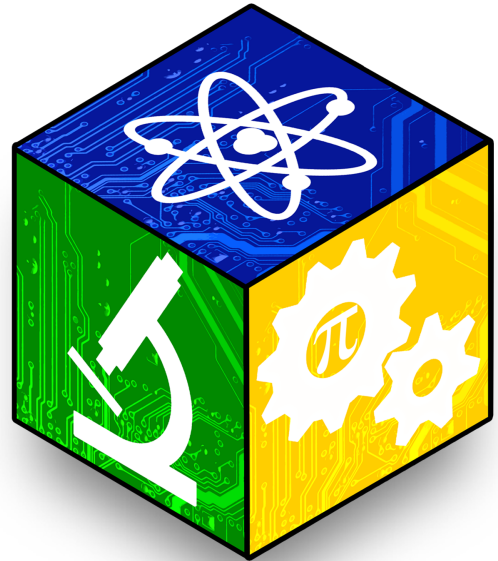


CONNECTICUT  
SCIENCE &  
ENGINEERING  
— FAIR —



**74th Annual Fair**  
**March 7-19, 2022**

**Student Abstracts**

## Fair Categories

	Life Sciences	Physical Sciences
<b>7<sup>th</sup> &amp; 8<sup>th</sup> Grade Team</b>	<b>LT (1001 – 1999)</b>	<b>PT (4001 – 4999)</b>
<b>7<sup>th</sup> Grade</b>	<b>L7 (2001 – 2499)</b>	<b>P7 (5001 – 5499)</b>
<b>8<sup>th</sup> Grade</b>	<b>L8 (2501 – 2999)</b>	<b>P8 (5501 – 5999)</b>
<b>High School</b>	<b>LS (3001 – 3499)</b>	<b>PS (6001 – 6499)</b>
<b>High School Team</b>	<b>LST (3501 – 3999)</b>	<b>PST (6501 – 6999)</b>

## Special Categories

<b>AT = Applied Technology</b>	<b>EE = Engineering: Electrical &amp; Mechanical</b>
<b>AS = Animal Science</b>	<b>ET = Energy &amp; Transportation</b>
<b>BE = Behavioral &amp; Social Sciences</b>	<b>EV = Environmental Analysis</b>
<b>BI = Biochemistry</b>	<b>EM = Environmental Management</b>
<b>CB = Cellular &amp; Molecular Biology</b>	<b>MA = Mathematical Sciences</b>
<b>CH = Chemistry</b>	<b>ME = Medicine &amp; Health Sciences</b>
<b>CS = Computer Science</b>	<b>MI = Microbiology</b>
<b>EA = Earth Science</b>	<b>PH = Physics &amp; Astronomy</b>
<b>EN = Engineering: Materials &amp; Bioengineering</b>	<b>PS = Plant Science</b>

## Special Category Composites

<b>Biotechnology</b>	<b>AS, BI, CB, EN, ME, MI, PS</b>
<b>Environmental</b>	<b>EV, EM</b>
<b>Engineering</b>	<b>EN, EE</b>
<b>Sustainability</b>	<b>EA, EN, EE, ET, EV, EM</b>

# CSEF Official Abstract and Certification

Word Count

226

Fair Category

PT

Project Number

4001

Title: Ice vs Substances: Which will melt an ice cube first?

Student Name(s): D. NiiAryee, K. Valentin, Y. Plummer

## Abstract:

We decided to test different kinds of substances (road salt, table salt and sand) to see which would melt an ice cube the fastest. It is winter time, we understand that roads are becoming icy. Icy roads are more difficult to drive as they are slippery. It's important to know if the materials we use to keep roads safe actually work.

We are going to take four cups and put an ice cube in each cup. A tablespoon of each substance will be placed on each ice cube, all except the fourth cup. The fourth cup is our control. We will use this untouched cube to see how fast ice melts on its own verses with the substances.

We predict that the road salt will melt the ice cube the fastest. We've made this prediction because the road salt is the strongest substance we're using chemical wise. Another reason we think the road salt will melt the ice the fastest is it's the only substance that we are using that is specifically designed to be used against ice.

In summary, we are testing with road salt, table salt and sand to see which substance would melt an ice cube the fastest. Reason behind our testing is to gain information on which substance will have a better result in melting ice and ultimately creating safer roads/ environments.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EV ET EM

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

247

2022

Fair Category

PT

Project  
Number

4002

Title: Measurement Techniques and Mathematical Analysis of Gum Bubbles

Student Name(s): R. Reid, L. Kozerefski

## Abstract:

This project had three parts: which brand of gum produced the biggest bubbles for testing and data collection, what gum bubble measurement techniques produced the most reliable data; how could gum bubbles be compared and analyzed mathematically.

In phase one, Dubble Bubble consistently produced the biggest bubbles and was selected for all further testing. Phase two tested different ways to measure bubbles to determine which worked best. Frozen bubbles developed dents if they were touched and often popped after being frozen. Calipers stuck to and popped the bubbles. Grids were hard to see the measurements and keep consistent distances. The iOS Measure app had variations due to leveling. Using a bicycle pump to produce bubbles would frequently pop the bubble or fail to inflate it. The two measurement methods selected were wrapping string around bubbles for circumference and holding a ruler up and taking a picture to capture the bubble at its biggest size before it popped.

Phase three looked at mathematical analysis of bubbles blown using the combination of methods chosen in phase two. Most bubbles were NOT spheres based on diameter and height measurements and photo evidence. Data was compared to check for consistency between measured and calculated values. Work was done with ellipsoid formulas to see if they were a better match for the bubbles than spheres. Calculations of volume & surface area were compared to observe how surface area and volume change when the diameter/radius or the number of pieces of gum changes.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

MA EN

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

PT

Project Number

4003

Title: School Bus Approach Alert System

Student Name(s): L. Kulon, S. Dash

## Abstract:

In this project, we get tired of waiting outside, being endangered by harsh weather, encountering wild animals, and even worse, being in contact with weirdos, so we create a system which can detect a bus coming into a student's 'zone' (a virtual circle surrounding the student) and notify the student via SMS, to minimize our time spent outside waiting for the bus. To make this system, we first had to explore our options, and to make things simpler on our hand, we made a set of initial requirements. We then brainstormed all of the ways we could execute our project and crossed out any methods from our list which would be unable to accommodate our requirements, so we ended up with only a couple of options left. Out of these, we sorted them from easiest to implement to hardest, and with that, we had found the base to our first prototype, which used the same structure that our current system uses. We created simulations to test our prototypes, which helped us reveal many bugs in the system. After we fixed those bugs, we began adding the remaining features listed in our initial requirements, and after three attempts and much more bug fixing, we came to our current prototype. Although it fulfills our requirements, we tested that it works about 96% of the time. This project serves as a 'proof of concept' where it shows that designs of this nature are able to be implemented at relatively low costs and experience.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT CS

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

213

Fair Category

PT

Project Number

4004

**Title:** How Does The Amount of Borax Affect The Bounce Height Of Homemade Bounce Balls?

**Student Name(s):** N. Bonilla Rodriguez, A. Garcia Martinez

**Abstract:**

How does the amount of borax affect the bounce height of a bouncy ball? Borax is one of the main ingredients in making a bouncy ball. When glue is mixed with borax, the borax acts as a cross-linker, hooking on to the glue molecules, making a chain of molecules. This forms a bouncy ball. For our project, we added different amounts of borax to the four different mixtures. Then we measured and compared the bounce height of each ball. We think that the more borax you add, the bouncier the ball will become. Based on our research, the borax is what creates a cross-link with the glue and creates the bounce. We think that if we add more borax, it will make the cross-link stronger which results in a stronger bounce. We concluded that the borax made the balls bouncier. This supports our hypothesis. Our results show that when we added extra borax, the bounce was measurably higher. If we had to do this project again, we would develop and test more variations of the bouncy balls using different amounts of borax. This project might have useful applications in industry where padding or cushioning of materials is required. We think that this project also could be useful for toy companies.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CH AT PH

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

188

Fair Category

PT

Project Number

4005

Title: What household materials will clean pennies the best.

Student Name(s): J. Miller, Z. Zhou

## Abstract:

We wanted to find out what easy to get household materials would clean pennies the best. This is useful because when you clean the pennies you are getting rid of the oxidation. Oxidation can be found on pipes if they are rusty so if you really needed to you could use these materials to clean pipes. First we did research and saw what materials were recommended to clean pennies. We chose hot sauce, toothpaste, dish soap, hand soap, ketchup, vinegar & salt, ginger ale, and lime juice. Then we took the materials and covered the pennies with each cleaning material and left them for 24 hours. The next day we came back and rinsed them all for about 10 seconds, then we ranked them from cleanest to dirtiest. In conclusion, vinegar & salt did the best. Lime juice did the second best and ginger ale got third. In fourth came dish soap, then ketchup. After that hand soap came in sixth and toothpaste got second to last. And finally, hot sauce came in last. This shows that vinegar & salt is the best easy to get household material to clean pennies.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CH

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

236

Fair Category

PT

Project Number

4006

**Title:** Analysis of Final Flight Times, Distances, and Altitudes of Clipped Parallelogram, Clipped Delta, and Elliptical Fins on Structurally Sound Fuselages

**Student Name(s):** N. Ananth Iyer, P. Gokhale

## Abstract:

Ever since their existence as single propellant, short-range arrows to spacecraft, rockets have been utilized for multiple purposes. Rocket fins effectively stabilize rockets, increasing their lift and decreasing drag while counterbalancing their weight, and thus have a substantial impact on rocket performance. The purpose of this analysis is to investigate the beneficial properties of the clipped parallelogram fin, the clipped delta fin, and the elliptical fin. It was hypothesized that the clipped parallelogram fin would yield the highest altitude, longest distance, and extensive flight time due to its aerodynamic structure. After they were sketched, the rocket fins were designed using the Autodesk Inventor and Tinkercad software. They were attached to the obtained fuselages after 3D printing, in addition to B6-4 Estes engines and self-made ropes connecting noses to their respective fuselages (“emergency ropes”). The rockets were tested using a launching pad, a stopwatch, measuring tape, and an altitude finder. The clipped parallelogram fin rocket produced the longest flight time of 12.5 seconds under a 19 mph wind speed, while the clipped delta fin rocket achieved the longest distance of 118.4 meters and highest altitude of 143.5 meters under an 8 mph wind speed. Due to a difference in wind speeds, the clipped parallelogram fin showed the most optimal results for flight usage. This supports the utilization of clipped parallelogram fins as customary model rocket fins, encouraging research into the aerodynamics of possible fin designs.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE PH

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

240

Fair Category

PT

Project  
Number

4007

Title: Sheets that dry, which one is fly?

Student Name(s): Q. Wherley, S. Martin

## Abstract:

Our experiment was created in order to test four different brands of dryer sheets, in order to conclude which brand can most effectively remove water weight from a hand towel. Prior to the experiment, we hypothesized that Downy would be the most effective way of removing water from our towel, due to the fact that it's priced the highest. The first action we took was soaking a hand towel in water and measuring the weight of it. We fully submerged the hand towel in water. Then we put it in the dryer for 5 minute increments, three times, with one of the four dryer sheets, (Downy, Snuggle, Ms. Meyers, and Bounce). Each trial was done on a different day, therefore the dryer wasn't already warm and wouldn't make the trials inconsistent. Throughout this experiment, we changed nothing except for the different types of dryer sheets being used each trial. After taking the towel out of the dryer, we weighed the towel to find the total weight loss. We averaged the weight loss among the three different trials we ran in order to find the average. Overall, our data supported our hypothesis by showing that Downy dryer sheets removed an average of 1.06 pounds of water weight from the towel after a full 15 minutes in the dryer. The overall purpose of our experiment is to help educate buyers, to help them save money on their electricity bill when drying clothing.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

PT

Project Number

4009

Title: Illusion vs. Reality

Student Name(s): A. Sullivan, M. Sullivan

## Abstract:

Most of us have encountered various optical illusions. Do we view them beyond mere amusement? Welcome to “Optical Illusions versus Reality”. What is an optical illusion? Is our perception of reality identical to / different from another’s? Our project seeks to show how the Ames window - designed by Adelbert Ames (1946) - provides insight into these questions. We crafted a model of the trapezoidal window with 16cm/8cm vertical sides to recreate the Ames illusion. When we rotated it with a motor, we saw the window oscillate! We then made models of the window, keeping the 16cm constant, but varying the other vertical side (2cm, 4cm, 6cm, 16cm). We hypothesized that the 16cm/2cm and 16cm/4cm wouldn’t create the oscillating illusion - the difference in the vertical sides being too wide; neither would the 16cm/16cm model - it didn’t fit with the familiar “near/large - far/small” depth-perception. However, we hypothesized that the 16cm/6cm model, being closer in dimension to the 16cm/8cm model, would. Our hypothesis was partially supported by data collected from 12 participating observers. We learned that having different sensory systems, we each view the world with our unique blend of experience and knowledge, resulting in different approaches and interpretations of reality. Reality, as demonstrated by the Ames window, is often interpreted erroneously. Therefore, in life and the scientific field (synonymous with objective facts/data) we should be mindful that data might be viewed through a less than objective lens - our brains being unique databases of individualised information.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PH

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

246

Fair Category

PT

Project Number

4010

**Title:** Determining the Most Efficient and Effective Method of Filtration for the Purpose of Creating Potable Water

**Student Name(s):** R. Wilson, J. Cieslak, O. Kolb

## Abstract:

The lack of clean drinking water is one of the most pressing global issues today. Many people that lack access to clean water must drink water contaminated with heavy metals, poisonous compounds, and pathogenic microorganisms. In this experiment, we tested the effectiveness of different filtration methods for removing these contaminants, with the goal of improving the potability of water. Five different filtration methods were performed on three different water sources; tap water from Enfield, Connecticut, water from Baldwin Pond in Monson, Massachusetts, and water from the Connecticut River in Enfield, Connecticut. The methods of filtration used were an ultraviolet light, a LifeStraw® filter, boiling, and freshwater clams. We also kept a control sample for each water source. After filtering each water source using each method, we measured the presence of different compounds in the water using a chemical test strip, as well as testing for bacteria in each water test. We then compared the filtered water to the control water to determine the most effective method of filtration. After reviewing the results, the overall most effective method of filtering water was the freshwater clams. The clams removed a majority of the bacteria from the water, and they also reduced the amount of dangerous compounds. Clams also do not require electricity, so they are easier to use in underdeveloped communities without access to electricity. Freshwater clams, while useful, could be implemented as a part of a larger process to increase access to clean water across the globe.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

EV CH MI

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

245

2022

Fair Category

PT

Project  
Number

4011

Title: Flow Infinity

Student Name(s): R. Conroy, C. Mannello

## Abstract:

Our experiment is about creating energy from waterpower and testing the thesis of how the flow rate can impact power output. To do this, we simulated a tidal barrage, also known as a dam. We used an 8 gallon bucket with different sized pipes (1 inch, ½ inch and ⅓ inch diameters) attached. As the water flowed through the pipe, it pushed a propeller. We measured the rotations completed in a certain time frame. The amount of rotations impact how much electricity is produced; the more rotations that happen in 10 seconds the more electricity will be produced. We performed 3 trials for each tube.

The results were as follows:

1” inch tube: 169 rotations, 173 rotations, and 186 rotations which was the most out of all trials.

½” inch tube: 165 rotations, 145 rotations and 158 rotations.

⅓” inch tube: 78 rotations, 46 rotations and 54 rotations.

Our goal for this project is to turn on an LED light, using the energy generated from the water flow. We worked with Daniel Conroy to build a second model and used the ⅓ inch tube to feed water into a propeller driven motor and successfully generated enough power to turn on an LED light. This demonstrates how to use water as a valuable energy source.

Waterpower is almost always accessible, making this a great reusable resource for energy. We hope that larger scale use of this power source will have a positive impact on our environment.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE EM

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

168

Fair Category

PT

Project  
Number

4012

Title: Does Potato Variety Affect Electrical Output in a Potato Battery?

Student Name(s): L. Santiago, D. Bailey

## Abstract:

The Potato Battery is a popular science experiment in elementary science classes. A potato battery uses the phosphoric acid of the potato to create an oxidation –reduction reaction between zinc and copper metal strips. In the reaction, zinc loses electrons and copper gains them which creates an electrical current. In this experiment, different varieties of store-bought potatoes were used to create a potato battery to test if the color or variety (Red, Yellow, Purple, Yukon Gold and Russet) influenced the voltage and amperage (current) created. We used multiple samples of each variety with a controlled amount of mass. Multimeter (Astro AI – AM33D) readings from each sample were recorded, with consistent voltage and amperage produced. We were able to calculate the voltage and amperage produced per gram of potato and analyzed the results. We calculated standard deviations of 0.0005 (voltage) and 0.0008 (amperage) across all test samples. We determined that the color or commercial “name” of a potato does not affect the electricity generated by oxidation – reduction reaction.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH ET PH

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

PT

Project  
Number

4013

Title: Benefit of Granular and Mesh Filters on Concentrations of Microplastics in Water

Student Name(s): K. Brahmkshatriya, B. Miller, A. Herzegovitch

## Abstract:

The purpose of the project was to engineer solutions that prioritize removing microplastics from community water sources at the water treatment plant level. We investigate, how does the design of a filter affect its efficiency and success in reducing concentrations of microplastics and how can it be implemented? The filter media were tested in filters in which a mesh is placed in a PVC connector, and two PVC pipes are enclosed around it, metal mesh and cheesecloth are used, for a granular filter multiple of these are stacked and filter media are placed in between. It is predicted the granular filter will do the best, and the Still River will be the most polluted. To test the efficiency, water from Still river, tap, and wastewater treatment plant will be put through all filters, and passed through BabyLegs multiple times to extract remaining particles, which will be counted to attain data. It was found that the treated wastewater had the most particulate matter, 179 per 500mL. The granular filter had the least amount of particles left in the water after it passed through it, 86.42% was used. But the conclusion was that the metal mesh filter was the most ideal filter media due to the fact that it was just under the granular filter in terms of efficiency, and it was cheaper, easier to manage, and had the least time for the water to pass through. In the future, we would work on potential design updates and implementations in water treatment.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EN EM AT

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

PT

Project  
Number

4014

Title: Can You Separate Solids and Liquids Going Down Your Sink

Student Name(s): C. Quinby, H. Serrano

## Abstract:

There are over 402 billion dollars of food thrown away each year in the United States and finds its way to landfills; that's 40% of all food produced! Therefore, our goal is to create a system which reduces food waste by promoting easy and convenient composting. We will disconnect the pipes under a sink, and replace it with a garbage disposal, which leads down to a "Y" PVC pipe where one side of the pipe is blocked by mesh so that food coming out of the garbage disposal cannot go down the drain and instead is forced to go down a different pipe that leads to buckets where the first one has mesh at the bottom that allows liquid to go through but not solids. The lower bucket is to collect the liquids that fall through. These buckets are removable so that you can dump the ground-up food into your compost, and the excess liquids can be used to water your garden. For further development, Another set of pipes will be connected to the separated solids and liquids. From there, air pressure through the pipes would be used to automatically send the food to the compost and the gray water to your garden. If this is implemented into houses' waste systems, people may put food down the drain in places like California where they mandate composting and have severe water restrictions. It also speeds up the composting process because the food going into the compost is already finely ground.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EM AT

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

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

235

Fair Category

PT

Project Number

4015

Title: Light it up with wind energy.

Student Name(s): L. Muy-Cardenas, D. Perez

## Abstract:

Can a wind turbine made of cardboard produce sufficient energy to power one LED light bulb? Yes, however our hypothesis stated that the wind turbine could produce a sufficient amount of energy to power two lights. This was proven to be incorrect. It was enough to power the one LED light bulb. This is due to the amount of kinetic energy produced by the dc motor. The kinetic energy is then converted to potential energy and stored for later use or in our case to power this LED light bulb. Kinetic energy is formed by a body in motion. In our experiment it was produced inside our dc motor. We experimented by measuring the voltage produced by the wind turbine with a digital multimeter. This showed us that stronger winds or certain amounts of energy didn't and did turn on the LED light bulb. This resulted in us finding out that anything under 1.9 volts didn't turn on the LED light bulb. For example, 1.9 only made it flicker but 1.98 made it turn on completely. When we got 1.88 on the multimeter it didn't turn on whatsoever. We thought of this experiment when researching alternative energy sources to fossil fuels. We were intrigued by wind turbines due to them being a lot better for the environment than the destructive fossil fuels we are currently using. So we wanted to further understand how they worked.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE EE

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

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

249

Fair Category

P7

Project Number

5001

Title: What Do Different Baking Ingredients Do?

Student Name(s): T. Adeniran

## Abstract:

Some ingredients are very common in recipes. This project aims to figure out what these ingredients do by removing it from a cookie. I hypothesized that removing different ingredients from a cookie will change the way it tastes, looks, and/or feels. For my experiment, I baked 4 batches of chocolate chip cookies with my mom. The first batch included all of the ingredients while the other 3 included all except one. The second batch excluded white sugar, the third batch excluded an egg, and the last batch excluded baking soda. I removed one ingredient from each batch. I used the differences between the cookies to figure out what each ingredient does.

I found that the cookies that did not have white sugar did not spread out as much while baking in the oven and did not taste as sweet. On average they had a diameter 0.8 inch smaller than the regular batch. The ingredients in the batch that did not have an egg did not stick together so it was less like dough than powder. After baking in the oven, the cookies stayed together, but they kept the same shape they had before. The cookies without baking soda were harder than the regular batch.

In conclusion, white sugar helps cookies to spread in the oven and sweetens them, eggs help combine all of the ingredients, and baking soda makes cookies softer. I could continue this experiment by trying to find alternative ingredients that would have the same results.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CH

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

176

Fair Category

P7

Project Number

5002

Title: Citrus Based Super Absorbent Polymers (SAPs) for Remediation

Student Name(s): A. Tran

## Abstract:

Many droughts happen every year, but this can be solved by using SAP (superabsorbent polymers). Can different SAP samples made with varying citrus peels effectively help stop drought? If orange peels can create effective SAP samples, then other citrus peels such as lemon can too, as oranges, lemons, and limes are all part of the same fruit family, the citrus family, meaning that they share similar properties, which most likely means that they will all have the same or similar results. The peels were left in lemon juice, boiled, chopped, and left in the sun for 14 days before being left in the oven for 20 minutes to create the SAP samples. The O + A sample absorbed the most distilled water, absorbing 81 ml, with the runner-ups being the LI + A and the LE + A samples, absorbing 79 ml and 62 ml. In the end, oranges, lemons, and limes did have similar results, averaging about 74 ml in water consumption. All of the samples successfully created SAP samples, supporting the hypothesis and proving it correct.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

BI EV EM

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

188

Fair Category

P7

Project  
Number

5003

Title: Folds in Flight

Student Name(s): A. Fenaroli

## Abstract:

Have you ever been asked to make a paper airplane? So you enthusiastically make precise cuts and folds, when you finally finish, you hand them the plane. However when they throw it the plane tragically nosedives into the ground. After seeing my experiment, this will never happen again. My hypothesis states that, if the "blunt dart" is thrown, then it will fly the furthest out of the five paper airplanes. I performed this experiment by laying out a measuring tape, in a wide, open area. Then I performed three tests on each plane, by throwing them across the room. Afterwards, I calculated the average distance each plane flew. The data obtained from this experiment has proven my hypothesis to be correct. After comparing the average distance each plane flew, data shows that the "blunt dart" flew the furthest distance, with an average of 267 cm. My science fair project contributes to aerodynamics because each plane has the four frictions working while they are in flight. These frictions include lift, gravity, thrust, and drag. This experiment has shown that the "blunt dart" is the worthy paper airplane to fly.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PH

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

225

2022

Fair Category

P7

Project  
Number

5004

Title: Magic of the Evidence

Student Name(s): A. Bourque

## Abstract:

The purpose of this experiment is to test the luminol visibility after the blood from a crime scene has been washed and dried to see if there is any residue blood.

For my experiment we are using four different types of cleaners and we will compare the luminol glow under different temperatures and conditions.

The cleaners used are bleach, Windex, Lysol, dish soap. Copper Sulfate will be used in place of blood. There will be four tests. First will be the control and then the four different cleaners. We will take pictures of the reactions for the records. We will see which one glows the best compared to the original test.

In conclusion after testing all of the cleaners and using heat, the best cleaner was bleach. The bleach cleaned everywhere where I scrubbed but still showed a little on the edges. It was more effective than the rest. I also compared hot to cold, what would it be in different conditions. The hot and cold samples both came out to be the same. For that I timed how long each one would stay glowing. They both glowed for a long time, but I looked back at the first sample we did that was over 25 minutes ago and it was still glowing. Overall, the most effective cleaner for the copper sulfate was the bleach.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CH

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

P7

Project Number

5005

Title: Power to the Puck

Student Name(s): J. Fisher

## Abstract:

Hockey players value the flexibility of their stick because it is the key to the speed of the shot, successful passes, and goal scoring. Most hockey sticks are very expensive and it is hard to decide which stick to buy when comparing the many factors involved. My project showed that a 75 flex hockey stick produces the fastest shot for me. My experiment is a method to test sticks before making a major investment in this piece of equipment.

Flex in a hockey stick is the amount of weight a player pushes into the stick for it to bend one inch. I needed to determine whether more or less flex in a hockey stick would be best for my shot. I tested seven sticks (40 flex, 50 flex, 55 flex, 65 flex, 75 flex, 80 and 86-91 flex). I conducted four trials. Each trial included 10 shots. I measured the speed of each shot I took using a speed radar and then averaged the speeds per trial and per stick.

The key impact of my experiment is that finding the perfect hockey stick flex is a blend of preference and strength. The hockey stick industry is creating better sticks every year. With so many different manufacturers, stick types, curves, and flex options, this experiment can direct serious hockey players to their best option. Players willing to invest the time and effort into the procedure used here would benefit from the data collected and would find their best flex stick.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EN EE PH

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

170

Fair Category

P7

Project Number

5006

Title: Its not a pro its a robot?

Student Name(s): G. Dusel

## Abstract:

The purpose of this project is to look at how an AI makes decisions in the form of Mario. To show this I used the BizHawk emulator and a copy of Super Mario World in which I ran a script containing Mario's "Brain" and my procedure consisted of a more thorough process but in higher detail. This experiment resulted in an AI that could beat the first level of super Mario as if it were a pro. Originally the AI started roughly because it did not know how to do anything but slowly it learned what learned and what didn't work to the point (which I already mentioned) where it was almost pro-like. in this project, I learned how an AI makes decisions and how it learns I also learned a little bit about the scripting language Lua. After this experiment, I concluded that yes an AI can learn to play Mario, yes it is better than I could be, and yes my hypothesis turned out to be true

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CS

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

253

Fair Category

P7

Project Number

5007

Title: Developing Tubing Attachment Methods for Soft Robots

Student Name(s): T. Gerlach, D. Gerlach

## Abstract:

A soft robot is a soft object that has pockets within it. Unlike other robots, a soft robot moves when the pockets are filled with air. This philosophy can be used to make many robots. My project was to make a wall climbing soft robot. This year I took a step toward this goal by experimenting with ways to supply air to the pockets.

I began my project by modifying a pre-existing soft robot mold 3D printer file. I modified several things, including the way the air entered the soft robot, how many limbs it has, and so on. I then 3D printed the mold. I went on to cast a two-part silicone resin in the mold(s). Depending on the prototype I may have cast 3D printed parts into the soft robot. I attached the parts. I attached tubing to the robot to supply air. I repeated this process for every prototype. I developed a number of new ways to connect tubing to the soft robot.

I was commonly faced with leaks, clogs and further issues with the soft robot. Once or twice the soft robot would inflate but then stop working, pop, and so on. I eventually got a robot that would actuate repeatedly.

In conclusion I tried many ways to attach tubing to the soft robot. These included glue, barbs, hair like appendages attached to the bottom of the hose barb, etc. In the end the hair-like appendages succeeded in repeatedly supplying air to the soft robot.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT EE PH

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

P7

Project Number

5008

Title: Underground Life

Student Name(s): O. Nicholas

## Abstract:

For my science fair experiment I chose to explore the process of living underground. If underground temperatures are more constant and moderate, then human's modeled living there year-round could reduce the energy required to heat and cool their homes. To perform this experiment I will have two identical model houses. First, take a plastic container, putting a hinge on the back side with wood to screw the hinge into and secure it. Then, I will take a shingle cut to fit over the house with some overhang and screw it through wood. I will fill any gaps between the container and the shingle with insulation cut to size to fit perfectly then secure it to prevent heat loss through air gaps. Next, I will take one house and bury it below ground and place another on the side of that sitting on top of the ground. Once the houses were in place I measured the temperature outdoors and inside of each model house 3 times per day to see how the temperatures varied. The results of my experiment confirmed that the underground home remained warmer than the identical model home above ground. In the end of my project my hypothesis was proven. Some modifications could be to build the houses during the warmer seasons to see if the house would stay similar in temperature. I would also try using a different building material for the houses themselves to see if the results might be even better with other materials.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EV ET

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

241

Fair Category

P7

Project Number

5009

Title: Impact of prediction methods on the percentage accuracy of a stock forecast.

Student Name(s): A. Mayorga

## Abstract:

The purpose of this experiment is to determine the most successful prediction method to forecast the future price of a stock. Mathematically, what is the most successful method to forecast the future price of a stock in a short-term period? Mathematical methods will be more successful in short term periods because there is less human analysis and more defined predictions that do not have human error. In this study, there were four methods applied, each using the same data. Data from 70 days was collected and a prediction was made every 14 days based on the methods collected. The stocks used were stable in price. The percentage error was then collected and used to draw conclusions. The stocks used were Microsoft, Best Buy and Apple. It was found that mathematical methods were more successful in 14-day time periods. All the methods on average had a percentage error of less than 3 percent meaning that they were only off by 3 percent. The hypothesis theorized was correct. The mathematical methods were most successful in short term time periods because the market would not move enough for the stock to increase to something unpredictable. The RSI indicator works better in short term periods, ranging from one to one- and one-half months. Volume is an analysis meaning there is a room for a great amount of human error. The mathematical methods used were regression and probability. They were both highly successful.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

MA CS AT

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

244

Fair Category

P7

Project Number

5010

Title: House Elevation

Student Name(s): O. Saviano

## Abstract:

Our home is the most precious possession we have, and an easy way to lose it is by flooding. I believe a hydraulic elevation system is a great option to protect homes from this kind of natural disaster, and it is my goal to inform people of this great option to consider in the future. The research I did before starting the building process demonstrated that although there is enough knowledge about hydraulic systems, and the main answer I received to prevent floods was to build a house above sea level, not many people knew about using a hydraulic system to prevent flooding. After the research I proceeded with my prototype. The first thing I did was to build a lego house. Then I gathered a 1/4" hydraulic tubing and 8 syringes, which I nailed to the house to keep it firmly secure. Next, I connected the syringes with 8 1/4" barbed tees; 4 on each side, connected to a bigger syringe, which would be the main pump. The big syringe pushes water evenly to the small eight syringes, to lift the house up. Although I found some obstacles during the process of building this project, I am happy with the outcome. I was able to show how a hydraulic system works, and how by adding eight jacks, the house can be lifted easily. I believe that with this project, I am able to inform more people about this option when considering alternatives against flooding.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EE

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

124

Fair Category

P7

Project Number

5011

Title: Coding an Affordable Goat Identification System for All Farmers

Student Name(s): A. Fowler

## Abstract:

There are a lot of different reasons why a farmer would need to identify a goat and link that goat to a database of information. Farmers need an identification system to confirm a goat's identity at a goat show, to provide information for a vet, or to identify a lost goat. Farmers can buy a system like this, but that would cost thousands of dollars, which most people can't afford. This project codes a goat identification system for less than 1% of the cost of other products. Overall, the Hypothesis was correct and the project was successful, the Python code worked with the Raspberry Pi. To prove the hypothesis, six different goat collars were scanned five times, the scanning worked every time but one.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT CS EE

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

170

2022

Fair Category

P8

Project  
Number

5501

**Title:** The effect that hours of the night have on magnitude per square arcsecond on a sky quality meter

**Student Name(s):** D. Miller

## Abstract:

This experiment was performed to test if the time of night when the night sky was measured affects the levels of darkness. If the hour when the sky brightness is measured is 9:40 pm, then the brightness level will be the lowest out of all of the data. This might happen because it will be the darkest at 9:40 pm, and will not pick up that much light from the environment. The procedure for this project is simply going out at the designated time, scanning the sky, taking an image, and recording the data. The results showed that it was darker at 9:40 than 7:40, but it was darkest at 8:40, depending on the data that was recorded. The weather played a major role in the experiment because the fog, snow, and rain amplified the levels of light in the area. This disproved the hypothesis because the data was only partially accurate because one of the days the data was tested followed the hypothesis, while the other disproved the hypothesis.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PH

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

236

2022

Fair Category

P8

Project Number

5502

Title: Fashion Frenzy

Student Name(s): J. Corpuz

## Abstract:

When I heard the science fair was scheduled this year, my brain immediately thought of sustainability. After brainstorming with Mrs. Chrostowski and Mrs. Lutz, I decided to make a blog on environmental issues in the fashion industry, another one of my interests. I ended up spending time with Mrs. Groglio, our school's computer teacher who helped me find a site to set up my blog and learn how to use the basic tools. I had already done some research prior to the project, so I thought it would be the perfect topic. However, I ran into many problems throughout the project. The decided website for the blog, Google Sites, was blocked by our administration, so not only did I have to create a separate email, but I also had to show others the blog through my computer. I decided upon two surveys, one survey before they were exposed to the blog and one survey after my classmates read the blog. I spent many hours researching and citing websites, but it came together in the end. The project succeeded tremendously. In the first survey, not surprisingly, many people responded to questions saying they didn't care or had no opinion. But after showing them my blog, not a single answer was "I don't know" or "I don't care." I am extremely proud of how well the project went and how much I was able to accomplish through it.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EM CS AT

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

254

2022

Fair Category

P8

Project Number

5503

Title: Revolutionary 3D-Printed Shoes to Change The Way We Think About Footwear

Student Name(s): W. Olmstead

## Abstract:

As the world population grows, limited access to affordable clothing and plastic pollution, are rapidly accelerating issues. On-demand, 3D printing provides an opportunity to solve both these issues. The project objective was to create a practical, economical, and environmentally friendly shoe that would be easy to produce in remote locations with little capital investment.

After many iterative redesigns in a 3D modeling software (Fusion 360 students and educators), as well as iteration with actual component production (Ender 3 Pro 3D printer), a practical 3D printed shoe was refined that is both economical and environmentally friendly.

The shoe is created with nylon plastic called thermoplastic polyurethane,(TPU). A specific TPU produced from 100% recycled plastics from landfills and ocean waste was used. This recycled TPU is also 100% recyclable at end of the shoe's life avoiding any post-consumer waste.

As the shoe has been designed in modeling software it allows easy infinite scaling customization matching the wearer's feet individually. The shoe is designed with simple yet innovative techniques like folding flat but flexible shapes into curves, making it extremely easy to reliably print the four components of each shoe.

The shoes consume a mere \$4.00 of materials per pair and require less than \$250 upfront investment to begin production. The On-demand operating model ensures zero product inventory and vastly reduced transportation costs/pollution as only TPU needs transporting rather than full shoe boxes.

Ultimately my project created a Low cost, Zero waste, Practical, Custom-fit shoes, that can be printed on-demand.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

AT EN

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

225

2022

Fair Category

P8

Project Number

5504

Title: Electrolyte Challenge

Student Name(s): H. Greasley

## Abstract:

The media makes people believe sports drinks help replace the loss of electrolytes, this topic was chosen to test whether there was a better option. When sugary drinks are measured in an electrolyte test, they will have a greater number of electrolytes (amps of electrical conductivity) as compared to non-sugary drinks. This is because electrolytes are naturally found in fruits, and that is what sports drinks are advertised to provide. Does a sports drink provide more electrolytes than orange juice? To do the project first cut the straw to 5cm and attach the wire on both sides with parts sticking out. Then set up the multimeter and connect the alligator clips to the free ends of the copper wire. Connect one of the alligator clips to the 9v battery and put the straw in the drinks. Turn on the multimeter and set it to 200 amps to collect the data. After each test, rinse with water. Do 5 trials for each drink and average the results. In the end, the results showed that orange juice produced the most at 65.36 amps, then sports drinks with 29.98 amps, tap water with 2.42 amps, and distilled water with 0.08 amps. In conclusion, the hypothesis was proven to be incorrect, in that orange juice provided more electrolytes than a sports drink due to it having natural sugars.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CH ME

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

255

2022

Fair Category

P8

Project Number

5505

**Title:** Design and Testing of an Integrated 360 Degree Pi Camera System for Deep Well Rescue Mission

**Student Name(s):** S. Sudarsanam

**Abstract:**

This invention was to solve the problem of inefficiency in locating the trapped person inside a well and to establish two-way communication during the rescue mission between the trapped person and first responders, which could significantly reduce fatalities and ambiguities beforehand. What is the effect of a Pi-controlled camera with Wi-Fi on the efficiency of rescuing citizens from deep, dark wells (for first responders)? The Pi Zero computer (Wi-Fi enabled), equipped with the IR camera and controlled through Linux commands, Shell scripting, simple Python coding, when integrated with tools of first responders, will be effective in locating and communicating from above ground. This increases the probability of a successful rescue mission and eliminates the guesswork. Three Pi Zeros were attached to individual cameras and were activated upon booting without any intervention. The Wi-Fi-enabled speaker/microphone acts as a way to communicate to the person trapped inside the well. A fourth Pi Zero above ground is used to control the entire setup (known as the management Pi). The first responders can see the live stream using a media player on their devices like cell phones while connected to the same network as the Pi by using Wi-Fi or the cell phone hotspot. They can get a 360° view inside a deep, dark well while continuously monitoring the status of the trapped person with two-way communication. Also, pictures can be emailed through the Gmail server remotely for an expert to review, who is not connected to the same network.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

CS AT EE

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

181

2022

Fair Category

P8

Project  
Number

5506

Title: designing an electric skateboard with a 36v battery

Student Name(s): E. Teixeira

## Abstract:

I am Elijah Teixeira and I designed an electric skateboard with a 36 volt battery. I ride skateboards and its so much fun. The reason why I wanted to do this is that when you ride a skateboard, you can go fast but you would probably need to go down a ramp. However, with an electric skateboard you can control the speed and how fast you want to go. I think my skateboard is different from any other because of my enclosure. My enclosure is totally safe but it is able to open whenever your want. This means that if any wire gets unplugged, you have access to it at all times. It also has a speaker on the bottom that you can listen to while riding it. I also used a different type of a board design. I used a bigger and wider cruiser board so it is easier to turn and balance on, This means that really anyone can ride it as long as you balance on the board and are comfortable at the speed you are going at.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE ET

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

252

2022

Fair Category

P8

Project Number

5507

Title: Refurbishing Computers, a Solution to the Digital Divide

Student Name(s): A. Balas

## Abstract:

Computers are necessary tools for human interaction, learning, and productivity. Yet, lack of access to computers either due to financial constraints or computer shortages creates a digital divide.

My project's goal is to refurbish old computers and make them functional. Two computers were refurbished: 2011 HP Pavilion and 2009 Macbook.

Using everymac.com and specificationslaptop.blogspot.com, four key components were analyzed and replaced to the maximum specifications: battery, memory, storage, and operating system.

For Macbook, ram and battery life were doubled, Hard Disk Drive was replaced by Solid-State Drive, Linux Mint replaced MacOS. For HP, the ram was doubled, Hard Disk Drive was replaced with faster Solid-state drive, and Cloudready replaced Windows 11.

Using Speedtest by Ookla, the web speed of each refurbished computer was measured and compared to a 2015 MacBook Air. HP's ping was 18.67 ms, 2009 Macbook's 19.33 ms, and 2015 Macbook air's 12 ms. Download speed was 23.34 mbps for HP, 23.95 mbps for Macbook, and 316.90 mbps for Macbook air. Upload speed for HP was 13.65 mbps, 9.46 mbps for Macbook, and 28.90 mbps for Macbook air. Time to open google was measured before and after refurbishing: 2009 Macbook took 30 minutes before and 2.78 seconds after. HP took 8 minutes before and 1.84 seconds after.

Opening a google document took: Macbook 5.38 sec, HP 3.46 sec, and MacBook Air 1.30 seconds.

Based on the data, the refurbished computers function similarly to modern computers and are a cheap and effective way to increase the accessibility of computers worldwide.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CS EE AT

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

247

2022

Fair Category

P8

Project Number

5508

Title: The Luboni, electric autonomous ice resurfacer

Student Name(s): L. Presbrey

## Abstract:

The goal of this project is to make a vehicle that can resurface ice that is electric and autonomous. This would save on gas, stop polluting areas that are concealed purposely and save on a zamboni driver. The materials that I used are a VEX Robotics kit and a miniature plastic rink. Some of the electronics that I used from the VEX Robotics kit was 4 motors, the brain, battery, remote receiver, and wires that connect the brain to the motors, wire that connects the brain to the battery, wire that would connect the brain to the laptop to download the code. The rink's width is 28 in, and the length is 67.5 in. You will also need a computer or laptop that can download the Vex V5 software. My procedure was to build the robot. The robot was built with a motor attached to each wheel. The height of the robot is 4 in., and the length is 14 in., and the width is 15.5 in.. Then I tested the robot to make sure that everything worked properly including all of the software and connecting it to the laptop. Then, I programmed the robot. My strategy for the programing is to do it step by step, trial and error, fixing problems as I go. When it would go off, I would shorten the amount of inches it would go forwards so when it would turn it wouldn't go off. In the end, the project was successful.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

ET EE EV

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

2022

Fair Category

P8

Project Number

5509

**Title:** A Domestic Violence Alerting Device comprised of an Analog Sound Level Meter, OLED Display, and iOS Mobile App built using Swift

**Student Name(s):** S. Srinivasan

**Abstract:**

Domestic violence is a substantial issue in the United States. During the pandemic, these cases increased significantly by 25-33 percent. This domestic violence alerting device reduces the impact of this problem by sending an SMS to the victim's contact list or the police. There are various technologies used in this project, such as Swift language to create the iOS mobile application, Firebase Authentication to authenticate the user, Cloud Firestore to store the user data, the Twilio Service to send SMS messages, and Arduino technologies used in the hardware to measure and display the environment's sound level. When the sound level detected by the sensor exceeds a certain threshold, the hardware device parses the JSON of the user information retrieved from Firebase. First, an SMS is sent to the user to check if this is a false alarm. If the user doesn't turn off the alarm in a certain amount of time, the contacts will receive a text alert. To test if the device could detect a person shouting from various distances, an audio was played at one foot increments from the device. The decibel values were then recorded. At zero feet, the sensor measures the sound as 106.73 dB. At ten feet, the sensor measures the same audio as 75.81 dB. For this reason, the sound threshold will be set to 75 dB. To reduce the number of false alarms, the alarm will be triggered if the sound exceeds 75 dB at least five times in thirty seconds.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CS AT EE

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

170

2022

Fair Category

P8

Project  
Number

5510

Title: The Effects of Ice Mitigation Strategies on Livestock Waterers

Student Name(s): S. Blumenreich

## Abstract:

The purpose of this project was to determine how ice mitigation strategies affect ice formation in livestock waterers. The research question is how do ice mitigation strategies affect the amount of ice formation in a livestock waterer? The hypothesis is that as the mean and methods of insulation change, the ice thickness either increases or decreases. The more insulation that is provided for the water buckets, the more difficult it will be for ice to form and keep the water accessible for a longer period of time. Various ice mitigation strategies were used on livestock waterers to test how they impacted the amount of ice that formed in the water, which was measured through the ice's thickness in centimeters. The more insulation that was provided, the less ice formed in the bucket and the thinner the ice block was. Prior to experimentation, it was hypothesized that as the amount of insulation increased, the amount of ice in the waterers would decrease. Overall, the experimentation proves that with the decreasing trend.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EA AS EV

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

243

2022

Fair Category

P8

Project Number

5511

Title: Converting Excess Heat Generated From Furnaces Into Usable Energy

Student Name(s): N. Khaled

## Abstract:

About 70% of the energy used in the U.S. every year is wasted in the form of heat. This wasted heat, however, could be converted to energy. Most homes in the U.S. are heated by furnaces or boilers, and depending on their efficiency, can waste anywhere between 10 - 44% of the energy it uses. The objective for this project was to design a device that can capture hot air emissions from furnace flue pipes that would otherwise be wasted, and convert them to electricity.

To do this, an aluminum tube was used to simulate the flue pipe, wrapped in insulation to prevent heat loss. Ten thermoelectric generators (TEGs) were attached to it in series. A heat gun was used to simulate the hot air from the flue pipe, directed into the aluminum tube. The voltage meter recorded 3 volts of energy potential generated by the TEGs. As this experiment was done on a small scale, it did not produce enough energy to power a battery, but if more efficient/reliable TEGs are used in a greater quantity, more energy would be produced. In addition, because of the heat gun needing to be held a few centimeters from the pipe for safety reasons, some heat was lost and not evenly distributed to all of the TEGs. With an actual flue pipe, this would not be an issue. The experiment demonstrated that waste heat from a flue pipe can be captured and converted to electricity.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE EM

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

221

2022

Fair Category

P8

Project  
Number

5512

Title: Energized

Student Name(s): C. Walsh

## Abstract:

For my science fair project this year, I tested the different levels of electrolytes in sports drinks. The purpose of my project was to find the sports drink with the most electrolytes in it. My hypothesis for this project was that the Gatorade sports drink would be the drink with the most electrolytes since it is the #1 sports drink in the United States. I used a conductance sensor that I made with a multimeter, copper wires, alligator clips with wires, a 9 volt battery, a 9 volt battery clip with wires, a plastic straw, and tape to test the levels of electrolytes. I put the plastic straw into the different sports drinks for 20 seconds and waited for the reading to stabilize. The constants and controls in my experiment were temperature, volume, time, the 9 volt battery, and the same conductance sensor/multimeter. The variables in my experiment are the sports drinks: Gatorade Zero, Gatorade, Body Armor Super Drink, Body Armor Lyte, Smart Water, and Body Armor Sport Water. The way that I measured the responding or dependent variable is by using the multimeter. The Body Armor Super Drink had the highest levels of micro amperes (mA). If you want a drink with a high level of electrolytes you should either get Body Armor Super Drink or Body Armor Lyte.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CH EE

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

230

2022

Fair Category

P8

Project Number

5513

Title: Rube Goldberg Machine

Student Name(s): Z. Barnett

## Abstract:

A Rube Goldberg Machine was named after a man named Rube Goldberg. The machine is meant for completing simple tasks in a complex way. I chose to build my own version of the Rube Goldberg Machine because it is an example of how gravity is being demonstrated. In this project I am having different objects roll down ramps from different heights as well as having a pendulum. Another reason why I chose this project was because it is a prime example of trial and error. There are a lot of measurements and a lot of different steps to building this. I have had a few problems that I needed to learn how to fix which is the trial part of the project. Next, was figuring out how to improve it and make it better, which was the error part. I like to do different projects like this because it expands my mind on how to do different things. A problem I have come across with this design is what size ball would fit the best throughout the course without getting stuck or rolling off. I was deciding whether to use a tennis ball, softball or a golf ball. To fix that problem, I decided to use a golf ball and a tennis ball. I really loved this idea because I can get very creative with the different designs and courses.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EN ET PH

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

232

2022

Fair Category

P8

Project Number

5514

Title: Model System Design For Technology-Assisted Insulin Regulation

Student Name(s): S. Borst

## Abstract:

Poorly regulated blood sugar impacts 90% of the population and has a significant effect on mood, the ability to handle stress, weight, and sleep. These conditions are only compounded for individuals with diabetes. The goal of this project was to demonstrate high glucose regulation in the human body through the use of a working artificial pancreas model. My hypothesis was that a glucose sensor coupled with a “smart” insulin pump and reservoir would provide high blood sugar regulation. The project challenge was to design a working model of an artificial pancreas using substances other than glucose, insulin, and human blood. The answer was substituting pH balancing for glucose control. Experimental results showed that the hypothesis was valid when tested in the pH balance framework. The artificial pancreas model’s conductivity sensor was able to detect an initial high pH basic baking soda solution, responded by pumping a lower pH acidic vinegar solution into the higher pH solution, and successfully stopped pumping when the resulting mixture achieved pH balance. The average amount of lower pH acidic vinegar solution pumped was within 15% of the expected value. The use of pH balancing allowed the validation of the design details of the smart sensor and pump control system. Currently there are limited options available for automated insulin delivery systems so the significance of my findings support continued development of new technologies in this critical medical area.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

ME EE CBIO

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

2022

Fair Category

P8

Project  
Number

5515

Title: impact Absorbing And Alerting (iAAA) BAND for fall protection

Student Name(s): R. Karunaratne

## Abstract:

According to several studies, fifty billion dollars are spent alone in the United States on medical costs related to falls. Out of 3 million annual falls, 34,000 people perish. About 20% of falls result in head injuries and broken bones, and on average, three adults die every hour due to falls. By 2030 the hourly death rate is projected to increase to seven. One of the key concerns is that some fall victims are not noticed for a prolonged period after they fall, causing severe long-term damage. This study is focused on head injuries and the damages caused by them. My goal was to invent a headband that would absorb the impact of the fall. It would further send a signal to alert anybody nearby to aid the victim. I conducted several interviews with medical experts, including doctors and nurses, and longtime caregivers of patients who had a history of falling. Employing the information gained from the interviews and external sources, I used lightweight absorbing material made of foam and electronics to create the headband. I used a "Century Martial Arts BOB Body" dummy (37 lbs) to test the band for effectiveness. I fastened the band around BOBS' head and pushed him from different heights and angles. Our observations prove the band successfully absorbs the impacts to the head and alerts once the impact occurs, especially when the fall occurs facedown or backward. In conclusion, I plan to use Anthropomorphic Test Dummies in future experiments to test the iAAA band.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE EN ME

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

230

2022

Fair Category

P8

Project Number

5516

Title: Creating an energy efficient LED light bulb.

Student Name(s): A. Ochoa

## Abstract:

I wanted to do this project to see how much energy I could save by creating a more efficient LED lightbulb design. Each year 625.6 million pounds of CO<sub>2</sub> is emitted into the atmosphere because of LED light bulbs. I conducted my research by taking a device to hold the light bulb in place and then put a lux meter across from the lightbulb. I tested three different light bulbs: an open cover, a ventilated one, and a regular bulb. I turned them on at night in a dark room and waited a certain amount of time. I concluded that the open bulb, because the temperature was lower, produced less lumens than the closed bulb. The ventilated bulb was in the middle of the two. I took the information that I learned and applied it to the amount of energy that would be saved each year by using these improved light bulbs. The decrease of lumens in the open bulb was much greater compared to the regular bulb. Every year alone this would save hundreds of millions of pounds of CO<sub>2</sub>. One possible idea to continue the work of this project would be to create a mesh covering around the outside of the lightbulb which would decrease the lumens even more than the current ventilated bulb. All of this would have an unequivocally constructive effect on the current deteriorating atmosphere.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ET

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

104

2022

Fair Category

P8

Project  
Number

5517

Title: The Impact of Acetic Acid and Citric Acid on the Integrity (Flexibility) of Plastic

Student Name(s): A. McAllister

## Abstract:

This experiment was trying to discover how acid would affect plastic. The driving question was “Which type of acid (Citric, Acetic, or both) weakened plastic more (which made it more flexible)?” Acetic acid should weaken plastic more because it is more corrosive. Straw segments were stretched as far as possible and measured (in centimeters), submerged in 100 milliliters of different acids (and water as a control group) for one week, then taken out of the acids and stretched and measured again. The acid had no effect on the integrity of the straws. Overall, the experiment yielded strange results that were contrary to the hypothesis.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CH EM EA

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

99

2022

Fair Category

P8

Project  
Number

5518

Title: Does the thickness of the wire effect the circuit?

Student Name(s): j. maldonado

## Abstract:

The purpose of the experiment was to figure out of if the thickness of the wire effects the flow and energy output of the circuit.

There was 6 procedures 3 of those were in day light Which was noticeable but the other 3 were in a dark room were I could get a better measurement to make my graph.

6AWG was the dimmest out of the 3 14AWG being the brightest out of the three and 10AWG being in the middle but closer to 14AWG. The thicker the wire it allows more electricity to flow without hitting the insulator.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

ET PH

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

247

2022

Fair Category

P8

Project Number

5519

Title: Tesla Coil

Student Name(s): J. Williams

## Abstract:

The purpose of this experiment was to wirelessly conduct energy. I am trying make energy less expensive for people and easier to access. In order to do this, I would plant tesla coils all around the world to power peoples' homes, which will cheapen the expense of electricity for people, as well as avoiding having to run wires from a powerplant to where the electricity will be used. My Tesla coil is an electrical resonant transformer circuit that creates an electro-magnetic field being able to power 8 watts and/or 450 lumens. Procedures conducted were to tightly wrap copper wire around the PVC pipe, connect a 9 V battery to a 9 V battery connector, connect the positive wire to one end of the 22 kilo ohms resistor, connect the negative wire to the right prong of the 2n2222a transistor, connect the other end of the 22 kilo ohms resistor to the metal prong, which is also connected to one of the copper wire that is coiled around the PVC pipe, and finally to wrap the black wire two times around the coil and connect it to the same side that is connected to the 22 kilo ohms resistor. The Tesla coil was successful in accomplishing my goal of wirelessly conducting energy, and was able to light a florescent bulb 100% of the trials. This means it could potentially be used as an energy source for people around the world if bigger tesla coils were made.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE ET PH

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

258

2022

Fair Category

P8

Project Number

5520

Title: The Effect of a Parabola on Wi-Fi Speed

Student Name(s): L. Layog

## Abstract:

Wi-Fi plays a big part in people's daily lives. Wi-Fi's signal strength varies depending on the type of router and its location. Many households do not have access to fast Wi-Fi. The goal of this research project was to find a way to boost Wi-Fi speed using household items such as aluminum foil and cardboard.

The first phase of this project involved creating an instrument to boost the signal strength of a router. The instrument was designed to be in the shape of a parabola. A parabola is a mathematical shape with a curve with points equidistant from both a fixed point called the focal point and a fixed line. An instrument called a parabolic reflector which is similar to a satellite dish is made by cutting cardboard in the shape of a parabola and mounting another piece of aluminum foil-covered cardboard on the back of it. Once mounted onto a router's antennae, it is capable of boosting its signal strength.

The second phase of this project involved testing various angles the parabolic reflector is mounted to determine the largest increase in signal strength. Wi-fi speeds were tested without the parabolic reflector and with the parabolic reflector mounted at 90°, +60°, +30°, -60°, -30°. Data was gathered at 140 and 641 inches away from the router. Placing the parabolic reflector at 90° produced the best results. This experiment allows people to increase their own Wi-Fi speed using household items. The main objective of the experiment, increasing Wi-Fi speed, was met.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CS

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

2022

Fair Category

P8

Project Number

5521

**Title:** Alerting Drivers That a Child was Forgotten in a Vehicle With a Circuit Sequence Alert System (CSAS)

**Student Name(s):** A. Pagnotta

**Abstract:**

The purpose of this project was to design and construct a safety device to prevent a driver from leaving a child inside a closed vehicle which could result in the child's death due to heat or cold.

A Power Wheel child's toy was altered to include a Circuit Sequence Alert System (CSAS) to notify a driver. The prototype build added a 12 V DC battery, a time delay relay, a strobe light, a 12 V power socket to charge the strobe, a CD/radio player, an on-off switch, a 6 inch recessed speaker, a terminal block to secure wires to battery, wiring under the seat connecting driver and child seat switches to light and speaker, wiring from battery to CD/radio to on/off switch, wiring to terminal block, time delay relay wiring with trigger wires and a 15 amp fuse to battery for overcurrent protection.

Data collection to optimize prototype settings included timing family drivers as they left vehicles ( $\approx 1$  minute), measuring decibel levels of various alarm volumes, at different distances to determine which volumes were above the noise measured in a parking lot (63 db). Based on testing, optimum value for volume setting was 20. Alarm duration was set to 2 minutes, with continuous repeats.

This project supported the hypothesis that a notification system to alert drivers of a forgotten child in a vehicle is feasible and valuable. "CSAS" could be installed in older and newer vehicles at a small cost. With simple engineering, it could save lives.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EE AT

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

131

2022

Fair Category

P8

Project Number

5522

Title: The Connection Between Coronal Mass Ejections and Sunspots

Student Name(s): M. Rosario

## Abstract:

A sunspot is a cooled area of the sun that appears to be darker than the area that surrounds itself. Sunspots were first discovered in 1612 by Galileo Galilei, but were recorded as a statistic in 1750.

A CME is the event in which the sun releases high amounts of radiation that is stored inside. CMEs, unlike sunspots, were recorded as a statistic in 1996.

The goal of the experiment is to find out what the connection is between CMEs and sunspots.

The data showed that there was some correlation found between CMEs and sunspots.

It was found that while the number of CMEs did not match well to the sunspots, there was a relation between the amount of mass and energy from the CMEs to the amount of sunspots observed.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PH MA

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

199

2022

Fair Category

P8

Project  
Number

5523

Title: Environmental Impact on the Corrosion of Steel Nipples

Student Name(s): E. Schweitzer

## Abstract:

This experiment was performed to find out how different environmental materials affected the corrosion of steel nipples. How do environmental materials in the environment affect the corrosion of steel nipples? If the environmental materials have more oxygen, then the steel nipples will have more corrosion. Since the environmental materials have different properties, they should affect how much the steel nipples corrode. This project involved the use of four bins, each of which contained a different environmental material, including: snow salt, beach sand, all-purpose sand, and potting soil. In addition, each bin included water and asphalt. Two steel nipples were placed in each bin and were kept in the bins for a period of time to rust, which was then measured in grams. The potting soil presented the most change, followed by the beach sand and the all-purpose sand, with the snow salt having the least amount of change. It was hypothesized that the more oxygen the environmental materials have, the heavier the nipples would be, which was true to this experiment since the materials with oxygen, which are the potting soil, the beach sand, and the all-purpose sand, all made the nipple's weight increase the most.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CH EM AT

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

120

2022

Fair Category

P8

Project  
Number

5524

Title: Converting Sound to Electricity

Student Name(s): H. Alsaleh

## Abstract:

The aim of my experiment is to see if sound was able to be used to generate electricity. This would help the world by producing electricity from a type of energy that is not used with its capabilities. Another purpose of this experiment was to see if sound can produce between 10 -17 volts of electricity.

To construct my prototype, I used a 2” radius birch wooden plank, which was attached to a copper wire coil. The copper coil had a magnet placed in its center. Every time sound bounces off of the wooden plank, it would cause the coil to vibrate, producing some electric current by electromagnetic induction. I found out that my project did not produce any electricity.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE ET PH

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

259

2022

Fair Category

P8

Project Number

5525

**Title:** Pellet-"O"-Trap: Capturing Plastic Pellets Through a Multi-Filter System & Analyzing Their Progression Using Binary Image Processing

**Student Name(s):** S. Reddy

## Abstract:

Plastic pellets are pre-production microplastics, made of polyethylene, ranging in size from 1mm-5mm. They are used to build virtually any plastic product, but are dangerous when released into the environment during manufacturing and transportation, eventually entering aquatic bodies through spills, storm-water discharges, and Combined Sewer Overflow(CSO).

Pellet-"O"-Trap is a multi-filter device which captures plastic pellets in stormwater pipes and CSO before they enter water bodies. Entering the device, large objects are rejected through the sides, and three filters with descending hole sizes were layered in a manner where the last filter would capture pellets ranging between 1mm-2mm and allowing for only water flow. A submersible pump was attached to the mechanism, to force water through the filtration device during scenarios when there is an insufficient current. As the water is being pushed debris and plastic pellets are collected, and clean water flows out through the end of the device.

To monitor their collection, an ArduCAM, supported by image processing, was used to measure the number of plastic pellets, indicated by white pixels. If they reach 75,000, the device is considered 70% full and a notification is published to empty the filter.

For testing, 600 grams of pellets were placed in an aquatic enclosure along with debris such as leaves and stones. A stormwater current was simulated using a shower head running for five minutes -- results show 87% of pellets were captured. With minor enhancements, Pellet-"O"-Trap can significantly reduce the pollution of this emerging contaminant, protecting marine and human life.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EM EE AT

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

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No