

73rd Annual Fair



**Connecticut
Science &
Engineering
Fair**

March 8 - 20, 2021

Student Abstracts

Middle School Physical Sciences

Fair Categories

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

Special Categories

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

Special Category Composites

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

CSEF Official Abstract and Certification

Word Count

203

Fair Category

PT

Project
Number

4001

Title: The Investigation of Common Materials in the Filtration of Soot and Smoke

Student Name(s): L. Czerwiec, B. Kelly

Abstract:

Carbon emissions have facilitated global warming and are becoming the major issue for the environment over the last decades. We came up with a possible simple solution to reduce carbon emissions by filtering harmful particles in smoke. We used common materials including cotton, nylon, and silk. First, we weighed the cloths. The filtration device consists of a cloth material secured to the top of a hurricane jar which is enclosed to stop the smoke from escaping. An air quality tester was placed inside the sealed environment. Before the use of the cloths, we tested the candle without a cloth in the filter. The candle was then lit, and the filtration device was placed on top. Smoke particles from the candle rose through the cloth, some getting trapped as they passed through. After we filtered through a specific cloth, we weighed the cloth again, to see if there was a difference in weight. Our results from this experiment were inconclusive because our air quality tester was not sensitive enough. We were hoping for more dramatic decreases. We have concluded there is no simple way to greatly filter our carbon emissions. The most basic solution to reduce global warming is to decrease fossil fuel usage.

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

EN CH 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

190

Fair Category

PT

Project Number

4002

Title: The Design and Testing of Debris Deflectors to Prevent Buildup in Culverts

Student Name(s): D. Thomas, C. Zhu

Abstract:

Culverts are pipes that are connected to storm drains. The purpose is to prevent debris buildup in culverts and design debris deflectors that will decrease debris. Using debris deflectors will help with culvert damage and buildup. Without debris deflectors, water can become contaminated and unsafe for drinking. This could also lead to disruptions to the aquatic ecosystems which the water ends up near. These animals may be harmed because of debris. The use of debris deflectors will decrease contamination in waters, make safer water for drinking, and it will help aquatic life in nearby ecosystems. How can debris deflectors prevent the least amount of buildup? For the control, no debris deflectors were used in the testing rig. The debris deflectors were measured by how much debris they captured in percentages and the debris deflector with the highest percentage performed the best. Mark 3 was the best at capturing debris with an average of 89% debris trapped. Mark 1 and Mark 2 did worse than mark 3 with an average of 73% and 78%. Based on the results, Mark 3 captured the most debris compared to Mark 1 and Mark 2.

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

EV EE EM

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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

242

Fair Category

PT

Project Number

4003

Title: Toilet Power: Capturing Wasted Energy from Home Fixtures

Student Name(s): L. Marshaus, C. Walker, F. Lamattina

Abstract:

The objective of our experiment is to convert kinetic energy from the inlet valve filling a toilet into electrical energy to charge a phone. Our initial inspiration was to move away from fossil fuels using wasted energy, which we succeeded in demonstrating during experimentation. When the toilet fills with a relatively fast flow, about 1.7 gallons/minute, it presents the opportunity to convert kinetic energy from the toilet's water flow into electrical energy that could be used for practical purposes. This has been done to an extent in Hong Kong in 2013 when wasted water from a shower drain was utilized for other needs. We connected a water turbine between the inlet valve and the holding tank of a toilet. Each flush resulted in the tank being refilled with water in approximately 48 seconds, producing a continuous charge up to 12 volts during the refill. In addition, we added a disassembled car charger rewired to connect the turbine to the phone. The car charger is used to limit the voltage so that the phone does not get damaged. Once the turbine and phone are properly connected and assembled, we flush the toilet and get an indicator that the phone is successfully charging. One flush may not fully charge a cell phone, but multiple flushes over time can fully charge a phone. For example, if one were to circuit-together multiple toilets in a large complex, substantial amounts of energy could be generated.

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

EE AT EV

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- 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

Fair Category

PT

Project Number

4004

Title: How Thermoelectricity Can Improve Warmth in Colder Climates

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

Abstract:

The objective of this project was to discover if human body heat, converted by a thermocouple, could produce enough electricity to power a resistor. The resistor would then warm a boot, making it more comfortable to wear in cold temperatures. Thermocoupling creates electricity by utilizing the Seebeck Effect, which works by harnessing the energy created by the difference in temperature between two pieces of metal.

The thermocouple used was attached to a Nickel-Chromium resistor circuit, contained between a layer of rubber foam and silicone. The resistor was placed in the sole of the boot. The thermocouple's probe was heated with 37°C water contained inside a sealed plastic bag. To take advantage of the temperature difference between the inside and outside of the boot, the output end of the thermocouple was moved closer to the outside of the boot, allowing the colder air to cool the thermocouple. Using a thermometer, we tested the heat output of the resistor several times with different thermocouples but with a consistent water temperature.

After comparing results, we discovered that K-Type thermocouples made with Nickel-Chromium and Copper wires produced the most electricity, but were less practical because the probe needed to be heated evenly. Conversely, a T-Type, made of constantan and copper, needed less equal heating and was easier to work with but produced less electricity. A thermocouple and resistor could produce enough heat to warm the wearer, although further testing is needed to identify the type of resistor that would be most effective.

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

EE AT

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

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- Yes No

CSEF Official Abstract and Certification

Word Count

250

Fair Category

PT

Project Number

4005

Title: Self-Sustaining Indoor Garden

Student Name(s): N. Khaled, B. Abed, Z. Khaliq

Abstract:

Some people may want to grow a garden but do not have space, time, or appropriate weather. This results in produce being purchased from grocery stores. The fruits, vegetables, and herbs purchased from the grocery store can be full of preservatives. Our solution was to create a self-sustaining indoor garden that can be used all year long as well as require minimal maintenance.

To begin the construction of our prototype, the planter was split into three equal sections, using 3 tubs, inside a 37-1/2"L x 15-1/2"W x 8"H planter. The middle one contains water, while the other two contain soil. Two 550 GPH submersible pumps were placed in the middle box inside the water, one powering the waterfall and the other powering the drip irrigation system. Attaching 1/2" pipes to one of the 550 GPH pumps, with 1/4 inch pipes attached to the 1/2 inch pipes, water was brought to the emitters in the dirt-filled containers. A timer was used to turn on the emitters and grow lights for the appropriate amount of time per day. The second 550 GPH pump powered a waterfall that sits on top of the water tub. Our functional purpose of the waterfall was to avoid the water becoming stagnant. Stagnant water can become a breeding ground for mosquitoes as well as develop mold. The result of our experiment was a working drip irrigation system that could sufficiently water our basil plants and a waterfall that kept the water cycling.

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

EE PS

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

Fair Category

PT

Project Number

4006

Title: A Better Solar Panel

Student Name(s): H. Mhaidat, S. Sheikh, A. Afolabi

Abstract:

The purpose of this experiment was to see if we could make a better solar panel that was more efficient and eco-friendly. After a long time of researching, we decided that we would remove the glass, which contained lots of harmful chemicals such as antimony and cadmium, and to replace it with acrylic glass. This would theoretically allow more sunlight to pass through and would be much stronger than regular glass, so it wouldn't break if you dropped it. To test if acrylic glass was better than the regular glass, we took two solar cells and put regular glass on top of one and acrylic glass on the other. We used a multimeter to measure the number of volts being produced by each of them, and used a light source and tested it from a 90 degree angle, a 45 degree angle, and a 180 degree angle. On our first experiment, at 45 degree, the acrylic glass got 2.76 volts, while the regular glass got 2.67 volts. At 90 degrees, the acrylic glass got 3.43 volts, and the regular glass also got 3.43 volts. On our final test, at 180 degrees, the acrylic glass got 2.46 volts, and the regular glass got 2.36 volts. After this experiment, we conclude that acrylic glass is better for solar panels than regular glass.

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

EE

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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

148

Fair Category

PT

Project
Number

4007

Title: What Are The Effects Of Water Depth On Tsunamis (wave Velocity)

Student Name(s): B. Werner, M. Werner

Abstract:

The purpose of this project was to determine the effect of water depth on wave velocity. The importance of this experiment is it can help save lives by helping to make better warnings for tsunamis. Our procedure for this experiment involved filling a bin with water three separate times with different depths of water; one, two, and three centimeters. Then, we dropped a small woodblock from the same point marked on the bin thirty times for each depth of the water for a total of ninety drops. Once the block was dropped, we started a stopwatch as soon as a wave was created. We stopped the stopwatch when the wave reached the other side of the bin. We recorded the times and then calculated those averages for each centimeter of water. The data showed that the deeper the water the faster the wave. Therefore, our hypothesis was incorrect.

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

EA

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

128

Fair Category

P7

Project Number

5001

Title: Oxidation Proclamation

Student Name(s): J. Bennett

Abstract:

The project purpose statement will demonstrate the effects that will occur when copper, stainless steel, galvanized steel, and iron are submerged in saltwater over time. The summary of the procedures will show if certain metals are affected by being submerged in saltwater. My project is important to society because it will prove what kind of metal is best to use when working in or around saltwater. The hypothesis is that some of the metals will be affected and others will not be affected. I will conduct this experiment by submerging different metals in saltwater over a recorded time frame. Each week, I will record the information and any changes to the metals by using visual observation and a microscope to document changes which will be shown in photographs.

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

CH EV EM

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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

Fair Category

P7

Project Number

5002

Title: A Covid-19 Social Distancing Device Using a PIR Motion Sensor and a US-100 Ultrasonic Distance Sensor

Student Name(s): S. Srinivasan

Abstract:

Social distancing has become a huge part of our lives in the past year. It is critical we keep ourselves safe to prevent the number of Covid cases from increasing further. My device assists in doing so by calculating how close the user is to another person nearby. This device comprises of two major components: a Passive Infrared (PIR) motion sensor and a US-100 ultrasonic distance sensor. This product allows the user to customize the distance in feet they want to be socially distanced, and can also arm or disarm the system as needed. When the device is armed, the motion sensor checks for movement within its range. Once motion is detected, the US-100 calculates the distance between the user and the person nearby. If this value is greater than the distance configured by the user, an RGB LED turns green, indicating that the user is in a safe zone. If not, the LED turns red and a text alert is sent, informing the user how close he/she is from the person nearby. As a test for accuracy, I used a measuring tape to find the actual distance between the device and a moving object and compared it to the distance calculated by the device. I performed this experiment for ten days and recorded the results. Overall, my device is fairly accurate and is only 2-3 inches off at most. In the future, I plan on creating a simple mobile app to make user interaction with my device easier.

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

CS AT

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

4. Is this project a continuation? Yes No

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- Yes No

CSEF Official Abstract and Certification

Word Count

138

Fair Category

P7

Project Number

5003

Title: Potato vs. lemon

Student Name(s): B. Dunkle

Abstract:

Cars use up a lot of gas and electricity each year which are non reusable resources. So what if you use a fruit or vegetable to try to run a car and if so which would go farther? for example a lemon or a potato and that is what this experiment was used to find out. The hypothesis for this experiment was if a potato or lemon was used to power a car then the potato would go farther and be more efficient than the lemon and for this experiment I made the potato and lemon go on its own with its own power. The problem was that they didn't go very far but they did go so that means that it could probably run its own car you would just need a lot more lemons and potatoes.

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):

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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

Fair Category

P7

Project Number

5004

Title: Purifying Water with Activated Charcoal

Student Name(s): A. Gibowicz

Abstract:

The purpose of my project was to find out if activated charcoal purifies water, and if so how much charcoal do you need to see the best results. I experimented with different amounts of activated charcoal. In each jar, I poured in ½ cups of water. I dropped in eight drops of red food coloring into the four jars. Then I put 2 tablespoons, 1 tablespoon, and ½ tablespoons into each individual jar. In the fourth jar, I did not add any activated charcoal so I would have a reference of the beginning color as the days went by. When I added the charcoal to the jars, I put lids on the jars so that the water would not evaporate over the days. I made a hypothesis that the charcoal would clear the water and I predicted the jar with two tablespoons of activated charcoal in it would clear the water faster. I also make a hypothesis that the jar with the least amount of activated charcoal would work the slowest. After five days I made a conclusion that my hypothesis was correct in that the jar with two tablespoons of activated charcoal was almost completely clear with no red food coloring left and the jar with the least amount of activated charcoal taking the longest to clear and to see results. In the end, the results I saw were that charcoal filters do work and are a good way to purify your water in an efficient way.

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

EV CH

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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

252

Fair Category

P7

Project Number

5005

Title: Separation of Food Dyes Via Column Chromatography

Student Name(s): A. Gadhachanda

Abstract:

The objective of column chromatography is to separate various substances that make up a mixture. In this demonstrated experiment, what makes grape soda purple? Food dye, the combination of blue 1 and red 40 gives the grape soda its characteristic purple color. While you cannot tell that those two different food colorings are in it by looking at the purple soda, you could separate them using a technique called column chromatography. Column chromatography is a technique that typically uses a transparent tube, filled with small particles that are tightly packed. We used a recycled C18 reverse phase column for separation. Blue 1 and red 40 are relatively non-polar molecules, red 40 is a more polar molecule than blue 1, and contents of the C-18 (stationary phase) are non-polar. If the dye molecules are dissolved in a relatively polar solvent (mobile phase) such as water in the resulting solution the dye molecules will preferentially associate with the stationary phase. A 2% isopropyl alcohol and 98% water as a mobile phase will remove the red 40 dye from the stationary phase and the resulting eluent will be red. A slightly less polar mobile phase consisting of 10% isopropyl alcohol and 90% water will remove the blue 1 dye from the stationary phase and the resulting eluent will be blue from the dye. The more polar molecule, red 40 is removed with the more polar mobile phase, and the less polar molecule blue 1, is removed with the less polar mobile phase.

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

CH BI

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

237

Fair Category

P7

Project Number

5006

Title: Thermoelastic energy generation using variable temperature gradients

Student Name(s): K. Suri

Abstract:

The amount of energy created using a thermoelectric generator with different temperature gradience. I performed this experiment in hope of finding a new way to create energy by only using one simple device.

How much energy can be created by using thermal energy to measure the temperature gradient?

The amount of energy (voltage) will be measured in this experiment. Using a multimeter, the two wires connected to the thermoelectric generator will connect with the two wires from the Multimeter. The highest amount of voltage would be measured for each test.

The reason for my project is to try to discover new and better ways to create energy without using any gas.

A thermoelectric generator is a piece of equipment used to create energy from a temperature gradient. The temperature gradient is the movement from something very hot to something cold. As well as something very cold, to something very hot. The thermoelectric generator is a thin device that on one side can collect energy from something hot, and on the other, energy from something cold. The mixture from the two temperatures collides and the generator collects it and forms energy from it. To be able to measure the energy amount being created, you would have to use a device called a multimeter to measure the voltage. One more thing about the thermoelectric generator is that it is extremely durable, and can last a while without being broken.

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

ET 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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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

5007

Title: lights on... or lights off?...

Student Name(s): A. Pagnotta

Abstract:

The purpose of this project is to investigate if flicking lights on/off uses more electricity than just leaving them on. Vampire energy tests on small appliances were also measured.

The hypothesis is it will take less electricity to turn a lightbulb on/off than leaving it on continuously, because less electricity will be used.

Four light bulbs were tested: incandescent, halogen, CFL and LED with the same output of 800 lumens. An electrical testing board was constructed that consisted of light receptacles, a kilowatt digital power meter and light switches. Each lightbulb was tested on continuously for six minutes then flicking it on/off for six minutes. Phase 2 tested small appliances to measure the energy used on standby. Energy cost and consumption were calculated from digital measurements.

Incandescent used 57 Watts when on continuously and 34 Watts flicking on/off.

Halogen used 43 Watts when on continuously and 21 watts flicking on/off.

CFL used 14 Watts on continuously and 8 Watts flicking on/off.

LED use 9 Watts on continuously and 4 watts flicking on/off

Most small appliances used between 0.8 and 13 watts in standby mode.

These results supported the hypothesis because the data showed that flicking lights on/off saved energy and cost versus staying on continuously. The LED bulb proved to be most energy efficient if it was kept on continuously or flicked on/off. Energy consumption could be decreased by unplugging appliances not constantly in use.

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

EE ET EM

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

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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

5008

Title: Remote Learning on a Budget

Student Name(s): J. Benin

Abstract:

During the COVID-19 Pandemic, online learning has become a key factor in our education. Some families have had trouble supplying their kids with the resources they need to learn virtually. Thanks to my research and testing there is a way to not spend a fortune on a computer, but still be able to learn! A Raspberry Pi is a low-end computer that is very inexpensive. I bought a Raspberry Pi 4 and tested the things you would do when you learn online. It could easily complete the tasks. I measured the difference between a high-end Windows 10 desktop and the Pi. The Raspberry Pi was only a few seconds slower than the Windows 10 computer and it was able to perform all of the tasks needed for middle school virtual learning. While the Pi is also able to do some more advanced things like programming and 3D modeling, these tasks will go considerably slower. The Pi runs on a Linux operating system, so some games aren't supported (such as Microsoft Flight Simulator 2020).

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):

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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

247

Fair Category

P7

Project Number

5009

Title: Using Snell's Law to Determine the Index of Refraction in Solutions

Student Name(s): S. Borst

Abstract:

The purpose of this project is to represent the concentration of sugar in a solution using the principle of light refraction. The scientific question is how does sugar in a solution affect the index of refraction? The hypothesis for this experiment is that the more sugar in a liquid the more laser light will bend or refract. A prism will be filled with different solutions containing known and unknown amounts of sugar. The prism will have a laser light passed through it. The prism will then be rotated so that the laser light inside of it is parallel to the bottom side of the prism resulting in a spot on a target board. This spot will be marked on the target board using colored pencils for each different solution. Based on these marks distance measurements in centimeters will be taken and used along with an understanding of trigonometry to calculate an angle theta. Knowing what theta is and plugging it into Snell's Law allows additional mathematical calculations and results in the index of refraction for each known and unknown solution. The results of my project showed that as the sugar concentration of the prepared solutions increased so did the index of refraction. That means the more sugar in a liquid the more the laser light bent or refracted resulting in a higher index of refraction. In conclusion, my hypothesis was supported by experimental data proving the more sugar in a solution the more the laser light refracted.

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

MA PH

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 vertebrate animals controlled substances

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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

166

Fair Category

P7

Project Number

5010

Title: How Fast Can Fabrics Dry?

Student Name(s): D. Ciscel

Abstract:

This project explores the drying properties of different fabrics. To do this, I did an experiment on what fabric dries the fastest out of cotton, corduroy, flannel, thin polyester, thick polyester, and mesh. The hypothesis was that the thin polyester fabric would be the fastest to dry. The experiment was conducted by wetting squares of fabric, wringing them out, then putting them in a place with equal sunlight to dry. Afterwards, the squares were tested every fifteen minutes to determine if the fabrics felt dry. The result of the experiment is that mesh was the fastest to dry followed by cotton, then thick and thin polyester, then corduroy, and finally flannel. Mesh only took fifteen minutes to dry while flannel took three and a half hours. The hypothesis was proven incorrect because thin polyester was only the third fabric square to feel dry. The results showed that the density of a fabric does not affect drying speed as much as the materials the fabric consists of.

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):

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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

240

Fair Category

P7

Project Number

5012

Title: Metal Hardening: Heating, Hammering and Holding Atoms Together

Student Name(s): A. Campbell

Abstract:

Metals make up over 30% of earth. Metals can be found in buildings, cars, appliances and more. Work hardening is a process where metals are heated up, cooled down and hit with a peening hammer. When the metal is heated, the atoms move faster and spread out. For metals with low melting points the atoms spread out so far they become a liquid for a short time and then reform into a solid. For metals with high melting points liquefying can take a long time and needs immense heat to happen, so the heated metal only softens. While the metals are hot and in a soft state, a peening hammer is used to force the atoms back together in a new structure. The peening hammer has a rounded tip for concentrated hits and the peening hammer focuses the energy on the metal surface and pushes atoms together. My hypothesis was that alloys when work hardened would be harder than the individual metals when work hardened, which was found to be true.

Copper, tin, zinc, bronze and brass metal coupons were work hardened. Scratch testing using metal hardness files was used to compare the hardness of individual metals, work hardened metals, and alloys. The alloys used were bronze and brass. Bronze contains copper and tin and brass contains copper and zinc. Some of the individual metals became harder while others did not change in hardness. Both of the alloy's hardness increased.

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

EN AT EE

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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

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- Yes No

CSEF Official Abstract and Certification

Word Count

240

Fair Category

P7

Project Number

5013

Title: Jump Distance

Student Name(s): D. Ferrucci

Abstract:

This science experiment will determine how running distance impacts jump distance. The experiment will test if running further before you jump will help you jump farther and by how much. The hypothesis was if you increase running distance, your jump distance will increase, if you decrease your running distance, your jump distance will decrease. The project was completed by marking distances on the ground. The marks were set on 0, 3, 6, 9, and 12 ft. Every mark represented how many feet the subject would run. Starting at 0, which was a standing jump because there was no running distance before the jump. Next was a 3-foot run, then a 6-foot run, etc. The variables were: Independent Variable: The distance running before a jump Dependent Variable: The distance jumped Controlled Variable: The subject who is jumping The hypothesis stated that if you increase running distance, the jump distance will also increase, if you decrease running distance, your jump distance will decrease. There is a significant difference if you stand still and jump, and run and jump. Three conclusions come out of this experiment: 1. Jump distances increase with run distance. 2. Jump distances with running starts (excluding standstill to 3-foot increase) increased consistently, approximately 4-inch jump increase for every 3 feet running increase. 3. The largest jump increase was from standstill to 3 foot running start. Overall, running is much more effective than standing still and jumping.

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

PH

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 vertebrate animals controlled substances

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- Yes No

CSEF Official Abstract and Certification

Word Count

248

Fair Category

P7

Project Number

5014

Title: Tennis Ball Disinfector

Student Name(s): S. Reddy

Abstract:

Statistics show that 125 million tennis balls end up in landfills per year, each ball taking 400 years to decompose, and generating 20,000 metric tons of methane! Tennis balls are made of felt nylon, which means they lose their ability to bounce when exposed to moisture. Due to this issue, there are no current solutions to disinfect tennis balls.

My objective was to design a mechanism that would effectively disinfect tennis balls by using a UVC light without impacting the buoyancy of the ball.

In order to attain my objective, I needed to build a base that would rotate the ball in all directions. To do this, walls were created with Lego technic bricks and pins to hold the spinning axles. Gears were placed in different positions on elongated axles to find the ideal setup where the ball would spin continuously. Following the completion of the concept of rotational mechanism, an "enclosure" was then built to hold the base and the UVC light commonly used for disinfection. Lastly, two motors were attached, one to the axles, and the other for the user to spin.

For best results, the motor handle needs to continuously be spun clockwise for one minute.

This mechanism helps tennis players safely reuse their tennis balls for three to four matches without the tennis ball losing its ability to bounce. This helps generate less methane in the environment, and is a safe solution to using UVC light without coming into direct contact with the rays.

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

EE MI ME

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- Yes No

CSEF Official Abstract and Certification

Word Count

246

Fair Category

P7

Project Number

5015

Title: Secure Stove

Student Name(s): E. Starr

Abstract:

The Secure Stove solves the ever present issue of houses burning down because of unattended stove tops. In the past 10 years, an estimated 71,000 home structures were burnt down and approximately 2,800 lives lost annually. Both home fire rate as well as deaths have been trending upwards in the recent years.

The Secure Stove is based upon an arduino design kit with a solenoid valve, piezo buzzer and an LCD timer. The user of the Secure Stove can select the desired cooking time with four buttons, start/stop, increase time, decrease time and set time. When the timer is done, the solenoid cuts off the gas to the stove while the piezo buzzer sounds. The Secure Stove can stop stove top fires from starting thereby reducing home fires. I prototyped the gas stove version since it is more difficult to shut a gas stove than an electric stove. My prototype can be easily adapted for an electric stove by changing the solenoid valve into a circuit breaker switch.

My invention is designed for integration into future stoves by appliance manufacturers. The low cost of Secure Stove at ~\$15 or less (which is about 3% of the price of an average stove costing \$500), mass produced, makes it a compelling differentiating safety feature for future stoves designs. Current safety products available to modify existing stoves are extremely expensive, costing \$200-\$800 excluding installation cost. With a small design footprint, the Secure Stove is affordable and effective.

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

EE

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- Yes No

CSEF Official Abstract and Certification

Word Count

89

Fair Category

P7

Project Number

5016

Title: The Algorithm of the Rubik's Cube

Student Name(s): M. Rosario

Abstract:

The Rubik's Cube is a 3-dimensional color based combination puzzle that was created in 1974 Ernó

Rubik. The original Rubik's Cube had six sides that were each covered by nine stickers, each side had

one solid color: white, red, blue, orange, green, and yellow. The goal of the Rubik's Cube is to mix it up and resolve it to its original form. I tested several algorithms and settled on two that solved the cube more frequently. In the end, both algorithms simultaneously were needed to solve the cube.

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

MA

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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

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- Yes No

CSEF Official Abstract and Certification

Word Count

255

Fair Category

P8

Project Number

5501

Title: Implementation of Metal-Oxide-Induced Agglomeration and Electromagnetic Filtration for Removal of Microplastics

Student Name(s): S. Mohanraj

Abstract:

Microplastics, nondegradable fragments of plastic debris less than 5mm in size that arise from the breakdown of consumer products, are persistently found in water sources and pose health hazards to all species. Their microscopic size renders them difficult to remove using conventional water purification processes.

This project investigated using novel electrically-driven methods to agglomerate and remove microplastics from contaminated water samples. Three methods were analyzed: electrically-magnetized filtration, electrically-magnetized filtration enhanced by the addition of metal (iron, manganese, nickel) oxides into the contaminated water samples to better agglomerate microplastics, and electrolysis. It was hypothesized that enhanced filtration would be most effective due to metal oxides' agglomeration with microplastics, allowing microplastics to be attracted to the filter, iron oxide being the most effective oxide due to strong magnetic properties.

Microplastics (HDPE, PETE, PP) were each added to distilled water to create separate samples, along with a sample of washing machine discharge containing microplastic fibers from synthetic cloth. These were assessed using three analyses prior to and following the above agglomeration methods: spectroscopic analysis (using Beer-Lambert's Law to determine the extent of filtration of suspended microplastics from the samples), microscopic analysis (quantifying the number of microplastic fragments within the samples), and turbidity tube analysis (determining turbidity levels).

In all three analyses, the implementation of iron oxide with the electrically-magnetized filter, removing about 50% of microplastics, worked most effectively in all microplastic samples compared to all other methods. The electrolytic cell worked the least effectively out of all the methods, removing only about 7%.

Technical Disciplines Selected by the Student
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CH EM AT

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CSEF Official Abstract and Certification

Word Count

128

Fair Category

P8

Project
Number

5502

Title: CATALYST CHEMICAL REACTION -Coke and Mentos

Student Name(s): M. Akbar

Abstract:

MEEM'S ABSTRACT: My research is about the "Coca Cola & Mentos Experiment" that shows how higher or lower the height would be from the Catalyst Chemical Reaction after we add the number of Mentos wanted. The number of Mentos added to the 2 Coca Cola Bottles would show the results by itself because the explosion is going to happen after the amount of Mentos are put into the Coca Cola Bottles. For example, 1 Coca Cola Bottle has 14 Mentos, and the other Bottle has 7 Mentos. I would like to know the results are the same height or different heights. Next the research of my project will be about heights. My definitive answer to my research project would be about how higher or lower the Coca Cola explodes.

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

CH EV

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

4. Is this project a continuation? Yes No

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- Yes No

CSEF Official Abstract and Certification

Word Count

157

Fair Category

P8

Project Number

5503

Title: Elephant Toothpaste Experiment Measuring Effectiveness of Different Concentrations of Hydrogen Peroxide

Student Name(s): M. Kim

Abstract:

Abstract

My hypothesis for this project was to determine if the concentration of hydrogen peroxide had an effect on the amount of foam and the time it took to produce in the experiment called elephant's toothpaste. I conducted my project by first finding out how to create elephant's toothpaste, my own ratio of the chemicals, which catalyst to use and finally testing the mixture myself. As I was going I was actually surprised at how difficult it was to create a large spontaneous reaction as it seemed like just mixing some chemicals and boom. To test my hypothesis I used four different concentrations of hydrogen peroxide 3% being the weakest and 6% and 18% being in the middle, and 35% being the most potent. Through my research I discovered that the concentration of hydrogen peroxide is vital to creating a large output of foam and that Potassium Iodide was also an important catalyst to use as well.

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

CH

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4. Is this project a continuation? Yes No

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- Yes No

CSEF Official Abstract and Certification

Word Count

249

Fair Category

P8

Project Number

5504

Title: The Effect of an Insulator with Styrofoam on the Temperature Difference in Celsius Between Two Pieces of Cardboard.

Student Name(s): C. Borges

Abstract:

In modern society, insulation can be found all around you, whether that be through insulation in your walls, or insulation in containers containing the Pfizer vaccine. All around the world, insulation is used, and all around the world, insulation saves lives. Insulation has propelled humanity to a place it would not have reached without it, and is crucial to our ever so fragile civilization. The experiment was done in order to add on to the vast amount of studies and data on insulation and try to discover new insulative properties or interesting phenomena. The project narrowed down the broad topic of insulation to combinations of insulators. The study aimed to figure out how insulator combinations differed from single insulators in terms of insulative efficiency. The experiment used styrofoam as the control and as the constant in each trial, and used polyester, leaves, and cotton paired with it to test each combination's efficiency. It did this by placing said insulator combination between two pieces of cardboard, one of which was heated up by a blow dryer. After 5 minutes, one would measure the temperature of both pieces of cardboard, and calculate for the temperature difference. A higher temperature difference would indicate better insulative efficiency since it showed how much heat was absorbed. The original hypothesis stated that polyester and styrofoam would perform the best due to polyester's density and manipulability, however the results instead indicated that cotton and styrofoam performed best because of cotton's higher density and less present manipulability.

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

EN

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

4. Is this project a continuation? Yes No

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- Yes No

CSEF Official Abstract and Certification

Word Count

224

Fair Category

P8

Project Number

5505

Title: How Much Water can a Solar-Powered Water Desalination Machine Produce.

Student Name(s): C. Cornelius

Abstract:

My topic is changing saltwater to freshwater using a solar-powered water desalination unit, with two different colored papers underneath. The two papers were black and white. I wanted to see how effective using this method is. My hypothesis was that the solar-powered water desalination unit with the black sheet underneath would be more effective. I believe this because the black paper underneath will absorb the heat from the sun. I first built two solar-powered water desalination units. Then, I ran a series of five tests. I used a heat lamp outside and inside focusing on both, then I ran tests where the heat lamp only focused on one solar-powered water desalination unit at a time. The results were that the black piece of paper was significantly better than the white piece of paper. I found it surprising that when I focused the heat lamp on just one of the units, it produced less freshwater. This happened because the heat lamp was making the water too hot so it evaporated. My hypothesis was correct because the solar-powered water desalination unit with the black paper underneath was more efficient. In conclusion, I learned that the solar-powered water desalination unit is not as effective as I thought because it takes too long to produce a significant amount but it still works.

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

EA

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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

154

Fair Category

P8

Project Number

5506

Title: Ventilation for COVID-19: What is Effective?

Student Name(s): A. Pourkavoos

Abstract:

COVID-19 is a virus that has plagued the world for just under a year. It has been a hard-fought battle to keep it at bay, one that we seem to be losing. CDC guidelines instruct us to wear masks and remain socially distanced, as well as to ventilate public spaces. In this project, I tested two different kinds of ventilation, as well as a control. First, I tested how particles moved in a room with no ventilation. Then, I tested how particles moved in a room with a fan blowing air in. I also tested how they moved in a room with a fan blowing air in, and a window open opposite the fan. My findings concluded that a fan is not useful, and is in fact detrimental, when there is not a window open. This is because the contaminated particles just get scattered around the room, rather than getting blown out.

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

PH EV ME

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4. Is this project a continuation? Yes No

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- Yes No

CSEF Official Abstract and Certification

Word Count

141

Fair Category

P8

Project Number

5507

Title: Rusting Nails

Student Name(s): A. Eneh

Abstract:

The purpose of my experiment was to find out if and how the amount of salt in water affected how much a nail will rust. My hypothesis was that if there is more salt added to water then the iron nail will rust more. To conduct this experiment I placed 4 iron nails into 4 test tubes which contained water with different amounts of salt in them. I repeated this process 3 times. The results showed that the nail in the test tube without salt rusted and gained 4.6 pounds. The nail in water with 3 bottle caps of salt gained 6.1 pounds of rust. This supported my hypothesis in that the nails in test tubes with more salt gained more weight, which means they rusted more. In conclusion the amount of salt in water increases the amount a nail rusts.

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

CH

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4. Is this project a continuation? Yes No

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- Yes No

CSEF Official Abstract and Certification

Word Count

246

Fair Category

P8

Project
Number

5508

Title: Crystal Current

Student Name(s): A. Mauborgne

Abstract:

I have had an interest in geology and sustainable energy for a long time. Recently, there has been a lot in the news about deep space travel, exploration and eventual colonization. Many new technologies will be needed to make long-term space living possible. Existing technology may not work for such extreme exploration. Perhaps information gathered from this experiment could be used to further the distance we could travel by providing energy-creation in deep space where resources may be limited. This could extend the length of a mission.

The purpose of my experiment was to find out if minerals can be used to generate electricity, and determine which crystals create the most electricity. After doing some research, I devised a way to test different minerals. I attached a magnet to a voltmeter and struck the individual crystals and recorded if any current was created. Then, I recorded the mV reading from each crystal. Out of the eleven samples I tested, all of them produced an electrical current ranging from 36.2 mV, to 7.6 mV. Clear quartz produced the highest mV reading, and "crazy lace" agate produced the lowest output.

The next step for this project would be to do more research into what minerals are known to exist on various planets that could be used in the process of electricity generation. Additional calculations need to be made to determine the scale of materials that would be required to make enough electricity to be of use.

Technical Disciplines Selected by the Student
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EN ET PH

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- Yes No

CSEF Official Abstract and Certification

Word Count

186

Fair Category

P8

Project Number

5509

Title: Are All Masks Equal?

Student Name(s): K. Cadmus

Abstract:

During the worldwide COVID-19 pandemic, experts recommended wearing masks to prevent the spread of the virus. The purpose of this experiment was to determine which day-to-day masks would prove most effective in reducing the distance of airflow. My hypothesis was that not all masks are created equal and that some will perform better at reducing airflow than others. The design, thickness, and type of fabric of each mask will influence its effectiveness. In this experiment, an air pump was used to determine the distance at which a candle flickered or extinguished while uncovered or covered by a mask. My results found that there were differences in masks' performance. The highest performing mask had an extinguish effectiveness of 97% and a flicker effectiveness of 90%. The lowest performing mask had an extinguish effectiveness of 72% and was not effective in the flicker test. The disposable mask, N95 mask, and all of the two-layered masks proved to be the most effective. However, all masks reduce the distance a candle extinguishes in comparison to the uncovered pump. This experiment proved my hypothesis to be correct.

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

ME

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4. Is this project a continuation? Yes No

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- Yes No

CSEF Official Abstract and Certification

Word Count

52

Fair Category

P8

Project
Number

5510

Title: Energy

Student Name(s): S. Shaw

Abstract:

I did this project because in class we learned how people use their bodies to create energy and I wanted to try it also. My project is making a knee brace that collects energy and a hand crank to see which charges the phone the fastest. The results are still being calculated.

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

EN EE

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4. Is this project a continuation? Yes No

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Yes No

CSEF Official Abstract and Certification

Word Count

246

Fair Category

P8

Project Number

5512

Title: The Effect of River Bank Medium on River Erosion

Student Name(s): B. Chaleski

Abstract:

The purpose of this project is to determine how river erosion is affected by the medium of the river bank. How does the medium of a river bank affect the erosion of a river bank? If gravel contains less volume and less density, then the water should flow through the gravel much faster than the sand. If the sand contains more volume and more density, then the water will have a harder time flowing through it leaving the gravel with the fastest time. In order to determine if river erosion is affected by the river bank medium, a percolation test was done. This will test how fast water passes through each specific medium. The container was held over the sink to contain all materials that might have fallen out of the holes to reuse them again. The fastest time of the empty container was 14.25 seconds. The Gravel came close, but only had a time of 16.47 seconds as its fastest time. The slowest medium was the sand at 118.82 seconds being the slowest. The fastest the sand ever came to was 116.66 seconds. The river bank medium effects erosion by slowing down or speeding up the drainage flow of water. This was predicted in the hypothesis and then proven throughout 12 trials. Hence, the overall conclusion is that gravel is the best medium for a river bank since it both reinforces the river bank, and it allows the water to flow at a constant rate.

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

EM EV EA

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- Yes No

CSEF Official Abstract and Certification

Word Count

247

Fair Category

P8

Project Number

5513

Title: Can Diodes Be Used to Reduce the Negative Impacts of Road Salt on Streams?

Student Name(s): A. Quinby

Abstract:

Winter in Connecticut has a common feature: road salt. We appreciate how salt makes driving easier but fail to notice the runoff from roads carrying high amounts of salt. The road salt reaches streams and inhibits aquatic species' growth and reproduction, as well as feeding into wells and reservoirs. If we stopped salting, accidents would increase, but we can try to remove the salt from the streams so that it does not continue to harm ecosystems. I wanted to study whether or not salt could be removed from water using electrodes, and how long it would take to do so. Therefore, I inserted copper electrodes into a cup of water with a variable amount of salt and charged them with 4.5 volts for a minute. Then, I moved the electrodes to a different jar, removed the charge, rinsed the electrodes, and measured the salt level before repeating the process. To measure the salt level, I used a multimeter to test the resistance. My initial hypothesis was that the salt level would be lowered, taking about 4 cycles for every 2% of salt. The salt level did lower initially but then quickly rose to levels much higher than the original amount. This, together with the color changing of the copper wire, indicated that copper was released into the water as an ion. It might be viable to use short bursts of electricity, but more testing is required. Meanwhile, electrodes should not be used to remove salt from streams.

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

EM CH EV

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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

110

Fair Category

P8

Project
Number

5514

Title: OXIDIZED CHEMICAL REACTION - Coke and Bleach

Student Name(s): L. Benzo

Abstract:

The following science project will identify the Oxidized Chemical Reaction of mixing coke cola with bleach. The materials used for this project is a 16.9 oz bottle of coke, Bleach, a cup, and a mixing tool. This project contains a breakdown in a 5 minute interval in which the chemical starts to react. This project also contains my data findings. The purpose of this project was to identify the use of house hold products along with the mixture of soda. This project is also based on the hypothesis of a colored substance turning into a clear substance. This project also concludes my results and future recommendations the research I performed.

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

CH EV

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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

125

Fair Category

P8

Project
Number

5516

Title: Fingerprint preservation

Student Name(s): M. Das

Abstract:

The purpose of this project is to test the preservation of fingerprints on different materials. To test this, I used wood, glass and metal to which I pressed my thumb against and blew some powder on top of. That revealed the fingerprint that I then transferred to a black paper after sticking it to tape. This experiment resulted in the glass fingerprints coming out clear, the metal ones clear but a little patchy, and lastly, the fingerprints from the wood were a little bit hard to tell because the ridges of the fingerprints clashed with the texture of the wood. After conducting this experiment, I can conclude that glass and metal are the best materials to preserve fingerprints, especially glass because of the smooth texture.

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

128

Fair Category

P8

Project Number

5517

Title: CONVECTION HEAT TRANSFER & MIXING METHODS

Student Name(s): B. Kelly

Abstract:

The question for this experiment was which mixing method transferred heat the fastest in a small tank. Heat travels from a hotter system to a colder one using either convection, conduction or radiation. When conducting the experiment one would first get two helpers; one to hold the thermometer and pour the hot water into the tank, one to call times and record temperatures, while the person conducting the experiment carried out the mixing methods. The mixing method that achieved a final uniform temperature most rapidly was the mid-width mixing method, which got to a temperature of 89.9 in 30 seconds. This mixing method experiment was successful because we were able to reach a conclusion after timing each method every 15 seconds until the time reached 120 seconds.

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

PH 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