



NORTHERN VIRGINIA REGIONAL SCIENCE AND ENGINEERING FAIR

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March 2, 2024

Lerch, Maxwell

Thomas Jefferson Middle School

What Are the Preferred Treats of My Bearded Dragon Lizard?

This experiment was conducted to find out the effect of treat selection on my lizard's behavior. I wondered what my bearded dragon's favorite treat is: banana, superworm, blueberry, or hornworm. I hypothesized that the hornworm would be his favorite because it has more vibrant colors and is very eye-catching. For the experiment, treat trials were conducted by offering two of four treats by hand on different days and comparing each of the treats with the others. The treat that the lizard preferred in each trial was recorded. My results were as follows: banana was never selected, blueberry only was selected against banana, superworm was selected twice, and hornworm was selected three times. My hypothesis was proven: the hornworm was the bearded dragon's favorite treat.

Kang, Aidan

Thomas Jefferson Middle School

The Effect of Different Soil Factors Under High and Low Temperature Settings on Earthworm-Induced Soil Carbon Dioxide Emissions.

This experiment was conducted to draw connections between earthworm induced soil emissions, environmental factors, and temperature. More specifically, this experiment tested how different soil factors under two separate temperature settings influenced earthworm induced soil emissions. Knowing that earthworms can instigate increased emissions from soil, from a study conducted in 2013, understanding how soil factors influence this is key to expanding our knowledge of mitigating global warming. This experiment was conducted with two separate condition sets: high temperature and low temperature. Each set had three containers. One with fertilizer, high moisture, and a control. With each container containing four earthworms the initial carbon dioxide (CO₂) level was measured in parts per million (ppm). After the initial ppm recording, 1.5 ml water was given to each container daily except the high moisture containers which were given 5.0 ml. Then after 72 hours the final readings were collected. The independent variable was the soil factor and the dependent variable was the amount of CO₂ released after 72 hours measured in ppm. The constants in this experiment were the soil type, earthworm type, number of earthworms per container, time tested for each factor, and the type and size of the containers. The experiment aimed to simulate high and low temperature settings with different soil factors. With it already being known that earthworms increase soil CO₂ emissions, the researcher wondered how human induced or natural factors impacted that. The results can further our understanding of the relationship between environmental conditions and global warming.

8AS103

Knauer, Nate

Gunston Middle School

Does Bird Seed Quality Matter? An Experiment to See if Birds Prefer Premium Bird Seed over Less Expensive Economy Mix

8AS104

Weber, Ryan

Francis C. Hammond Middle School

8AS105

Awotwi, Lysette; Andrade, Vanessa; Muñoz, Mia

Thomas Jefferson Middle School

Cracking the pH Code: Exploring the Effect on Brine Shrimp Hatching

This project was conducted because the researchers wanted to learn more about ocean acidification and its effects on marine life. If you decrease the pH of water, then fewer

Check, Ava

Yorktown High School

The Effect of pH on Planarian Regeneration

The effect of pH on the planaria's ability to regenerate was tested. This experiment was chosen because the pH of the world's oceans is rising due to increasing carbon dioxide levels. Since Planaria are aquatic organisms and rely on regeneration for survival, the experiment was chosen to see how the rising pH of the ocean would affect their regeneration. In addition, the human liver regenerates with stem cells, similar to planaria. Because it is dangerous to experiment on the human liver without causing harm, planaria can be used as a substitute to research stem cell regeneration. It was hypothesized that if the pH of the water is below 4 or above 10, then the planaria will not regenerate. 3 planaria each were placed in 7 250 mL plastic containers filled with solution with pHs of 2, 4, 6, 7, 8, 10, and 12. After a week it was observed whether or not the planaria regenerated. In pHs 2, 4, 10, and 12, none of the planaria regenerated. In pHs 6, 7, and 8, all 3 planaria regenerated. The results did not support the hypothesis. The planaria could not regenerate at pHs 2, 4, 10, and 12 because planarians get their regenerative abilities from stem cells called neoblasts, which contain the enzyme SMEDWI-2, which replaces cells. When the pH of enzymes becomes too high or low, they will denature and no longer function. SMEDWI-2 seemed to denature at pHs 2, 4, 10, and 12, stopping the planaria from regenerating.

Turner, Olivia

H-B Woodlawn Secondary Program

Can Humans Taste the Difference Between a Hersheys Bar and Homemade Chocolate?

My project is about if humans can taste the difference between a Hersheys bar or homemade chocolate bar. The hypothesis for this experiment was that humans would be able to taste the difference and my hypothesis was correct. I had a sample of 49 and only 8 of that sample could not taste the difference. In conclusion my hypothesis was correct that humans would be able to taste the difference between the two chocolates



9BE202

Schildknecht, Ingrid

Alexandria City High School (includes Minnie Howard)

Taste the Rainbow

My science fair project tested whether or not people could tell the different Skittles



Marcy, Ava; Powers, Olivia

Alexandria City High School (includes Minnie Howard)

The Effect of Music Genre on Test Taking

The human brain is an intricate system that is stimulated in many different ways, one of the most prominent stimulants being music. For that reason, we aimed to test how different genres affect testing scores. The question that was asked for the procedure is "Does music genre affect testing Accuracy?". The four factors tested in the experiment were pop music, classical music, heavy metal music, and no music (control). The results found that students that listened to classical music had the highest scores. This follows our hypothesis that stated, "If classical music is played for students taking a test, they will have the fastest results". This project is a continuation, following last year's experiment which tested music genres on testing speed. Data from last year showed that pop music produced the fastest results. By comparing the results from both experiments, one can conclude that students test faster when listening to music they are comfortable with (pop) and apply more focus when listening to music that stimulates their reasoning skills (classical). With this knowledge, future education programs are able to alter learning and testing environments to specific students' needs.



Kelley, McKenzie

Swanson Middle School

The Effect of Kiwi Slice Thickness on Mass Lost Through Dehydration

My project is “The Effect of Kiwi Slice Thickness on Mass Lost Through Dehydration.” I hypothesized that, “If the thickness of kiwi slices is less, then the percentage of mass lost will be more.” The independent variable was the thickness of kiwi slices and the dependent variable was the percentage of mass lost in the kiwi slices. I tested this hypothesis by cutting 6 six millimeter slices of kiwi and 6 ten millimeter slices of kiwi, measuring the mass of each slice before dehydration, dehydrating the kiwi slices for seven hours at 135°F, and measuring the mass of each kiwi slice after dehydration. I found that the six millimeter sliced kiwis lost a higher percentage of mass than the ten

Erwin, Margaret

Dorothy Hamm Middle School

The Effect of Digestion on the Concentration of Glucose in Common Drinks

Many things that we consume contain glucose, a type of sugar, the amount of which is shown on the nutrition label when these products are packaged and sold. Glucose provides immediate energy to our bodies. Foods often also contain complex carbohydrates, which are slowly broken down into glucose when digested. This project shows the amount of glucose before and after being digested in water, milk, a store-bought smoothie, a homemade smoothie, a protein shake, chocolate almond milk, and orange soda. The hypothesis is that if a drink contains complex carbohydrates, then the amount of glucose in the drink will increase after being digested. Digestion was

Siddiqi, Husna

Francis C. Hammond Middle School

Flowy Slime

Slime is fun to play with and I have loved to make slime for years now with my siblings. It can be a great stress reliever, and can provide guidance for many learning chemicals. Slime flows like a liquid, but unlike other liquids, its viscosity is not constant but its viscosity changes depending on what's applied on to it. Viscosity is when you measure a liquid's resistance on how fast or slow it flows. There are many ways that slime can be created with and in this case, different kinds of glues. I will test 3 different Elmer's glues and do 3 trials on each glues and test which one of the slimes has the highest viscosity.

Rahim, Inaya

Washington-Liberty High School

The Effect of Different Kinds of Sugar on Yeast Growth

This experiment was conducted to find out which kind of sugar affects the growth of yeast and to see if the faster or slower effect of each sugar on yeast growth. The hypothesis stated that if a certain kind of sugar is added to a yeast solution, the yeast will grow faster or slower than the control.

Eclarinal, Elise; Madigan, Michael

Wakefield High School

How Smell Affects Taste

Smell and taste are two vital senses the body utilizes. Flavor is commonly described as the "taste" of food, when in reality, is much more. Though smell and taste are two different senses, the connection between the mouth and nose holds relevance over the experiment. While taste buds in the tongue identify taste and the nerves in the nose identify smell, both sensations are communicated to the brain, hence the ability to recognize and differentiate flavors.

Pearson, Amelia

Atewologun, Corsen

Thomas Jefferson Middle School

Does Your Food Lie?

I will find out if different chip brands lie about their amount of calories in their chips. This is interesting to test because I want to find a healthier version of chips. The hypothesis that I created was that the chip brands with the lower ratings on Yuka will have a bigger

Nyambayar, Saruul

Swanson Middle School

The Effect of Soil on Water pH

My Hypothesis: If I change the type of soil, then the pH of the water will likely be different. The purpose of this experiment is to see if soil can play a role in changing water pH and whether or not it's important or not. Soil is a mixture of organic and inorganic materials.

The type and composition of material affect texture, color, and other characteristics. I used three soil types: loam, silt, and clay. The type of soil affects plant growth, lifespan, and health. Many plants need acidic soils, and others need alkaline soils. For instance, strawberries need acidic soil, while lavender needs alkaline soil. In my procedure, I used a soil and water pH meter to measure the samples before and after mixing. I used test tubes to hold the mixture, a coffee filter to separate the soil and water, and a pH strip to find the results. The results show that loamy soil results in the highest pH with an average of 6, and silty soil makes the water the most acidic with an average of 4.8. In conclusion, according to the results, the effect of soil does change the pH of water because not only does soil play a role, but also the type of soil can play an effect too.

Piester, Daniel

Gunston Middle School

The Effect of Baking Soda versus

Ramboz, Gavin

Kenmore Middle School

Froze and Cons: The Effects of Viscosity and Sugar on the Freezing Time of Liquids

I was interested in exploring whether the type of liquid affected how fast it freezes. Based on my research, viscosity and sugar were two big factors in the amount of time it takes liquids to freeze. The goal of the science project was to find out how much viscosity and sugar affected the freezing time of liquids. To start, I researched how they affect the freezing process, and found that viscosity decreases the freezing time and sugar increases freezing time. I chose 5 liquids that have different viscosity and sugar contents: Diet Coke, Coke, Apple Juice, Orange Juice, and Milk. I included Water as a control liquid. I put the same amount of each liquid in different cups in the freezer at the same time, and checked them periodically until they were all frozen. I hypothesized that Orange Juice would freeze first and Coke would freeze last. The results followed the predicted order of viscosity and sugar content except for Water and Apple Juice. I concluded that sugar had a greater effect on freezing time than viscosity.

7CH407

Choi, Olivia; Carney, Abigail

Dorothy Hamm Middle School

Pineda Sarmiento, Andre; Bartels, William (Fin); Raver, James

Francis C. Hammond Middle School

Pliability of Wet Wood

Have you ever wondered what wood would hold best against rain-like conditions? Us too! We wanted to find out so we can help you and the community. So we did some research and found some of the best types of wood. So we gathered pine, cedar, and oak wood. After buying the wood we soaked 3 slabs of each wood in water for 5 days. Then we applied 200 pounds worth of weight to each piece of wood to see the amount the wood bent. Then the piece that bent the least is suspected to be the most weather-proof type.

Hazlett, Amelia

George Washington Middle School

Don't Dry ThiD36 f () Tj at Home

The athletic-wear industry is a rapidly growing market and the options for exercise

8CH410

McCaughan, Benjamin

Gunston Middle School

Netto, Sofia

Gunston Middle School

The Effect of Natural Resources in Water pH Levels

About 2 billion people don't have access to safe drinkable water. Water and Climate Change are connected; higher water temperatures and frequent floods and droughts exacerbate water pollution. Drinkable water has neutral pH 7, and reflects drinkable water quality. Commercial water filters can be relatively expensive, based on factors such as brand, features, and filtration capacity. So homemade water filters could be an alternative using available materials, specially for places with limited financial resources. This experiment aimed to determine if homemade filters could be effective as commercial water filter in achieving good water quality, by neutral pH value, and absence of visible impurities and odor, being an sustainable alternative to commercial filters. Three types of homemade filters were constructed: sand and rock (filter 1), gravel and activated charcoal (filter 2), and cloth and cotton balls (filter 3). Results indicate that water filtered by homemade filters 1 and 3 exhibited a pH value of 8.0, closer to the commercial filters pH value of 7.5, comparable water quality. Waters from filters 1 and 3 were clearer, suggesting more effective filtration. In contrast, water from homemade filter 2 demonstrated a higher pH value of 9.0, indicating alkalinity. The effectiveness of homemade filters 1 and 3 in achieving water quality similar to commercial filters shows their potential for use in regions with limited resources. The study also shows that homemade filters using recyclable resource could an environmental sustainability and affordable solution for obtaining drinkable water purification challenges exacerbated by climate change.



Pamulapati, Reve

Dorothy Hamm Middle School

The Effect of Different Types of Solutes on the Boiling Rate of Water Using Radiative and Conductive Heating Methods

Saperstein, Margaret

Swanson Middle School

The Effect of Salinity on Capillary Action

Plants use capillary action for their vital functions. Though with climate some plants will be exposed to water with differing levels of salinity. For my project I chose to study the effect salinity would have on the function of capillary action. To test this I used glass capillaries and water with various salinity levels. I found that salinity disrupts capillary action because my data showed an inverse relationship between salinity and how far the solution rises from the surface in the capillaries. A possible explanation is that the cohesion between water and water and the adhesion between glass and water got disrupted by higher levels of salinity.

Beaulieu, Gabriela; Busigo, Marlana

Gunston Middle School

The Effect of the Way You Make Chocolate on the Speed of the Process

This project is a great way to learn how people made chocolate back when it was done all naturally versus the way it's made today which is using technology. The goal of the scientists' project was to find out the most efficient way and the amount of speed it took to make chocolate from scratch. The scientists decided to figure this out by making chocolate in the most used processes, which are the traditional and modern ways. The difference between the two is the modern way uses all technology like a blender, whereas the traditional way uses more hands-on and traditional tools, such as a molcajete. In the end, the scientists found that the traditional way had a shorter setting and mixing time than the modern, which meant that the traditional way was faster overall.

The scientists are a part of the Hispanic community, specifically Colombian. They also enjoy culinary arts so they found a project that combined both. The purpose of the project was for the scientists to connect to their roots and see how making chocolate

Goldhirsch, Lucy; Gwilliam, Laura-Kate

Gunston Middle School

The Effect of Natural Water Filters on Dirty Water

Most people know that a human being can only survive without water for a maximum of 3 days, but most people don't have access to safe drinking water. The goal of this

Temprosa, Noah; Haiki, Tahar

Francis C. Hammond Middle School

Preposterous pH Levels

The reason for doing this experiment is to try and help reduce ocean acidification by finding the most effective item that many people have in their house. We are trying to find the best household item to raise the pH levels. We used baking soda, liquid chlorine, soap, pepto bismol (milk of magnesia), vinegar, baking powder, wine, and an alkaline water filter to test this. Our hypothesis was that, if you use baking soda, liquid

9CH419

Broadway, Sunny

Alexandria City High School (includes Minnie Howard)

Breakfast Item? Not Anymore

The purpose of this experiment is to explore the potential of transforming milk into a

9CH420

Day, Chloe

Yorktown High School

Freeman, Sarah

Washington-Liberty High School

The Effect of Chalk Additives on Water Absorbency

This experiment was conducted to determine whether FrictionLabs Unicorn Dust climbing chalk, a popular and highly rated brand, or 321 Strong, a generic brand, would be more effective at absorbing atmospheric moisture due to their respective additives.

Because climbing chalk, made of mostly magnesium carbonate (MgCO_3), is purified from sediment found in bodies of water, different brands' levels of purification and possible drying agents/other additives included can have a significant impact on the effectiveness of any one brand of chalk.

FrictionLabs Unicorn Dust was hypothesized to perform better compared to 321 Strong and two controls, pure magnesium carbonate and silica gel beads, because of its higher rating and larger audience in comparison to 321 Strong chalk. This implies that its specific recipe of magnesium carbonate and additives is more effective than a lesser-known, generic brand such as 321 Strong.

The hypothesis was supported by the data, which concluded that of the two brands, FrictionLabs Unicorn Dust chalk absorbed 0.0619 grams more on average. Predictably, magnesium carbonate as the negative control was the least effective, and silica gel as the positive control was the most effective.

The results were determined via an ANOVA test to be statistically significant, leading the null hypothesis to be rejected. It was concluded that FrictionLabs Unicorn Dust likely has a more effective variety and ratio of magnesium carbonate to additives.

Mataka, Tomio

Arlington Tech/Career Center

The Effect of Paint on Paints' Lightfastness and the Effect of Light on Paints' Lightfastness

The purpose of this experiment was to inform artists about the lightfastness of different paint brands, and the effect of different levels of light on paintings, something critical to creating art. For IV 1, Crayola Acrylic Paint, Crayola Watercolor Paint, Winsor & Newton acrylic paint, Liquitex acrylic paint, and ARTEZA watercolor paint were chosen as the swatches. For IV 2, a zero lux light level (no sunlight), 509.26 lux light level (indirect sunlight), 2915.13 lux light level (direct sunlight), and 4000 lux level (UV light) were chosen as varying intensities of light. A scale from 0-10 was created, with 0 being 0%

9CH424



Denton, Lilah; Combs, Juliana

Wakefield High School

The Effect of the Amount of Baking Soda Added to Cupcakes on Their Growth

The goal of this project was to test how the amount of baking soda added to cupcakes would affect their growth. Some people would think that cupcakes and other treats

Goody, Claire

Washington-Liberty High School

pH and its Effect on the Oxidation Rate of Apples

This experiment was conducted to determine the effect of pH on the oxidation rate of apples. It was hypothesized that a lemon juice solution with a pH of 3.0 would be the most effective at slowing the rate of oxidation since studies have shown that solutions with a low pH have been the most effective at slowing down the oxidation process in apples. Additionally, Ambrosia apples treated with the solutions would brown slower than the Red Delicious ones since they have a lower concentration of phenolic enzymes, including PPO. The groups tested were lemon juice solutions of pH 3.0, pH 4.0, and pH 5.0, as well as distilled water with a pH of 6.6. The experiment was conducted by dipping apple slices into each solution and setting them on a plate. Data would be recorded when initial browning started to show (DV #1) or after a two hour period (DV #2).

The results showed that the pH 3.0 solution was the most effective at slowing down the oxidation process, with averages of 12.18 minutes and a browning score of 0.7 for the Ambrosia apples, which browned slower than the Red Delicious ones dipped in the same pH level (10.68 minutes and a browning score of 1.1). ANOVA tests conducted for the dependent variables were both statistically significant. T-tests conducted for dependent variable #2 for both varieties were not significant.

Regen, Suzanne

Alexandria City High School (includes Minnie Howard)

Dye Depth

Color is a universal language, offering meaning when it cannot be translated. Color is often derived from dye that is made from plants, animals, and other natural properties. To that end there two main types of dye: synthetic and natural. Synthetic dyes can cause exponential harmful to the environment, so I focused my project on seeing if natural dyes could achieve the same vibrant color that synthetic dyes achieve. I measured how swatches of 100% cotton were dyed in increments of 1, 3, and 9 minutes. These swatches compared a red rit dye and a beet sourced dye. Both sets of swatches measured on the same depth scale, achieving the same depth. The swatches were compared on the pantone color scale. Overall if the switch was made to natural dyes equal color depth could be achieved.

Snyder, Elliana

Washington-Liberty High School

Comparison of Liquids with Varying Calcium Levels to Undergo Spherification and Reverse Spherification

This experiment explores the ability of spherification and reverse spherification. Spherification is the process of turning liquids into spheres through the creation of a gelatinous membrane which has applications within the culinary industry to create high quality meals. The capabilities of liquids with varying calcium levels were tested to better understand the effect it has on the success of undergoing spherification and reverse spherification. It was hypothesized that if a liquid has a high calcium content, then reverse spherification will be more successful in creating spheres of equal diameter because rather than combining calcium filled liquids with calcium lactate, reverse spherification combines the liquid with sodium alginate allowing the liquid to quickly form bonds with the sodium alginate bath and keep a spherical shape. These rapidly formed bonds allow the liquids with a higher calcium concentration to merge. This was supported by the results.

Whereas the data gained from the process of spherification proved not to be statistically significant, the data gained from reverse spherification did prove to be significant. Further testing was completed and found that the results from comparing orange juice and yogurt as well as orange juice and milk were statistically significant. These results supported the research hypothesis, because the difference in calcium content between these liquids was the greatest, proving that calcium content has a significant effect on the success of liquids to undergo spherification and reverse spherification.

Craine, Isabel; Schuerhoff, Cate

Alexandria City High School (includes Minnie Howard)

Organic Chemistry of Glossier You Perfume

The marketing line for a popular perfume called “Glossier You” is that it “smells a little different on everyone.” We investigated how pH influenced the perfume’s compounds to react on skin. We chose to analyze the perfume sample at pH 4, 5, and 6 to bracket the range of human skin pHs. The main way that perfume is analyzed is through a gas chromatograph- mass spectrometer (GC-MS) system (PerkinElmer). This instrument separates gas molecules on the basis of weight and measures how much of a compound is present. When we reached out to a company called Innovatech Labs, they were willing to help run our samples and help us with our project. We hypothesized that “If the perfume is exposed to surfaces of differing pH, then the gaseous compounds released will be different in quantity, identity, or both.” Kimwipes were dipped in



Tong, Brian Tiansheng; Huang, Meixuan; Xu, Shengying

Veritas Collegiate Academy

Development and Application of Online Acrolein Detector

At present, the detection of acrolein often requires more complex and cumbersome sample processing steps, coupled with high-performance liquid chromatography and other expensive instruments for detection, featuring poor effectiveness and higher costs. Another part of the difficulty of acrolein detection is the collection of acrolein. Common gas sampling device is often large, complex, and difficult to carry out testing at home. Such a device makes acrolein detection cannot be carried out online, causing people facing acrolein exposure risk to be difficult to notice the existence of risk and avoidance the first time.

We developed a visual acrolein online detector by selecting the isophorone-based

Owens, Eamon

George Washington Middle School

Let's Roll

My science fair project is finding out what the slowest surface for a marble on a 5-inch ramp is among different textures at the bottom and I will measure the distance traveled by the marble to find the surface that slows it down the most. After running multiple tests, I found that the hardwood floor allowed the marble to roll the farthest, along with this information I also figured out that the bubble wrap slowed down the marble and added the most friction. This research project is important in history because learning about friction is important to make things start and stop, and it is helpful worldwide to keep people safe on the roads. Leonardo da Vinci is credited with discovering friction and tribometers are used to measure it. Car companies design cars taking friction into consideration to reduce drag and rubber distribution. Electric cars help reduce pollution and keep the air cleaner. In the future, friction will continue to play a significant role in our world because it keeps people safe and smart.

Smith, Edward

Dorothy Hamm Middle School

Carpenter, Kylie

Williamsburg Middle School

The Effect of Shingle Color on Temperature

My project is The Effect of Shingle Color on Temperature. The main way this project is linked to climate change is that many roofs absorb sunlight and heat buildings. So new roofs could decrease power plant emissions (p) -0.2 (o) -0.2 (w) -0.2 (e) -0.2 (r) 0.2 (p)-0.2 (e) -0.2, gppww

Fenster, Esther

Williamsburg Middle School

The Effect of the Angle of a Solar Panel on the Amount of Power It Produces

The purpose of this experiment, testing the angle of a solar panel on how much power is produced, is that solar panels are becoming more frequently used for a variety of different purposes such as homes, buildings, and schools. Knowing the correct angle of the panels is critical to be able to maximize the amount of power being produced. Solar panels are also more climate friendly and can help to reduce greenhouse gas emissions. The hypothesis for this project was that the angle at 0° would produce the most amount of power because it's directly facing the light source. The experiment was tested by placing a solar panel on an adjustable stand below a lamp and changing it to

Harris, Brendan

Swanson Middle School

The Effect of Wind Turbine Design on the Efficiency of the Power Output

Wind is a renewable source of energy increasingly used for power generation. Because of concerns about affordability and climate, small-scale residential wind turbines have become increasingly popular. This project compared the efficiency of different designs using a common generator. It was hypothesized that a 3-bladed horizontal axis wind turbine would exhibit superior efficiency due to its larger rotor-swept area. The wind turbines and generator were constructed with a 3D printer and filament. The stator and rotor utilized permanent magnetic bearings to reduce frictional losses. The main steps of the project were collecting the materials, constructing the generator and wind turbines, gathering values for air pressure, temperature, and wind speed, and then testing the wind turbines. Wind power was calculated using wind speed and density, and energy output was measured using rotational velocity and voltage. Because a common generator was used, relative efficiencies could be determined by dividing the energy output by the power input. The experimental data showed that the Archimedes turbine was more efficient at low wind speeds and the vertical axis turbine was more efficient at high wind speeds. Two issues should be corrected in future experiments. First, the ceramic-coated windings never demonstrated reliable continuity. The voltages measured during the experiment should be considered unreliable. Second, the use of a common generator may have reduced the performance of some designs due to potential deflection and flexibility in the connection. This project provides useful research as it could help optimize designs for small-scale wind power generation.

Shaw, Ryan

Kenmore Middle School

The Effect of Light's Wavelength on the Amount of Power Produced by a Solar Panel

The purpose of my project is to find out what wavelength of light creates the most amount of output power from a solar panel. People should care about this project because it could help solar panels produce more power. The goal of my project was to find the effect of light's wavelength on the amount of power produced by a solar panel. My procedure was to take my materials outside, set up my solar panel, and connect the

Silva, Christian-Delfin

Francis C. Hammond Middle School

The Design of a Parachute's Descent

When you think about a pilot, anyone who flies an aircraft, anyone who goes skydiving, or anything that involves being in the air, the first thing you think about is their safety. A typical procedure to guarantee your safety is to have a reliable parachute in an emergency. The problem with parachutes is that the vast majority of incidents with them are the result of human error. I believe that this human error is caused by the user's panic, which may be the result of their parachute still falling too fast. The solution is to make a parachute that descends as slowly as possible. My results have shown that a canopy with a circular shape is the best type of canopy if your goal is to slow your descent as much as possible. They also show that the more surface area a canopy has the slower it will descend. My design met the criteria which was to make the descent 300% (3x) slower than a fall without a parachute.

Seyran, Zeynep; Komlodi, Kira

Thomas Jefferson Middle School

Fortissimo: Music Teaching Technology

It's no surprise that both of the researchers play one or more instruments. This, as you have probably assumed, was the main reason Fortissimo was created. The researchers

Ayele, Efrata



Fitzgerald, Maya

Alexandria City High School (includes Minnie Howard)

The Effects of Structure Type and Bond Strength on a Building's Earthquake Durability

Earthquakes cause immense damage and harm to all things, living or not. Not only do

Flashberg, Natalie

Washington-Liberty High School

The Effect of Different Insulation Materials on Heat Transfer

Conserving energy is crucial to save a significant amount of energy. Therefore, Insulation is the process or material that is used to reduce the transfer of heat. This

Pines, Asher

Yorktown High School

The Effect of Faraday Box Designs on EMF Radiation and the Potential to Prevent Car Theft

This study investigated various Faraday box designs in blocking electromagnetic fields (EMF). A Faraday box is able to prevent car thefts through relay attacks when people store their car keys in the box. Relay attacks are a method used to steal cars where thieves amplify the signal between a car's key fob and the vehicle. This allows the car to be opened and turned on remotely even when the key is far away. Faraday boxes are metallic enclosures that block EMF and thus the signal which could be potentially amplified by a car thief. The research tested five different materials to cover Faraday boxes: 1) aluminum foil, 2) stainless steel mesh, and 3) Faraday fabric, 4) no material, and 5) phone. The outcome was the

Sun, Juyeng

Washington-Liberty High School

The Effect of Material Type Used as Sound Insulation on Sound Level Detected

Acoustics is the study of sound/sound waves. Acoustic architecture uses the principles of acoustics to control sound. Sound insulators are materials which limit the travel of soundwaves by absorbing/reflecting them. The purpose of this project is to determine which material is the most effective sound insulator and reduces the most sound from

Tappan, Gabrielle

Alexandria City High School (includes Minnie Howard)

Generating Renewable Energy for the Grid

My goal was to use wind energy as an alternative resource to power a household item. I started by building a homemade windmill. I needed 8 to 12 volts of electricity out of this windmill, so I experimented with different blade materials and how many blades were needed to achieve the voltage. The current, 22 milliamps (mA), was enough to charge a battery. I got a small plastic fan blade which created about 9 volts of electricity.

After finalizing my windmill, I designed and built my circuit that can take the voltage from the wind turbine and step it down to 5V. I tested the circuit with a 9

Tarpley, Michael

H-B Woodlawn Secondary Program

A Wearable Sign-to-Text Translation System Using Sensor Arrays

There is a communication barrier between users of American Sign Language (ASL) and English speakers. It is very difficult for English speakers to receive and understand sign language without prior knowledge and it is difficult for the Deaf community to know and understand English. A wearable sign-to-text translation glove can accurately translate the symbols of the ASL alphabet onto a screen in real time. A common glove has been modified to include an array of sensors, a circuit board and an Arduino allowing for a real-time translation of signs into English text on a screen. The translation glove offers a technological solution to the communication barrier between the Deaf community and English speakers.

Kwan, Alexander; Kwan, Benjamin

Burden, Owen

Alexandria City High School (includes Minnie Howard)

Creating an Automatic Plant Watering System

The demand for efficient and sustainable solutions in agriculture and home gardening

Hogans, Catherine

Washington-Liberty High School

The Effect of Different Blade Lengths of a Wind Turbine on the Amount of Energy the Wind Turbine Produces

The purpose of this experiment was to determine whether longer blades on a wind turbine would create more energy, making this form of clean energy as efficient as possible. The research hypothesis tested was: If the length of the blades on a wind turbine is changed, then the wind turbine with the longest length of blades will create the most energy in volts on the multimeter because the longer blades will be able to pick up more torque and feed off of more of the aerodynamic forces from the wind. The independent variable was the length of the blades, with independent variable levels of 8 cm, 10 cm, 12 cm, and 14 cm. The dependent variable was the amount of energy produced in volts.

The blades that were 14 cm long produced the most amount of energy. The energy was produced by kinetic energy and the change in air pressure around the blades coming from the wind. The larger blades would have been able to pick up the most wind, so they would be able to generate the most kinetic energy. The lift and drag, created by the changed air pressure, would cause the rotor to spin, spinning the generator and producing the most electricity. The 14 cm blades had the most mass and were the longest, hence, they were able to produce the most energy. The research conducted prior to the experiment also supported the results.

Noorzai, Mohammad Elyas

Alexandria City High School (includes Minnie Howard)

Optimizing Drone Design for Improved Stability and Control

We wanted to make drones fly better, so we tested a store-bought drone and a homemade drone made from popsicles and motors. We looked at how different designs

Espiritu, Arianna; Hettinger, Grace

Alexandria City High School (includes Minnie Howard)

Sun Seeker 2.0: Thermal Generating Heliostats

In this project, we are answering the question, “Can we improve a DIY Heliostat and enable it to generate thermal energy efficiently?” According to the U.S. 2020 Census, Alexandria consumes about 61 million kWh of electricity per month; 55% of which is nonrenewable (Morawski, 2018). We propose an easier and more cost-effective method of gathering energy for our community. A dataset from NASA’s Solar Energy Program assessed the potential of global CSP (Concentrating Solar Power) plants, which amounted to 150 times the present world electricity consumption (Müller-Steinhagen, 2013). This makes our research on thermal-generating Heliostats relevant and fitting for young people wanting to help solve environmental crises. We designed and built a new heliostat using Onshape and a 3D printer, then flew it out to the desert for testing. The heliostat reflected sunlight onto an aluminum can, heating the water inside. A control can was used for compah 0.24 0 6 1

Bahrambegi, Cyrus

H-B Woodlawn Secondary Program

Analyzing Sustainable Energy Production Using Anaerobic Cellular Respiration from Microorganisms Derived from a Modified Microbial Fuel Cell System

Research into alternative energy sources is a priority due to increasing concerns over the effects of climate change. Microbial Fuel cells (MFCs) are a partial but promising solution towards combating the over-reliance on fossil fuel-based electricity. MFCs

6EV600

Nizami, Arooj

Patrick Henry K-8 School

Filter Fun

Many individuals have wondered, which resource filters lake water the best? My Science Fair project is about testing different resources and to figure out which resource

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7EV603

Zee, Rebecca

Kenmore Middle School

The Effect of Different Fertilizers on Water pH Levels

Each time a fertilizer is used, run-off carries those fertilizers into waterways. These fertilizers significantly impact water quality by altering the pH levels. Aquatic organisms struggle to survive as their lives are uprooted, and their habitats are destroyed. The goal of this experiment was to find the effect of different fertilizers on water pH levels, and more specifically, to find which of the three main components of fertilizers would have the greatest impact on water pH. Three fertilizers were chosen, each having more of either nitrogen (blood meal), phosphorus (bone meal) or potassium (kelp meal) (independent variable). 8 grams of each of the fertilizers was mixed with 250 millimeters of water, and after 10 minutes, the pH of the mixture was a 9 0.2 (u).2 (w) -0 () 0.2 .00 -658 Tw chomir

7EV604

Hsu, Eowyn; Hsu, Esme

Dorothy Hamm Middle School

Demonstrating the Greenhouse Gas Effect in a Simple Experiment

In order to demonstrate the greenhouse-gas effect (GHG), we created two closed systems consisting of glass mason jars containing one-half cup of plain water each. One of the jars had three alka-seltzer tabs to introduce the CO₂, which is a greenhouse gas, while the other jar contained only water. The two mason jars were placed an equal distance away from each other and from the energy source, a halogen lamp. We recorded the temperature above the water's surface for both jars every 3 minutes until the temperatures stopped increasing. Subsequently, we turned off the lamp and continued to take measurements every one minute as the temperatures decreased. We repeated this process several times. In each case, we observed that the jar with CO₂ heated up more slowly, reached a higher peak temperature, and cooled more slowly compared to the jar without CO₂. These results are consistent with the GHG effect, which is expected to slow the rate of heat loss.

8EV605

Bell, Darin

Dorothy Hamm Middle School

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8EV606

Chudiwale

8EV607

Duckworth, Sullivan

Kenmore Middle School

The Effect of Cloud Coverage and Pollution on the Electrical Output of a Solar Panel

All around the world there are places that only use fossil fuels like coal and natural gas as their main source of energy. For example the Middle East, most of their countries are a hundred percent fossil fuels. This is bad because fossil fuels produce over 75% of greenhouse gasses emissions. The goal of my experiment was to determine the effect of pollution on solar panels and the amount of electricity they produce. In this experiment I set up a rig to show the sun beaming down on a solar panel. I measured the amps, volts, and Lux. After each time I measured Volts, Amps, and Lux I added 2 semi transparent sheets to simulate pollution. On average without semi transparent sheets t2 (h) -0.2 (o) -0.cno-0.2 () .2 (u)- cm-0.2 (l) 5 (e) -0.2 (e) -0.0.2 (i) 3 1 T24 0 0 0.le2 (e) -0..2 (

Kuhn, Lorien

Francis C. Hammond Middle School

The Effects of Different Amounts of Water on the Success of Composting

The goal of this project was to answer the question: What would happen to the success of decomposition if you didn't add the ideal amount of water, which is 40-60%? Using this question I conducted an experiment where I set 3 groups of trials with different amounts of water to determine which amount of water would work the best.

At the beginning of this experiment I measured 4 different items and put equal amounts in all of my trials so that at the end I could re-measure them and whichever one had decomposed the most was the most successful trial. I hypothesized that if you add 25% of the mass of the compost in water then you will have less success than when you add 50% of the mass.

After 4 weeks I opened up 1 bucket from each set of trials and found my original 4 items. I re-measured these items to see which trial had the most progress after 4 weeks. My results were that the 50% trial was working the best followed by the 75% trial an

8EV610

Procida, Eliana; Milam, Emmeline

Abdelbagi, Amna

Arlington Tech/Career Center

The Effect of Different Levels of Salt Concentration on Plant Growth

Road salt can be defined as heavy amounts of salt that are distributed onto roads that reduce the melting point of ice when it snows. While this clears up the road quicker for safer driving, it can worsen the impact on the plant's lives that lives beside the road. The purpose of this experiment was to test out different salt concentrations that range from low to high to determine the maximum amount of salt a salt-tolerant plant needs to tolerate and grow. It was hypothesized that if the plants are watered with different salt solutions, then the 3.5% salt solution will grow the highest because less salt concentrations increase growth. The independent variable is the different levels of salt concentration. The dependent variable is the plant height, measured in centimeters. The experimental variables were 0%, 3.5%, 5%, and 8% salt concentration. The salt concentrations consists of the respective amount of salt for each (e) -0.28 72 (,) 0.2 0.2.2 (i) -0.2 (me)

9EV613

Hearding, Reese

9EV615

Organeck, Noa

Alexandria City High School (includes Minnie Howard)

Stay Cool!

This project was designed to determine which building insulator is the most cost-effective. Three common insulators were tested: fiberglass, polystyrene, and radiant barrier. Two combinations were also tested: fiberglass with a radiant barrier and polystyrene with a radiant barrier. To assess cost-effectiveness, an experiment involving the change in temperature over time was conducted using different types of insulators. The data showed that the fiberglass and radiant barrier insulation together were the most cost-effective. The results of the experiment provide valuable insight into the cost-effectiveness of different insulation materials, aiding homeowners and builders in making informed decisions to maximize energy efficiency and minimize long-term expenses.

Yimer, Sabrina

Washington-Liberty High School

Impact of Soil Type on Fertilizer Runoff and Algal Growth

The experiment was performed to find the type of soil that induced the lowest fertilizer runoff. The purpose was to allow farmers to be aware of the soils that hold the lowest fertilizer runoff and algae growth. The dependent variables were the nitrate levels of the fertilizer runoff and the algae growth, measured using a nitrate strip and sechhi disk. The hypothesis was that sand would have the lowest nitrate levels and algae growth, meaning it filters more fertilizer, and clay would have the highest nitrate level and algae growth, meaning it filters less fertilizer. The results showed that clay held the highest nitrate levels followed by topsoil and sand. An ANOVA test showed a p-value of $1.0125E-12$, and the results were statistically significant. For the second dependent variable, results showed that clay held the highest algae growth however it was not statistically significant. A T-Test was run, it showed a statistical significance between sand and topsoil, sand and clay, the control and topsoil, and the control and clay. While the two dependent variables held slightly different results, theory states that an increase in fertilizers induces higher levels of nitrate and algae growth. The hypothesis was supported, and it can be inferred that the second dependent variable's results were due to limitations in the experiment, and the type of soil impacts the fertilizer runoff and algae growth. In future studies, one can allow for the algae to grow for longer periods of time and use more fertilizer during the experiment.

10EV617

Ackleson, Emma

Washington-Liberty High School

The Effect of *Pseudomonas fluorescens* and *Bacillus cereus* on the Degradation of Microplastics

This experiment evaluated and compared the biodegrading efficiency of two bacterial species, *Pseudomonas fluorescens* and *Bacillus cereus*, on polystyrene microplastics. It was hypothesized that if *Pseudomonas fluorescens* and *Bacillus cereus* bacteria were placed in sterile nutrient broth solutions and combined with polystyrene microplastics, the *P. fluorescens* will break down and feed on the polystyrene more effectively than the *B. cereus*. This is because *P. fluorescens* has a faster metabolism with a primary diet of carbon, the main component of polystyrene, and *B. cereus* has a relatively decreased capacity for carbohydrate metabolism compared to *P. fluorescens*.

Both species of bacteria were cultured with 0.05 g of microplastics in separate nutrient broth tubes and incubated at 37°C. After 35 days, the remaining microplastics were filtered from the nutrient broth, treated with a bleach solution, and washed with water to remove any residual bacteria. The remaining polystyrene was then massed, and the data was analyzed. Results showed that both bacterial species were able to degrade microplastics, but *P. fluorescens* had a larger margin of degradation: *P. fluorescens* had a mean mass of 0.017 g, and *B. cereus* had a mean mass of 0.029 g. Results were then

10EV618

Chudiwale, Vedica

Washington-Liberty High School

The Effect of the Type of Absorbent on the Amount of Absorbed Motor Oil

This experiment was conducted to study the effects of the planet's primary fuel, supplying 33% of the world's required energy. Motor oil is used everywhere, but the environment is not prepared when even the slightest spills occur. Through the project, acce

10EV619

Kambhampaty, Kedar

Washington-Liberty High School

The Effect of Ecological Region on Emissions from Wildfires

This experiment investigated carbon dioxide and particulate emissions from wildfires in different ecological regions of the western United States by simulation. These emissions are the direct or first order effect of wildfires, affecting climate through their impact on global warming. Particulate emissions also harm respiratory health in humans.

The research hypothesis was that wildfires in the Northwestern Forested Mountains would produce the most emissions of carbon dioxide (CO₂), particulates of 10 μm diameter and smaller (PM₁₀), and particulates of 2.5 μm diameter and smaller (PM_{2.5}). Mixed coniferous forests present in Northwestern Forested Mountains have ample trees and dense vegetation that release CO₂, PM₁₀, and PM_{2.5} as they burn. The null hypothesis stated that if wildfires are simulated in selected ecological regions, then there will be no difference in emissions data for wildfires in these ecological regions. The regions tested were Northwestern Forested Mountains, Great Plains, North American Deserts, and Mediterranean California.

Ten trials (simulations) were run per ecological region using the First Order Fire Effects Model (FOFEM) available within the FlamMap software package. ANOVA tests on data from the simulations showed statistical significance in the difference between ecolog0.2 (I) -0.2 (rstP0.

Taimanglo, Sol

Alexandria City High School (includes Minnie Howard)

The Effects of Parking Lot Sediments on Daphnia Viability

The intent of this project was to determine if sediments from a parking lot contain toxins that are harmful to aquatic organisms, specifically *Daphnia magna*. The answer to this question could help raise awareness for the aquatic ecosystems that are negatively affected by these pollutants. The hypothesis was that if parking lot sediments are added into an aquarium with *Daphnia*, then the number of viable *Daphnia* will decrease.

This experiment was conducted by setting up 3 separate aquariums that each received a separate concentration of the parking lot sediment sample. The number of dead *Daphnia* were then calculated every 8 hours over the span of 48 hours before being added together to find the final number and percentage that had died in each test group.

The results showed that the aquariums that had the sediments placed in them saw a larger decrease in viable *Daphnia* compared to the control, which supports the hypothesis. If this experiment were to be repeated in the future, conducting more trials would help prove that it is, in fact, the sediments that are causing the decrease in population.

10EV622

McMillan, Alex; Katz, Sofia

Alexandria City High School (includes Minnie Howard)

Sol Power Part 2

This experiment will examine a potential adjustment to the standard SODIS procedure that could accelerate the process using commonly found materials and allow bottles to be recycled through the process within one day. These findings could lead to better clean water access throughout the world. To perform this experiment, we collected water samples from Timber Branch Creek by using a 16.9 oz water bottle to collect the samples from the creek and transferred them to 3.78-liter bottles. We filled 3.78-liter bottles to 80% capacity with 6 full 16.9-oz bottles. We also filled two 16.9 oz water bottles from the creek and preserved them in a dark place away from the sun (dirty control). We concluded that the water surrounded by rice was quicker to reach potability than the water that was not surrounded by rice.

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11EV624

Liu, Ziyin (Daniel)

Episcopal High School

Fukushima Wastewater Release and its Profound Impact on the Fishing Industry

This study investigates the profound impact of Japan's decision to release Fukushima wastewater in August 2023 on the fishing industry, utilizing comprehensive analysis through linear and multivariate regression models computed with SPSS. Following the catastrophic event at the Fukushima Daiichi Nuclear Power Plant in 2011, concerns have heightened regarding the discharge of treated but still radioactive wastewater into the ocean. This research aims to understand the extent of contamination and its effects on marine life and the fishing industry, crucial for regions relying heavily on fishery exports, especially in the Northern Pacific.

Utilizing data from the North Pacific Anadromous Fish Commission and Japan's Exports of Fish & Fish Preparations, alongside a simulation model developed by Tsinghua

7MC700

LaFalce, Gavin

Dorothy Hamm Middle School

Can a Computer Program Predict Survival on the 1D (t) LaFalce, Gavin, Dorothy Hamm Middle School, 1999. 1 page. (o) -0.2 (d) -

Mirabile, Mason

Williamsburg Middle School

A Model of Acceleration in Sports Cars

The purpose of this project was to identify which aspects of sports cars affect their acceleration. My hypothesis was that as power increases or mass decreases that acceleration would increase. Through my research I identified the independent variables I wanted to use in my project: power, torque, mass, drivetrain, and decade manufactured. I found a reliable data source and collected data on over 100 sports cars. To understand how each of these variables independently impacted acceleration, I created a multiple linear regression model. Microsoft Excel's multiple linear regression add-on analyzed all the data and created a model to predict the acceleration of a sports car as a mathematical function of all the independent variables in my project. One significant finding of my project was that the most influential factor of acceleration in sports cars was the power to mass ratio of the car. The power to mass ratio variable had a coefficient value of 9.40, meaning that for every unit increase in the power to mass ratio variable, the dependent variable, acceleration, increases by 9.4 m/s². The other factors (torque, drivetrain, decade manufactured) were each statistically significant predictors of acceleration as well. Newton's second law of motion can be rewritten as acceleration equals force divided by mass. The most significant predictor of acceleration in my model was power to mass ratio, a strong proxy for force to mass ratio. The relationship displayed in my model was very closely supported by Newton's second law of motion.

Desai, Suhani

Yorktown High School

The Effect of Building Materials on WiFi Signal Strength

This experiment tested how common materials used in houses will affect the strength of a WiFi signal. This research is important because this knowledge can help maximize the function of WiFi as its usage has become an essential part of life. This was tested by placing a building material in between a router and a phone, which has an application that scans the WiFi signal strength in decibel-milliwatts. The tested materials should weaken the signal because they are blocking the radio waves used by WiFi from traveling. It was hypothesized that if an aluminum sheet was used, then the WiFi signal strength would be the weakest. A one-way ANOVA test was conducted, resulting in a p-value of 0.0000000012281, which the data is statistically significant. The data shows that dry wall, wood, aluminum, glass, wooden pegboard, and plastic all decrease the strength of a wifi signal. The hypothesis was supported because aluminum decreased the strength of the signal the most, due to it conducting the electromagnetic signal the greatest. The wooden pegboard decreases the strength of the signal as well, however slightly less than the other materials. Dry wall, wood, glass, and plastic all similarly decrease the strength of the wifi signal.

Docena, Jacob Oliver

Washington-Liberty High School

The Effect of Different Interference Types on the Accuracy of a Particle-Filter-Based Image Tracker

This experiment was conducted to determine which interference type would have the strongest impact on the accuracy of particle filter-based object trackers. The independent variable was the type of interference used and the dependent variable was the pixel error of the tracker. The interference types tested were a control with no interference, full occlu0.2 (f) 0.2 (u) -0.2 (l) -0.2 (l) -0.2 () 0.2 (o) -0.2(ccl) -0.2 (h) -0 -0.2 (h) -0 -0.2 0 0

Finnegan, Sean

Arlington Tech/Career Center

Using Python to Create a Password Cracking Algorithm

In today's digital age, password security has become a pressing concern for individuals and organizations alike. To explore this issue, I embarked on a science project to create a hash cracker using Python. My goal was to understand the intricacies of hashing and hash cracking and to test various methods of enhancing password security. Modern passwords use a technology called "hashing," which turns plain passwords into unrecognizable strings of numbers and letters in an irreversible process. During my testing, I explored various hash-cracking methods, including dictionary attacks, rainbow tables, and brute-force cracking. After rigorous testing, I found that brute-force attacks were the most efficient and reliable. They were able to test over 1.9 million attempts per second and required almost no memory, unlike rainbow tables, which took over ten

O'Reilly, Brendan

Yorktown High School

An Investigation of Stochastic Cellular Automata and Coherent Noise and Their Utility for Natural Terrain Generation

The goal of this project is to create a Java program that is capable of making unique terrains (game worlds), that conform to set constraints, everytime it runs. I want to make such a program so that I may experiment with applied coding and game design without the most time consuming step in game design—which is the creation of multiple enjoyable game worlds for a replayable game. The main techniques used in the program were stochastic cellular automata (a way of applying non-deterministic functions on a set of “cells” to change their state) and coherent noise (algorithms based on interpolating purely random values for continuous outputs across their domain). First, I created a data format for my “cell”, made my first few cellular automata functions, made debugging tools, and finalized my cellular automata library. Then, I used FastNoise Lite by Jordan Peck to sample noise values for biome aspects (temperature, humidity, and erosion), and deliberated the cutoffs for biome placement (ie: necessary humidity to make a dessert). Finally, I made the code to place biomes and output the finished map. My final program is able to output a biome map and key after around six

Stansbury, Devesh

Washington-Liberty High School

The Relationship Between Regional Household Income and Cell Signal Strength

This experiment was conducted to investigate the relationship between different areas with varying income levels and the cellular strength in those respective areas. The hypothesis for this experiment was that areas with lower average household income levels would tend to have lower levels of cellular strength throughout the zip code. Four different income levels were tested throughout the experiment; high-income levels, which had an average annual household income level of \$125,000 or more, middle to high-income levels (\$95,000 to \$125,000), middle-income levels (\$45,000 to \$95,000) and low-income level, which had an average annual household income of less than \$45,000. It was found that areas with low average income levels had stronger cellular connectivity, rejecting the hypothesis.

Five separate points in each zip code were visited, and cellular strength was measured in Megabits per second (Mbps). Three separate zip codes were visited in the D.C. metropolitan area, including northern Virginia. An ANOVA test was conducted, and it was found that the data was statistically significant, with a p-value of 8.6×10^{-11} , rejecting the null hypothesis. The data collected consisted of high-income levels, with a mean cellular strength of 31.4 Mbps, middle to high-income levels, with a mean cellular strength of 34.1 Mbps, middle-income levels, with a mean cellular strength of 62.2, and low-income levels, with a mean cellular strength of 92.9. The purpose of this experiment was to identify any sort of disparity across various socioeconomic statuses.

Song, Sicheng

Episcopal High School

Attention Graph Neural Network Solution for Early Detection of Pancreatic Cancer

The diagnosis of early-stage pancreatic cancer is notoriously difficult for its lack of characteristic symptoms, leading to a particularly challenging situation for even experienced doctors and radiologists to discern. Pancreatic cancer, after passing the early stages when it is the most curable, also becomes one of, if not the most, lethal cancer. Computer vision, especially Graph Neural Network (GNN) based solutions, however, presents a promising solution for pancreatic cancer early diagnosis. Other neural networks like convolutional layers, vision transformers, and segmentation

8ME800

Foerster, Nolan

Thomas Jefferson Middle School

The Effect of Natural Cleaners Compared to Chemical Cleaners

In my experiment I compared the organic cleaners to chemical cleaners. I wanted to

Menta, Rahil

Williamsburg Middle School

The Effect of the Concentration of Ampicillin on the Size of the Inhibition Zone

Bacteria and microorganisms exist all around us. Most of them are harmless, and some of them are even beneficial to humans. Nonetheless, there are also many bacteria that cause diseases. Discovering antibiotics and other antimicrobial agents assists us in preventing and stopping bacterial infections. However, “the excessive use of antibiotics can lead to bacteria developing some sort of resistance/immunity to these antibiotics,” (Horowitz, D, 2022). This may lead to the growth and multiplication of a new population of resistant bacteria or to a longer recovery time for people suffering from an infection. “Stronger/more effective antibiotics might have to be used on the patient with harmful side effects,” (World Health Organization, Jul 31, 2020). In investigating how E. Coli K-12 reacts to different concentrations of ampicillin, this experiment is important in understanding how to create better and non-bacterial-resistant antibiotics.

Sirak, Sam

Alexandria City High School (includes Minnie Howard)

ColonRiskNow: A Machine Learning Based Desktop Application to Detect Colorectal Cancer

According to the World Health Organization, “Colorectal cancer is the third most common cancer worldwide, accounting for approximately 10% of all cancer cases and is the second leading cause of cancer-related deaths worldwide.” Colon cancer typically arises from polyps, which are abnormal growths inside the colon. Early detection is key to preventing colon cancer, and colonoscopies have proven effective in reducing its incidence. However, colonoscopies are operator-dependent, and hold a concerning average miss rate of 22-28%, which prompts the need for the advancement of more comprehensive and minimally invasive diagnostic approaches. In response to this issue, I created an accurate, accessible, and non-invasive colorectal cancer assessment tool: ColonRiskNow. ColonRiskNow was developed using machine learning and integrated into a desktop application. ColonRiskNow comprises imaging and survey tabs, with each model meticulously trained using artificial neural network classification techniques. The survey model utilized basic health information and cancer diagnoses as input features and labels. Meanwhile, the imaging model sourced data and labels from diverse online polyp databases. The training of these models involved iterations until both succeeded with commendable accuracy. The classification models achieved accuracy scores greater than 95% and 90% respectively, exceeding benchmark accuracies. ColonRiskNow can be used by doctors globally, from enabling them to pinpoint patients that are high at risk of colorectal cancer, prompting them for more

White, Peyton

Alexandria City High School (includes Minnie Howard)

Which Drink Has The Most Electrolytes?

For my science fair project, I tested multiple drinks, and recorded which ones contained the most electrolytes. Because many drink brands put on the market are not always true, the goal of my experiment was to see if these companies live up to their promises. I tested orange juice, water, blue Gatorade, and an electrolyte packet mix. To test my experiment I made a closed circuit using a multi meter and other various materials. Once my circuit was created, I poured each of the drinks that I was testing into separate bowls. I dipped the straw into the drinks for 30 seconds, I recorded the number shown on the multi meter. I did this five times for each drink that I tested. My hypothesis was that blue Gatorade would have the most electrolytes. The graphs showed that orange juice had the most electrolytes. Following close behind was the electrolyte packet mix. From there however, there is a significant drop to blue Gatorade. Finally, the beverage with the least amount of electrolytes is water. This does not come as a surprise because aside from its hydration benefits, there are no other nutritional supplements contained in water. My hypothesis was incorrect and I learned to be more selective of the drinks I buy when I am looking for a re hydrating beverage. Because this project had a very wide variety of drinks, In the future, I plan on testing specific categories of drinks to go into greater detail.

Batenhorst, Maya

Yorktown High School

The Effect of Suture Techniques in The Dermis on Tensile Strength

This project aimed to research various suture techniques on an incision wound in the dermis of pig skin. Suture techniques are commonly used in surgical settings for providing mechanical support to the wound and aiding in the body's natural healing process of cell proliferation and migration. Different suture techniques are used in various wound states. The force that is being applied to the wound and cosmetic preferences of the patient help in clinicians' decisions of the use of a particular technique. Four techniques were tested, using nylon monofilament suture thread; simple interrupted, running, horizontal mattress, and figure of eight. LoggerPro software was used to graph the probe force being applied to the skin as it was pulled apart using a force testing rig. Six relative maximums were recorded for each technique to determine the maximum number of newtons that were withstood before failure. The techniques were then observed for alleviation of tension of the thread, force vectors in the subcuticular region of the skin, and force directions being applied to the incision.

Ladewig, Madeline

Yorktown High School

The Effect of Brand of Tampon on Absorbency

Women across the world face a monthly problem: menstruation. In 2023, the FDA tested a wide range of period products with human blood, ranging from period underwear to menstruation cups. That study found that many products absorbed less than advertised. That led me to question whether tampon brands absorbed as much as advertised. This study aimed to find the most affordable tampon option for consumers that had a high absorbency level and were relatively inexpensive by testing three major brands U-by Kotex, Tampax, and Cora. The expected outcome of this experiment was that Cora would be the most absorbent because the main ingredient, cotton, is a very absorbent material. The result of this study was that Tampax, on average, absorbed the most solution out of all three brands; followed closely by Cora. We can connect this to the number one ingredient in both brands: cotton. The brand of tampon that was the least absorbent was U-by Kotex, however, even though this brand did poorly in the experiment, we can conclude that U-by Kotex is successful at sales because of the targeted advertisement U-by Kotex sends to teen girls. This study was statistically

Muhammad, Khamille

Alexandria City High School (includes Minnie Howard)

How Do Different Biomarkers Help Diagnose Different Types of Dementia?

The problem researched was how biomarkers found affect how a person is diagnosed with a specific type of dementia; the purpose of this project is to research factors that impact early diagnoses. This project provides background information on the three most common forms of dementia in the U.S and biomarkers associated with that type of dementia. There were five biomarkers studied in Alzheimer's, Lewy Body Dementia, and Vascular Dementia. The procedures involved researching how each form of dementia develops and looking into openly available trials already performed comparing the different amounts of a certain biomarker to different types of dementia. The information was then condensed into tables on a Google Sheet. The data I found are that higher amounts of neurofilament light chains and homocysteine indicated VaD; higher amounts of CSF tau indicated AD; and higher amounts of a specific form of alpha-synuclein and beta-amyloid 42 peptides indicated DLB. Furthermore, testing samples from CSF compared to blood serum resulted in CSF displaying much higher amounts in pg/mL of NfL than serum did, which supports additional studies on how invasive diagnostic tests such as the sampling of CSF is more precise than non-invasive techniques. In conclusion, there are certain amounts that could be found of a certain biomarker or protein that could assist in identifying the specific form of a disease, potentially allowing a patient to receive early treatment; however further research would involve identifying a certain range for scientists to use to point to a certain disease.

South, Caroline

Washington-Liberty High School

The Effect of Digestive Enzymes on Cellulose Microplastics

This experiment was conducted to test the effect of digestive enzymes on cellulose microplastics. The hypothesis for the experiment was if different digestive enzymes are

10ME809

Uddin, Maqsuda

Maguire, Ian; Logsdon, Cole

Wakefield High School

The Impact of Chest Exercises on Heart Rate

This independent scientific inquiry explores the nuanced and acute impact of chest exercises on heart rate, aiming to contribute to our understanding of exercise-induced modifications in cardiovascular function. The study adheres to standardized protocols, involving three chest exercises – Bench Press, Pec Flys, and Chest Press – with a focus on immediate cardiovascular responses. The hypothesis, suggesting that exercises r ypothesi]TJ ET Q cm BT 50]TJ ET Q -0.2 (t) 0.2 ()]TJ ET Q q 0.24 (n) -0t E

11ME811

Mohanty, Anna

Washington-Liberty High School

Alcott: A Convolutional Neural Network to Predict Drug Target Binding Affinity in HIV-1 Neural Infection Treatment



12ME813

Bartrum, Olivia

Wakefield High School

Harnessing the Signalosome to Enhance Ex-

Caparas, Paige

Williamsburg Middle School

The Effect of the Type of Natural Antibiotic on the Area of Inhibition Against *Escherichia coli*

Escherichia Coli (E. Coli) is a gram-negative bacterium that can occur in contaminated food such as under-cooked meat. The medical community has treated infections from E. Coli by using synthetic antibiotics such as penicillin. However, the overuse of synthetic antibiotics has created antibiotic resistance and decreased its efficacy over time. A potential solution is to utilize natural antibiotics which have been found to be effective in inhibiting bacterial growth without resulting in antibiotic resistance. It was hypothesized that melaleuca (tea tree) oil would most significantly inhibit the growth of E. Coli. This experiment tested six natural antibiotics: apple cider vinegar, garlic extract, ginger extract, manuka honey, oregano oil, and tea tree oil, along with a control (no substance was added) against the strain E. Coli K12 to determine which would have the most significant area of inhibition. The efficacy of each natural antibiotic was tested by a disk diffusion method in which agar mediums and antibiotic sensitivity disks were used. The areas of inhibition against E. Coli K12 were monitored and assessed every other day for a week. After a week, the experiment revealed that garlic extract had the most significant area of inhibition against E. Coli K12. Therefore, the hypothesis that tea tree oil would have the most significant area of inhibition was rejected. The experimental data suggested that garlic extract and other natural antibiotics can serve as viable alternatives to synthetic antibiotics in inhibiting the growth of E. Coli K12.

Ghosh, Sid

Williamsburg Middle School

The Effect of Temperature on the Brightness of Bioluminescent Bacterium *Aliivibrio fischeri*

The purpose of this project was to determine how bioluminescence, a lighting-emitting biochemical process, can be used to replace modern-day lighting technology. This is important because electrical lighting contributes to climate change and light pollution. The bioluminescent bacterium *Aliivibrio fischeri* was tested at 4 different temperatures: 5°, 15°, 25°, and 35°C, to see which temperature produces the most glow. Additionally, another factor that was tested was if subculturing the bacteria allows for greater bioluminescence, or if just refrigerating the bacteria beforehand is better. The bioluminescence was tested by taking photos of the bacteria and analyzing the mean pixel luminosity of each photo. The hypotheses were that the 25°C plate would glow the brightest, and that subculturing the bacteria would result in greater light intensity. Both hypotheses were proven correct, because the subculture put at 25°C glowed the brightest. In addition, the data shows that although subculturing the bacteria beforehand results in greater light intensity at 25°, the subcultures did not glow very much at any of the other temperatures. Also, it is evident that refrigerating the bacteria without subculturing it results in a less intense, but more consistent glow across the temperature range. However, none of the bacteria glowed nearly as bright as electrical lighting, barely able to be captured on camera. Although this project provides a lot of important information about the nature of bioluminescence and *A. fischeri*, in order for bioluminescence to be implemented as a light source for society, more research needs to be conducted.

8MI902

Ghosh

Coyle, Hannah

Washington-Liberty High School

Does the Distance from a Street Affect the Level of Bacteria in a Stream?

The purpose of this experiment was to test the effect of the distance from the street on the level of bacteria in the stream. The hypothesis was if the distance from the road increases, then the bacteria levels will decrease. The group with the highest bacteria concentration was Location A. The group with the lowest bacteria concentration was the control. Tap water had a bacteria level of 2 compared to Location A at 9. This shows there was a big difference between the bacteria level of Location A and the control

Garcia Jimenez, Zoe

Alexandria City High School (includes Minnie Howard)

Yeast Balloons

This project was trying to answer the question of which material (glucose, sucrose, salt, or flour) would be best as food for baker's yeast, *Saccharomyces cerevisiae*. The hypothesis for this experiment was that if flour is used as food for baker's yeast, then it will create the biggest circumference on a balloon of yeast produced CO₂. This hypothesis was proven wrong. This project was done by putting yeast into a flask with different solutions then putting a balloon on top of a yeast-filled flask to catch the CO₂ produced. The CO₂ was how the activity of the yeast was measured. The constants in the experiment were taken from previous experiment done. The data collected showed a pattern of the two sugars having the biggest circumference across all the trials with glucose having an average circumference of 28.6 cm and sucrose having an average of 29.2 cm. The circumference average for the flour was slightly bigger than water, which was the control. Salt had the smallest circumference throughout all the trials. This experiment means that sugars are a simple carbohydrate for yeast to break down. Knowing optimal growth conditions for yeast is important because yeast is incredibly important in everyday life. Yeast is used to make many bioproducts, beverages, and breads.

Hengst, Sadie

Washington-Liberty High School

The Effect of Different Natural Antibacterial Agents on *Escherichia coli*

Concentrated animal feeding operations (CAFOs), commonly known as factory farms, are a large contributor to the spread of antimicrobial resistance (AMR) due to the unsanitary, overcrowded conditions livestock are kept in and the excessive use of antibiotics in their feed to prevent disease. The purpose of this study was to find the natural antibacterial agent that was the most effective against *Escherichia coli*, a species of pathogenic bacteria commonly found in chicken intestines that has evolved multiple antibiotic-resistant strains. The antibacterial agents tested were garlic extract, oregano essential oil (EO), cinnamon EO, and cumin EO, while the control was no antibacterial agent. It was hypothesized that the garlic extract would be most effective due to the consistently high antimicrobial activity of allicin, a molecule prominent in crushed garlic. The experiment was conducted by inoculating Petri dishes with *E. coli* bacteria, then treating each colony with a different antibacterial agent and measuring the diameter of the zones of inhibition after 48 hours of incubation. The results showed that the oregano EO and cinnamon EO were most effective against *E. coli*, with the same mean zone of inhibition of 3.5 cm. Conversely, the control had 0 inhibition. The data collected suggests that while all four antibacterial agents were effective against *E. coli*, the oregano EO and cinnamon EO had the highest and most consistent levels of inhibition. This provides further insight into the best alternatives to antibiotics for factory farms to add to animal feed.

Normington, Beckett

Washington-Liberty High School

The Effect of Anti-Acne Treatments on the Zones of Inhibition of *Staphylococcus epidermidis*

This experiment quantified the inhibition of *Staphylococcus epidermidis* by different topical anti-acne treatments. The hypothesis stated that the group treated with filter paper discs containing 5% benzoyl peroxide topical wash would have the greatest mean zone of inhibition. Sterilized filter paper discs were treated with 5% benzoyl peroxide topical wash, salicylic acid 2% anhydrous solution, 100% tea tree oil, and distilled water. Petri dishes were prepared and inoculated 48 hours later. The discs were applied to the dishes, and the plates were incubated for 48 hours. The mean diameter for each quadrant of each dish was recorded from three directions through the center of each disc and compiled into a data table. The summative data table includes the mean diameter of the measurements for each group. The standard deviations of each group were calculated and recorded, along with an ANOVA test to determine if there were significant differences between groups.

9MI907

Olson, Ula

Arlington Tech/Career Center

9MI908

Putchakayala,

Madison, Kaitlin

Washington-Liberty High School

The Effect of Conjugation Time on Area of Bacteria Growth

Antibiotic resistance is a critical issue that poses a significant threat to the medical community worldwide. Despite the advancement of modern medicine, the misuse of antibiotics has led to an alarming increase in antibiotic resistance. The purpose of this experiment is to provide valuable information to medical professionals regarding the length of time it takes bacteria with resistance to two of the most used antibiotics, ampicillin and tetracycline, to conjugate and pass along antibiotic resistance. It was hypothesized that if tetracycline resistant *Escherichia coli* and ampicillin resistant *Escherichia coli* were left to conjugate, then at ten minutes, the area of growth would be the greatest because when bacteria replicate, which can happen at a minimum $0.2(w) - 0.22(w) - 0.22(w)$

10MI911

McPhillips-DeFilippi, Bellum

Washington-Liberty High School

Mohamed, Aya

Alexandria City High School (includes Minnie Howard)

The Rise Of Bread

What does baking powder, baking soda, and yeast do to bread? Does the leavening agent you put in bread affect how much it rises? The experiment will be done with 11 ml of baking soda, baking powder, and yeast to find out which produces the higher/fluffier bread in centimeters. This information would be useful for bakers that want to try new recipes. To find out which leavening agent works the best I made 15 loaves of bread with 5 of each type using the same amount of every ingredient. Yeast was the tallest at an average of 8.8cm baking powder coming 2nd in 4.4cm and baking soda coming 3rd at 2.8cm. This science fair project will help with new recipes that might be written that only want a little bit of rise or a lot of rise.

Garcia, Ethan

Gunston Middle School

The Effect of Friction on a Hovercraft

This experiment is designed to show how friction affects a hovercraft. This information could help us develop amazing new technologies that will change the way we travel across our planet. The goal of this project is to find which surfaces a hovercraft will travel over the fastest. The procedure used involved getting identical ramps with different surfaces on them and measuring the time it took for a hovercraft to travel over them. The data showed that the roughest surface had the longest time of 1.51 seconds and the smoothest surface had the shortest time of 0.85 seconds. This experiment contributes to engineering by telling what surface affects a hovercraft the most. In conclusion this will make hovercraft designs more efficient.

Ayalew, Maedot

Garcia Mogollon, Miranda

Gunston Middle School

The Effects of Weights on a Magnetically Levitated Train

From Marty McFly's incredible flying DeLorean in 'Back to the Future' to the thrilling flying speeder bikes found all over the 'Star Wars' franchise, the concept of futuristic

Herrick, Sam

Swanson Middle School

The Effect of Magnet Density on Magnetic Levitation

My experiment explores the forces generated by varying the number of magnets and the mass on a levitating platform. By adjusting magnet placement and mass, this experiment aims to understand how these factors influence magnetic levitation. Magnets, regardless of shape, have north and south poles. Similar poles repel, while opposites attract. This repulsion can levitate objects, as forces push against each other. I used this principle to construct my apparatus. To conduct this experiment, I used a single type of magnet at varying intervals along a platform. I then increased the mass in increments of 500g and measured the distance the platform was levitating off the base after each addition of mass.

The data I collected by carrying out my procedure showed that the platform levitated higher above the base when it had more magnets closer together. It also showed that the amount of mass needed to sink the platform by one millimeter rose exponentially the closer it got to the base, indicating that in a perfect system, the amount of mass needed to get the two boards to touch would be infinite.

Oberkirsch, Purvi

Gunston Middle School

The Effect of Solubility on the Conductivity of a Salty Solution

Have you ever wondered if there is more to salt than flavoring your food? Salt solutions are an important part of many battery types, and this depends on a salt's ability to dissolve into water creating a strong electrolyte. This experiment tests a variety of chloride salts to determine the effect of solubility on the conductivity of a salty solution. To do this, salt was dissolved in distilled water. Then, using a simple circuit made from a 6-volt battery and copper wire, a current was passed through the solution. The current, measured in amperes, was read on a multimeter. The solution that read the highest current was determined to be the most conductive. The hypothesis of this experiment was that the Calcium Chloride solution would have the highest conductivity because it has the highest solubility in water (74.5g/100ml). The hypothesis was proven wrong by showing that the Ammonium Chloride solution had the highest average conductivity (1.78 amperes) even though it has a lower solubility (37.2g/100ml) than Calcium Chloride. The experiment also showed several interesting effects: salty water is very conductive and very corrosive; Calcium Chloride is highly exothermic (raising the temperature of the solution by 56 degrees Celsius), and Ammonium Chloride is highly endothermic (lowering the temperature of the solution by 15 degrees Celsius).

Totten, Credence

Dorothy Hamm Middle School

Does More Resistance Mean Higher Volume?

The invention of the electric guitar pickup revolutionized music in the mid-20th century. Electric guitar pickups utilize thousands of wire-wraps around an electromagnetic coil to produce their sound, each wrap adding to the strength of the pickup. | 1. -0.di

Vajjhala, Kavya

George Washington Middle School

Elevated Energy: How Does Altitude Affect the Amount of Cosmic Rays?

High-energy, charged particles, called cosmic rays, constantly bombard Earth. Cosmic rays are of extraterrestrial origin, so studying them can lead to discoveries about the universe. Cosmic rays are usually invisible, but a DIY cloud chamber makes them visible to the human eye. At different elevations, I recorded the number of cosmic rays that passed through the cloud chamber. The data shows that as the elevation increased, the amount of cosmic rays also increased, which proves the hypothesis correct. At sea level, there were about 3.3 cosmic rays a minute. At a 30-foot elevation, there were approximately 4 cosmic rays per minute. There were 6.2 rays at 500 feet and 8.2 cosmic rays at 1000 feet. In summary, There are more cosmic rays at higher elevations because there is less protection from cosmic radiation due to the thinner atmosphere.

Williams, James

Swanson Middle School

The Effect of Earth's Position in Relation to the Sun on North America's Temperature

The purpose of the experiment was to determine how much the temperature of a given point on a spinning sphere differs based on the effect of its tilt in relation to a heat source. This experiment was conducted using a heat lamp and two 5 inch diameter globes printed from PLA filament. When conducting this experiment I placed a globe 5 inches away from the heat source, the globe had a motor which made it spin and after 3 minutes I would record the temperature of a spot on the globe representing North America using a celsius thermal camera. The globe was made to face the heat source in a w

Yassin, Haya

Francis C. Hammond Middle School

Stick Or Swim

During my experiment, I tested the effectiveness of waterproof bandages and regular bandages when resisting water. The aim was to determine if waterproof bandages perform better than regular bandages when wet. To conduct the experiment, I used a grapefruit, as it resembles human skin in texture. I placed a bandage on the grapefruit and sprayed it with water ten times to observe the performance of the two types of bandages. Results revealed that waterproof bandages adhere better to the surface than regular bandages, even a few minutes after getting wet. This confirmed my hypothesis that waterproof bandages would perform better than regular bandages. Based on my experiment, it is recommended to use waterproof bandages if you require long-lasting protection from water. While regular bandages can be worn, they are not as effective as waterproof bandages.

Barua, Preontee

Wakefield High School

The Effect of Barriers on Magnetism

The question that was asked in this experiment is “What is the effect of barriers between magnets on the amount of distance it takes for them to connect?”. The hypothesis based on this question was “If there is a barrier such as aluminum foil or plastic between magnets, then the amount of time it takes for the magnets to connect and the distance it takes will remain the same as two magnets without a barrier because magnetic fields cannot be blocked, and only two classes of materials can be affected by magnetic fields (ferromagnetic and paramagnetic), to which plastic isn’t and aluminum is weakly paramagnetic.”

To test this question, two magnets were set apart at a distance of 1ft on the ends of a ruler. One magnet was wrapped in aluminum foil, and then plastic (after the foil was trialed three times). The magnet not wrapped in anything was slowly moved towards the other magnet until they connected, the distance at which they connected was then recorded. The control group had no barriers used yet followed the same process. The results of this experiment minimally proved this hypothesis false as the results showed an average difference of 2.1 cm between magnets with a barrier and without a barrier and the difference between the two barriers averaged 0.2 cm.

Burks, Thomas

Alexandria City High School (includes Minnie Howard)

Thermo Micro-Fluidics

For my project, I decided to perform an experiment on thermo micro-fluidics, which is the manipulation of small droplets of liquids with heat. I wanted to see if there would be a correlation between the ΔT (the temperature gradient) and the movement of the liquid droplets. This topic is important because thermo micro-fluidics can be used for cell

Coulby, Lillian

Alexandria City High School (includes Minnie Howard)

Performance of Composite versus Aluminum Bats

I researched how the composition and location of impact on a bat affected how far a softball traveled. For my project I used both aluminum and composite bats and also measured where the ball hit the bat in order to get more concise results. For my experime

Mathew, Nicholas

Washington-Liberty High School

What is the Effect of the Temperature of Water on the Rate of Cooling?

This experiment was conducted to see if the Mpemba effect exists or if it is a result of errors. The hypothesis for the experiment was that if the starting temperature of water is increased, then the rate of cooling will increase because hot water freezes faster than cold water due to a phenomenon known as the Mpemba effect. The null hypothesis stated that if the starting temperature of water is changed, there will be no difference in the rate of freezing between the different levels. The groups tested were the following temperatures: 50°C, 75°C, 100°C, and the control group of 20°C. The dependent variable in this experiment is the time it took for the water to reach 0°C. The water was heated up to the required temperature and then put into the freezer with a timer to see

9PH1017

Moran-Uriona, Tomás

Washington-Liberty High School

Parment, William

Wakefield High School

The Design of Paper Airplane that Flies the Furthest

The purpose of this experiment was to explore aerodynamics and to investigate concepts relating to the field of aerodynamics and fuel efficiency. Lower fuel



10PH1020

Iov, Sebastian

Alexandria City High School (includes Minnie Howard)

The Effects of Magntic Configuration on Velo0.24 0 () 0.2 3 ET Q q 0.24 0 0 0.24 0 601

Kaldahl, Julia

Wakefield High School

What Solar Panel Produces the Most Power?

The purpose of this experiment was to determine which type of solar panel generated the most energy per unit area. The three types of solar panels investigated were monocrystalline, polycrystalline and amorphous solar cells. Monocrystalline panels were hypothesized to generate the most energy per unit area because they are made of pure silicon, which was predicted to make them more efficient than the other cells that are made from a mixture of silicon and other materials. For the procedure, the cells were tied to a board and placed in an area where they will receive the same amount of sunlight. All cells are individually connected to a voltage and current probe and data is recorded for each of the three different cells. The results found that monocrystalline consistently had sl

Leighton, Declan

Yorktown High School

The Effect of Voltage and Nozzle Size on the Force Generated by Radial Magnetohydrodynamic Drive

Magnetohydrodynamic drive (MHD drive) is an effect that uses Lorentz force to accelerate a fluid. MHD drive performs this by using a magnetic field and an electric current, but no moving parts which makes it virtually silent. Hypothesis A was if the voltage increases in a radial MHD drive, the force generated will increase at a nonlinear, plateauing rate because the electrolysis reaction will surpass that of the Lorentz force effect and result in a plateau of the generated force. Hypothesis B was if the nozzle throat size is decreased, then the force generated by MHD drive will increase because the nozzle will accelerate the fluid as it exits the radial MHD drive increasing the force. Using a custom designed and 3D printed radial MHD drive, the experiment was conducted and 60,000 data points were collected. The following conclusions were drawn:

- 1) Hypothesis A was confirmed with a P value of <0.01 .
- 2) Hypothesis B was disproved because the force decreased when the nozzle throat

Monroy, Sebastian

Washington-Liberty High School

The Effect of Pitch Angle on an Airfoil's Lift

The purpose of this experiment was to find the most efficient pitch angle of a wing model to allow it to produce the most lift. If the pitch angle of an airfoil is changed to 25 degrees, then the amount of lift created will be the greatest because there will be a larger pressure difference resulting in more lift, but not too high an angle that the wing

Vena, Allegra

Wakefield High School

The Effect of Altitude on Muon Flux

Muon events are ones that can cause damage on impact. They can cause “bit flips” or data conversion in electronic device memory, mechanical errors and even mutations in DNA. When muons travel from the ozone layer to the surface of the Earth, they have only a short time before they decay into photons. As muons, their mass and energy can cause the damage mentioned above. It is hypothesized that more muons will be detected at higher elevations than at lower elevations. This would show higher risk to computer data and humans at higher elevations. Muon flux data for three approximately 20 hour periods was collected from seven sites across the world which was accessed from the internet site, Quarknet.org. The muon events (flux) were then averaged over those three periods, and compared to the average elevation at each site. A graphical comparison of elevation vs. flux was then graphed, and a linear regression performed. The correlation coefficient (r^2) was calculated to be 0.933—a value which implies an extremely significant correlation result. This implies that the null hypothesis can be rejected, and that muon flux is indeed related to elevation on Earth. It is predicted that computer data systems will work ever harder to protect bits from flipping and crashing systems. The continued use of expensive ECC (error correction code) will drive down the cost, so that modern technology can use more compact storage and still be protected from single event upset.

Capiaux, Flora

Kenmore Middle School

The Effect of the Concentration of Neem Oil on Fungi Infected Crape Myrtles

Should neem oil be used to cure a fungi-infected tree? How much should be used? These are some of the questions asked if someone wants to begin this project using neem oil, but you need to know how much. The goal and purpose was to cure the fungus-infected Crape Myrtles in a backyard. The hypothesis was, that if the concentration of the neem oil increases and uses two tablespoons, it's believed that the two tablespoons will be the most efficient. So, put various amounts of neem oil into the solutions. The solution included one gallon of water, one teaspoon of dish soap, and 1, 2, or 3 tablespoons of neem oil based on the tree. The researcher then sprayed and poured the solution over the trees one time every week. The result of the experiment is that the solution with two tablespoons worked the best on the trees, but since they didn't do it for enough time, the fungus wasn't completely gone but it improved the tree's health. The experiment was important, because the trees needed to be saved, and we still need more healthy trees. In conclusion, now is it known that 2 tablespoons of neem oil in the solution is the most efficient way to cure a fungal infection on Crape Myrtles during the winter/fall.

7PS1101

D'Amico, Alessandra

Swanson Middle School

7PS1103

Nunez, Annabela

Kenmore Middle School

The Effect of Different Colored Lights on Lima Bean Height

The purpose of this experiment was to determine what colored light would be better to make a Lima bean plant grow taller. This project looks at 3 different types of be

Tran, Y-Lan

Williamsburg Middle School

The Effect of the Soil Additive on the Height of the Plant

In the far future, we may need to terraform planets for human habitation. Plants will need to be grown in soil that may be completely sterile on arrival, which could lead to poor growth and crop failures. One method by which to ensure an earth-like environment to promote plant growth for food and oxygen production would be to introduce microbes to the sterile soil. The different options for introducing these microbes may be easier or harder for space travel and better or worse at growing plants. By identifying and testing growth using multiple microbe sources, scientists can better plan for terraforming. This project focused on growing a common, beneficial crop plant (beans) in soil that was sterilized to mimic a terraformed planet as a control, and in sterilized soil that was amended with three different microbe sources: worm castings, oak leaf litter compost, and probiotic tablets. The growth of the bean plants was measured at 7 days after planting. Results showed the oak leaf litter was the most successful soil additive in promoting growth. Possible errors and future research are discussed.

7PS1105

Asnake,

7PS1106

Yoon, Alex ; Scott, Sylvia

George Washington Middle School

Make It Rain: What is the Effect of pH Levels in Water on Plant Growth?

This experiment is designed to study the effect of pH on plant growth, and it aims to simulate that effect on kidney bean plants. If the pH levels of the water decrease, then the plant growth will be negatively affected, because most plants cannot survive in an acidic environment. The converse is true for alkaline plants because nitrogenous fertilizers are alkaline. The experiment used equal amounts of water, acid water, and alkaline water to measure the height change in kidney bean plants. Contrary to our hypothesis, alkaline watered plants were not healthy, and the control plants were the tallest. This result corroborates the pre-existing data that acid and alkaline-watered plants are less healthy than plants watered with normal water.

8PS1108

Gallagher, James

Swanson Middle School

The Effect of Apple Type on Sugar Content

For my Science Fair project I chose to measure the different sugar contents of apples.

Gunter, June

George Washington Middle School

Nitrogen versus Potassium: What is the Best Type of Fertilizer?

There are several types of chemical fertilizers used in farming: nitrogen, phosphorus, and potassium. These fertilizers help plants grow faster and better, but can also be very expensive and bad for the environment, especially nitrogen fertilizers. The purpose of this experiment was to determine whether or not nitrogen fertilizer is worth the extra cost by comparing a nitrogen fertilizer and a potassium fertilizer. My hypothesis was that

Karlton, James

Swanson Middle School

The Effect of Caffeine on Plant Growth

This project is on the effects of caffeine on plant growth. This project could definitely prove to be useful, for example it could inform plant owners on whether they should keep caffeine away from their crops, or use it as a super fertilizer. Another way this project could be used is to inform people about whether caffeine will help their household plants or not. This experiment could also show the effect of caffeine on living things, making it a good source of information if someone were to do their own experiments on the effects of caffeine on human growth.



Phi, Duc

Williamsburg Middle School

The Effect of Type of Soil on Radishes

A general rule of thumb for growing plants is to grow them in the soil they grow best in. So then what is the best type of soil for growing radishes? This project looks at what type of soil is best for growing cherry belle radishes by looking at the height of the radishes. The radishes were grown in silty, sandy, clay (mixture of 90% silt/sand/clay, and 5% each for the other two) and loamy (mixture of 40% sand, 40% silt, and 20% clay) soils (independent variable). Then the radishes were measured each day until the end of the experiment by centimeters (dependent variable). Each plant received the same amount of water and sunlight each day. My hypothesis was that the loamy soil

Purdy, Elijah

Swanson Middle School

The Effect of Different Wavelengths of Light on the Growth of Plants

Soil, water, and light are three key requirements for plant growth. This experiment focuses on light; the purpose of the project was to find the effect of different wavelengths of light on the growth of plants. I used three different lights with varying wavelengths: a grow-

8PS1114

Puri, Leikha

Dorothy Hamm Middle School

Ameer, Adil

Alexandria City High School (includes Minnie Howard)

Comparing Different Types Artificial Light on Plant Growth

My project is about Comparing Different Types of Artificial Lights on Plant Growth. The purpose of doing this project is to see which artificial light helps the plant grow better because as global warming is happening scientist are finding new ways to grow plants indoors although we have greenhouses we still need to find more better and efficient ways to grow plants indoors. Another purpose of doing this project is that me and my mom love to grow plants, they are fine in the summer and spring but as fall begins and the temperature gets colder our plants die so me and my thought to grow them indoors and find which artificial light would be best form the health and growth of the plants. So for my experiment I will take ten same type of plants (money plants) and place five under white tube light and the other under colorful wire light, giving them 236 milliliters of water three times a week for a month and recording their data once a week. The hypothesis is that If the plants receive artificial light from the white tube light they will grow healthier. If you`ll have a look at the data you`ll notice that the white tube light has better growing results than the colorful wire light. The conclusion is that the results supports the hypothesis and if I was to do this project again I would have more different types of artificial lights and plants

Heatherington, Declan

Alexandria City High School (includes Minnie Howard)

The Effects of Water Salinity on Seed Germination

The purpose of this experiment is to see the effects of water salinity on seed germination. The reason for this is because with global warming causing sea levels to rise and droughts to be more frequent, crops will come into more contact with salt. I tested how much time a seed would take to germinate compared to normal, if at all. My independent variable was water salinity and my dependent variable was seed germination. Water salinity was measured in grams of salt per liter of water, with the 4 groups being 0 g/l (control), 15 g/l, 25 g/l, and 35 g/l. My hypothesis was the saltier the water, the worse the germination. The results showed only the control group grew, supporting my hypothesis. Future studies should keep temperature levels static for the entire experiment. Sample size should be increased as well. Future experiments should also use more variable levels, such as 5 g/l.

Hogan, Connor

Washington-Liberty High School

The Effect of Increased Gravitational Force on Seed Germination Percentage

The purpose of this experiment was to see how increased gravitational force affects seed germination percentage. The hypothesis was if plant seeds are subjected to four times the gravity on Earth (4g) then the overall germination percentage of the seeds will be less than the control group because the seeds will have been damaged by the G-force. Sixty seeds were spun at 150 rotations per minute (rpm) 6 cm, 11 cm, and 17 cm away from the center of the rotor—the equivalent of 2g, 3g, and 4g. Having them spin for 2 minutes would put stress on the seeds equivalent to that which they would experience on a real rocket launch. The sixty seeds plus an additional twenty for the control group were then germinated for four days. The results were put into a table and the germination percentage was calculated for each group. An ANOVA test was performed and standard deviation was calculated. The P-Value of the ANOVA test was 0.00452578763120694 which meant the data was statistically significant. The data from the experiment agreed with the hypothesis: if plant seeds are put under increased

9PS1119

Schofield, Caroline

Alexandria City High School (includes Minnie Howard)

Graywater and Lima Bean Plants

In this experiment I tested the effects of different types of greywater on lima bean plants, which is important to help conserve water in households and urban environments. To test this, I grew lima beans in four different types of greywater and measured the height in centimeters after ten days. I used washing machine greywater, shower greywater, sink greywater, and dish washing greywater. My hypothesis was that

Schwentker, Claire

Washington-Liberty High School

The Effect of Lower pH Levels on *Cucumis sativus* Germination Rate

The purpose of this experiment was to determine which varieties of *Cucumis sativus* (cucumber) seeds had the highest germination rate in an acidic environment over a 10-day period. The hypothesis was that cucumber varieties with larger seeds would have faster germination rates, as the higher surface areas may give them more protection, allowing them to perform better in stressful conditions. The null hypothesis stated that there will be no statistical difference in how many seeds of different *C. sativus* varieties germinate when put in an acidic environment. The independent variable was the variety of seed. The varieties used were 'National Pickling,' 'Lemon,' 'Straight Eight,' and 'White

Fiorino, Anthony; DelVecchio, Caleb

Washington-Liberty High School

The Effect of Light Malt Extract Concentration in Agar Recipes on the Growth Rate of *Pleurotus djamor* Mycelium

The purpose of this experiment was to identify the optimal concentration of light malt extract in agar solutions for culturing mycelium. The species of mushroom used in this investigation was the pink oyster mushroom (*Pleurotus djamor*). 7 plates were poured for each of the following concentrations of light malt extract: 0g/L, 10g/L, 20g/L, 30g/L, and 40g/L. It was hypothesized that the group containing 30g/L would promote the fastest growth rate. 30g/L is a commonly used concentration of light malt extract for the cultivation of mushrooms.

A region of growth was marked 3 days after inoculation with liquid monoculture. The plates were left to colonize for an additional 3 days, and new growth was measured. After data collection, ANOVA tests were run to identify statistical significance, resulting in a p-value of 3.7543×10^{-5} . T-tests conducted between each group identified statistical significance when comparing the group containing no light malt extract with all groups containing light malt extract. Results were inconclusive when comparing all groups containing light malt extract. Observational data indicated a difference in hyphal density between the groups containing light malt extract and those containing none. The group lacking light malt extract exhibited minimally visible mycelium when compared to the denser, whiter mycelium of the other groups. The findings from this experiment aim to serve cultivators and researchers by identifying the optimal concentration of light malt extract in agar recipe solutions for the growth of mycelium.

Soisuvam, Daisy; Duss, Nadja

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Grow Your Hair, Grow Your Plants

Most people pay little attention when a strand of hair falls out into their brush. However, salons contribute significantly more to this, and all this hair waste ends up in landfills that emit greenhouse gasses, contributing to climate change. Scientists have sought ways to recycle hair, and they found that it has potential as a plant fertilizer due to its proteins and nutrients. To test this method of reducing waste, we decided to use human hair as fertilizer in pea plants. We hypothesized that if the percentage of hair in the soil is increased, the pea plant growth will accelerate. To start, a control pot filled with soil was weighed in grams. This starting weight was used to calculate what 2.5% of that mass is, then we filled another pot up with that weight of hair, and adjusted the soil to only 97.5% of the initial mass, to keep the weight equivalent to the control. This was repeated for the final pot, doubling the hair to 5%, with soil adjusted accordingly. Three pea seeds were planted in each pot. After caring for the plants for twenty days, our data on the growth revealed that the average height of the 5% hair trials was 3.2 centimeters, closely followed by the average of 3 centimeters in the 2.5% trials. The control averaged

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