle School

The Effect of Washington D.C. Waterway on Nitrogen Levels

The purpose of this project was to determine, by measuring Nitrogen levels, the likelihood of an algal bloom in the Washington D.C. waterways. Because Nitrogen and nitrate levels are one of the main indicators of algae or a possibility for algae, the experiment was conducted by testing 100 mL samples of water from four selected locations. These locations served as the independent variables and were as follows; Potomac River at Memorial Bridge, Anacostia River at Frederick Douglass Bridge, Potomac River at Woodrow Wilson Bridge, and Arlington, Virginia tap water. The dependent variable was the nitrate levels (mg/L) in a 100 mL water sample. The procedure was to go to each location, collect the water sample, dip ten testing strips in the sample (one at a time) for two seconds, then lay the strips flat for one minute to dry. After one minute, compare color on end of the testing strip to the bottle to find the nitrate levels. It was found that the Anacostia had the lowest nitrate levels and the tap water (control) had slightly higher levels. This was very surprising because of the poor water quality in the Anacostia River. This project is important and valuable because large amounts of algae take much of the oxygen out of the water they occupy, and this eutrophication can lead to dead zones. Dead zones are a major issue in general because without oxygen in the water, aquatic plants and animals can die.

8 EV 625

Kruse, Nicholas; Dellaria, Anais

Hammond Middle School

Go Green and Drink Clean

Our science fair project is called go green and drink clean, and it is about testing different contaminants in multiple bodies of water. To test the contaminants, we went around Alexandria and gathered 3 test tubes full of water from 3 different bodies of water, Holmes Run, Backlick Run, and the Potomac River. For our control, we gathered rainwater and tap water. A few days later we took the test kits and tested all of the different bodies of water, each for the same 10 contaminants. As a result, we found out that the cleanest water source was rainwater, and the most contaminated one was the Potomac River.

8 EV 626

Sammis, Maura; Rackauskas, Maddy

Gunston Middle School

The Effect of Location on the Cleanliness of Water

The purpose of this experiment is to find what water source is the cleanest, in the sense that it has the best levels of pH and Chlorine (It has been compared to tap water levels which is our control). The goal of the project was to find the effect of location on cleanliness or the quality of water. If the Anacostia is tested then it will have a worst pH and Chlorine level because there is history of many people putting trash and things in the Anacostia that does not belong. During this experiment, water was collected from the following sources: The Anacostia, Potomac, Gunston Creek, Four-Mile Run, and Tap Water. The water was then tested with test strips for chlorine and pH and information was recorded. The results showed that the best water source happened to be the potomac with no chlorine and had a level of 5.8 pH. The worst source was the Anacostia with 0.8 Mg/L. The rest were staggered in the middle somewhere. We found that the location does matter because the Potomac and Anacostia intersect at one point but out of the water sources that were tested the Anacostia was the worst and the Potomac was the second best after the tap water.

8 EV 627

Sughrue, Margaret; Kivi, Olivia; Walysus, Evelyn

Gunston Middle School

The Effect of Different Laundry Detergents on the pH Level in Soil

The purpose of this project was to test the soil pH level. This project was chosen because the water runoff from washing machines in use is a huge problem that affects the environment. We wanted to find out which laundry detergent is the least harmful to plants. The hypothesis for this project was if a plant is given Ultra Clean, then the soil would have the lowest pH level because the package stated that is has no dyes or perfumes. The experiment was tested by giving the Heuchera micrantha 29.57 mL of water mixed with 29.57 mL of laundry detergent everyday for fifty days. After fifty days the pH level was measured with pH strips. Then all of the soil was removed and the mass of each plant was measured. Finally the roots were cut out and looked at closely through a microscope. The results of this experiment did not support the hypothesis. Woolite was the laundry detergent with the lowest pH level of 4.7. Tide was the detergent with the highest pH level of 5.7. This experiment also showed that the root of the plant with Woolite looked very healthy and looked the most similar to the control which was the plant with water. The root of the plant with Tide turned blue and look very unhealthy.

8 EV 628

Wellons, Lilly; Stephens, Gianna

Gunston Middle School

The Effect of Different Resources Filtering Out Lead in Water

The purpose of the experiment 'The Effect of Different Resources Filtering Out Lead in Water' is to see which natural resource offers the best water filtration system. The group chose this experiment because of the high death rate associated with lead poisoning from drinking dirty water, and the potential solutions to this problem that are readily available in nature. When conducting the experiment, filters were created from five water bottles that were cut in half and each filled with different combinations of resources that have, in previous studies, been found to remove lead from water. Dirty river water was run through each filter and was individually tested for lead. The results of the experiment showed that the hypothesis was supported, and that the filter that consisted of a combination of activated charcoal, sand, and river rock consistently removed all lead from the water. This trend was supported for every trial except for an outlier trial, in which the water had a lead concentration of 5 ppb and every other trial using this filter had a lead concentration of 0 ppb. If this experiment were to be repeated, it would be improved by testing more components of the water (e.g., Alkaline level, hardness level, and ph level).

9 EV 629

Mukhtar, Suheila

Wakefield High School

Fueling the Future

In my experiment, I am testing to see how efficient a Fuel Cell is by building a circuit that includes a Reversible Fuel Cell. In my hypothesis, I predicted that the Fuel Cell would have an efficiency rate of 50% or over. I formed my hypothesis after researching that unlike batteries, Fuel Cells replenish the chemical energy in the fuel supplied to silently, cleanly, and efficiently produce electricity. To conduct my experiment, I produced a procedure with 28 steps that are separated into five sections: preparing the motor, setting up the Fuel Cell, electrolysis, creating electricity, and determining efficiency. To calculate efficiency, I studied and used Ohm's Law. I bought a Horizon Solar Hydrogen education kit that included mostly everything I needed to construct my circuit, including a Reversible Fuel Cell. At the end of my three trials, the Fuel Cell's highest efficiency rate was 53%, which corresponded with my hypothesis.

9 EV 630

Nemirow, Devin

Washington-Lee High School

Washington-Lee Water Fountains: What Is the Effect of Location in School on Water Quality

The experiment was created to comparatively test the water quality from different floors of the school to see if location affects it. The hypothesis was: that the water quality would be the best on the first floor and decrease in quality as the floor level increases. The only outlier would be chlorine, which would be the worst on the first floor due to the pool. The floors tested were 1, 2, 3, and 4, along with a control group of Reverse Osmosis filtered water. The chemicals tested for were chlorine, lead, copper, pH, TDS, and iron. The 10ml samples of water were placed in a sterile glass container. The test strips were placed into the water. They were compared to the chart and data was recorded. Next, the TDS meter was placed into the water. When the number appeared in the screen, it was recorded. The first floor had the most chlorine, none of the floors had iron or lead, the pH and TDS were gradually higher as the floors increased. 10 T-tests were done to data to analyze the significance. The T-Tests were all significant (above .05). The highest value was TDS because the control was almost perfect compared to all the values at school. Chlorine was very significant between the first and other floors. The mean and standard deviation were also tested. So, the results helped the research hypothesis. The information found from this experiment gives the school access to the quality of water and possible areas of

9 EV 631

Thomas, James

Arlington Tech and Career Center

The Effect of Aircraft Activity on the Amount of Air Pollution On or Near an Airport Tarmac

The purpose of this experiment was to find the effect of aircraft activity on the amount of air pollution on/near an airport tarmac. The hypothesis was that if there are more planes that had recently taken off and/or landed, then the amount of air pollution would be greater than if no planes had recently taken off and/or landed. This is because aircraft burn fuel and produce exhaust that creates air pollution. To test this hypothesis the procedures were to travel to a nearby general aviation airport, take air quality samples and record many different factors such as weather, temperature, PM2.5, PM10, HCHO (Formaldehyde), and humidity. The student then analyzed the data to determine if it supported the hypothesis. The results showed that there was a positive correlation between aircraft activity and the amount of air pollution. Therefore, the data did support the hypothesis. The Anova test P value was 0.01, which means that the results were significant and reliable.

10 EV 632

Akhtar, Ansah

Washington-Lee High School

The Effect of Different Potato-Based Bioplastic on the Melting Point

This project was conducted to identify the melting points of bioplastic made from different species of potatoes. The bioplastic was tested with an electronic thermometer to ensure the temperature recorded was valid. Certain benefits in conducting this experiment were to create the best type of bioplastic that can sustain the needs of the world's growing population. By figuring out the melting point of different types of bioplastic, plastic manufacturing companies can later implement these types of renewable sources into plastic and create a plastic that was both usable as well as beneficial to the environment. The hypothesis was that if the sweet potato was used in the creation of bioplastic then the bioplastic would have the lowest melting point. The hypothesis was supported.

The types of potatoes used in the project were russet, sweet, and red potatoes. Starch was, first, extracted from the potatoes then used to create bioplastic. Later it was tested to measure the melting point of the bioplastic. Each type of bioplastic was tested 10 times each. The average and standard deviation were calculated for each potato bioplastic using the data. This was done to determine if the variables were significantly different. An ANOVA test and T-Test was conducted with the data collected. An unavoidable problem present in the experiment was how the bioplastics were exposed to oxygen and other variables that could have affected the temperature at which it melts. This problem was unavoidable because if the bioplastic mixture was kept in an airtight container it

10 EV 633

Dillard, Abigail

Yorktown High School

The Effect of Ocean Acidification on Shell Degradation

Since the Industrial Revolution, burning fossil fuels has become more common and more frequent in use, resulting in excess carbon dioxide in the atmosphere. Due to CO2 being a greenhouse gas, its increasing amount, and the fact that it absorbs energy from the sun, the earth is continuously heating up. This process is called global warming or climate change. However, global warming isn't the only problem caused by the excess carbon dioxide. Recent studies show that, since the beginning of the earth, the ocean has been absorbing 25% of CO2 in the atmosphere. Normally, this would be beneficial because if it weren't for the ocean, global warming would be far worse than it already is. But since so much carbon dioxide is being soaked up in the water, its pH has already dropped from 8.4 to 8.0. This may not seem like a huge difference, however, the quick change in the marine environment is causing shell degradation due to the increasing acidity.

When carbon dioxide dissolves in the ocean, it reacts with the surrounding water to create carbonic acid. That reaction results in the drop of pH in oceans, or more known as, ocean acidification. This process is harmful to calcium carbonate, something vulnerable to acidity. Unfortunately, most shells and corals are made of calcium carbonate, so ocean acidification is causing the degradation of these shells. In addition, many marine animals use corals and shells as shelter, raising the question of how those organisms will survive if global warming continues.

10 EV 634

Hartmann, Elyse

Washington-Lee High School

The Effect of Grocery Bag Material on the Change in Mass of Material After Being Composted

The purpose of this experiment was to study the effect of grocery bag materials on their rate of decomposition. Five types of grocery bags were tested in a 20 L compost bin. The different materials were paper, polyethylene plastic, Glad compostable plastic, If You Care compostable plastic, and biodegradable plastic. The data from this experiment could be used to encourage more people to compost instead of increasing the amount of waste in landfills. The hypothesis was: if the type of grocery bag material is changed, then the paper grocery bag will have the most percentage of mass decomposed because it is made up of cellulose. The hypothesis was supported because the paper decomposed 100% and the If You Care compostable plastic decomposed the second most with an average of 6.81%. It was concluded that compostable plastics decomposed more than polyethylene plastic did because the If You Care compostable plastic had an average 5.79% higher than the polyethylene plastic. It was also concluded that the biodegradable plastic and the polyethylene did not decompose at different rates because the data was not significant. The material most suited for compost is paper, though if it is not composted then it remains in landfills just like any of these other grocery bag materials.

10 EV 635

Johnson, Riley

Washington-Lee High School

The Effect of the Type of Stormwater Control System on the Water Quality

The Chesapeake Bay's water quality has decreased throughout the years because of pollution. Should this continue, the Chesapeake could be permanently damaged, harming its inhabitants and the U.S. In order to prevent this, Arlington County, VA and others within the watershed have reformed their stormwater ordinances. This experiment was designed to study Arlington's new required stormwater control systems and observe the effects of the system on water quality. This analysis will help to develop and improve the stormwater systems ensuring the best efforts in aiding the Bay's water quality. The hypothesis for this experiment was: if the type of stormwater control system is changed, then the bioretention basin will produce the least amount of erosion, turbidity, nitrate and phosphate, and a pH closest to 7. Four model stormwater systems were created and tested: piedmont soil combination (control), bioretention basin, bioretention planter box, and dry well. On the 14th day of the experiment the dry well had the lowest mean erosion of 1.20 g, the bioretention planter box had the lowest mean nitrate of 0.32 ppm, the piedmont soil combination had the lowest mean phosphate of 0.026 ppm, and the dry well had the lowest mean turbidity of 101.52 NTU. ANOVA tests were done and all dependent variables, other than pH and erosion, were significant having p-values less than the critical value of 0.05. While the data was significant, the hypothesis wasn't supported by the data. The final results helped to conclude possible ways to reform the systems for improvement.

10 EV 636

Kelly, Joseph

Wakefield High School

Saving the Styrofoam Seas: Can a Household Cleaning Product Safely Dissolve Polystyrene and Reduce Waste

The purpose of this investigation is to find out which commonly found household cleaning product is best able to dissolve polystyrene, known as Styrofoam, while still being environmentally friendly. The liquids used in this experiment were vinegar, acetone, and D-Limonene. The control was water. This information is important because polystyrene, a neurotoxin, takes 500 years to biodegrade, allowing it to collect in rivers, sewers, oceans and other places where it could be harmful. The hypothesis was that Limonene would best breakdown the Styrofoam in a way that is environmentally friendly, with little to no toxic chemicals. After the experiment was conducted, it was found that water and vinegar were completely ineffective in breaking down Styrofoam. The acetone dissolved the Styrofoam but left a residue. Additionally, acetone is toxic and needs to be disposed of accordingly. Only the Limonene completely dissolved the Styrofoam leaving nothing to weigh and nothing toxic to dispose.

10 EV 637

Kilkenny, Erin

Yorktown High School

The Effect of Slow Release Fertilizer versus Mushrooms on the Bioremediation of Oil

This project's goal was to study the applications of bioremediation, or the taking advantage of the oil-minimizing qualities in bacteria to lessen the effects of oil/other contaminants on the environment. Slow release fertilizer (environmentally friendly) has been shown effective as a stimulant. Mushrooms also show effectiveness in bioremediation.

It was hypothesized that if both slow release fertilizers and dried mushrooms are added to oil and water, then the dried mushroom will remediate more oil from the water, because it is able to absorb as well as break down the hydrocarbons of oil.

40 mL of tap water and 15 mL of unrefined motor oil were added to clear plastic containers Then, 0.1 g, 0.2 g, 0.3 g(3 trials each) of dried mushroom were added, and the same was done for the fertilizer. They were stored for 7 days and the solid was removed, then they were frozen and the oil on top was removed and weighed.

The average amount of oil left for fertilizer was 8.71 g, and the average amount of oil left for mushroom was 8.25 g, thus the mushroom was more successful. However the P-value was O.076938-greater than 0.05, but shows some correlation between IV and data, some further testing is required to make a clear statement on the effect of either fertilizer or mushrooms on the bioremediation of oil.

10 EV 638

Licato, James

Washington-Lee High School

Optimizing Metformin Removal: Utilizing Molecular Sieves and Absorbents Within Sand Filtration Units

Diabetes is one of the most prevalent diseases on Earth. The most commonly used pharmaceutical to treat diabetes is metformin HCl. Attention and alarm over the environmental effects of this drug have increased because metformin has been found in our lakes, rivers, and drinking water. With known detrimental effects on aquatic organisms, including intersex and stunted growth, metformin's presence in the environment calls for a solution that can be implemented in water treatment. In this experiment, three aluminosilicates were tested for their effectiveness at removing metformin: two molecular sieves (zeolite Y, mordenite) and an absorbent (bentonite). These materials were tested under a variety of conditions within constructed sand filtration units to simulate tertiary stage wastewater treatment. Deionized water with metformin concentrations of approximately 400 ug/L were processed through the treatment systems. Sampling was done using liquid chromatography tandem mass spectrometry. Mordenite proved to be the most effective, removing 99.0% of metformin on average, compared to the control's 63.5%. Zeolite Y was 92.8% effective, and bentonite was ineffective. The channel and cage dimensions within the zeolite appear to be the reason for mordenite's high success, as mordenite's channel diameter is congruent to metformin's particle diameter, facilitating increased adsorption. By matching the channel diameter with particle diameter, mordenite could be utilized to remove metformin in water treatment. With an increasing number of pharmaceuticals posing an environmental threat, mordenite and other zeolites could potentially prove to be an inexpensive and easily implemented solution.

10 EV 639

Little, Katherine

Yorktown High School

The Effect of Volume of Dactylis glomerata Grasses Planted on Volume of Runoff

The experiment was formulated in order to better the understanding of the extent to which plants and green spaces can prevent flooding in a world increasingly affected by climate change. The hypothesis of the experiment was “if the volume of Dactylis glomerata grasses planted in a section of soil increases, then the volume of runoff when 200 mL of water is poured on the section of soil will decrease.” The independent variable of the experiment was the volume of Dactylis glomerata grasses planted, while the dependent variable was the volume of runoff collected when 200 mL of water was poured through the section of soil. The hypothesis was tested by pouring 200 mL of water in sections of soil containing increasing volumes of Dactylis glomerata grasses planted and measuring the volume of runoff collected. The data of the experiment supported the hypothesis of the experiment, showing a decrease in the volume of runoff as the volume of Dactylis glomerata grasses planted increases. The results are likely due to plants' absorption of water and prevention of erosion using root systems.

10 EV 640

Mendelsohn, Alexandra

Yorktown High School

The Effect of Salinity on Growth of Chlorella sp.

This experiment investigated the effect of salinity on the growth of Chlorella sp., a genus of photosynthetic algae. It was hypothesized that if the salinity of the water increased, the growth of the Chlorella would decrease. To conduct this experiment, 20 1-liter bottles of distilled water were split into four groups and 10mL of Carolina Biological Chlorella culture were added to each bottle. The first group, the control, did not receive any salt. The next group had 5g of salt added to each trial, another group received 10g per trial, and the last group received 15g per trial. After a three-week growth period, 10ml samples from each bottle were collected and measured using a spectrophotometer. A lower transmittance reading on the spectrophotometer would indicate more growth, since there would be more chlorella blocking the light. The data supported the hypothesis— The control group had an average of transmittance of 34.28% and a range of 11.6%, the 5g group's mean transmittance was 64.28% and its range was 3.4%, the 10g group had an average of 88.2% with a range of 6.8%, and the 15g group had a mean of 92.6% and a range of 11.4%. A one-way ANOVA test was performed. The p-value was less than .05, thus proving the data to be statistically significant. Additional experimentation could potentially investigate the effects of different environmental factors on Chlorella, or the effect of salinity on different species within the genus.

10 EV 641

Peale, Kayla

Yorktown High School

The Effect Of Fertilizer Runoff Levels On The Survival Rate Of Daphnia

It is evident that poor water quality is a common problem due to the rapidly growing industrialized society. It is important to study the effects of water pollutants on aquatic life to help better protect ecosystems in the future. Of the several pollutants that enter water systems, fertilizer is one of the most common. 'Miracle-Gro' 15-30-15 powder fertilizer was used to demonstrate a variety of contaminated areas and Daphnia Magna (commonly recognized as a water flea) represents aquatic organisms. Daphnia Magna are primary producers and have natural responses to environmental stresses and can indicate poor watershed health. In the experiment, 25 Daphnia Manga were placed in three groups: a low/medium concentration, a high/extreme concentration, and a control with no exposure to pollutants. The hypothesis was if there is less fertilizer runoff than the survival rate of the Daphnia Magna will be higher because the water pollutants often are toxic and create undesirable organic reactions in our aquatic ecosystems. The data set supports this hypothesis because as the amount of fertilizer increased, so did the death rate of the Daphnia Magna. In the high to the extreme level, it took only one day for all 25 daphnias to die. Whereas it took 7 in the low to the medium group and 10 in the control. A similar experiment could be conducted to learn the effects of microplastics on Daphnia. Increasing the knowledge of these urgent topics will lead to further measures to protect Earth’s extraordinary ecosystems.

10 EV 642

von Eckartsberg, Rose

Yorktown High School

The Effect of the Age and Use of Pavement on the Amount of Pollutant Runoff into Storm Drains in Arlington, VA

Runoff from roads are harmful to the ecosystem. The purpose of this experiment was to discover how the age and use of the road affects runoff pollution. The hypothesis for the age of a road was if older pavement is tested then it will have the lowest concentration of pollution. The hypothesis for use of road was if less used pavement is tested then it will have the lowest concentration of pollution. The dependent variable was the amount of pollution in water. The independent variables were the use and age of pavement (6 locations). A PCI is a number 1-100 that determines the quality of the road. The use of roads each road had a PCI of 40-50. There are three categories for use, neighborhood minor, neighborhood principle and other principal arterial. The roads that were tested for age were all neighborhood principles. A spectrophotometer was used to figure out the amount of pollution in the water. Each set of data was a graph, the data was being taken from the ABS. The lower the ABS the less pollution. The null hypothesis was rejected. The hypothesis for use of pavement was incorrect, the less used pavement had the most pollution compared to medium use and heavy use. A possible explanation for this is the chemicals from the asphalt had not been washed away yet. The hypothesis for the age of the pavement was incorrect, the older road had less pollution than the medium road but more than the new road.

10 EV 643

Donnellan, Katherine; Kosinski, Nikolai

T.C. Williams High School

Mega 'Mounts of Microplastics: The Effect of the Size of a Watershed on Microplastic Concentration in Corresponding Bodies of Water

Microplastics are small “pieces of plastic less than 5 millimeters in size that are becoming increasingly common” in numerous bodies of water (Katsnelson 5547). This project’s problem links the size of watersheds to the concentration of microplastics in the corresponding bodies of water. This is the focus because in today’s society, daily life is impossible without the use of plastic materials. As the size of a watershed increases, the amount of people using plastics also increases. Thus, as watershed sizes increase, the concentration of microplastics in water in those watersheds should increase. This project is relevant to the real world because organisms on land and in water are interacting with these plastics and ingesting them, which is dangerous to their health. This research is scientifically important because it will deepen the understanding of what microplastics are, and establish whether or not watershed size affects pollution. Expected outcomes of this experiment is that the largest watershed will yield the highest concentration of microplastics in the corresponding water samples.

10 EV 644

Feist, Haylee; Bernhardt, Will

Yorktown High School

The Case for Permeable Property in Arlington

The purpose of this project is to collect and measure water quality at various stages in runoff to identify what happens to stormwater if it is permitted to flow directly into local waterways. For this study, water samples at different locations on a residential property were collected. For comparison, pure rainwater was collected during each storm as a control group. The 3 other locations were: water directly from the property's gutter, street water in front of the property and water from the creek that the streetwater runs into. These samples were collected and this process was repeated for a total of 8 trials. Five water quality tests were performed on each sample to determine it's Water Quality Index (WQI). It was hypothesized that if a sample of water is taken from rain or a gutter it will have significantly higher WQI than if it were taken from creek or street water.

The results of this study confirm that the location of sample collected does have an immediate effect on the water quality of stormwater runoff. The biggest difference in data was found between the gutter water and street water locations. This indicates that preventing stormwater runoff from reaching the streets and creeks will help work towards ending stormwater pollution. One way to accomplish this is by building properties with permeable surfaces, so that the stormwater goes directly into the ground. This study demonstrated how permeable surfaces can make an impact on stormwater pollution.

11 EV 645

Durham, Annie

Yorktown High School

Measuring Skyglow with a Digital Camera

For this project I will be exploring the effect of light pollution on skyglow. I will be doing so with a digital camera and taking pictures with different exposure times at multiple locations that vary in artificial light sources. I chose to explore this topic because I think the effect that artificial light has on the environment and how it can wash out the brightness of the stars is very interesting. My first step in collecting my data was taking pictures of a white piece of paper and collecting pixel values. After that, i went to my 3 locations and took pictures of the sky with different exposure times. I found that my camera was not able to take the picture no matter the exposure time, but I did find how the amount of light in the sky can affect how clear the picture would appear to come out. In conclusion, my results were not successful but I do plan to seek greater equipment to help me in further exploring this topic.

11 EV 646

Raack, Corinna

T.C. Williams High School

Which Stitch? Testing the Strength of Different Stitches

this topic was chosen because sewing is something that I enjoy doing. I wanted to choose my science fair project based on something that I enjoy doing in order to be fully committed to my project and to learn information that may one day be beneficial to me. Another research project done about this topic was created by Holly Jackson in 2014. She used a winch to pull apart pieces of fabric sewn together with nylon and polyester thread. My project will improve this research by applying it to everyday activities. While the original experiment used nylon thread and discussed how the research can be used in intense situations, such as space, I used canvas fabric and cotton thread. Both materials used in my experiment can easily be found at any craft or fabric store. While the original research done is incredibly important for future scientific achievement, my project helps to provide information about stitch strength in everyday products.

11 EV 647

Robinson, Lucy

Washington-Lee High School

The Effect of pH level on the Amount of Nitrates (ppm) in Stream Water

It was decided that it would be interesting and helpful to find out what pH level had the greatest effect on stream water and its nitrate levels. The relationship of pH level and nitrate level of a sample of stream water was tested to determine which pH level was most harmful to the stream. The hypothesis was, if a section of Four Mile Run with a pH of 4.80 is measured, then it will have highest nitrate level because it would be overgrown with plants that took all of the oxygen due to increased nitrate levels. The pH of 4.80's results were a nitrate level of 16 ppm which was lower than expected. To account for this discrepancy, two Anova tests were performed. First an Anova test was performed to find out if there was a statistical difference between any of the pH's mean nitrate levels. The original P-value found using all the data was 0.315 which is greater than 0.05 and thus proves that set of trials to be insignificant. When the outlier of 4.80 was excluded in the second Anova test the P-value was found to be 7.938E-05. This was less than the significance level of 0.05 and proved that the data was statistically significant. This rejects the null hypothesis and proves that there is a correlation between the increase in the level of pH causing it to be more acidic and the decrease in the level of nitrates.

11 EV 648

Zavala-Diaz, Kelvin

T.C. Williams High School

The Effect of Activated Carbon On Contaminants

Activated carbon is used in water filtration systems around the world. When certain chemicals pass next to the carbon surface, they attach to the surface and are trapped. Water is the most important resource, next to oxygen, on the planet. However, 1 in 9 people do not have access to fresh water. Therefore, many need to use filtration devices to remove the contaminants from-non potable water. Since activated carbon is used in many water filtration systems, it is important to know how effective it is in removing other chemicals. My research question was how effective is activated carbon in removing contaminants out of water, specifically nitrates, nitrites, and ammonia. My hypothesis was that the more activated carbon there is in a filter, the more effective it will be in removing contaminants because it can absorb the chemical contaminants. In my experiment, I made four filters out of water bottles and then added 0g, 50g, 100g, and 150g of activated carbon in each bottle respectively. For my experiment, I made contaminated water, which I then tested before and after entering each filter with ammonia, nitrates, and nitrates strips to measure the amount of contaminants. I recorded each data point on three different data tables. I repeated this for 15 trials and then calculated all the averages, which I noted on a process data table. I then proceeded to analyze my data and make graphical representations so I can see the trend lines of whether my data supported my hypothesis or not.

12 EV 649

Byers, Jessica

Washington-Lee High School

The Correlation Between the Populations of Crassostrea virginica and Ulva lactuca on the Oyster Castles at Greenbackville, VA

The Eastern oyster, Crassostrea virginica, plays an essential role in bay ecosystems due to its ability to filter up to 50 gallons of water a day, improving the water quality for other organisms. In areas where previous oyster shucking business is prolific, such as Greenbackville, current oyster populations are dwindling. Even with the installation of oyster castles, the Greenbackville population has yet to see a resurgence. There has been a significant growth in several algae species, namely Ulva lactuca, better known as sea lettuce. Past research has indicated that sea lettuce can negatively influence oyster growth. Based on this research, there will be a negative correlation between sea lettuce and oyster populations. A visualization technique was used to estimate the percent coverage of general algae, sea lettuce, oysters, and empty space. The oyster category was then broken-down into percentage of dead oysters and percentage of live oyster. The analysis of this data indicated a positive correlation between the sea lettuce and oyster populations. This was backed by a p-value that was less than 0.05, making the results significant. On the other hand, there was a negative correlation between the general algae and oyster populations. This was also backed by a significant p-value. The pie-charts reveal that there was not a high population of sea lettuce, which might be a factor in the results. It is possible there is another extraneous factor that is causing these results, but more research would be needed.

12 EV 650

Holmes, Zachary

George Mason High School

The Effects of Domesticated Cats on Birds

I am going to research the effects of cats on bird populations. For this study, I am going to research the Chatham Islands in New Zealand as they have had a multitude of issues concerning cats predatory behavior and how it has negatively affected birds. Also, I am going to look at the effectiveness of management and conservation programs for birds. This would further validate my argument that cats are a great cause for birds steady decline in Chatham Island.

7 MC 700

Soares, Simone

Jefferson-Houston School

The Effect of Music on Video Gaming

In order to figure out a better way to play video games, I decided to find what type of music was best to listen to in order to get a better or higher final score. I believed that between hated, favorite, never heard before, and no music in general, hated would work out the least for helping achieve my goal. I thought that because if you disliked it, you would focus on blocking it out more than favorite music. When listening to other types, you would be more in the right mindset. If you like a song, it normally makes you motivated or encouraged so I thought that because of this, it would make me feel more intertwined with the game and more focused on my goal.

I used a racing game, Mario Kart 8 Deluxe, that allowed me to see my time afterward. I went to a game mode where the computer players wouldn't mess me up with either pushing me off the road or throwing an item that could be potentially game-changing. This would have me end up with wild varieties of times based off luck. In the end, I was proven correct as hated music tended to make me about 3 seconds slower. Not much, but it could still result in a defeat anyway. With this information, I hope to make my and other people's game experience much more rewarding and entertaining.

7 MC 701

Togans, Calvin

Hammond Middle School

Jammin the Signal

I choose this project topic because of how much I like wi-fi and how I sometimes don't trust it. To me sometimes people just use wifi a lot and people are always making it better. We rely on wifi too much that someone could just hack the world and he would be in control. That made me change my opinion on wifi. My problem was what is the best material to block a wifi signal? My hypothesis was If I use metal barrier, then it will be the best material to block wifi. My procedure involved using a measuring app on my phone to measure the internet strength when the router was placed in boxes made of different materials (metal, wood, and glass). I performed 3 trials each. Metal blocked the signal far more than, wood, and glass. In conclusion, metal best blocks wifi out of the 3 materials and because of my experiment it proved my hypothesis is correct.

8 MC 702

Akhtar, Afrin

Kenmore Middle School

The Effect of Different Banks on the Amount of Accumulated Money with Interest Rates in a Savings Account

The purpose of this experiment was to see which bank accumulated the most money in a savings account. The different banks banks that were used in the experiment were Marcus by Goldmans Sachs, CIT, Wells Fargo, BBVA, and Capital One. This project was chosen because of the interest in further educating self in economics. It was assumed that Wells Fargo would have the highest accumulated money due to the situation that occured that caused the amount of people to come to the bank to decrease. The experiment was conducted by taking the Annual Percentage Yield and converting it to interest rate using google sheets. Then an information was inputted into an online calculator that calculated the amount of money that accumulated in a savings account. The hypothesis was rejected.

8 MC 703

Huddleston, Joshua

H-B Woodlawn Secondary Program

SQL Injection

Suppose your personal information is stolen on the internet. You thought not downloading anything would be enough to protect it, but by only signing up for an account on a website that was not well protected, you lost all of your secure data, including your address, email, and full name. One way a hacker could have stolen that information was through SQL Injection. SQL Injection is a hacking technique where a hacker enters code into a text field on a website to gain access to private data.

I did my science project on SQL Injection. I did this project to demonstrate the danger that SQL Injection and also hacking in general can pose to websites and online databases. My goal for this project was to hack into and steal information from a test website, then to make the website protected from the hacking I did.

I did this by using SQL Injection on a test website, then editing the code of the test website to be resistant to SQL Injection attacks. In the first phase, I hacked into the test website. I learned the secure information belonging to everyone on the database, and also had the ability to edit, add to, and delete from the database. In the second phase, I changed the code of the website to think of all text inputs to the website as words, rather than code. This stopped the computer from being fooled by SQL Injection.

8 MC 704

Lyons, Mark

George Washington Middle School

Saving the Salmon: The Limits of Computer Vision

Idaho Fish and Game, IDFG, shoots thousands of photos of the rivers in Idaho to count salmon redds, which are small depressions salmon will make in a riverbed to lay their eggs in. IDFG spends months counting these by hand annually, so I set about creating a program to do this for them. I would know I was successful when IDFG's redd count was equivalent to mine. The photos I received from IDFG had incredible variability, so some preprocessing was needed to prepare the photos for a haar classifier, Convolutional or standard Neural Network. The three main methods I tried were monochrome edge detection, color edge detection and color thresholding. Monochrome edge detection produced noise and nothing else, the color edge detection had some distinction of the redd, but there were other locations with the same attributes. The color thresholding had some good results inside the river, but there was a large amount of noise outside the river. After these methods failed, I wrote to Mattias Disney, at University College London who specializes in counting trees and canopies with drone footage to find out what I could do, but he told me it might be impossible with the photos I had due to the variances such as a glint off of the water. In the future, IDFG could use an infrared camera to identify the river in the visible image, then use something like color thresholding to find the redd in the river.

9 MC 705

Jones, Wyatt

Yorktown High School

An Investigation Of Search Engine Dictation

This Experiment is going to be performed to test the capabilities and consistency of the dictation feature of five search engines. Three sets of twenty questions, each set of different lengths, will be recorded. Each set will be played back five times while a search engine is performing dictation, and repeated for every search engine. The number of missed or incorrectly interpreted words per question will be counted and averaged. The data collected will be analyzed using a One Way ANOVA test. The test will produce a P value which determines the likelihood that the results are not correlated. The results of this test would be valuable to people who regularly rely on dictation and the developers of each search engine. For those who rely on dictation, the results could show what search engine is the most consistent and accurate at performing it, therefore likely the most useful to them. For the creators, it would provide information on possible areas to improve or further develop the feature for the specific search engine.

10 MC 706

Powers, Zoe

Washington-Lee High School

Do Government Enforcement Actions Against Undocumented Immigrants Affect Locality Decisions of Legal Immigrants?

This project examined the effects of ICE enforcement actions on the legal immigrant population in the four U.S. states that border Mexico. The purpose of this project was to see if ICE had adverse consequences on more than just its intended target audience of illegal immigrants. This paper contributes to the rather small literature on the effects of ICE immigration which did not examine this particular effect. This project looked at the change in the number of ICE arrests in 2015-2016 and the change in legal immigrant population per county per year in the four border states and other variables that may impact an immigrant's locality decision. The other variables examined in this project included economic and demographic controls. The economic variable used was the change in the number of paid employees from 2015-2016 and the demographic variable used was the change in Democratic vote share.

The overall population, number of legal immigrants and number of paid employees exhibited positive trends while the number of ICE arrests and democratic vote share fell over time. It was hypothesized that an increase in ICE enforcement actions would lead to a decrease in the number of legal immigrants per county. This hypothesis was rejected at the 95% significance level as the p-value was only 0.09. However, all the variables were significant at above the 90% level, and the democratic vote share was significant at about the 99% level.

10 MC 707

Tarter, Matthew

George Mason High School

Should You Invest? Using Google Search Analytics to Predict Stock Prices

Nowadays, people turn to Google, and other search engines, to answer many of life's questions. One such question is “should I invest in (insert any company)?” or “what companies should I invest in?” While Google is sure to have millions of pages lined up to answer this question, the best answer might lie in Google’s search data itself, that is the data of who is searching what, when, and in how great of numbers. Through effective analysis of the data provided by Google “trends,” the service dedicated to holding this search data, a model can made to predict stock price movement. Spikes in searches related to certain stock market trigger words, or to one stock specifically, can often mark the beginning of a sudden rise or fall in a stock’s price. By using a model to consider data from these various sources, it can effectively predict movement in the stock market.

10 MC 708

Buchholz, Adrian; Crisafulli, Francesco; Green, Andrew

Arlington Tech and Career Center

The Effect of Different Machine Learning Algorithms on the Accuracy of Each Song

This experiment was conducted in order to test the most effective form of machine learning in video games in performing tasks and learning. Machine learning is a relatively new concept that our experiment tested the effectiveness of. To test its effectiveness, the experiment does trials on three of the four most common machine learning algorithms, supervised machine learning algorithms, semi-supervised machine learning algorithms, and reinforced machine learning algorithms. After two thousand trials, the most effective algorithm was reinforced, followed by supervised, and then semi-supervised. Our experiment determined that reinforced machine learning is the most effective algorithm, however, the time required to create the data it uses makes supervised the most convenient for practical use.

10 MC 709

Rahman, Mahia; Tesfaye, Belen

Washington-Lee High School

The Effect of Tree Cover Loss and Population on Air Quality

The purpose was to evaluate if tree cover loss and population density contribute to air pollution. The hypothesis was if both tree cover loss and population increase, then air quality will decrease. The independent variables were the added amounts of tree cover loss in 2001-2017 and population from 2017. The dependent variable was the Air Quality Index (AQI).

Tree cover loss and population data were collected for the 50 states in which each state was a trial. Tree cover loss density and population density, both per square mile, with their corresponding AQI were divided into 4 groups, high and low. t-tests with equal variances and correlation tests were conducted for the 2 groups. The t-test of high vs. low tree cover loss did not have a significant p-value. The correlation test for tree cover loss vs. AQI was negative. The t-test for high vs. low population had a significant p-value. The correlation test for population vs. AQI was positive. The hypothesis was supported by the population results. Tree cover loss was not significant due to the quantification of tree cover loss, not the amount of tree cover. Further experimentation with same procedures was conducted with 2010 data for tree cover and AQI. The t-test of high vs. low tree cover did not have a significant p-value. The correlation test for tree cover vs. AQI was negative. It was concluded tree cover loss and tree cover is not the main contributors to air quality as other factors impact air quality.

11 MC 710

Cunningham, Caroline

Washington-Lee High School

Investigating Cancer Mutations: Improving the Analysis of Cancer Data with Software

Cancer is a genetic disease characterized by mutations, but little is known about cancer mutational processes. As such, it is important to study cancer at the mutational level. To do this, computational methods analyze patterns in mutated DNA. Current computational methods, however, are hard-to-access or do not have clearly-defined analysis methods.

To address these issues, this study aimed to create software to analyze mutational patterns in cancer mutational data, and, as a secondary goal, to determine the associations between cancer type and prevalence of mutational patterns using the created software.

Over 900 lines of Python code were written to build and test the cancer analysis software, which detects the significance of five mutational patterns, APOBEC, UV, Tobacco, AID, and Aging, in cancer data. Afterwards, open-access TCGA cancer mutational data was downloaded for 15 cancer types, and, using the created software, 39 significant associations were found between the cancer types and the mutational patterns present.

The importance of the results is twofold. First, the cancer analysis tool strengthens the understanding of the mutational processes occurring in a cancer sample and establishes a novel framework through which to analyze cancer mutational data. Second, the associations discovered between cancer type and mutational patterns present have research and clinical implications, along with bettering the knowledge of how mutational processes vary by cancer types.

The cancer analysis software will be implemented into online, bioinformatics software, allowing the program to be easily accessible over the internet by cancer genomics researchers.

11 MC 711

Khan, Noah

T.C. Williams High School

Identifying Aquatic Invasive Species Using a Neural Network

The purpose of this project was to determine if invasive species in the Chesapeake Bay Watershed could be quickly identified using a neural network. Four goals were developed to test success; identify subjects with at least 90% confidence, in under five minutes, from an image, and from pictures above the water or of fish taken out of water. To construct the neural network, Python 3.6 was installed along with pip, Numpy, Keras, Tensorflow, and Virtual Environment. A folder was filled with hundreds of pictures of invasive (Northern Snakehead, Blue Catfish, and Rusty Crayfish) and native species (Bluegill, American Shad, and Largemouth Bass). Using a Python editor, codes were run to retrain the neural network. Using three pictures of each species, the network was tested. With few exceptions in confidence, all the goals were achieved. To reduce the potential for false positives, the network was further trained on objects that were not fish. The network was able to correctly identify vehicles, land animals, and people as not fish with at least 90% confidence. For the plant images unfortunately, none of the trials were able to produce an above 90% confidence. To increase the confidence levels in both plants and fish, many more training images must be included during retraining. A future goal for this project is to convert this laptop based neural network into a phone app for field use so that if people catch an unknown fish, they can check if it is invasive or not.

12 MC 712

Boesen, Erik

George Mason High School

Can AI Tell Programming Languages Apart?

The notion of "Artificial Intelligence" evokes a variety of reactions, from excitement at the prospect of driverless cars to guttural fear of a robot uprising. Despite these lofty goals and ethical concerns, applications of AI are and have long been present throughout society. Smartphone owners have their physical locations, web traffic, and social interactions monitored by advertisers. When taking a plane flight, passengers rest safely in the hands of an artificially intelligent autopilot, enjoying the benefit of a trip automatically scheduled to ensure full seats. One heavily researched branch of AI is known as ‘machine learning,” in which models are trained from sample data to find patterns and learn to perform a task without direct human input. One popular technique of machine learning, the “neural network,”' is distinguished in that it attempts to simulate the decision-making style of a biological brain in order to adapt and learn much like a human. The field of natural language processing relies heavily on neural networks. However, little research has been done on how neural networks may aid in artificial language processing, i.e. that of software programming languages. Here, we explore the extent to which neural networks can be applied to differentiating between 10 different programming languages. We outline the fundamentals of neural network technology, and implement a network which correctly determines the language of code in 84% of trials.

12 MC 713

Henrich, Caden

Washington-Lee High School

Mutation Rate and Its Effect on the Efficiency of a Simple Genetic Algorithm

This experiment's purpose was to gather data on and determine the optimal mutation rate for a simple genetic algorithm. This data could then be extrapolated to be used on more complicated and practical genetic algorithms, thereby streamlining both the development process and the genetic algorithm itself. It was hypothesized that the optimal mutation rate would be between 0 and 1. Mutation rates from 0 to 1 in increments of 0.1 as well as mutation rates from 1 to 5 in increments of 0.5 were tested in a genetic algorithm that guessed a string containing ASCII letters and punctuation. The lowest mean number of generations needed were those of mutation rates 0.1 and 0.2, with their values both being 45.5. Statistical tests were done on the raw data, and it was found that there was no statistical significance in t-tests of adjacent mutation rates until the comparison between mutation rates 2 and 2.5. This finding, however, does not necessarily void the factor of the lowest means being in a range of 0.1 to 0.5. There was an immediate difference between mean generational values of 0 and 0.1, showing that no mutation rate fared worse. There were also only 200 trials done per level of mutation rate. Running more trials might provide different results. And finally, genetic algorithms fundamentally employ randomness in their search process, and therefore it can be assumed that the area of absolute lowest mean generations (0.1 to 0.5) is the optimal range to run in a genetic algorithm.

7 ME 800

Shumsky, Abbey; Buchholz, Claire

Swanson Middle School

Iron versus Speed

The purpose of this experiment was to find the effect of the brand of multivitamin on the dissolution time and the iron content. The independent variable was the brand of the multivitamin and the dependent variables were the dissolution time and the iron content. A variety of multivitamins were tested and Nature Made was believed to contain the most iron, because it was the only one that advertised it's containing of iron on the bottle. CVS was presumed to dissolve the fastest because it was the smallest pill and had a thin coating. The hypothesis was supported by the data. Nature Made contained the most iron with an average of 137 PPM (parts per million). CVS dissolved the fastest with an average of 15: 31. The approach, was to test five common multivitamin brands and compare The key results were that CVS brand dissolved the fastest, and that Nature Made contained the most iron. Overall, Centrum performed the best; it had the third most amount iron content, and dissolved the second fastest.

8 ME 801

Reyes, Sofi

Swanson Middle School

Heartburn Helpers

The goal of my experiment was to see which heartburn medication got to a pH of 7 after being left in a fake stomach acid solution for six hours. My hypothesis was that the natural medication choice (Licorice Root) would get to a pH of 7 for sure. I choose this independent variable out of the other ones because natural solutions for things are said to work just as much or better than normal medications. However, my hypothesis was incorrect, and I understand why. The independent variable that was the best (as in got a pH of 7) was an antacid. The brand of antacid I was using has been around for a long time, and had lots of time to perfect their recipe.

8 ME 802

Walsh, Elizabeth; Yingling, Helen

H-B Woodlawn Secondary Program

What is the best way to wash your hands?

Our experiment helps society by teaching people the best way to wash their hands. This is helpful because if people can remove more germs, then they have a smaller chance of getting sick. Our research question was, “What is the best way to wash your hands?” Our hypothesis was that washing in between fingers for 30 seconds, would remove the most germs. We thought this because it is washing for the longest amount of time, and washing in between fingers covers more area when washing.

We tested the hypothesis by washing our hands with two different methods (rubbing palms together and washing between fingers), each for 10, 20, and 30 seconds. The results of this experiment were that washing in between your fingers removes more germs than rubbing your palms together. We also found that washing for 20 to 30 seconds gets rid of the same amount of germs. The conclusion for this experiment was that when washing hands, the method that you wash with is more important than the time you spend washing your hands.

10 ME 803

Gibson, Julia

Bishop O'Connell High School

Synesthesia in Students

For my experiment, I will the determine the ratio of student synesthetes and non synesthetes. I will do this by giving students the alphabet to color, and they will color accordingly to what they visualize in their head. If they do not see anything, they are allowed to refrain from coloring. I will give them a stack of cards that contain both letters and words. They are to color the words as they see them. I will determine if they are synesthetes by looking at both of the papers and seeing if they colored the letters in the words given the same as the letters colored in the alphabet worksheet. Because the most common form of grapheme-color synesthesia is visualizing the days of the week as colors, I will be writing out the days of the week and asking them if they visualize it as a certain color.

10 ME 804

Smith, Sadie

H-B Woodlawn Secondary Program

The Effect of the Type of Liquid on How Quickly Advil Medication Disperses

The purpose of this experiment is to determine which type of liquid is best to take with a pill. Many people believe that plain water is the best liquid but others say that fizzy water is better because the bubbles will break down the pill faster. In this experiment, five different types of liquids will be tested. Distilled water, hot water, cold water, Sprite, and seltzer water. It will be measured by the time it takes for the Advil tablet to disperse medication. Therefore if the type of liquid is changed then the time it takes for an Advil tablet to disperse will be fastest in hot water because the heat will break down the coating and disperse the medicine quickest. A pill will be placed in 8 milliliters of the specified liquid and 1.5 milliliters of hydrochloric acid of pH 2 will be added to the vial every minute to replicate the amount of stomach acid added to the stomach every minute. There will be four trials for each independent variable level. The liquid that performed the best was hot water because of the heat. The liquid that performed the worst was Sprite because of the sugar and chemicals within the soda. In conclusion, hot water had the quickest dispersal which supported the hypothesis.

11 ME 805

Alleyne, Kristen

Washington-Lee High School

The Effect of Different pH Levels on Pancreatic Amylase Enzyme Activity and Its Relation to Diabetes

Glucose is a major energy source in the body, but it can only be consumed in polysaccharides like sucrose. Amylase is an important enzyme in the digestive system that breaks starches into individual glucose units, it is secreted by the pancreas and salivary glands (Goodsell, 2006). Amylase works most efficiently at 37□ Celsius and between pH 6.7 and pH 7.1, the same pH levels as the human pancreas. Type one diabetes and type two diabetes prevent optimal pancreatic activity and also lead to an increase in blood and pancreatic acidity. If the pancreas is stressed, the proper amount of amylase and insulin will not be released. The purpose of this experiment was to investigate the effect of different pH levels on amylase's ability to break starches into glucose. To conduct this experiment, twenty small test tubes were placed in the rack of a water bath and filled with two drops of iodine (Iodine forms a blue color in the presence of amylose in starch). Test tubes were filled with a 10 mL amylase solution, 10 mL starch solution, and 10 mL pH solution. Amylase activity was measured based on iodine color change. The data showed an expected trend: the more acidic the pH level, the longer the enzyme activity duration time and conversely the more basic the pH level, the lower the activity duration time. The starch solution was most effectively converted to glucose in a pH 6.75 solution. `

11 ME 806

Atkinson, Morgan

Washington-Lee High School

The Effect of a Carrier Substance of the Medicine, Diphenhydramine, on the Ion Concentration of a Solution

The purpose of this experiment is to provide people with serious allergies information on which form of medication will be the most effective (diphenhydramine). If different forms of diphenhydramine are dissolved in a solution, then the liquid form will not disassociate, and therefore will have the lowest ion concentration and will be the most lipid soluble to cross the cellular membrane. 25mg of the medicine, as a tablet, capsule, liquid, liquid gel, chewable, and diphenhydramine powder, was placed into a solution of the buffer solution (pH 4) and tap water. Then, ion concentration was measured at 15, 20, and 25 minutes, using a conductivity probe. The total change in conductivity was calculated. Both Liquid and Liquid gels had a negative change of 55.5 uS/cm, and 28.9 uS/cm. The main increases were; orally dissolving tablets (129.5uS/cm), and Capsules (98.5 uS/cm), and control (50.9 uS/cm). Looking at the T-Test, the only data with significance was between: Capsules and Liquid Gels, Capsules and Diphenhydramine, Capsules and Liquid, Gels and Diphenhydramine, and Liquid and Diphenhydramine. For almost all of the data collected on the solution, the T-Test showed insignificance, however this does not matter because it was before any change could have occurred. When an ANOVA Test was conducted it showed the overall data was significant. This shows that liquid is the most effective at crossing the cellular membrane, and that the null hypothesis can be rejected, but the hypothesis cannot be fully accepted, due to the discrepancies in the order of concentrations.

11 ME 807

Cocke, Townson

T.C. Williams High School

The Effect of Missing Value Imputation Methods on Asthma Patient Cluster Accuracy

Smartphone-based health studies are increasingly being used by researchers to collect data from larger cohorts than possible through traditional medical studies. One issue with these types of studies, however, is the issue of missing values. Medical researchers face a challenge of higher rates of attrition and longer non-overlapping enrollment periods compared to traditional incentivised studies, where research cohorts are actively recruited. Furthermore, missing values are especially problematic when the mechanism for missingness is non-random. For example, in the studies, such as the one this project is focused on, where missing values are more likely to occur on non-symptomatic days for asthma patients, because patients feel less inclined to report their condition if nothing is wrong, or if patients are more likely to not report their symptoms to a panel because they are too sick to do so, the mechanism for missing data cannot be overlooked because it affects conclusions drawn from the data. The goal of this project is to investigate the application of one missing data imputation method from a study of protein abundances in ovarian cancer (FDA NCI–CPTAC Multi-omics Mislabeling Challenge) to smartphone-based asthma study, the Asthma Mobile Health Study (AMHS), where the non-ignorable mechanism of missing data might be similar enough to improve missing value imputation accuracy in the AMHS data. To test the accuracy of the missing data imputation strategies, data for several asthma symptom profiles will be simulated, and cluster accuracy--a metric for imputation accuracy in the AMHS--will be assessed for each imputation strategy.

7 MI 900

Gibson, Adam

Williamsburg Middle School

The Effect of the Brand of 2% Milk on the Number of Days After the Expiration Date When the Milk Sours

Different transportation, processing and production methods can all affect how quickly milk sours. The expiration dates on gallons of milk are used by consumers to determine when to discard it. If dates are inaccurate, consumers' behavior could result in food waste or inadvertently drinking spoiled milk. This study examined three brands of milk and when they soured relative to their expiration dates, in order to determine expiration date accuracy. Five trials of Trader Joe's, Costco, and Lucerne gallons of 2% milk were conducted over 84 days. As the amount of lactic acid in milk increases, the pH decreases and the milk sours. For each gallon of milk, 50 mL samples were measured daily using a pH meter until they reached pH 6.4, when the milk was considered to be sour. The mean number of days between expiration date and the milk souring varied by brand, Lucerne milk lasted the longest on average with a mean of 21.2 days, Costco's mean was 19.4 days, and Trader Joe's was the shortest with a mean of 9. Although Trader Joe's was the quickest to go sour on average, there was a high degree of variation within each brand. Days between the expiration date and when the milk spoiled ranged from 0 to 30. Only one container of milk spoiled on the expiration date. For consumers this means that not only are the expiration dates inaccurate, they are also unpredictable. This makes it difficult for consumers to know when their milk will spoil.

7 MI 901

Harris, Nikolas

H-B Woodlawn Secondary Program

How Do Preservatives Affect Mold Growth in Bread?

The experiment was conducted to determine which store-bought brand of bread had the longest shelf life and whether preservatives helped to extend the shelf life. The experiment was designed to identify the impact of preservatives on the onset and growth rate of the mold.

It was hypothesized that preservatives would delay the onset of visible mold and reduce the mold's rate of growth. The types of preservative most commonly found in bread deters mold growth by interfering with the normal functions of the cells in the mold. To test the hypothesis, five different brands of bread with varying levels and types of preservatives were purchased simultaneously. Each brand of bread was cut into three test samples of equal size and sealed in bags with 10 ml of water. Images and measurements were collected at the same time each day. Mold growth was measured using a one cm grid overlay. The bread and mold were disposed of at the conclusion of the experiment.

In conclusion, higher preservative breads showed delayed onset of mold growth and a slower overall growth rate. However, Wonder BreadTM appeared to be an outlier that would warrant additional testing to validate results. Wonder BreadTM showed early onset of mold growth and mold growth rates unlike the other high preservative breads. In the future, additional experiments would be needed to control for the variation in the bread texture's impact on the onset and growth rate of the mold.

7 MI 902

Tudorache, Demetra Aurora

Swanson Middle School

Bacteria: The Quest to Live or Die

Are we able to use ultraviolet light to disinfect or sanitize our homes, or even hospitals? How well will it kill bacteria? “Bacteria: the quest to live or die” is an experiment that explores the effect of different amounts of ultraviolet light exposure on E.Coli bacteria. The experiment was trying to determine what amount of exposure killed, or slowed the growth of bacteria. The independent variable levels were 0-minute, 30-minute, and 60-minute exposure. The investigator’s hypothesis was that 0-minutes under ultraviolet light would have the most growth and best results, the 30-minute exposure would have slowed growth, and that 60-minute exposure would have the least growth. To conduct this experiment, the bacteria was placed in a total of fifteen Petri dishes, five for each independent variable level, and put under ultraviolet light for their specific amount of time. The hypothesis was partially supported by the data. The best results were shown by the Petri dishes with 0-minute exposure with an overall average of 6.2 square inches of empty space in the Petri dishes. However, the 30-minute exposure had the worst results with an average of 14.0 square inches of empty space, while the 60-minute exposure category had a better overall average of 12.8 square inches of empty space. The experimenter could only measure the surface area of the dishes, and not the height, so the results might have been affected. Also, the amount of bacteria in each Petri dish was not equivalent.

8 MI 903

Blackburn, Isabel

Hammond Middle School

What Are the Most Common Germs in School?

My 2018-2019 Science Fair project is answering the question, "What are the most common germs in school?" This project would benefit the students and staff that attend Francis C. Hammond Middle School (FCH), by letting them know what germs are common in their school. The different places from which I collected my germ samples is my independent variable and my dependent variable is the germs that appear in the sample. How I collected each sample, the temperature and location of where the samples were incubated and how the samples were observed are my project's constants. After my experiment was conducted, many germs grew in the Petri dishes. Many bacterial colonies appeared. However, two were most dominant: a colony that was bright yellow, and a colony that was a translucent, pale yellow. Other colonies appeared as well, however there were very little of them. I plan to identify and name the colonies that appeared in the samples I collected.

8 MI 904

England, Riley

Thomas Jefferson Middle School

The Effect of Different Salinities on Algae Growth

The purpose of this study was to determine the salinity that produces the most algae. The independent variable was the salinity of the water in which the algae was grown. The experiment groups were: 8%, 16%, 24%, and 32% salinity. The control group was 0% salinity (distilled water). The dependent variable was the thickness (in mm) of algae that was grown. The constants were the amount of water, the temperature of the water, the nutrients added to it, and the equipment used to grow the algae. The hypothesis was: If algae are grown in different salinities, then it will grow the most in the highest salinity (32%). There were three trials repeated for each level. 7mL of algae, 7mL of nutrients and salt (amount according to each percent) was added to each bottle. They were then shaken and placed under the 750 lumens light and watched for the next 28 days. Each day to measure the amount of algae growth, the secci stick was placed into the water, slowly lowering it until the bottom of the stick was no longer visible. The researcher recorded the measurement (in mm) the secci stick had sunk. The smaller the number, the thicker the algae. The results showed that the 16% salinity grew the most algae. These results reject the hypothesis. In conclusion, the study suggests that mid-salinity (or 16%), produces the most algae.

8 MI 905

Johnson, Phillip

Williamsburg Middle School

The Effect of Method of Cleaning Sponge on the Amount of Bacteria Colonies Remaining

Sponges are a common household item for many people, but to some they are a very dirty, full of bacteria cleaning device and that is why many people do not use them. This experiment was designed to find a good and doable method for cleaning a sponge, so people would use sponges more often and not throw away as many as they do. The different methods of cleaning sponges included using a microwave, putting the sponge in a bleach solution, a vinegar soak, and putting the sponge in the dishwasher. The control for this experiment was an uncleaned sponge. To get data I washed dishes, conducted the method of cleaning the sponge, then swabbed the sponges and put the bacteria on nutrient agar then after three days counted the number of bacteria colonies that grew. In the end my hypothesis of the microwave would work the best was not supported and the method that worked the best was using a bleach solution and the second best method was using vinegar. I concluded that using certain sanitizing liquids works the best because of the sponges ability to absorb liquids. In this project there were some errors but none that affected the data extensively. There are many ways to extend this project including experimenting with method of cleaning dishes. After this experiment it was clear that I have found many very effective ways to clean sponges and minimize bacteria.

8 MI 906

Kassi, Mariska

Williamsburg Middle School

The Effect of Ultraviolet Light Irradiation ime on Percentage of Bacteria Death

The purpose of my project was to find the effect of UV light Irradiation time in bacterial mortality. My project is important the information found can be used to figure the appropriate amount of time for 100 of bacteria death, and to disprove some UV light companies's suggested usage time. To conduct the experiment I allowed 16 plates of K-12 E. Coli to grow, then exposed the plates to UV lights for different amounts of time. After observing the plates 24 hours later I found that 60 seconds of UV light Irradiation was the least effective because most of the plates resulted with a 0% bateria mortality rate. The most effective was 300 seconds with 100% mortality rate in all of it's plates. There might have been and error in the experiment with one of the plates that were exposed to 200 seconds of UV light because in one plate all the bacteria died but the other three failed to reach a 90% mortality rate. In conclusion it would be best to use Germicidal UV light for at least 300 seconds (5 minutes) for the best results. There could be more experimentation done to find a lower time than 300 seconds, and an experiment can be done to research how effective UV light is compared to other commercial disinfectants.

8 MI 907

Papacosma, Charlotte

Gunston Middle School

The Effect of Type of Vinegar on Zone of Inhibition

The purpose of the experiment 'The Effect of Type of Vinegar on Zone of Inhibition' is to determine which of six types of vinegar is most effective in killing/preventing the growth of common bacteria. A zone of inhibition is the area around an antimicrobial agent that is completely clear of bacteria. When conducting the experiment, five Petri dishes (for five trials) were first filled with a liquid agar and left to harden, and then swabbed with the K12 strain of E. coli bacteria so as to cover the entire surface of the agar. The dishes were divided into sevenths, and cardstock circles ('chips') were soaked in each type of vinegar and the control (water) and applied one per section. The dishes were incubated for 48 hours, and once removed, the zones of inhibition around each chip were measured to determine the effectiveness of each vinegar as an antimicrobial agent. The results determined that the most effective vinegar was the white wine vinegar. It was also discovered that the effectiveness of a vinegar is directly related to the vinegar's acidity percentage. This is because the acetic acid in vinegar is the ingredient that causes bacteria to die and creates the zone of inhibition. Future repetitions of this experiment may be improved by using only non-pigmented vinegars, as in this experiment, exact zone of inhibition widths were impossible to determine with the pigmented balsamic vinegar.

9 MI 908

Crosby, Torin

Yorktown High School

The Effect of Hand Sanitizer on the Growth of Escherichia coli

This experiment tested the effectiveness of hand sanitizer on the inhibition of E.coli to determine which brand of hand sanitizer lives up to its claims. The hypothesis was that Signature Care will have the largest zone of inhibition because it claimed to kill 99.99% of the common germs. The aseptic technique was used to inoculate agar plates with the E.coli K-12 strain. Disks soaked with each of the five types of hand sanitizer (five trials each) were placed in these agar plates. The plates were incubated and the zone of inhibition was measured at 24 and 48 hours. The average zone of inhibition measured (in mm) from the highest to the lowest were as follows: Signature Care (1.08), Topcare (1.06), CVS Health (0.98), Purell (0.24), and water (0.20). The results were statistically significant. The hypothesis was accepted because Signature Care was the most effective within 24 hours. This experiment could be improved by making sure the disks placed on the bacterial lawn contained the same concentration of sanitizer. Further research could test a variety of hand sanitizers with more diverse ingredients because the hand sanitizers in this experiment had very similar ingredients. A future experiment could also test different forms of sanitizers, such as gel (used in this experiment), bar, foam, and hand wipes to see which type is most effective and to determine if it would be more effective to use a combination of sanitizers instead of one form.

9 MI 909

Koumans, Elizabeth

Yorktown High School

The Effect of Type of Light on the Opacity of Escherichia Coli Growth

As bacteria evolve and become resistant to common antibiotics, it is important to find other ways of eliminating potentially dangerous bacteria. The purpose of this experiment was to contribute to microbiology research on alternatives to antibiotics by determining what type of light was most effective at inhibiting bacterial growth. The bacteria being tested in this experiment was Escherichia coli (E. coli). Five cardboard boxes were filled with five agar plates of E. coli each and placed next to five different types of light. The types of light were darkness (control), white light, red light, blue light, and ultraviolet light (UV-B range). The E. coli was left to grow for 48 hours. Afterwards, the opacity of the E. coli growth was measured. The hypothesis was that ultraviolet light would inhibit the growth of E. coli the most. The data did not support the hypothesis but rather showed that no type of light successfully inhibited the growth of E. coli. This was shown by the mean opacity of E. coli growth for each type of light being about 50% opacity and a p-value of 0.4996 showing that there was not statistically significant variation in the data. This could be because E. coli is not a photosynthetic bacteria, so light may not affect its growth as much as light may affect the growth of other bacteria. Future studies should make sure that the amount of light shown on each agar plate of bacteria is equal to ensure accuracy of the data.

9 MI 910

Wernicke, Molly

Washington-Lee High School

The Effect of Type of Disinfectant on the Growth of Staphylococcus epidermidis

Staphylococcus epidermidis is natural flora on the skin but can become incredibly pathogenic if it enters the bloodstream, which can happen due to a break in the skin. The skin is broken very often, though, from falls, shots, IV sticks, cuts, etc. The objective of this experiment was to determine and compare the efficacy of three different disinfectants used on skin to kill S. epidermidis. It was hypothesized that, if different disinfectants are tested then isopropyl alcohol would be the most proficient in the killing of the bacteria. There were 16 trials per disinfectant and overall, each performed relatively well. The disinfectant that killed the most S. epidermidis was hand soap, which was completely unpredicted. The results of this experiment left both the research hypothesis as unsupported, but also showed that because the majority of disinfectants are made with such similar materials, the results will all be similar.

9 MI 911

Gutshall, Ava; Barclay, Lina

Arlington Tech and Career Center

The Effect of Animals on the Similarities of their DNA

The purpose of our experiment is to see if different animals have the same or similar DNA. Our hypothesis was that if cow and calf liver are similar, then the the chicken won't be similar to either, because the calf is a young cow, and the chicken isn't related. We ended up never getting any results because after several different trials, the bands didn't show up or if they did they were to light for us to be able to compare. Some of the errors that we came across were, the gels breaking, not being able to extract DNA from the liver, the gels disintegrating during the electrophoresis process, and the bands not showing up in the end.

9 MI 912

Lewis, Spencer; Foster, Jacob

Washington-Lee High School

The Effect of Black Cumin, Turmeric, and Ginger Oils on DH5-Alpha Escherichia coli

The purpose of this experiment was to test Black Cumin, Turmeric and Ginger oils on their antibacterial ability when applied to DH5-Alpha E. Coli. This could be beneficial due to bacteria constantly increasing their resistance to modern medicines. The hypothesis of this experiment was if Black Cumin oil was applied to growing E. Coli than the number of colony forming units (CFUs) would decrease. We chose this hypothesis because of other studies with successful data of Black Cumin having antibacterial properties. We tested this by diluting the oils and bacterial stock down to the -5 and -6 dilutions. The solutions were then plated on agar plates using pipettes. We incubated the agar plates for 24 hours and then counted the colonies of E. Coli.

The experiment showed that in all three dilution sets (Cumin, Turmeric and Ginger) the spices limited the growth of the E. coli. Based on the data from the independent variables and comparing it to the data of the control there were significant decreases in colonies. Black Cumin had 4.6 CFUs average at the -5 and Ginger had 6.1 CFUs at the -5. This being compared to the 57 CFUs of the -5 for the control was a massive change. Turmeric's average was 21.5 CFUs which although larger than Black Cumin, still decreased the colonies. The -6 dilutions were just as effective. Black Cumin averaged 0.4, Ginger averaged 0.3 CFUs and Turmeric averaged 4.6 CFUs. The control averaged 8 CFUs for the -6 dilution and a larger colony

10 MI 913

Kysilko, Madeleine

T.C. Williams High School

The Effect of Hand Sanitizers on Bacterial Growth

Many hand sanitizers claim to kill 99.9% of bacteria, but how do they really stand up to that claim? This project investigates the effects of hand sanitizers on bacterial growth, comparing four different types of commonly used sanitizers: hand soap, antibacterial hand soap, hand sanitizer with an alcohol content above 60%, and alcohol-free hand sanitizer. The hypothesis for the experiment predicted that the antibacterial hand soap would be the most effective at preventing bacterial growth. In order to test the hypothesis, the experiment was conducted with the use of K-12 E. coli in petri dishes. Paper disks were soaked in the sanitizers and transferred to each of the petri dishes, and the dishes were then put in an incubator to allow the bacteria to grow for 24 hours. The results were measured with a zone of inhibition, or the area around the paper disks with no bacterial growth. The results eventually proved the hypothesis wrong, with the hand soap being the most effective compared to the other sanitizers, the mean diameter of the zone of inhibition being 14.3 mm. The antibacterial hand soap followed in terms of effectiveness, with a mean diameter of the zone of inhibition of 12.5 mm. The least effective at killing bacteria was the alcohol-free sanitizer, where the samples did not have a zone of inhibition. The ideas investigated in this project contribute to research about cleanliness, and how important it is for people to wash their hands.

10 MI 914

Long, Meghan

Washington-Lee High School

The Effect of Colloidal Silver on the Growth of Staphylococcus epidermidis

Silver is an up and coming necessity in modern medicine. It's known for its antibacterial qualities and scientist are learning how to use in in different forms for different uses. The purpose of this project was to see if different concentrations of colloidal silver would have an effect on the growth of Staphylococcus epidermidis. The hypothesis was that if greater concentration of colloidal silver is introduced to the S. epidermidis bacteria then the zone of inhibition will be more significant because the silver ions will attach to the bacteria's membrane causing inhibition of cellular respiration and reproduction and eventually death of the microbe. The experiment contained 16 trials for each level of concentration. The zone of inhibition was measured by averaging three different measurements of the diameter of the zone. The experiment supported this hypothesis. The highest concentration of silver, 30 ppm, yielded the largest zone of inhibition with a mean of 1.2. Followed by 15 ppm with a mean of 0.8. On the bottom end, 7.5ppm yielded a mean of 0.6 and the control had total growth meaning there was no effect on the growth of the bacteria. The silver had a significant effect because when a larger concentration of silver was added, the zone of inhibition increases.

10 MI 915

McDonald, Alexandra

Yorktown High School

The Effect of the Amount of Artificial Urine on Wattage Produced in a Microbial Fuel Cell

The world is having an increasingly prevalent problem with pollution. The major cause of this issue is from where we get our energy: fossil fuels. What if there was a way to produce energy that is both good for the environment and renewable? There is about 7.125 billion liters of urine produced a day in the world. There is a way to create energy by using this monumental amount of unused waste through the use of a Microbial Fuel Cell (MFC). In a Microbial Fuel Cell there is soil which contains electrogenic bacteria that feed off of nutrients present in the soil. The electrogenic bacteria conduct cellular respiration which allows the movement of electrons throughout the fuel cell completing the electrical circuit. It was hypothesized that as the amount of artificial urine was increased, then the wattage output would also increase. The added artificial urine component in the project introduces urea, an organic compound found in urine. The urea, having an abundance of hydrogen, significantly increases the amount of nutrients for the bacteria to feed off of, which increases the electron output in the MFC. Through the creation of the Microbial Fuel Cell, using a tupperware along with an anode and cathode wire, the shifts in wattage output were able to be observed. With an average of 64.1 watts using 20 ml of artificial urine, 74.3 watts using 30 ml, and 81.8 watts using 40ml, a clear increase of wattage was shown through the varying independent variable levels. In conclusion, the

11 MI 916

Shafiq, Hamna

Washington-Lee High School

The Effect of Concentration of Colloidal Silver and Gram Positive or Negative Bacteria on Zone of Inhibition

This research was conducted to test the effect of colloidal silver and gram positive or negative bacteria on zone of inhibition. The silver nanoparticles in the colloidal silver attach to the cell membrane and damage the DNA and other organelles making it hard for pathogenic bacteria to replicate itself. The hypothesis: If the different concentrations of colloidal silver will be used on Escherichia Coli (gram negative) and Bacillus Subtilis (gram positive), then the 250 ppm solution will have the smallest zone of inhibition on the gram-negative bacteria. The IV levels were: gram-positive (B. subtilis) vs. gram-negative bacteria (E.coli) and 250 vs 500 (ppm) of colloidal silver. The petri dishes containing nutrient agar were inoculated with the E. coli and B. subtilis, and the sterile discs dipped in colloidal silver were placed in every quadrant. The petri dishes were sealed and incubated for 48 hours. The data was collected from these petri dishes using the zone of inhibition and observations of type of growth.

The mean zone of inhibition was larger for the 250 ppm than the 500 ppm colloidal silver. The standard deviations for both concentrations on gram-negative bacteria were very high. The ANOVA test gave a p-value of 0.99. A t-test between the two concentrations of colloidal silver provides a p-value of 0.052, which shows no statistical significance. The p-value of a t-test between the gram-positive and gram-negative groups gives a p-value of 9.7E-07, which suggests a statistically significant difference between the type of bacteria.

7 PH 1000

Flannigan, Noah

Mary Ellen Henderson Middle School

What Are The Best Conductors Of Electricity?

The purpose of my experiment was to find out which of the 3 materials that I used is the better conductor of electricity. I had 3 independent Variables, one was the outstretched paper clip, the second one was a candy cane and the third one was a plastic knife. When I put these in the contraption I used a multimeter on the ohmmeter setting to measure the ohms on the material. The measurements were in the decimals the multimeter probably was not military grade but it still worked and it worked well enough to see a difference in the three materials. In order for the experiment to happen many things had to occur beforehand. The steps I took in order to conduct the experiment were to put the IV into the clips and measured the two ends with the multimeter.

The Worst conductor was definitely the plastic knife with the average of 103.3 ohms. The second Best conductor was the candy cane with an average of 92.5. And the best conductor was definitely the paper clip with an average of 78.3, almost 15 ohms less than the candy cane and 20 ohms less than the plastic knife.

7 PH 1001

Gowdy, Scott

Thomas Jefferson Middle School

Acoustic Panels: An Exploration of Their Effectiveness at Various Frequencies

The purpose of this study was to identify how frequency impacted the effectiveness of acoustic panels. The independent variable was the frequency of the sound. The dependent variable was the effectiveness of acoustic panels. The constants were the room temperature, pressure, and humidity, as well as the intensity of the sound played. The hypothesis was: The effectiveness of acoustic panels will decrease as frequency decreases. To prepare the experiment, a "soundproof box" was constructed using acoustic panels and a Bluetooth speaker was connected to a laptop and placed inside of it. A device capable of reading present dBA was placed one meter away from this box. Frequencies of 80 Hz, 125 Hz, 500 Hz, 1000 Hz, 2500 Hz, and 4000 Hz were then played at 100 dBA five consecutive times, each for fifteen seconds, until there was no fluctuation in dBA reading for five seconds. This indication was then recorded, averaged and translated into NRC. Throughout the aforementioned frequencies, NRC gradually rose as frequency increased, with an exception at 1600 Hz, in which it dramatically spiked. This data trend, excluding the discrepancy at 1600 Hz, generally supported the hypothesis. These results indicate that soundproofing solutions that implicate porous material are strained at lower frequencies. This may be because of a lack of density or broadness which would be helpful in the deadening of lower frequency noise. To compensate for this flaw, physicists should work on a design of soundproofing that deadens lower frequency noise more effectively.

7 PH 1002

Holland, Luke

Kenmore Middle School

The Effect of a Parabolic Reflector on WiFi

In my project the Effect of a parabolic reflector on WiFi, I tested a curved device that I built out of cardboard and tinfoil on my WiFi router and saw how that effected my WiFi signal strength. I chose this project because I wanted something I could apply to my real life. To test my signal in upload and download speed (mbps) I used the sprint WiFi tester. After putting the parabolic reflector onto my WiFi routers antenna, the sprint WiFi test showed me that my signal strength for upload and download speed was more than doubled in megabytes per second! It went from 20.3 mbps to 47.4 mbps. This means if without my parabolic reflector if I wanted to download a movie and it took 60 minutes, it would only take around 30 minutes with the parabolic reflector attached! In the end, I learned an easy way to make something I use every day faster and easier.

7 PH 1003

McBride, Maegan

H-B Woodlawn Secondary Program

The Effect of Temperature on Diamagnetic Force

It was hypothesized for this experiment that once the magnets became stronger using colder temperatures, the diamagnetic force between pyrolytic graphite and neodymium magnets would increase. In turn then, when the magnets were heated up and the magnetic force would weaken; the diamagnetic force between the pyrolytic graphite and the neodymium magnets would decrease as well. To measure and analyze the magnetic pull and diamagnetism, the experiment used three different temperature scenarios. The first step was to determine the control, which was the observed diamagnetic force between pyrolytic graphite and neodymium magnets at room temperature (23.9ºC). The next step was to light neodymium magnets on fire using a butane flame (800ºC), and to freeze others using dry ice (-78.5ºC). A ruler and compass were used to measure the change in magnetism due to temperature. Finally, pyrolytic graphite was placed on the charred and frosty magnets to see if the graphite floated or slid as it did at room temperature.

The hypothesis was rejected. The experiment showed that when the neodymium magnets were placed in fire, and the magnetic force lessened, there was no observed flotation caused by diamagnetic force on pyrolytic graphite. When the neodymium magnets were frozen, and the magnetic pull was increased, it did not seem to have any effect on the diamagnetic force between the pyrolytic graphite and the magnet.

7 PH 1004

Sharrer, Kate

Mary Ellen Henderson Middle School

Left In The Dark

The purpose of this experiment was to find out at what time each battery had too low of light intensity that it would not be able to be used. A small LED flashlight was run using 5 trials of 3 different brands of AAA batteries (Sunbeam, Rayovac, and Harris Teeter) at different prices. The battery discharge rates were determined by measuring flashlight light intensity and logging results every 5 minutes. Light intensity was measured using a (insert instrument name/model) with a data logger. Light intensity was measured in lux.

In the data, It was found that the Rayovac battery held the highest light intensity for the longest amount of time. Then, it was found that the Harris Teeter didn't have the highest battery light intensity but help a strong light intensity for the longest time. Alswell, it was recorded in my graphs that the sunbeam had the best cost per minute at 2,000 lux. It depends what battery individual might want to use. If the flashlight user likes the highest light intensity then the Rayovac battery is the best. But, if the flashlight user prefers to save as much money as possible then the user should get the Sunbeam battery. However, if a user likes to keep a pretty high light intensity for a long period of time then they should use the Harris Teeter battery.

7 PH 1005

Carestio, Isabella; Kesteloot, Kalee

Kenmore Middle School

The Effect of Phone Charger on Charging Time

Our experiment was testing different types of phone chargers on an iPhone 6 to see which one would charge the phone the fastest. We conducted this experiment because now a days most people have phones and when it runs out of battery people want know the fastest way to charge it. We thought we would solve their problem by doing an experiment and figuring out which charger would bring your phone from dead to fully charged. (100%)

7 PH 1006

Shipley, Alexander; Blaha, Mitchell

H-B Woodlawn Secondary Program

Frisbee Aerodynamics

The reason for Frisbee Aerodynamics was to further understand how discs work in flight, and more importantly, which discs had the potential to fly the farthest in different wind conditions. So which disc flies the farthest? The predicted outcome, was that a standard 175 gram disc would fly the farthest in the milder, five, and ten mile per hour wind condition, and the heavyweight 200 gram disc will fly the farthest in the 15 mile per hour wind. The idea is that the lighter discs will not cut through the wind as effectively as the heavier ones. The method used for testing was to stand at a point, so that the thrower was facing the wind. The thrower would then throw all of the discs as far as possible, then count their paces to each disc. This process would be recorded and repeated three times. After each trial, the size of the thrower's pace would be measured in feet, and converted to meters.

The results were surprising. The standard 175 gram Discraft Ultrastar had about a two meter edge over the next farthest flying option. However, in the 15 mile per hour trial, the KanJam Ultimate Pro Flying Disc flew an average of two meters farther than the Discraft Ultrastar. This is surprising because the KanJam Disc is 143 grams. This was more surprising because the Innova Big Kahuna was advertised as wind resistant. The hypothesis wasn't supported by the data, because the last part of the hypothesis was false.

8 PH 1007

Artiedamarin, Nicholas

Mary Ellen Henderson Middle School

Investigating the Variation of Speed of Sound with Air Temperature.

The objective of this research was to study how air temperature affects the speed of sound. This is important because the temperature affects the transmission of emergency sound signals. The experimenter hypothesized that the higher the air temperature, the faster the speed of sound. To collect the data, one person filmed another person clapping two wooden blocks together within a specific distance between the two people. The experimenter measured the speed of sound at different temperatures using a video editor software. Using the software, the experimenter measured the time elapsed between the visual clapping and the sound clapping by calculating the frames per second between these two moments. The researcher calculated the speed of sound using the measured time converted to seconds and dividing by the distance between the two people.

The results showed that as the temperature outside increased, the speed of the sound increased. The speed calculated for 60 fps compared with that of a theoretical formula showed a maximum difference of 7.5 %. This difference was for the case with -5 degrees Celsius, the speed of sound was 303 m/s compared to 328 m/s from the formula. The standard deviation of the data was 8. With a better resolution camera, the results would have been more consistent with the formula. Using a 30 fps camera was inconclusive. Comparing the speed of sound using 30 fps with that obtained with the formula, there was a maximum difference of 17%. The standard deviation for this was 21.

8 PH 1008

Carlson, Isla

Gunston Middle School

The Effect of the Type of Light Bulb on the Current, Light Outout, and Temperature

In this experiment, the light output (lux), temperature (°C), and current (amps) was measured to find the most efficient light bulb. This experiment measured the effect of the type of light bulb on the current (amps), temperature (°C), and light output (lux). The light bulbs tested were Halogen, LED, Incandescent, and Fluorescent. The light bulbs were left on for 10 minutes, at two minutes the current (amps) was measured, then at five minutes the light output (lux) was measured. Finally, at ten minutes the temperature (°C) was measured, this allowed the light bulb to heat up. The light bulb with the highest temperature was Halogen with 59.68 °C. At this temperature this light bulb could be dangerous in a home. The most temperature efficient light bulb was the LED which was only 23.14 °C, which is very close to the temperature the experiment was started at (21.1 °C). The Halogen light bulb gave out the most light (29,708 lux) and the LED light bulb was a close second (26,546 lux). This experiment will show home designers, electricians, and many more the most efficient and safest light bulb to use. The researcher learned the most efficient light bulb is a matter of opinion. If a consumer's goal is to have the brightest light bulb Halogen is the choice, and if a consumer wanted the safer option an LED light bulb should be used.

8 PH 1009

Krohl, Brady

Kenmore Middle School

The Affect of Air Pressure on How Far a Soccer Ball Travels

If you play soccer you probably have the same question as me, does the air pressure affect how far a ball can travel? This experiment finds out the answer to that question. Based on prior knowledge I know a ball with less air pressure in it is flatter or looks deflated. I also know that a ball with a lot of air pressure in it is like a rock. After jotting down some of my prior knowledge I did some research and found out that the air pressure in a ball has a different meaning then the one we are feeling right now. Air pressure in a soccer is the random act of air molecules inside of the ball that creates a force of impact on the ball. Also found out that air pressure doesn't affect weight so that could be a big factor of the experiment. One other thing I found out is that the regulation ball is 8.7 psi so a ball with less air pressure should be less than that and a ball with more air pressure should be more than that.

8 PH 1010

McCormack, Maxwell

George Washington Middle School

Ouch! That's Hot! The Effect of Different Materials on Shielding Heat

The purpose of this experiment was to determine what acquirable material - aluminum, steel or ceramic - would create the best heat shield. The hypothesis is that if aluminum, steel, and ceramic materials are used as heat shields, then the aluminum will prevent the most heat transfer into steak. Two steaks were cut into nine equal size pieces, and the grill was heated to 500 degrees Celsius. Once the test temperature was reached, one of the test materials was placed onto the grill with steak on top. The temperature of both the test material and steak were recorded. Three trials were completed for each test material; each trial was about 20 minutes long. Following the experiment, the data was analyzed to determine how much heat from the test material was transferred into the steak. The result was that the steel transferred the most heat into the steak, resulting in an average temperature of 62 degrees Celsius, but the aluminum transferred the most thermal energy into the steak at 18%. The ceramic tile heated up quickly, but it did not transfer as much of its heat into the steak, which only had an average temperature of 46 degrees Celsius, transferring 13% of its thermal energy into the steak. Therefore the ceramic material was the best heat shield of the three materials tested. Testing of heat shields can be applicable to real life to determine what materials will best prevent the transfer of heat in hot temperature environments, such as in the aerospace

8 PH 1011

Olic, Aleksandar

Williamsburg Middle School

The Effect of the Type of Golf Ball on the Distance the Golf Ball Travels

The purpose of this experiment was to determine if a more expensive, higher quality multi-layer golf ball offers better performance in terms of distance compared to a less expensive dual-layer golf ball. Golf experts believe that multilayer balls are higher quality because the core helps the control, feel and the shot sculpting. The experiment was designed to measure the distance traveled by the two types of golf balls using a specially-constructed machine that applied a gravity-powered consistent swing using a driver club.

I always wondered if the extraordinarily expensive balls were really worth their price, and what made them so expensive. It was hypothesized that the higher quality Taylormade TP5x golf ball would travel farther than the lower quality less expensive Top Flight XL golf ball, due to its multi-layer construction. I tested if an expensive golf ball would go farther than a cheap golf ball, and doing research on different types of golf balls. The way I eliminated human error was by creating a mechanism from wood beams, screws, and Duct Tape to hit all the golf balls with the same amount of force.

My results did not support my hypothesis because the less expensive golf ball traveled a longer overall distance on average. When viewing the data is it important to note that there is a negative trend for both types of golf balls, caused by the mechanism I created wearing down over time.

8 PH 1012

Pericak, Emma

Swanson Middle School

Strong Magnets: The Effect of the Type of Metal on How Much Mass the Magnets Can Support Before Touching

My experiment found which magnet held the most weight while repelling. I was interested in hovercrafts and many stay up with repelling magnets. Hovercrafts usually need to hold lots of weight, so I wanted to find a strong magnet. When researching, I found three exceptional options for metals in magnets: neodymium, samarium-cobalt, and alnico. After other research, I made my hypothesis that the neodymium would perform best because it is a rare-earth metal.

I made three contraptions to help in testing the magnets. A straw and supports hot glued straight up on a piece of cardboard held the magnets in a vertical position. The other two were dowels with containers on top that held marbles, which I used for weight. The containers were different sizes because one magnet was not strong enough to hold the larger container. I placed the first contraption with the magnets inside the straw on a scale and zeroed it out, then put one of the other contraptions on top. I added marbles until the magnets touched and recorded the data.

The data supported my hypothesis. The neodymium held the most, over 1000g each time; the samarium-cobalt held about 650g each time; finally the alnico held around 50g each time. The data sets did not overlap, so any experimental errors made (it sometimes was hard to tell when the magnets were touching, the scale not being as precise as I wanted, etc.), did not largely impact the results. Conclusively, neodymium is best from what I tested.

8 PH 1013

Sartori, Colin

Williamsburg Middle School

The Effect of the Type of Plunger Spring on the Launch Velocity of a Pinball

The objective of this experiment was to discover the effect of the type of plunger spring on the launch velocity of a pinball. This question was approached by purchasing six plunger springs from the company Marco Specialties Pinball Parts. Each of these springs had a tension label (e.g., lowest tension, medium tension, medium high tension). The six purchased springs and one included in the pinball machine were tested to find the theoretical and experimental velocities of a pinball, which included measuring the k constant for each spring. Each spring was placed in the pinball machine, and the pinball launch was recorded with a high speed camera. To calculate the velocity of the pinball, the recordings were analyzed using the software Logger Pro. From the results, as the k constant of the spring increases, the velocity of the pinball increases because there is more energy to be released when the spring is compressed. The experimental velocities of the pinball were greater than the theoretical velocities. This difference likely occurred because not all of the energy put into the pinball was accounted for in the equation used to calculate theoretical velocity. Further the results showed two tension descriptions given by Marco Specialties were inaccurate. One spring had a higher tension than the other because of the higher k constant and the pinball's velocity. Marco Specialties was informed that their product was mislabeled, and they thereafter updated their description to fit the results of the experiment.

8 PH 1014

Shoji, Flynn

Swanson Middle School

Blast Off! The Most Aerodynamic Shape

The purpose of my project was to discover the effect of different rocket fin shapes on how far the rockets travels. I tested this by launching rockets with semi-ellipse fins, triangular fins, and rectangle fins with the same criteria (psi of launcher, day of launch, angle of launcher, etc) to essentially see which shaped fins are the most aerodynamic.I hypothesized that if all of the rockets were launched with the same criteria then semi-ellipse fins would travel the farthest, because the fin shape minimizes drag and turbulence behind the rocket. My hypothesis was supported In my data because I found that the semi-ellipse shaped fin travels the farthest out of my three chosen fin shapes.

8 PH 1015

Stanley, John

Hammond Middle School

Physics on the Court: The Energy Behind the Dribble

Basketball players are always looking for ways to maximize their effectiveness and winning capabilities on the court. Having a competitive edge over other players and teams help win championships. Conserving energy is one method players can use to sustain performance throughout a game. This project examines how changing the surface material to which a basketball is dropped upon and the height at which is dropped from, can maximize the potential energy of the ball, allowing the player to exert the least amount of energy in a game. The surface materials tested included; carpet, rubber, wood, asphalt, and concrete. The two basketball drop heights used were 100 and 200 centimeters for each surface material. My hypothesis was that in altering the surface material to which the basketball is dropped from the basketball bounce height would change due to the surface's absorption of energy. The experimental data supports my hypothesis by showing that the basketball bounced the highest at 100 centimeters on concrete and at 200 centimeters on wood. The experiment also showed that the higher the basketball is dropped the more potential energy the ball possesses.

8 PH 1016

Woodworth, Jason

Kenmore Middle School

The Size of Hot Air Balloon Lifting Envelopes

The project was about the size of hot air balloon lifting envelopes. The tester held dress-shirt laundry bags over a toaster until they filled up with hot air and were prepared for release. There were ten trials for each of three lifting envelopes which were different volumes. The tester then released the balloon and timed how long it took the balloon to reach a height of 3.4 meters. The data was then recorded to find that the larger the volume of the lifting envelope, the faster it flies. This proved the hypothesis.

8 PH 1017

Aniss, Lina; Bain, Angelica

Swanson Middle School

Dangers Of Radiation

For our project, we measured the effect of different devices on the amount of radiation emitted. The purpose of our experiment is to advise the public on the most dangerous devices and also, advise the public if there is any health concern while using radiation emitting devices. Our hypothesis was that “if all the devices are placed in the same area and position then, each device should emit the same amount of radiation because of the placement of the antenna. However, our hypothesis was not supported. We measured the radiation emission using a CellSensor which measured the amount of radiation in milliWatts per squared centimeter. For our experiment, we used two very big companies, Samsung and Apple we, tested both a phone and tablet from each company. Towards the end of our project, we came to the conclusion that you had to pick up each device a certain amount of times in order to reach the federal limit of 2.0 SAR. However, the number of pickups were very easy to reach since all of them were under one thousand. Meaning, that in under 5 weeks of picking up your devices could lead to major health impairments.

8 PH 1018

Boudjemaa, Farouk; Gleaton, Cameron

Swanson Middle School

The Physics of a Magnetic Linear Accelerator

Magnets are used everywhere, from sealing refrigerator doors to MRI scans. Their applications are endless, and they have allowed for advancements in countless fields, one being computer science. But what is the most powerful and affordable magnet out there? This project assesses the effect of various types of permanent magnets used in a magnetic linear accelerator on the distance and velocity of the launched projectile. The magnets tested were Neodymium, Samarium-Cobalt, Alnico, and Ferrite. Our hypothesis was that if a Neodymium magnet was used in a magnetic linear accelerator, then the distance and velocity would be greatest. The experimental results supported our hypothesis by showing that Neodymium magnets resulted in the farthest distance traveled and the highest velocity reached. The experiment also showed that magnets comprised of rare-earth elements such as Neodymium and Samarium-Cobalt are far more powerful than regular permanent magnets like Alnico and Ferrite. Rare-earth magnets are stronger because of the arrangement of their electrons. In most materials, all the electrons are in pairs with opposite spins, canceling the magnetic field. In rare-earth magnets, however, many electrons are not paired, resulting in the magnets to be much more powerful.

9 PH 1019

Block, Joy

Arlington Tech and Career Center

The Truth Hertz: The Effect of Different Materials on Sound Reducing Capabilities

The purpose of this experiment was to find out the effect of different materials on their sound reducing capabilities. It was hypothesized that the carpet would reduce sound the most due to its higher density. To test this hypothesis, the procedures involved lining boxes with the different materials, placing a speaker in the box with a decibel reader 1 meter away, and recording the dBs measured from different pitches. In the end, it turned out that overall carpet did the best job reducing sound especially for the higher pitches tested. Though the felt did slightly better with the lowest pitch tested, overall the results supported the hypothesis.

9 PH 1020

Corral, Rebecca

Yorktown High School

The Effect of the Amount of Electricity on the Weight the Electromagnet is Able to Lift

I performed my experiment on the effect of the amount of electricity on the weight the electromagnet is able to lift. Electromagnets are used everyday for industries such as construction, recycling, and mines. Without an efficient way of using electrically powered magnets, recycling companies can have difficulties with their clean up duties. My hypothesis for my experiment was as the amount of electricity inputted into the electromagnet increases, the magnetic pull of the electromagnet will also increase. I built 6 volt battery packs and connected them to a series circuit to regulate the current put into the electromagnet. I turned the series circuit connected to the electromagnet, on and off to measure the amount of weight the it was able to lift. As the amount of electricity increased, the weight lifted by the electromagnet also increased, which supported my hypothesis because as voltage which is related to current increases the magnetic field of the magnet grows stronger. A one way ANOVA was performed on my data. The p-value was 0; therefore, the null hypothesis was rejected and there was a statistically significant difference in the data. On average, the lowest amount of electricity (0 volts) was able to lift 0 grams, whereas the highest amount (18 volts) was able to lift 4.62 grams. In the future I would like to use greater amounts of electricity to power a stronger electromagnet that is able to make a difference in real life.

9 PH 1021

Hsu, Jason

Washington-Lee High School

The Effect of Different Gases on the Microwatts Absorbed from a Laser

The purpose of this experiment was to explore the effect of the type of gas used on the number of µW remaining from a 503.5 µW laser. It was hypothesized that if the gases used in a self-constructed, semi-airtight apparatus changed, then the µW lost from a 503.5 µW laser will be greatest with air, because it had the widest variety of gases. The control, ambient air, was tested without pumping any gas into the chamber. 2 cups of dry ice were placed in the apparatus. Based on the sublimation of dry ice, the vessel, about 381.4 cm^3 in volume, could be filled with 2 cups of dry ice, translating to about 396.4 cm^3 of carbon dioxide. A 503.5 µW laser was aimed down the vessel, landing on a Sper Scientific Laser Power Meter 840001. After recording the initial value on the meter, 10 seconds elapsed before the next value was recorded, this was repeated 9 more times, for a total of 10 trials per gas. The average µW remaining for air, helium, propane, and carbon dioxide were 426.6, 438.4, 427.6, and 414.5 µW, respectively. It was later found that the laser power meter reads at 633 nanometers, since the laser used is 650 nanometers, the numbers had to be multiplied by 0.95 to calculate the final values. The calculated average for air, helium, propane, and carbon dioxide were 447.3, 460.6, 449, and 435.1 µW, respectively.

9 PH 1022

Kusel, David

Yorktown High School

The Effect of the Air to Water Ratio on Projectile Flight Distance

Rocket scientists, physicists, and teachers are always seeking new ways to inspire young kids in science. Stomp rockets and water bottle rockets are widely used for projectile and rocket displays. But, how much fuel (water) will launch the projectile (rocket) the furthest? This project is focused on finding the optimal air to water ratio (independent variable) for maximum flight distance (dependent variable). To control variables, a launch mechanism was created where compressed air was stored in the launcher until a button released it into the rocket. The different amounts of water tested were 0ml (control), 200ml, 400ml, 600ml, and 800m. Up to 600ml or an air to water ratio of 2:3, the results supported the hypothesis that because of Newton's first law of motion, more water will propel the projectile further. It's hoped that this experiment will inform scientists and educators about creating experiments that will get young kids interested in STEM.

10 PH 1023

Bass, Dillon

Yorktown High School

An Exploration of Amateur Astrophotography

The purpose of this experiment was to use a telescope and a camera to take pictures of the night sky. The hypothesis was that with amateur gear, decent pictures could be taken of stars and nebulas and this hypothesis was supported by the results. Using a 5.1 inch aperture telescope and a DSLR camera in Arlington Virginia, pictures were taken of the Orion Nebula which were then processed on a computer. The final result of the project was the development of a process for amateur astrophotography and pictures of the night sky. In the future the process will be perfected, an attempt will be made to visit a darker area and the collection of more concrete data will be done.

10 PH 1024

Sokol, Josh

Yorktown High School

The Study of Acoustical Properties of Tenor Saxophones Mouthpieces on Maximum Volume Output

When playing the saxophone, the mouthpiece is one of the most vital pieces of equipment in regards to sound output. Musicians must choose from a large variety of mouthpieces, each presenting unique specialization depending on musical category. The saxophone mouthpiece is incredibly complex. The most comprehensive research studies available fail to examine all possible variations of mouthpiece design. Knowledge of how each modification of the interior dimensions of the mouthpiece will affect the sound is crucial for saxophonists pursuing their optimal mouthpiece. Maximum volume output plays a pivotal role in a band setting because a mouthpiece with increased volume capability allows the player to project their individual sound above others, an imperative ability for lead players. To collect data, a sound probe recorded the maximum volume output of eight different mouthpieces. Data was gathered at the same distance from the sound probe, in the same room, using the same reed, saxophone and ligature. Drawing on research from experiments that proved mouthpiece tip openings increase maximum volume output and that mouthpiece material has no discernible effect, the remaining variables were examined. The data suggests that higher baffles, smaller chamber sizes, and longer lengths of curve increase the maximum volume output of the mouthpiece. The validity of the data could be enhanced by testing more mouthpieces to further support the findings. Further experimentation could be conducted to isolate the variables tested by 3D printing mouthpieces with one change, for example, a set of identical mouthpieces with contrasting chamber sizes.

10 PH 1025

Toaso, Jr., Nicholas

T.C. Williams High School

Growing on Mars

NASA is trying to colonize in Mars. Obviously, you have to be able to create and maintain a food source. The main goal of the project is to see if pea plants can grow in Mars soil. My project is also trying to see what they should add to grow plants in Mars soil. Now, this isn't 100% accurate because we're not using real mars soil, but a soil made by NASA that they use for experiments. Basically, it's the closest we can get. Also, gravity is different and the weather is different. I am just trying to see if it's even possible.

10 PH 1026

Tojieva, Shokhinabonu

Wakefield High School

We Are Made of Stardust

The Big Bang theory suggests that the Universe was created from a colossal explosion and when the first chemical elements were created, they started to form the first generation stars. In inner cores of stars, they fused into other kinds of elements, eventually leading to an explosion of a star and in cast out of all elements it has ever created. This experiment presents evidence to support the theory that the six most common elements in a human body (Carbon, Hydrogen, Nitrogen, Oxygen, Phosphorus, and Sulfur) could have made a long journey to us from all those ancient stars. Twenty stars, which differ in color and size, were chosen and spectrum, showing their light intensity at a certain wavelength, was created for each one of them. From twenty stars 15% contained Nitrogen, 25% Carbon, 25% Phosphorus, 25% Sulfur, 90% Oxygen, and 40 % Hydrogen. Among the stars collected for this experiment, those elements are in lesser abundance than among people, because they are essential for our lives and all of us must contain them. This evidence supports the theory that humans are made of stardust which opens new perspectives on the evolution of Humans, Stars, and the whole Universe.

11 PH 1027

Klug, Ryan

Wakefield High School

Crash Test Eggies

First, a point on a seatbelt is anywhere where the seatbelt attaches to the car/seat. In my research I found that the first seatbelt was created by American Edward J. Claghorn in 1885 in order to keep tourists safe in taxis in New York City. However seatbelts made great strides when in 1958 Swedish engineer Nils Bohlin invented the three-point seatbelt. Before this most cars only had two point seatbelts, which strapped across the body, with the buckle placed over the abdomen. In today's world the seat belt is one of our best protections in a car crash. I conducted this experiment to learn more about seatbelts and specifically the safety of different types of seatbelts. In order to test this I used eggs to represent humans in my experiment. I built a wooden car and made the seat belts out of pipe cleaners. I sent the car down the ramp and rated the damage of each egg from the crash to see which seatbelt was the safest.

7 PS 1100

Audi, Maya

H-B Woodlawn Secondary Program

What Is the Effect of Packaged versus Fresh Seeds on Plant Growth?

The research question for the experiment was what is the effect of packaged vs. fresh seeds on plants growth. The rationale for this experiment was to see if people really need to buy separate seeds from a fruit or can they buy a fruit and take the seeds out and plant them and then eat the seeds afterwards. The hypothesis was that the packed seeds would work the best because some of the seeds inside of plants, people put things so they won't grow. The student tested her hypothesis by planting the seeds and watching them grow but the hypothesis was not supported because all of the seeds sprouted and fresh pumpkin seeds grew the tallest. The results were that the packaged tomato seeds grew taller then the fresh ones and the fresh pumpkin seeds grew taller than the packaged seeds. The conclusion was that the length of the plant varies on the different fruit seeds you plant.

7 PS 1101

Gerardi, Mara

Williamsburg Middle School

The Effect of pH of Water on the Height of Alliaria petiolata

The purpose of this experiment was to test how the pH of water affected the growth of Alliaria petiolata. The hypothesis stated if Alliaria petiolata is watered with the alkaline solution, then the height will be greater than if they were watered with the acidic solution because the success of the plant, as measured by plant dry weight, has been found to be greater in less acidic soil, and Alliaria petiolata also increases the pH of the soil around it to a higher and or neutral range. The independent variable was the pH of the water and the dependent variable was the height of the plant. Ten Alliaria petiolata plants were separated into two groups of five plants. One group was watered with an acidic solution (pH of 4.0-5.0), while the other group was watered with an alkaline solution (pH of 9.0-10.0). One separate plant, used as the control, was watered with water that had a neutral pH of 7.0. The hypothesis was rejected. The average height of the plants watered with the acidic solution (7.68 cm) had an increase over the plants watered with the alkaline solution (6.64 cm). This experiment can help further the knowledge of the effect of soil components on the growth of invasive species. Future experimentation could involve testing the effect of the acidic solution on the growth of different types of invasive plants. This could be linked to how acid rain impacts the non-native plants.

7 PS 1102

Morse, Allan

Thomas Jefferson Middle School

The Effect of Ethylene on Fruit Ripening

The purpose of this study is to determine how to control the ripening of fruit. The hypothesis is if different amounts and types of fruit are put in bags then the doubles of each fruit would ripen faster. For each different type of fruit, I put one item in one bag, two items in a second bag, and one item a banana in a third bag. Through rough estimates of all data my conclusion is that the more fruit, the faster it ripens. Avocados were the fruit that ripens fastest and the fruit with a banana was the group that ripens fastest. My hypothesis was accepted.

7 PS 1103

Rowley, Travis

Hammond Middle School

Natural versus Man Made: How Chemical and Organic Fertilizers Effect the Growth Rate of Bush Beans

There are two main types of fertilizers chemical and organic. These two fertilizers both have pros and cons such as the chemical fertilizers deliver all of the nutrients at one time, which could lead to a possibility to damaging the roots. But they do have all of the things a plant needs to thrive such as nitrogen, phosphorus, calcium, magnesium, and sulfur. While organic fertilizers do release the nutrients slowly, they have a lot of nitrogen and less to none of some of the other things a plant needs to grow. This experiment will decide which fertilizer is better and will tell people like farmers, or people with a garden which one to use. Also it will help all those who are having trouble choosing which type of fertilizer to use for their plants. If Bush Bean plants are given organic fertilizer, chemical fertilizer, and no fertilizer then the group with the chemical fertilizer will grow the best. Because it has more nutrients then the organic fertilizer.From the data, it is clear that the unfertilized soil came out on top. You may be thinking that both of the fertilizers overwhelmed the plants, this may be the case. But, organic fertilizer (which releases its nutrients slowly preventing over fertilizing) was less than all of the other groups. I think that the chemical and organic will in the long run pass the no fertilizer.

7 PS 1104

Scally, Evelyn

Williamsburg Middle School

The Effect of Salinity on Seaweed Growth

This experiment was conducted to examine a possible impact that climate change will have on marine life. It was hypothesized that if the salinity level is at 55 ppt, then the seaweed growth will stop, because osmosis will distribute too much salt into the plant and it will die. After measuring plant heights every 5 days for 20 days, data was gathered by collecting the mean growth rate of every plant and then every salinity group. The natural ocean salinity level, 35 ppt, had the highest growth rates. The hypothesis was not supported by the data gathered. Possible inconsistent environments and unreliable factors could have affected the results that were gathered. The data shows that if salinity levels experience change by decreasing or increasing, seaweed growth will suffer in response.

7 PS 1105

Stewart, Samantha

Thomas Jefferson Middle School

The Effect of Different Amounts of Coconut Water Given to a Living Plant on How Quickly the Plant Dies

The purpose of this study was to determine if different amounts of coconut water given to a growing plant affect how quickly the plant dies. The independent variable was the amount of coconut water given per day. The experimental group included 15 ml, 30 ml, and 44 ml of coconut water. The control group was 15 ml of regular tap water daily. The dependent variable was the death rate of the plants. Some of the constants were: the age of the plant, the time of day the death rate was measured, the location of the plants, and the materials used to measure the death rate of the plant. The hypothesis was: If a plant is given 30 ml of coconut water a day, then it will take the longest to die. 12 basil plants were gathered and labeled based on trial number and experimental group. Then they were watered for 14 days based on their label. Next, the plants were left without water for ten days. The plants were then measured. After this was done, the starting height was subtracted from the ending height, and the mean was found for each condition, and the data were graphed. The results showed that if 30 ml. of coconut water are given to a plant, then the plant will live the longest. These results supported the hypothesis. In conclusion, the study suggests that coconut water could be used to help plants grow, but has mixed results based on amount and freshness.

7 PS 1106

Greco, Lucy; Vazquez, Sofia

H-B Woodlawn Secondary Program

Testing Plant Growth in Varying Environments

This project, “Testing Plant Growth in Varying Environments,” was chosen to see if radio waves affect plant growth, and if any growth difference could be observed between light and shade. The hypothesis was that the plants in the shade and near the router would not grow as well as the plants in the control group. The router used in testing was emitting 2.4 GHz of radio waves. The experiment’s conclusion was that the plants grown near the router and in the shade did not grow as well as those in the control group. Past experiments have shown that plants may grow as much when located near routers. The hypothesis was tested by growing 12 bean plants for two weeks, three bean seeds in each of four locations, near a WiFi router, in the shade and by a window, and with similar light conditions farther from the router. The experiment’s results showed that the average growth of all of the plants in the shade was much lower than the average growth of plants by the window, and that the average growth of the plants grown near the WiFi router was lower than those grown farther from it. The experiment’s conclusion was that it is unwise to grow plants near WiFi routers, and that forms of air pollution such as radio waves are harmful to the environment.

7 PS 1107

McKinnon Jr., Semaj; Myles, Carsen

Hammond Middle School

Non-Organic versus Organic Fruits

Introduction:

We choose this topic because we often see organic fruits in the grocery store and hear people talking about how organic fruits are healthier. During our research, we began to question which one had the longest life shelf. We learned about the uses of pesticides and waxes on fruits; in addition to, how those things negatively impact the health of some individuals.

Problem Statement: Which will spoil faster, organic fruit or non-organic fruit?

Procedures:

1. Label bowls (OA1, OA2, OA3) (OP1, OP2, OP3) (NA1, NA2, NA3) (NP1, NP2, NP3)
2. Put fruit in bowl
3. Put in fridge (fruits section) (set temp 34°f)
4. Take a picture. Record data (11:30 am/ 5 weeks)

Results:

The organic pears showed the most signs of spoiling than the non-organic pears.

The organic and non-organic apples did not show as much change. Overall, the pears (organic and non-organic) showed more signs of decomposition than the apples (organic and non-organic).

Conclusion:

Based on the results, we saw that the organic fruits spoils faster than the non-organic fruits. The data proved our hypothesis to be correct.

Through research we learned that organic fruits spoils faster than the non-organic fruits because they are not exposed to pesticides, increasing the chances of bacteria growth. Organic fruits are healthier for but non-organic fruits last longer.

8 PS 1108

Brennan, Anam

Kenmore Middle School

Power Plants

My hypothesis for my project named Power Plants is, if I grow a flowering plant, a feather plant, and a reed plant in malathion, a popular suburban pesticide!diluted with water, then the reed plant will filter out the malathion the best. Reed plants will act like a straw and oxygenate the water, breaking down the malathion molecules. The reason I choose my project is because in the agriculture business pesticides are widely used and some farm owners may choose to use them but others may not. For the businesses that use the pesticides on the crops, the chemicals can get caught in the runoff from the rain and travel to other farms in the runoff. Other farms that don't wanna the pesticides on their plants because it could be against their morals or they could negatively affect their plants. So for two weeks I grew three different types of water plants golden club, parrot feather, and horsetail reed in 2 gallon buckets having two groups, group one control plants that grew in tap water and group two independent variable plants that grew in the malathion. Then I recorded the amount of total dissolved solids (TDS) in parts per million in the water the plants grew in both the malathion water mixture and the tap water. My hypothesis was accepted and the horsetail reed plant did filter out the malathion and it brought down the total amount of TDS in the water from 569 ppm to 284 ppm.

8 PS 1109

Brodsky, Julia

H-B Woodlawn Secondary Program

Duckweed: A Revolutionary Wastewater Treatment System

Water pollution is a major issue facing Earth, and this experiment tackles one large part of water pollution- nutrient pollution. Most nutrient pollution comes from nutrient runoff from agricultural sites, but some of it even comes from the backyards of people who aren't involved in any agriculture, through "harmless" fertilizers. Water pollution is causing toxic algae to grow in water, releasing toxins into the water which harms animals, including humans.

My research question for this experiment is "Which type of duckweed can most efficiently remove specific nutrients from wastewater?" My hypothesis was that Lemna would remove nutrients the fastest. I hypothesized that because Lemna is the most commonly found and most hardy duckweed, and can thrive in difficult conditions like extreme nutrient pollution. My hypothesis was proven correct by the experiment. Lemna Minor was better at removing the nutrients from the water than the other types that I tested, which were Spirodela and Wolffia. I tested my hypothesis using three different water test kits (correlated to the nutrients I tested) from the company API. My conclusion is that Lemna Minor duckweed is a great way to clean polluted water, because it is cheap and easy to use, while also working efficiently. It also uses no chemicals, which can be harmful to humans, and duckweed is free to find and plentiful when growing. It can be grown on any continent except Antarctica, and is a very beneficial plant, even though not everyone looks past it's disguise as an ordinary plant.

8 PS 1110

Fanning, Lily

Jefferson-Houston School

The Effects of Pharmaceuticals on Plant Growth

The plant and agriculture industry is constantly changing. Scientists have been testing for years what kind of medicines work best when trying to get plants to grow the tallest and that is what I have done too. My project was testing the effects of pharmaceuticals on plants. I used children's ibuprofen, Benadryl, and aspirin dissolved in water to see what would happen to my plants. My hypothesis was that the aspirin would work the best because that is what my sources said and based off of personal experience using Aspirin to keep plants alive, it made the most sense. Before I added the medicine to the plants, I had to germinate my radish seeds on a wet paper towel for 7 days so I could put them into the planters. I dissolved my medicine in ¼ cup of water and poured them on the plants. I measured my plants for 8 days. My hypothesis was completely rejected. The Benadryl did the best by not only growing taller, but it was the only one that didn't start growing mold. Aspirin on the other hand didn't grow and had so much mold, you couldn't see the plant.

8 PS 1111

Goeke, Madi

Swanson Middle School

Medicated Radishes

How does the runoff of aspirin into our water supply impact the environment?

The experiment, “Medicated Radishes,” investigates the effect of aspirin on the root length and plant height of radishes. The hypothesis was that no aspirin, the control, would result in the greatest plant height and root length because the plants’ molecular structure would not be affected as it would with aspirin exposure. To conduct the experiment, fifty seeds were placed in fifty pots of potting soil. Five jars were filled with water containing zero, two, four, six, and eight crushed aspirin tablets per gallon. The trays were placed under grow lights and measured after four weeks of watering every other day. The hypothesis was not supported by the data. The zero tablets caused the most growth height wise, with an average growth of 12.71 centimeters. The eight tablets gallon showed the worst height results with an average 10.84 centimeters. Based on this data, more aspirin resulted in shorter plants. However, eight tablets per gallon performed the best root wise, with an average growth of 7.57 centimeters. The control radishes demonstrated the worst root results with a mean of 6.42 centimeters. This data concluded that more aspirin resulted in longer roots. Further research supported this finding. Aspirin contains an active ingredient called acetylsalicylic acid, derived from salicylic acid. Plants produce minute amounts of salicylic acid when stressed, helping them cope. In conclusion, aspirin helps boost plant immune systems, just as it does for humans.

8 PS 1112

Gookin, Eleanor

Thomas Jefferson Middle School

The Effect of Mycorrhizal Fungi on the Pigmentation, Height, and Amount of Water in the Leaves of the Oregon Snow Pea

The purpose of this study was to find out how mycorrhizal fungi affected plant growth. The independent variable was the amount of mycorrhizal fungi present in soil. The experimental group included the plants with mycorrhizal fungi present in the soil. The control group was the plants without mycorrhizal fungi. The dependent variables were the pigmentation, height, and amount of water in the leaves of the plants. The constants included: the plant type, soil type, soil amount, equipment used, temperature of the room, and the amount of water and sunlight given to the plants. The hypothesis was: If plants are planted with mycorrhizal fungi present in the soil, then they will grow higher, have a higher pigmentation, and have a larger amount of water present in their leaves than plants without mycorrhizal fungi present. This study was important because if mycorrhizal relationships help plants produce more food, then more food can be spread to areas where starvation is a problem. Snow peas were planted with and without mycorrhizal fungi present. After 24 days of growth, the height, pigmentation, and amount of water in the plant leaves were measured. The results showed that mycorrhizal fungi appeared to have no effect on the height, pigmentation, and amount of water in the leaves of snow peas. These results rejected the hypothesis. In conclusion, the study suggested that mycorrhizal fungi appeared to have no effect on the pigmentation, height, and amount of water in the leaves of the Oregon snow pea.

8 PS 1113

Islam, Nabiha

Thomas Jefferson Middle School

The Effect of Volatile Organic Compounds Commonly Found in Urban Areas on the Health of Mexican Marigolds

The purpose of this study was to investigate the effects of different types of volatile chemicals (VOCs) that are commonly found in urban areas on the health of Mexican Marigolds (Tagetes erecta). The hypothesis was: If Mexican Marigolds were exposed to the gasoline and glass cleaner fumes, then their growth will be stunted. The independent variables were the different types of volatile chemical sources: glass cleaner, gasoline, bananas. The dependent variables were the height and color of the marigolds in each group. The control group was made up of Marigolds receiving no specific volatile chemical sources. The constants were: the amount of potting mix, water, temperature, light, chemical exposure, and the type of water bottles. In the experiment the marigolds were germinated on a wet paper towel in a plastic bag, and were then transplanted into their own water bottle. The marigolds were exposed to the VOCs by cotton balls glued to the underside of each cap, which contained their designated scents in a liquid form. The marigolds received carbon dioxide for a twelve hour period after every week, and the scents were renewed afterwards. The results showed that the VOCs that are harmful to humans caused the plants to undergo negative changes and eventually die. These results support the hypothesis because the Mexican Marigolds that were exposed to the gasoline, and glass cleaner fumes experienced the least amount of growth. Overall, the study suggests that VOCs which are detrimental for humans are also harmful for the environment.

8 PS 1114

Lindsay, Naomi

Gunston Middle School

The Effect of Organic Fertilizer Combinations On Plant Growth

Ever since the evolution of the Haber-Bosch process, farmers and other agricultural managers have been using chemical fertilizers to boost the production of their crops. Although chemical fertilizers provide many benefits to the agricultural industry, they have a detrimental effect on the natural environment. Soil erosion, water pollution and the endangerment of sea life are among the several negative effects chemical fertilizers have on the environment. To help reduce the expansive use of chemical fertilizers, this project aims to create a homemade, organic fertilizer that is effective, environmentally-friendly, inexpensive and easy to reproduce. To do this, four different organic fertilizer combinations were created using three essential ingredients; potatoes, sunflower seeds and vegetable waste (the three macronutrients that plants lack the most; potassium, phosphorus and nitrogen). These four levels of organic fertilizer combinations were Water + Potato + Salt, Water + Potato + Salt + Baking Soda, Water + Potato + Salt + Baking Soda + Vegetable Waste and Water + Potato + Salt + Baking Soda + Vegetable Waste + Sunflower Seeds. During the experiment, the four organic fertilizer combinations were tested against the control, water, to determine which organic fertilizer combination had the greatest effect on plant growth. During the experiment, twenty out of the twenty five red peas plants used were given an organic fertilizer combination (excluding the control). The results did not support the hypothesis as it showed that the fertilizer combination with only two of the macronutrients had the greatest effect on plant growth.

8 PS 1115

Portner, Benjamin

Williamsburg Middle School

The Effect of Potash on the Release of CO2 from Decomposing Plants

Fertilizer runoff is a major environmental problem, as it results in large unwanted algae blooms, which can then lead to dangerous areas of hypoxia, or low oxygen. The release of CO2 is also a important problem, as it is one of the most common greenhouse gases. This study aims to link these two problems by testing whether potash, a common potassium based fertilizer, affects the release of carbon dioxide from decomposing plants. In order to conduct this experiment, Southern Naiad, a common water weed, was acquired and placed into test tubes with varying amounts of potash. A CO2 test kit was used to test the amount of CO2 in the water after 15 days, and a trend was shown. The results supported the hypothesis that, as the amount of potash in the water increased, the amount of released CO2 would increase as well. It was theorized that this was due to a growth of bacteria in the water, which would lead to a faster decomposition. A considerable amount of growth was also noticed in the water, most likely from bacteria, algae, or other plant material, and this prevented CO2 from being measured beyond 15 days, as was originally planned. A small side experiment was also conducted in order to study whether the potash directly affected either the CO2 measurements; it was shown that this did not occur. Overall, this experiment successfully found that the amount of potash fertilizer does affect the level of CO2.

8 PS 1116

Stoller, Gillian

Swanson Middle School

The Effect of Radiation on Plant Growth

The purpose of our experiment was to find the effect of microwave radiation on plant growth. We hypothesized that if the plant seed was exposed to radiation, then its growth would be stunted because of the negative effects radiation has been shown to have on living things. We chose this experiment because of how commonly used microwaves are. Given the popularity, we thought that it would be interesting to observe the negative effects microwave radiation can have on living things. Going over the results of our experiment, we concluded that our hypothesis was mostly correct. The radiated seeds had significantly less growth, except for the 10 second group. The 10 second group performed very well, even surpassing the growth of the control group. We believe that this was due to beneficial mutations that could've occurred during the radiation. However, excluding the results of the 10 second group, we think that the radiated seeds had such poor growth because of negative mutations that damaged the seeds during the radiation.

8 PS 1117

Terefe, Efrata

Thomas Jefferson Middle School

The Effect of Types of Soap on Plant Growth of Sunflowers (Helianthus annuus) Seeds

The purpose of this study was to determine if different types of soap affect how well a plant grows. The independent variable was different types of soap (toothpaste, detergent, dish soap, shampoo, hand soap). The control group is seeds watered with tap water. The dependent variable was the number of sunflower seeds that sprout after two weeks. The constants are the type of cups used, type of soil, amount of water, the amount of soap used, and room temperature. The hypothesis was: If sunflowers are watered with water mixed with toothpaste, then they will not germinate. Three cups with three sunflower seeds in there were watered with 20 mL of dirty water with toothpaste mixed in, then three more cups were watered with 20 mL of dirty water with detergent mixed in, then three more cups were watered with 20 mL of dirty water with dish soap mixed in; three more cups were watered with 20 mL of dirty water with shampoo mixed in; three more cups were watered with 20 mL of dirty water with hand soap mixed in and finally, three cups were watered with 20 mL of tap water, by using a graduated cylinder for measurement. Results suggested that the plants that were not watered with soap germinate. These results supported the hypothesis. In conclusion, the study suggests that feeding plants with soap mixed with water didn't have an effect on germination.

8 PS 1118

Watson, Ivy

Kenmore Middle School

The Effect of Produce Wash on Mold Prevention

The purpose of this experiment was to determine the most effective method to prevent mold growth on strawberries. The hypothesis stated that if the strawberries soaked in distilled water, then they will have less mold growth than the other groups. Four methods of fruit wash were used on the strawberries: distilled water, tap water, a mixture of vinegar an tap water, and an organic produce wash. Results were compared to unwashed strawberries. The strawberries were checked for mold growth twice daily, and those exhibiting growth were removed from the experiment. At the end of three weeks, the strawberries were counted to determine the effectiveness of the liquids. In conclusion, the vinegar solution was most effective in preventing mold growth on the strawberries. However, over the course of the experiment, the strawberries degraded into a less rigid state, lacking its natural firmness.

8 PS 1119

Kral, Max; Gabbay, Ned

H-B Woodlawn Secondary Program

Eat Your Vegetables, Just Don't Cook Them First!

The purpose of this experiment was to study the effect of heat (Independent Variable) on Vitamin C in fruits and vegetables (Dependent Variable). In addition, the hypothesis was that it would take fewer drops of the iodine solution (made with iodine, water, and cornstarch) to eliminate the Vitamin C in all of the heated trials. Some major findings were that the number of drops of iodine solution used in raw (unheated) broccoli and grapefruit trials were similar as were those in the heated broccoli and grapefruit trials. Further, the experiment indicated that it took less iodine drops to eliminate the Vitamin C in the heated trials than the raw trials thus representing that the data supported the hypothesis. Another major finding that supported the hypothesis was that the heated orange, lemon, and carrot trials nearly only took half the number of the drops of iodine solution as the raw trials. The results from this experiment can benefit the health of people. It can tell people that it is better to consume raw (unheated) fruits and vegetables than heated fruits and vegetables for maximum Vitamin C intake.

8 PS 1120

Schumann, Lydia; Wetmore, Celeste

Swanson Middle School

To Grow or Not to Grow: The Effect of Greywater on Plant Growth

The purpose of our project was to see if greywater can be reused successfully to water plants. We chose this experiment because water is a finite resource, and water conservation can help the 780 million people that do not have access to clean water and should reuse what they have. Greywater is the leftover water from domestic activity, such as washing hands or taking a shower. In our study, we wondered whether greywater may be reused for watering plants just as efficiently as tap water. We tested this by making 3 groups containing 10 plants each and giving those groups either shower greywater, dishwashing greywater, or tap water. Our initial hypothesis was that the plants watered with dishes greywater would be the tallest because greywater is shown to provide more nutrients for the soil, but the oils from the shower greywater would lead to hydrophobic soil, stunting plant growth. As we measured the height of these bean plants consistently, we found that all plants had similar growths, and therefore any type of water could be used effectively. Greywater from the shower turned out to be the the group with the tallest average height, with greywater from dishwashing having the lowest average height, but not by much. We think this was due to one outlier that never germinated, a normal bad seed. While the results didn't support our hypothesis, this is still beneficial information, helping people save money and provide food for low income families.

9 PS 1121

Bream, Taylor

Yorktown High School

The Effect of the Amount of Irradiation on the Germination and Root Length of Radish Plants

The purpose of this experiment was to see the effects of irradiation on germination and root length of radish seeds. The hypothesis was that seeds exposed to 500 mrad will germinate the fastest and have the highest root length. Pre-irradiated seeds exposed to no irradiation (control), 50 mrad, 150 mrad and 500 mrad were purchased online. CD cases were lined with paper towels, five seeds from each level were placed in each CD case, placed upright in front of a window, and watered by moistening the paper towel. The average root length from the longest to the shortest was, 150 mrad, no irradiation, 50 mrad, and 500 mrad. Seeds with no irradiation germinated first while seeds with 500 mrad germinated last. The germination rate was 40% for seeds with 500 mrad, and 100% for all other levels. The results were statistically significant ($p=0$). The hypothesis was rejected. The 500 mrad group was statistically significant ($p<0.05$) when compared with all other levels. This experiment showed (1) that irradiation affects the growth of radish seeds, and (2) that large amounts of irradiation can affect the plant negatively. This experiment can be improved by using a measured volume of water to provide all seeds the same amount of water, and by placing one seed in each CD case to give seeds the same amount of sunlight. Future experiments could test more seeds in each level, higher levels of irradiation, different types of irradiation, and different types of seeds.

9 PS 1122

Hall, Atiya

Yorktown High School

The Effect of Number on Seeds on Plant Height

Radish seeds take three to four days to germinate, but can take as many as ten days. Radishes are ready for harvest in four weeks (average 2-4 weeks). Crowding is large amounts of groups gathered closely together. Plants have a natural defense mechanism called allelopathy that is designed to prevent overcrowding and protect them from its consequences. Overcrowding can decrease the amount of nutrients of plants that can absorb from the soil, causing developmental problems in all of the plants. Overcrowding can also allow taller plants to block sunlight from smaller plants, preventing photosynthesis and essentially starving the plants.

9 PS 1123

Hicks, Hunter

George Mason High School

The Effect of Caffeine on Plant Growth

In this experiment, the effect of caffeine on the growth of bean plants, Triomphe de Farcy, was measured to find out whether caffeine was an effective fertilizer for plants. There was one level of plants with no caffeine, the constant, and then one group with 100 mg of caffeine, one with 200 mg of caffeine, one with 300 mg of caffeine, and one with 400 mg of caffeine. Each plant received 100 ml of water daily and 100 watts of light 24 hours a day. The growth of the Triomphe de Farcy was determined by their height after 20 days. This resulted in a consistent pattern of less caffeine resulting in more plant growth. The 100 ml of caffeine provided the most growth, although this was likely just a fluke. Since the dosage was so small, it would not have affected germination. After 100 ml of caffeine, the plant growth decreased every level after. The reason for this is the allelopathic effects caffeine has on plants. The biochemicals of caffeine attack the growth systems of Triomphe de Farcy, inhibiting the germination. The final results came out with the constant group averaging 12.333cm of growth, the 100 ml of caffeine averaging 14.166cm, the 200 ml of caffeine averaging of 8.5cm, the 300 ml of caffeine averaging 1.333cm, and the 400 ml of caffeine averaging 0cm. Based on these results, caffeine is detrimental to plant germination and an ineffective fertilizer.

9 PS 1124

Voigt, Will

Yorktown High School

The Effects of Martian Soil Elements on the Growth of Plants

My experiment could be crucial to minimizing how much soil we have to take to Mars, so we can bring more items valuable to scientific progression on the trip. I believed If the martian elements of the soil are correctly controlled, they will be more efficient than the normal soil from earth because they will act as natural fertilizers to boost growth. In my experiment, I added the different Martian elements into and regular soil that had nothing added. I then put in one radish seed per container (with 350ml of soil) and let them grow for a month and a half. I also measured every plant and watered every plant every other day with 15 ml of fresh water throughout the growing period. My data showed not too much fluctuation in the range and that my data was statistically significant. Last my model showed that in the potassium samples it was zero since potassium tended to kill the plants. Finally, the experiment was a success, and the information gained could be extremely beneficial to extending the research on growing plants on Martian soil. Almost all tested elements performed better than the Control group. There was one exception which was Potassium but, the group with all of the elements succeeded on both levels which show promise for the Martian soil and using Potassium in a group. In conclusion, I conclude that these elements of the Martian soil will act as a natural fertilizer and plant growth is efficient and feasible.

9 PS 1125

Alvarado, Vivian; Franco, Jhandira

Wakefield High School

The Effect of Electricity on the Growth of Plants

The project's main focus was to see if electricity can affect the growth of cress plants. Many scientists have done experiments with electricity and plants, also known as electroculture, and the results have been mixed, with either very high or very low success rates. Findings relating to electroculture have seen that grass when hit with lightning during a thunderstorm have grown better than plants without the shock. In this experiment, plants were connected the batteries using copper rods. Each plant would then be exposed to 9V of electricity for a certain amount of time (30 seconds, 1 minute, 2 minutes, and 4 minutes) with one plant left to not be shocked (control). Both variables were done with two plants for each (2 controls, 2 with 30 seconds, etc.). This experiment occurred over a 2 week period, which the plants being connected once every day for their assigned amount of time. Results varied, mirroring the ones of multiple scientists who have also done experiments in this field. The middle measurements, such as the plants with 2 minutes and plants with 30 seconds, were the ones that thrived the most. With this information, we concluded that there may be a happy medium to the amount of electricity given to the plants.

10 PS 1126

Portner, Noah

Washington-Lee High School

The Effect on Sunlight on Mycorrhizae Network Quantity in Soil and Growth in Plants

The purpose of this research was to determine whether mycorrhizae (microscopic symbiotic fungi) influence the growth of plants through their mycelium network, and whether plant health affects mycorrhizae. Previous research has suggested that mycelium networks transfer nutrients between plants, and an experiment was conducted to determine whether this would occur among group of bean plants.

Two hypothesis were tested. The first hypothesis that in shade conditions plants growing with mycorrhizae will grow better than plants growing without mycorrhizae, while unshaded plants that share the same mycelium network would do worse. The second hypothesis was as the amount of shade is increased, then the amount of fungus on shaded plants would decrease, while fungus on other plants would remain unaffected. To quantify results, two independent variables were used: percent shade (0%, 33%, 66%, 100%) was used to affect the health of plants, and presence/absence of added mycorrhizae was used to see how fungi affected plant health. The amount of fungi on plant roots was also measured.

Both hypotheses were supported. The data indicated that adding mycorrhizae may help weaker plants while simultaneously harming adjacent healthy plants (by transferring nutrients to the weaker plants). It was also seen that the underground mycelium network was only adversely affected when the plant nearest them was subject to shade. This suggests while adjacent plants were harmed by fungal linkage to dying plants, the fungi itself was not harmed.

10 PS 1127

Yokitis, Grace

T.C. Williams High School

Reap What You Sow: Impact of Organic Fertilizer versus Synthetic Fertilizer on Tomato Plants

This project explored whether organic or synthetic fertilizer yielded the most growth in tomato plants. To evaluate this, tomato plants from two specific fertilizers from the two fertilizer categories were grown and their heights averaged, then measured against one another to see the highest average. In the end, it was concluded that synthetic fertilizers spurred plants to grow more than plants grown with organic fertilizer. The hypothesis was proven right in that chemical fertilizer would result in higher growth, and that on average, using synthetic fertilizer provides substantially more growth than organic fertilizers. This is possibly because synthetic fertilizers were directly made to spur plant growth, while organic fertilizers were made from natural ingredients that are not as effective.

11 PS 1128

Keough, Savannah

T.C. Williams High School

Hydroponic Gardening: A Solution to Limited Produce Production in Urban Environments

To feed the growing population, alternative food production methods for urban environments are needed to augment traditional agriculture. Two hydroponic systems were constructed, one horizontal and one vertical, with dimensions of a 43'' x 19" x 6' area on the floor or wall, to determine which system could grow lettuce and kale plants with more height, mass, crispness, and a brighter color. The horizontal system was constructed by cutting styrofoam to fit 40 net cups and allow the plants to float on water. The vertical system was constructed by cutting drainage pipes with 40 holes to fit the plants at an angle where, the water would flow onto the roots using a pump. After building, the plants were seeded for two weeks and added to the systems for six weeks. Through week five, the horizontal plants were healthier because they could regulate their water flow while the vertical plants drowned due to the constant flow of water. However, by week six, the plants in both systems had become dry, withered, limp, and drained of color. While the vertical plants were already dead, the horizontal plants died because they were fed too many nutrients. As a result, the hypothesis was rejected because the vertical system did not grow better lettuce and kale than the horizontal system. The next steps are to grow new plants, such as microgreens, to test a different type of plant in the systems, and test the improved vertical system with dry periods.