

Abstract: Science and Engineering Fair of Houston

1243

The Effects of Battery Length and Weight on Gravity Battery Efficiency

Levi Stephens, Paul Dupre

Spring Branch ISD/Spring Branch Academic Institute

Category:

Environmental
Engineering

Chemical batteries are in almost everything we use, from phones to clocks, but each and every battery requires materials that are not environmentally friendly to obtain or work with, and they will eventually degrade, as they aren't entirely stable. A gravity battery is much more environmentally friendly, and stable, as you do not need specific or hazardous rare earth minerals to create them, only something with a lot of mass and a DC motor. This project tested the efficiency of gravity batteries with different weights and lengths, finding valuable information about what sizes and types of batteries to use on full scale batteries. To test efficiency, we calculated the Gravitational Potential Energy in joules, and then measured the joules of electrical energy, and finally divided the two to get the efficiency of the battery. There was an increase in efficiency from the single 20% bar to the single 60% bar, with the double 60% bars being an outlier, dropping before the overall peak with the double 80% bars, at 0.95% efficiency. Our hypothesis was not correct, but it was right in some regards. When we look at the trendline, we do see the efficiency going up as the weight/length increases, but there is a small decline at the end- most likely because heavy bars are very fast, jamming the gears.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

1244

KrabKleanX: A Biomimicking Robot to Remove Trash From Beaches

Shanaya Sharda, Arjan Sra

Houston ISD/T. H. Rogers MS

Category:

**Environmental
Engineering**

Marine pollution is a global crisis, with around 11 million metric tons of trash entering our oceans annually. A significant portion (2.2 million tons per year) of this trash ends up on beaches (primarily single-use plastics like bottles, food wrappers, and cigarette butts) and kills approximately 100,000 marine animals and 1 million seabirds every year through ingestion and entanglement. Human volunteer efforts are not nearly enough and have managed only around 4,500 metric tons/year of trash collection within the last 40 years. A beach-cleaning robot using biomimicry can help collect trash more efficiently and consistently than human cleanup efforts or other existing solutions, significantly reducing animal mortality rates and improving the coastal habitats. This project proposes KrabKleanX - a solar-powered, six-legged robot biomimicking the Ghost Crab and the Tiger Beetle. Unlike current heavy, tread-based robots, this design would utilize an angular, three-segment leg system for enabling fast movement, maximum stability, and load bearing capacity to target a removal rate around 10-fold greater. Testing included sieving efficiency (time taken to achieve separation) size and mass of debris, as a function of area of sieve, and varying moisture content of underlying sand. It also included sizing the solar panel to power the robot. Testing demonstrated that a biomimicked robot can be developed that will be more efficient than human efforts and most other existing solutions.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

1245

Clean Water for Less

Shanvitha Challarapu

Conroe ISD /York Junior High

Category:

Environmental
Engineering

Safe access to water for drinking remains a concern across the world, with about 26% of the world's population not having access to clean water. This project investigated water insecurity by testing three low-cost methods, boiling, chlorination, and solar water disinfection (SODIS), to make contaminated water safer to drink. Water samples were collected from a local stream, filtered, and treated using each method in three trials. After disinfecting, samples were placed on nutrient agar plates to measure bacterial growth using colony-forming units (CFU). The results showed that all three methods reduced bacteria compared to untreated water. Chlorination produced the lowest CFU counts, showing it was the most effective method. Boiling and SODIS also reduced bacterial growth but were less effective than chlorination. Overall, this project demonstrates that simple and affordable water treatment methods can improve water safety and help reduce the risk of waterborne diseases, especially in areas without access to modern water treatment systems.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

1246

Optimizing Algae Photobioreactors

Marc Quezada

Fort Bend ISD /Quail Valley Middle School

Category:

Environmental
Engineering

This project aims to determine whether specific design improvements to a photobioreactor (PBR) can increase the efficiency of algae growth while also making the system more user-friendly. Many current photobioreactor designs suffer from uneven lighting, low CO₂ absorption, and difficult maintenance, which limit their productivity and accessibility. The purpose of this study is to evaluate whether the addition of dimmable LED lighting, a microbubble CO₂ diffuser, and simple sensors can create a more effective and user-friendly PBR for small-scale cultivation. To test this idea, I will construct two systems: a standard control photobioreactor and an improved photobioreactor featuring enhanced lighting control, upgraded CO₂ transfer, and monitoring components. Both reactors will be filled with identical algae cultures and nutrient solutions. Over two weeks, I will measure turbidity (growth), pH, and temperature daily to compare growth rates and stability between the two systems. I expect the improved PBR to support faster algae growth due to better photosynthetic conditions and more efficient gas exchange, while also reducing user intervention by automatically maintaining ideal lighting. The goal of this project is to determine whether practical, low-cost modifications can significantly enhance the performance of photobioreactors. If successful, this research could help make algae cultivation more accessible for classroom use, environmental science projects, and future bioengineering applications.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

1247

Filtration Station

William Davis

Clear Creek ISD /Creekside Intermediate School

Category:

Environmental
Engineering

The purpose of this study is to identify the most efficient and effective water filtration system. This experiment will test the different cleanliness levels in each of the waters after they have experienced the different filters. There will be different types of water different levels of cleanliness, my cause for doing this experiment is to find for people the most efficient and effective water filtration system. When interacting with any water that is non potable, I will wear safety gear eye protection and gloves and do so under adult supervision. I will wear disposable gloves and wash my hands after handling any water samples. From the data I have collected the results show that the most effective filtration system was LifeStraw averaging 8% coverage out of two separate Petrie dishes. While the most non effective filtration system was the Brita filter averaging 73% coverage out of two different dishes and the Brita Pond water had four distinct types of bacteria which was the most out of all the Petrie dishes. The last part of this data is the most fascinating part of this project which was the tap water when tested averaged 85% coverage from bacteria the 2nd most out of all the test specimens. This data is important for the many people in the world who suffer from lack of clean and potable water, this goes to show there is a cheap and efficient way to access clean drinking water and that is the LifeStraw.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

1248

Design Vs Disaster

Isabella Sandoval

Charter/SST - Champions College Prep - MS

Category:

Environmental
Engineering

This project investigated how different house design features help protect a model home from three major natural disasters: floods, wind, and heat. Three versions of each design feature were tested, including flat, raised, and stilted bases for floods; flat, sloped, and dome roofs for wind; and cotton, foam, and reflective foil insulation for heat. Each structure was exposed to controlled tests that measured how well it resisted water levels, wind damage, and rising temperatures. The results showed that stilted bases resisted the highest water levels, dome roofs remained the most stable during wind tests, and reflective foil insulation kept the model home the coolest. These findings suggest that specific structural features can significantly improve a building's ability to withstand environmental hazards. Understanding this can help engineers design faster, more resilient homes for communities affected by natural disasters.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

1249

Breaking down a tornado

Gracen Saunders

Galveston ISD/Crenshaw School of Environmental Studies

Category:

Environmental
Engineering

The purpose of my project is breaking down a tornado. I created an small model of a Tornado using a fan, box and water vapor. I used my research on my model and tested whether it will react differently to temperature changes, and changes in wind and speed. I wanted to see how it reacted and if it would break apart.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

1250

The Effects of Glycerin Concentration on the Decomposition of Starch-Based Biodegradable Bioplastics

Alyssa Janco

Private/The Emery/Weiner School

Category:

Environmental
Engineering

Conventional petroleum-based plastics impact our lives every day- while they have revolutionized industries, there are tradeoffs: they pollute freshwater sources and air, harm wildlife, and pose deteriorating health risks to humans. This project studies the effect of glycerin concentration on the biodegradation of starch-based bioplastics to discover a solution for making inexpensive, easily accessible, and actually compostable bioplastics. Glycerin was used as a plasticizer because it is cheap, easy to find, and biodegrades effectively. Bioplastic samples were created with simple, cheap ingredients, but each with varying glycerin concentrations, and then they were buried in soil, and their masses were measured every 5 days over the course of 50 days. The results showed that no glycerin concentrations produced brittle, non-biodegradable bioplastics, whereas higher glycerin concentrations produced very dense and moist bioplastics. The bioplastic with the glycerin concentration of 3mL produced a near-perfect balance of flexibility, structural integrity, and quick biodegradation. These discoveries suggest that glycerin concentration influences the movement of polymer chains within the bioplastic, which leaves the enzymes within the soil access to starch chains. This enables the enzymes to consume the starch, travel back to the microbes, and then the microbes consume the enzymes, subtracting from the overall mass of the bioplastic. This experiment demonstrates how bioplastics can be a sustainable alternative to conventional plastic in our environment.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

1251

Diesel Desistance: Analyzing Bacillus subtilis for Alkane Biodegradation and the Possible Uses of Surfactants

Noah Ansari

Conroe ISD /McCullough Junior High

Category:

Environmental
Engineering

Oil is a serious environmental pollutant that can destroy ecosystems. So far, no solution has ever been found to clear all oil without causing more environmental harm. One solution that is being studied and is in use is biodegradation, or, put simply, the degrading of larger hydrocarbons into smaller ones through the use of biological agents. Bacillus subtilis is one bacteria that is known for its ability to degrade longer chain alkanes into smaller ones. B. subtilis has been found to work best on alkanes in the >nC12 range down to gasoline range (nC6 to nC12). This ability to degrade oil is impacted by the cell surface hydrophobicity (CSH) of the organism. Surfactants are compounds that contain both lipophilic and hydrophilic parts, which reduces the surface tension between lipophilic and hydrophilic substances. B. subtilis is a naturally hydrophobic organism, and surfactants have been found to lower its CSH%. Although this is traditionally considered bad for degrading oil, the surfactant is simultaneously breaking down the oil into smaller particles, which has been found to have a much more positive impact on degradation. This study focuses on further studying Bacillus subtilis for biodegradation, and the impact surfactants have on it. For this project, B. subtilis was suspended in test tubes and had pure diesel added to it. The surfactant Polysorbate 80, or Tween 80, was added into half of the test tubes. At the end of the study, B. subtilis was effective at degrading oil and Tween 80 had a slight positive impact on it. These results prove promising, and further research should be done into biodegradation and the uses of surfactants.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

1252

Automatic compost/water distributor for senior citizens

Yohelin Nambo, Bella Sandoval, Sabrina Chiu

Harmony Public Schools - North District/Harmony School of Excellence-Houston

Category:

Environmental
Engineering

This project focuses on designing and testing an automatic compost-spreading and watering system to support elderly gardeners who have difficulty with manual gardening tasks. The system applies compost evenly while watering plants, reducing physical effort and improving accessibility. To see if it actually helps, we compared two groups of plants, one got both compost and water from the system, and the other just got watered. The plants with compost grew taller, had more leaves, and just looked healthier overall. It's a good example of how mixing engineering with plant science can make gardening easier and more sustainable, especially for people who need a little extra help.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

1253

A Shade Cooler

Kaylee Guerra

Charter/YES Prep

Category:

Environmental
Engineering

This study aims to help homeowners make more informed choices on their homes color and how they effect their homes efficiency. I conducted research to understand if the color of your house can reduce your energy footprint. My method included placing a heat lamp over different colored boxes to simulate the suns heat on colored houses. The results showed that red and orange were the coldest after 30 mins under a heat lamp. In conclusion my findings suggest that the color of your house do effect your energy footprint, and temperature is not only decided by how light or dark a color is.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

1254

An investigation of microplastics and most effective/efficient ways to remove it

Asher Hsieh, Jinu Kang

Spring Branch ISD/Spring Branch Academic Institute

Category:

Environmental
Engineering

Around 358 trillion particles of microplastics (mostly PET) have been estimated to be in the oceans, 14 metric tons believed to have sunk to the bottom of the ocean, with an additional 1.5 metric tons added to the oceans per year. Out of those plastics, a couple hundred (900) particles are in contact with and ingested by humans per day, resulting in the accumulation of around 0.48% of a human's bodyweight of microplastics. This project has tested the most efficient/effective ways of removing microplastics from aquatic environments in hopes to reduce that level of microplastic exposure. Out of the 6 different methods of microplastic removal, we theorized that the chemical methods of clumping microplastics were the most effective and efficient ways of microplastic removal, due to the cost and input required to make Aluminum Chloride ($AlCl_3$) and Aluminum Sulfate ($Al_2(SO_4)_3$). After testing, we concluded that our hypothesis was proven correct. The way clumping would work in real life is that the chemicals would stick to all the plastic and sink to the bottom of the ocean where no harm can be done.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

1255

H2O Heroes: innovative Accessible Clean Drinking Water

William Johnson

Clear Creek ISD /League City Intermediate School

Category:

**Environmental
Engineering**

16 million people in America and 2 billion globally lack access to clean drinking water. I saw a Mark Rober video of how clean water was being made in Africa, and it sparked my interest. I had the idea of making an affordable and portable machine that can make water where it is needed. I am using a technique called Atmospheric Water Generation, utilizing Peltier coolers which freeze the heatsink, making frost. I figured out that I would need a big heatsink to cool down the hot side of the cooler to make freezing the most efficient. I also went through an abundance of ways to collect the frost after it melted. In the end, I had to resort to making legs, because too much or too little airflow, would make the heatsink not freeze. The problem with this is that it is harder to collect, as I used aluminum foil to collect it. Once I got it to freeze, I took the time intervals to see what the best cycle for freezing and then melting would be. I ran these tests for five minutes each up to 30 minutes, on two different days. I found out from the testing that 20 minutes was the best cycle, and that humidity affects freezing time. In the future, I will research on how I would figure out how to collect water efficiently, and if I could scale up the Peltier coolers to freeze more surface area of collector heatsinks.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

1256

VERDE - Vegetation Erosion Real-Time Detection Engine

Dev Sanghavi

Houston ISD/Lanier - MS

Category:

**Environmental
Engineering**

Deforestation in the Amazon Rainforest and many others is a major environmental issue, yet existing monitoring systems often detect forest loss weeks or months after it occurs due to reporting delays and cloud-covered satellite imagery. This project investigates whether artificial intelligence applied to publicly available satellite data can improve the speed and accuracy of deforestation detection. Multi-spectral satellite images from Landsat and Sentinel missions were analyzed using machine learning models to classify forested and deforested areas. Model performance was evaluated using accuracy, precision, recall, and F1 score, and results were compared against historical deforestation reports to estimate improvements in time-to-detection. The study also examined model performance across different forest densities and environmental conditions to identify bias and limitations. Results indicate that AI-based analysis can detect deforestation earlier than traditional reporting methods while maintaining high accuracy under real-world conditions. These findings show that low-cost, AI-driven monitoring systems could support faster environmental response and improved forest and species protection results, which in turn could curb climate change by up to 5% if implemented right.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

1257

Katrina Levee 2.0

Victoria Kerr

Clear Creek ISD /Seabrook Intermediate School

Category:

Environmental
Engineering

Levees are used along rivers and flood plains to protect communities against storm surges and high tides. This project evaluated the failed levee system which resulted in the devastation of New Orleans during Hurricane Katrina in 2005. A levee system was built within a tank. The levee base was made out of various combinations of earth materials and tested for stability. Rocks, sand and soil combinations were tested. The levee base was topped with a wall (brick) and anchored with wooden pilings. Water was added to one side of the levee and a storm surge effect was created with the use of a vacuum. The researcher recorded the total test time in minutes. The final test case for the rock/sand/soil combo was reduced due to equipment malfunction. Rocks/Soil levees lasted an average of 57 minutes, Rocks/Sand levees lasted an average of 42 minutes and Rock/Dirt/Sand levees lasted an average of 31 minutes. The Rock/Dirt levee had the longest average test time but had significant water seepage that was constantly removed. This is technically a failed test but continued expecting a true levee break. In conclusion the hypothesis was incorrect, the rocks and soil was not the strongest earth material combo. Surprisingly the sand and rocks combo was the best. Specifically, when the sand was turned into mud/clay which is an impermeable barrier, which does not allow any water to pass through.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

1258
Let's Go Solar

Mehdi Merchant
Private/AL-HADI SCHOOL OF ACCELERATIVE LEARNING

Category:
Environmental Engineering

The purpose of this experiment is to find out if solar energy can heat water and reduce the use of fossil fuels. Solar energy comes from the sun, is renewable, and does not cause pollution. In this experiment, two sizes of copper coil pipes (1/4-inch and 1/8-inch) are tested to see how well they absorb heat from sunlight. The pipes are painted black to absorb more heat and placed on aluminum sheets over wooden boards. Water flows through the pipes, and the setup is left in the sun for four hours each day for three days. The temperature of the water is measured after each four-hour period. The results show that the size of the copper coil affects how much heat is absorbed. The 1/4-inch pipe starts at 32 °C and increases steadily by 1 °C over three days. The 1/8-inch pipe starts at 33 °C, drops by 1 °C, and then rises by 2 °C. This shows that different pipe sizes absorb and release heat at different rates. In conclusion, the experiment demonstrates that solar energy can effectively heat water, and the size of the copper pipe plays a crucial role in efficiency. This supports the idea that solar energy is a clean, practical, and renewable energy source that can save resources and reduce electricity use.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

1259

When the moon bites back, The effect of Lunar Dust on Space Rated Cables

Olivia Saucedo

Clear Creek ISD /Brookside Intermediate School

Category:

Environmental
Engineering

The purpose of this project was to determine which space rated cable was the most durable and shows less degradation when being dragged on 3 different surfaces, Sand, Sandpaper, and a Lunar dust simulant. According to Budzyń and colleagues (2022), Lunar Dust has been proven to pose a challenge for surface hardware operations. During the Apollo program researchers found the negative effects of Lunar dust on almost all the equipment the dust encountered. There is not much research done about the damage lunar dust causes to lunar mission equipment and that is why this project is important because it shows what space rated cable is more effective when used in lunar missions with a greater resistance from lunar dust damage. Four space rated cables were dragged with a weight on top of 3 different surfaces, sand, sandpaper, and a lunar dust simulant. The cables used in this project are WI-M-8-100-2 (8 AWG silicone-insulated flexible wire), WMRC-122S09, WMRC-122S09 without sleeve, M22759-12-16-05973 (Multiconductor shielded aerospace cable, 2 conductors, PTFE/FEP insulation, MIL-spec), The hypothesis was that the cable, WMRC-122S09 with the sleeve on will show the least abrasion because it has a coating on it to protect the cable. According to the experiment, after testing the results show that the cable WI-M-8-100-2 (8 AWG silicone-insulated flexible wire) space rated cable showed the least abrasion, and the hypothesis was proven to be wrong. WI-M-8-100-2 trials show the thickness of the cable after every trial, 5.82mm, 5.81mm, and 5.78mm, this shows that the WI-M-8-100-2 (Red Cable) is the most durable cable compared to the other three.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

1260

Engineering the Shore

Cooper Dorsey

Clear Creek ISD /Seabrook Intermediate School

Category:

Environmental
Engineering

Storms and tsunamis can destroy infrastructures and injury people. Coastal areas are vulnerable to the impact of waves. In this experiment seawall designs were modified to curved, straight, sideways V, mound, and stepped. A coast was recreated in a tank filled with water and a flap paddle attached to a 12-volt motor to simulate a storm. A study was devised to evaluate this hypothesis that if assorted designs are used, then the curved seawall design will be most effective at stopping waves during a storm. The five different seawall designs were repeatedly hit with waves to see the effectiveness of the walls. The average for the curved design was 62.6, while the Mound design was 24.8. Therefore, the data does not support the hypothesis proposed. However, you can predict that curved designs and mound designs act similarly if assessed again.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

1261

Eutrophication: P-N (Phosphorus-Nitrogen) Monitor

Atish Anuramchand, Shreehan Pawar, Arjun Gajja
Fort Bend ISD /Quail Valley Middle School

Category:

Environmental
Engineering

Eutrophication is a growing environmental problem caused by excess nitrate and phosphate entering lakes and rivers through fertilizer runoff, leading to harmful algal blooms and oxygen depletion that can kill aquatic life. Many current nutrient monitoring methods are expensive, laboratory-based, or detect the problem only after visible damage has occurred. The purpose of this project was to design and test a low-cost, portable detector capable of rapidly measuring nitrate and phosphate levels in water to identify eutrophication risk early. The problem investigated was whether a budget-friendly optical detection system could accurately measure nitrate and phosphate concentrations using colorimetric water-testing reagents. It was hypothesized that the intensity of color produced by these reactions would be directly proportional to nutrient concentration and could be quantified using light-based measurements. To test this, a custom detector was built using an Arduino microcontroller, LEDs, photodiodes, and a light-tight sample chamber. Affordable commercial nitrate and phosphate test kits were used to produce color changes in water samples. Calibration standards with known nutrient concentrations were prepared, and absorbance values were measured to create calibration curves that converted light readings into parts per million (ppm). The results showed a clear linear relationship between absorbance and nutrient concentration for both nitrate and phosphate, allowing the detector to accurately estimate nutrient levels within the tested range. This project demonstrates that a low-cost, portable eutrophication detector can be created using simple optical components and affordable reagents. The detector successfully met its design objectives and shows potential for early, on-site monitoring of nutrient pollution in aquatic environments.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

1262

How does the amount of Co2 being released in one environment and not the other affect the temperature difference.

Janet Flores

Houston ISD/BCM Biotech Academy at Rusk - MS

Category:

Environmental
Engineering

My science fair project was titled "Trapping the heat", and the testable question was "How do increased co2 concentrations (from dry ice) affect the environmental temperature within an environment when exposed to light, compared to at nighttime (no sun exposure)" The project was representing how the co2 and temperature levels can change differently in two different settings such as day and night. During daytime the temperature did rise to an average of 96.6 degrees Fahrenheit and the highest co2 average was 1000ppm. Compared to when there was no sunlight meaning nighttime the average temperature was 71.1 degrees Fahrenheit and the highest average of co2 was 5000ppm. As a result, when I had placed the environment outside in the sun the temperature was higher and co2 lower, when compared to the environment when placed out at night with no sunlight making the temperature lower and co2 higher. In conclusion my hypothesis was correct, this experiment demonstrates that when I placed the environment with plants out in the sunlight it helped make the temperature higher with radiation by heat waves and by the release of co2.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

1263

How does changing the material being burnt to make everyday objects, such as toys, change what will happen to the quality of the air?

Jonas Veloz

Houston ISD/BCM Biotech Academy at Rusk - MS

Category:

Environmental
Engineering

My project is about if we change the material that is being burnt to make everyday objects, such as toys, will it change the amount of pollution in our air, and if so, what material can we use to make toys without polluting the so much. The problem is that we keep burning products, such as steel, wood, and plastic, to make everyday objects such as toys, and that's polluting our air, which is bad for us. I aim to find what materials can we use to make toys, without polluting the air, as much as we, humans, already do. My approach to this crisis is to burn steel, wood, and plastic, as safely as possible, and see which materials release the least PM2.5 and PM10, because the more there is, the more harm it is to us. One of my main claims is that I thought wood would have been the best material to burn, to make everyday objects, such as toys, because I believed that wood would have released less PM2.5s (a chemical that is good for us), which unfortunately, did not (my hypothesis was incorrect). Some of my key discoveries were that small amounts of steel was the best material to burn to make everyday objects, such as toys, because it released the least amount of PM2.5s and PM10s, for example hot wheels is a perfect example, for a toy that uses small amounts of steel, it uses small amounts of steel on the axels. Another key discovery of mine is that wood was actually the worst material to use, to make everyday objects, such as toys, because it releases the most PM2.5s and PM10s. Then I realized, what if they don't have to burn the steel at all, but you would absolutely have to so that they can mold the hot wheels axels in the small shape of an axel. In conclusion, steel is the best material to burn to make everyday objects, such as toys, without polluting our air as much as we already do.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- Human participants potentially hazardous biological agents
 Vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no

