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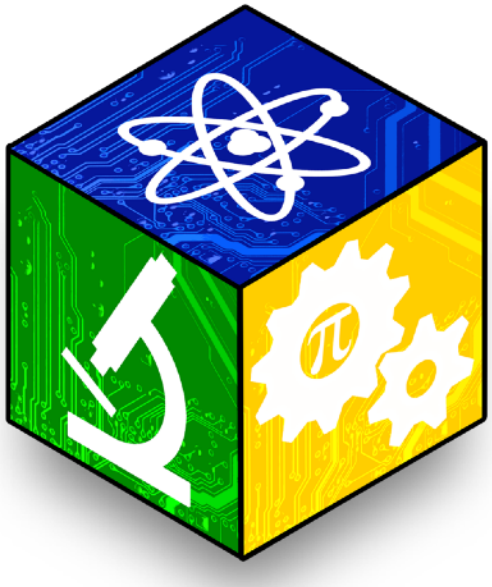

76th Annual Fair
March 4-16, 2024

Student Abstracts

Fair Categories

	Life Sciences	Physical Sciences
7th & 8th Grade	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)

Technical Disciplines

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

Technical Discipline 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

2024

Word Count	Fair Category	Project Number
253	PT	4001

Title: Combining Optical Wireless Communications (OCW) and Neuromorphic Architecture for Large-Scale Computations

Student Name(s): R. Suren, A. Chevva

Abstract:

Deep Learning (DL) is a rapidly growing field of Artificial Intelligence that requires large datasets and complex neural network layering. To meet the increasing demand for DL, quantum computers have been introduced to decrease model training time. A new approach called neuromorphic photonics (NP) is also being explored, combining brain-like resource utilization with the scalability of photonics. This project aims to identify a key research area and develop a prototype design that could rival quantum computing.

This study developed a baseline prototype that encompassed a wide range of computational traits, such as Layered-Optical Neural Networks (L-ONN) and Spiking Neural Networks (SNN). Additionally, Collocated Processing, SNN, Asynchronous Processing, Scalable Logic Gates, and Parallelism were implemented in our NP model. The program focused on solving matrix multiplication and DP problems for simplicity, targeting primary operations in DL.

Comparisons of CPU time and RAM usage were made between the performance of the prototype and with a traditional In-Memory Parallel (IMP) processing model. This neuromorphic photonics (NP) model demonstrated significantly better results, with a CPU Time of ~10 milliseconds compared to ~300 milliseconds for the IMP model. The NP model had lower RAM usage, with ~11% compared to ~96% for the IMP model. The collocation of RAM and CPU in the NP model was roughly 11% each, while the IMP model had ~6% CPU and 96.3% RAM.

In conclusion, the focal point of NP model efficiency application to DL models is ColloP. Combining ColloP & miscellaneous methods can optimize DL models with less resources.

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

2024

Word Count	Fair Category	Project Number
190	PT	4002

Title: Hovercraft the New Transportation

Student Name(s): S. Suarez, J. Perez, N. Hov

Abstract:

The purpose of the Experiment is to demonstrate that a hovercraft can carry a human up to 200 pounds.

Our hypothesis is if we purchased materials from Home Depot and use household materials, we could create a hovercraft that could hold and move a (up to 200 pounds) family member.

Procedure - Sanding and cutting wood, reinforcing board with duct tape, testing the board using family members to make sure the board will rise, move and can carry the load of a human (up to 200 pounds).

Observation/Data/Results - Each human family member (weights from 90 to 210 pounds) who tested our hovercraft design was lifted and moved around. The holes in bottom of the hovercraft reduce friction and cause the tarp not to over inflate.

Conclusions - Our procedures went as planned and our hovercraft design was a success.

Safety Precautions - You must tie long hair to avoid it getting stuck in the fan of the leaf blower. Individuals must stay in middle, close to leaf blower to balance the load.Family members will use their hands or feet and push the hovercraft if it gets too close to a wall.

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

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4. Is this project a continuation? ☐ Yes ☒ No
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☐ Yes ☒ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
245	PT	4003

Title: The Pinwheel Problem

Student Name(s): F. Marin, P. Nguyen

Abstract:

Have you ever been traveling along a road and seen huge fan-like structures? Those are wind turbines, and they are the future of energy. Wind turbines use wind to create renewable electrical energy. Using renewable fuels reduces climate issues and replaces fossil fuels. Pinwheels use the same concept as wind turbines to rotate. With this project, pinwheels will be used to demonstrate the effect of blades on wind turbines and determine what number of blades is the best choice for producing more energy.

Our hypothesis is that increasing the number of blades on a pinwheel would increase the number of rotations performed. To test this, pinwheels with two to ten blades were placed in front of an electric fan for one minute, with many trials performed. Then, the rotations were measured using a tachometer. Next, the number of rotations for each pinwheel was averaged and compared. Finally, a conclusion was made based on the data for this experiment.

In conclusion, our experiment supported the hypothesis. Results show that increasing the number of blades on a pinwheel increases the number of rotations it performs on average, up to a point. The number of rotations peaked with 8 blades with 345.02 rotations per minute, compared to 2 blades with 260.71 rotations per minute. The increased rotations enhance energy production efficiency. These results show that increasing wind turbine blades boosts energy production cost-effectively, advancing clean and renewable energy efforts while reducing pollution for a healthier planet.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) ET EE 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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
242	PT	4004

Title: Integrating Pelton Turbines into Industrial Pipes to Harvest Energy

Student Name(s): A. Sadhvani, R. Kumar, A. Sadhvani

Abstract:

There are not enough clean sources of energy that can be easily implemented into the power grid. Using Pelton turbines in industrial pipelines is a viable option because implementing turbines in industrial pipelines is a cheap and efficient way to generate clean energy. To find the most efficient solution, the number of buckets, wind speed, and experimentation with multiple turbines in a single system was investigated.

While it is anticipated that the turbine would be placed in a manufacturing pipeline containing water, this investigation modeled the engineering problem using air flow since both air and water obey similar fluid dynamics. Prototypes with 18, 12, and 9 buckets were designed and fabricated using a 3D printer and tested in a wind tunnel at various speeds. After testing individual turbines, the investigation moved towards testing pairs of turbines to see the effect of one on another. Computational Fluid Dynamics simulations was used to view how fluids interacted with the turbine.

Results indicated that as the number of buckets increased from 9 to 18, the generated power increased from 11.88mW to 31.48mW.

Results on the effects of two buckets showed that at a distance of 19cm between buckets, the power generated increased to 59.76mW. Simulations showed that the use of water as a fluid would give a higher power output but more drag due to the density of water. The data shows implementing Pelton turbines in industrial pipelines can provide a clean source of energy.

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

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☐ Yes ☒ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
233	PT	4005

Title: Determining if 5G radiations from cell phones affect yeast cells

Student Name(s): J. Eldridge, A. Tucker

Abstract:

For this experiment, we hypothesized that 5G radiations would have a negative effect on the yeast cells over a period of time. We chose to do this experiment as a follow-up to a previous experiment from 2018 on how 5G radiation showed no negative effects on the growth of wildlife and the environment (democracy.bathnes.gov.uk/documents.pdf). We put balloons on 10 Erlenmeyer flasks filled with a mixture of yeast, water, and sugar to capture produced CO_2. To test the 5G radiation, there were 5 flasks on top of cell phones. As the yeast feasted on the sugar to create CO_2, pictures were taken to document the progress and results. The results proved that the hypothesis was wrong because the 5G radiation had a positive effect on the yeast cells. In the end, we saw that the flasks on top of the phones let off the most CO_2. All five of the 5G powered balloons were inflated, while the ones without 5G had only four inflated. 5G radiation does not have a negative effect on the yeast mixture, and small amounts of CO_2 were produced. This can be useful in the future because other experiments with 5G radiation (such as the effect on plant cells, humans, etc.) can use this information to predict what will happen, for example, the experiment done on bugs and wildlife had a result that helped us develop a hypothesis.

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

2024

Word Count	Fair Category	Project Number
194	PT	4006

Title: Self Inflating Balloon

Student Name(s): S. Gnoza, A. Pino

Abstract:

The Self Inflating Balloon project was selected to help us and others learn about chemical elements and observe features of a certain chemical reaction. This experiment also explains how the three states of matter can change. Our hypothesis was that a balloon containing baking soda will self-inflate because of the formation and release of carbon dioxide gas caused by combining the baking soda, a solid and a base, with vinegar, a liquid and an acid. We conducted our investigation by first filling an empty 500ml water bottle with 250ml of vinegar. One teaspoon of baking soda was then poured into a balloon, using a funnel. The opening of the balloon was stretched over the opening of the bottle. The balloon was lifted in a way to make all the baking soda fall into the bottle containing vinegar. The reaction of the base mixing with the acid caused carbon dioxide to form and bubble up from the bottom of the bottle. The pressure of the expanding gas forced it to rise into and be trapped by the inflating balloon. The experiment was repeated two more times and our hypothesis was proved to be correct.

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

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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

2024

Word Count	Fair Category	Project Number
232	PT	4007

Title: The Effectiveness of Different Distillation Methods for Desalination

Student Name(s): S. Ramakrishnan, P. Madden

Abstract:

The purpose of this project was to compare the effectiveness of Thermal Lab Distillation, residential Countertop Distillation, and residential Ion Exchange for desalination in terms of two measurable quantities: the amount of water processed and recovered and the salinity of the processed water. This study answers the investigative question of how Thermal Lab Distillation compares to Countertop Distillation and residential Ion Exchange for desalination. It was hypothesized that Thermal Lab Distillation would be the most effective in both the amount and salinity of water processed and recovered . Three 250g solutions, one with 2.5% salt (weight) concentration, another with 3.5% salt (weight) concentration, and a last one with 4.5% salt (weight) concentration, were fed into the Thermal Lab Distiller one at a time. Condensate samples were collected every 10 minutes for all three solutions. The same thing was done for the Countertop Distiller with 200g solutions instead of 250g. Three 50g solutions with 2.5% salt (weight) concentration were fed through the Ion Exchange device. In the experiment, the Thermal Lab Distiller produced the least water per trial with the lowest salinities, the Countertop Distiller produced the most water per trial with the second lowest salinities, and the Ion Exchange device produced the second most water per trial with the highest salinities. The results have shown that the hypothesis was partially supported. The Thermal Lab Distiller produced the least water with the lowest salinities.

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

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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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
251	PT	4008

Title: Does Municipal/Household Infrastructure Affect the Quality of Drinking Water in Bridgeport, CT?

Student Name(s): A. Villatoro, G. Reilly

Abstract:

This project addresses concerns regarding potential water contamination beyond purification processes, highlighting the importance of monitoring and addressing water quality issues in urban areas like Bridgeport, CT, a city with mixed-age housing stock and a rental population that may have no control over the pipes in their house or those under the city streets. Our experiment aimed to investigate the influence of city and household pipes on water quality, considering that water undergoes purification before distribution but may still encounter lead or other contaminants from aging pipes. According to a published 2022 report on the water quality of Bridgeport's water system, Aquarion (the water company) reported that Bridgeport's water is mostly clean and meets or exceeds state and federal quality standards, despite some despite some slight contamination. The report noted that homes constructed before the 1930s may contain lead piping, while those built before 1986 might have lead pipes using lead solder and brass fittings. Charts in the article represented contamination levels and water quality. To evaluate the impact of city pipes on water safety, we tested samples from different areas around the city using drinking water test strips. While most samples were safe, three locations showed lead contamination, an unexpected finding given the associated dangers of lead poisoning. The focus was primarily on lead due to its severe health implications, but other contaminants were also considered. We seek to continue our analysis of a larger sample for both the benefit of the residents and the health of the public.

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

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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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
250	PT	4009

Title: Does the temperature of a tennis ball affect how high it bounces?

Student Name(s): R. Goncalves, A. Teixeira

Abstract:

Our purpose for the project was to see if the temperature of a tennis ball would change the height of its bounce. What we had done is we had researched 3 different websites that had also done this same experiment to get a basic understanding of what was to come. After researching, we made a hypothesis. According to the data, the hotter the tennis ball, the higher the bounce. Our independent variable was the temperature of the ball, the dependent variable was the tennis balls height in ft. Some constant variables we came up with were the freezer we used to cool the tennis ball, and the hairdryer we used to heat it up. Our method was that we would take the ruler that was 1ft long, and drop it from the top and record the highest point it got on its first bounce. Then, we would heat it up with the hairdryer for 15 seconds, and then drop it. Then we repeated the same process but heated it for 30 seconds. Then we would do the same for 45 seconds. After that, we would repeat the same process we did with the hairdryer, but instead with the freezer, and then we would repeat the WHOLE process 2 more times, heating it with the hairdryer and cooling it with the freezer. After we finished our experiment, we came to a conclusion. The hotter the tennis ball, the higher it bounces and the colder the tennis ball, the lower it bounces.

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

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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

2024

Word Count	Fair Category	Project Number
201	PT	4010

Title: Which Road Salts Are Best Used to Melt Ice?

Student Name(s): M. LaCroix, K. Cupillo, N. Bohonowicz

Abstract:

The purpose of this experiment was to show which melting salt works the best on icy roads. Three different melting salts were experimented on: Calcium Chloride, Driveway Heat, and Iodized Salt. We started by pouring 50 ml of water into all of the petri dishes and placed them into the freezer. The next day, the petri dishes were taken out and 5 grams of Calcium Chloride was sprinkled on the first row of four. We proceeded to sprinkle 5 grams of Driveway Heat on the 2nd row of petri dishes, 5 grams of iodized salt on the 3rd row, and for the last row, we let the petri dishes sit out to melt without any salt. The average amount of water that melted by calcium chloride was thirty milliliters; for Driveway Heat, it was twenty milliliters; for iodized salt, it was fifteen milliliters; and in the control, it was approximately five to seven milliliters. In conclusion, Calcium Chloride would be better to use for melting ice on the road than any other salts used in this experiment. It is also much safer for the environment than driveway heat but the only downside about it is that it would irritate the skin.

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

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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

2024

Word Count	Fair Category	Project Number
219	PT	4011

Title: Using Piezoelectric Sensors To Harvest Energy From Automobile Tires and Road Surface

Student Name(s): P. Manikandan, D. Clottey

Abstract:

Piezoelectric sensors can be used to harvest energy from automobile tires and the road surface. The idea would be that the tires from cars would run over the piezoelectric sensors in the road and generate energy from applied stress. The stress may be caused by pressure, acceleration or temperature change. This investigation explored the effects of mass and speed on the response of the piezoelectric sensor when voltage and current were measured. Speeds of 0.15 m/s and 0.35 m/s were investigated and it was found that the faster the car was traveling, the more voltage, and thus, the more power was produced. The second effect was added mass and the testing ranged from no added mass to 1000 g of added mass to the car. During these experiments, it was found that the distribution of the load in the car was significant and so the added mass was investigated both as a point load and a distributed load. It was found that the more mass added to the car, the larger the voltage and power response from the sensor, with the distributed load always higher than the point load for the same added mass. In conclusion piezoelectric sensors embedded in public roads are a viable way to create renewable energy to sustain the world's growing energy demands.

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

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☐ Yes ☒ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
181	PT	4012

Title: Building a Versatile Air Sensor That Can Detect PM10 & PM2.5 in the Air

Student Name(s): S. Sankarnarayan, G. Anderson, E. Amperidis

Abstract:

The purpose of the project is to design and build an air quality monitor that detects the amount of PM10 and PM2.5 in the surrounding air. This study determined how much particulate matter is in the air. The device detects particulate matter smaller than 10 micrometers, and particulate matter smaller than 2.5 micrometers. The proposed solution to the problem was to create an sensor that could monitor the air quality of the surrounding area. This device consists of one micro-controller (ATmega328p-based Seeeduino Lotus) 1 gas sensor, 1 dust sensor, and 1 temperature and humidity sensor. We programmed the software for all of the sensors and the OLED display. the device can be used as a stand-alone device or connected to a computer to harvest the data. We can conclude that we can detect PM10 and PM2.5 in the air using a custom-built air monitor. The device detected dust and gas where they were present; for example, it pointed out that there was a lot of smoke near a campfire and a lot of dust near old books.

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

2024

Word Count	Fair Category	Project Number
196	PT	4013

Title: Oxidation rates of different metals in various liquids and temperatures

Student Name(s): E. Kobelski, B. Savoie

Abstract:

The purpose of this project was to find out what conditions affect metal oxidation. Acids, a base, water and salt water were selected as the liquids. Iron, zinc, aluminum, brass, copper and steel were chosen as metals. The metals were tested in three temperatures: room temperature (21 degrees celsius), incubator (50 degrees celsius), and refrigerator temperature (5 degrees celsius). Tests were run for a 2 week set and an 8 week set. Observations were recorded every 3 days for the 8 week trial and every other day for the 2 week trial. Metal weights were recorded at the beginning and end of each set and containers were covered to avoid evaporation and contamination of the liquids. A wide range of qualitative data such as color and coatings on the metals were observed and recorded. Information on rates of oxidation was calculated as percent change of metal weight. Other qualitative observations that showed evidence of oxidation were recorded. The hypothesis that iron left in salt water would show the most oxidation was incorrect. The top oxidation results were observed with iron in acidic liquids. The hypothesis that warmer temperatures would show more evidence of oxidation was supported.

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

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CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
224	PT	4014

Title: Do Homemade Filters Work?

Student Name(s): N. Peaper, S. Korn

Abstract:

More than 1 billion people worldwide do not have access to clean drinking water. Water may be contaminated by particles, chemicals, and/or microbes. We tried to test if homemade water filters are effective. If successful, we could show that, instead of using expensive store-bought water filtration devices, an effective filter could be made at home with a couple simple ingredients. If our filter really does work the way that we wanted to, in the future, we could make clean water easier to obtain.

We created a filter with charcoal, gravel, and sand. At the start of our project our research question was "Is charcoal the most important ingredient in a filter?" But soon after following through with our experiment there the water filter without charcoal clogged, so we had to change our topic to, "Are homemade water filters effective?" After deciding with this new topic we still were able to use our original data. We filtered water with particles and chemicals, and we measured the amount of chemicals before and after filtration using water test strips.

After completing our project we concluded that homemade filters do work to get the sediment/particles out of the water but did not get all the chemicals out. We could do more experiments with different filter materials to see if they were better at removing chemicals.

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

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☐ Yes ☒ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
175	PT	4015

Title: Mycelium Trash Bags

Student Name(s): G. Sauer, M. Mantz, A. Pember

Abstract:

Mycelium is Nature's biggest recycler. It breaks down toxins such as plastic or oil turning them into available nourishment for other organisms to thrive. It can also be a great alternative to plastic because it can break down very fast in soil, but it's decomposition rate is much slower when not in soil, which in the case would be a landfill. When Mycelium breaks down in soil it can start decomposing plastic already existing in the soil. A mycelium trash bag is perfect for decomposing in a landfill. Mycelium is the vegetative root of fungus and does not need light to survive. Mycelium has a lifespan of 20 years before going into soil, so there is no need in replacing it. In this project what will happen is making a mycelium bag and comparing how much it decomposes by testing how much methane gas comes off of it compared to a plastic bag to see which can decompose trash more efficiently. We will record the mass of the containers daily as a second independent variable.

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

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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

2024

Word Count	Fair Category	Project Number
203	PT	4016

Title: Soccer Ball Inflation

Student Name(s): N. Rataic, C. John

Abstract:

Fascinated by how well-renowned soccer players, including Ronaldo, Messi, and Neymar, kick the ball, we sought to understand what contributes to a great kick. This experiment studied the relationship of soccer ball inflation to the distance traveled after a kick, specifically how far a soccer ball travels at a given air pressure when kicked with steady force. Research suggested a range of air pressures to be tested. We hypothesized that a soccer ball inflated to the highest air pressure, 13 psi, would travel the farthest as compared to a soccer ball inflated to mid-range pressure, 8.0 psi, or low pressure, 3.5 psi. To perform this experiment, an apparatus was built to kick the ball with equal force for each test. This apparatus used a swinging foot mechanism to kick the ball. Each air pressure was tested for 5 trials. The results of these trials show that low pressure soccer balls traveled the least with an average distance of 12 meters. The soccer ball inflated to the highest pressure traveled marginally farther with an average distance of 12.13 meters. The best performance was achieved by the soccer ball at mid-range air pressure, 8.0 psi, which traveled an average of 12.67 meters.

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

2024

Word Count	Fair Category	Project Number
139	PT	4017

Title: The Effect of Different Temperatures of Salt Water on the Rate of Oxidation

Student Name(s): B. Douangta, E. Rodriquez, S. Brahmkshatriya

Abstract:

The purpose of this project is to find out if raising temperatures of saltwater in the ocean will affect swimming and fishing gear. The purpose of this project is to find out if rising temperatures of saltwater in the ocean will affect swimming and fishing gear. This experiment predicts that the rate of oxidation will be increased in the warmer temperatures of saltwater, and the rate of oxidation will decrease in colder temperatures of saltwater. Iron nails were placed in different temperatures of saltwater to see which one rusted faster. As the temperature of the saltwater increased, the amount of rust produced also increased. To conclude this experiment, it was shown that in higher temperatures of saltwater, the rate of oxidation was faster and in lower temperatures of saltwater, the rate of oxidation was decreased and it was slower.

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

2024

Word Count	Fair Category	Project Number
248	PT	4018

Title: "Which Will It Be?"

Student Name(s): K. Noel, J. Williams

Abstract:

We tested three different pot sizes to see which one would boil water faster. Our testable question was "How does changing the size of a pot affect how fast water boils?" We used a small, medium, and a large pot. All three pots were made of the same material. We used three cups of water in each pot and placed it on the heat source. We observed the pots until they reached boiling and recorded the time. We repeated these steps for three trials. Our hypothesis was that the smaller pot would boil faster since there was less surface area. This was wrong. Our result was that the large pot boiled the water the fastest because of the width of the pot and larger surface area; the heat spread more quickly. We did this project because it was something that intrigued us. With this experiment, we figured out which pot will help us prepare our meals quicker. Readers should care about our project especially if they are interested in culinary. This is because if you have a limited amount of money and you can't afford an expensive pot set, then you should know what pot would be most useful to cook your meals. Also, if you are a chef in the culinary industry at a high-end restaurant and it is busy you would want to know which pot would prepare the customers' food faster. This is our experiment and how it can apply to the real world.

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):

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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

2024

Word Count	Fair Category	Project Number
225	PT	4019

Title: Using Vortex Hydropower Turbines To Harvest Electrical Energy

Student Name(s): M. Davis, D. Gao

Abstract:

The Hydropower turbine is going to be built by a 3-d printer. The first prototype used organic materials. The blades will be used as the turbine to run the hydropower turbine. The second prototype has succeeded more than the previous, and has generated about 0.45 volts. The final prototypecreatedthemostamountofenergyasitcreated0.6volts.Thegathered amountof volts are going to be compared to which one created the most amount of volts. Using different blades to see the effect of the flow of the water, and the amount of energy it creates. Each design of the prototypes are all different. The first prototype used a bucket. The second made out of spoons and a bucket. The third is completely made out of 3D printing material. The students also used different shaped bases to see if the water runs more efficiently and creates more energy. Finally they decided to settle for the final prototype built like a funnel. They also tested out the different pressures of water to see if it affects the turbine in any way. Using high water pressure creates more energy and using low water pressure will create less energy. Squeezing the tube of the water will create a massive amount of water pressure causing the turbine to rotate really fast, and creating at least 1 whole volt. Currently they have not measured the PSI of the water yet.

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

2024

Word Count	Fair Category	Project Number
246	PT	4020

Title: Does Color Affect the Way Taste is Perceived?

Student Name(s): M. McCloskey, S. Testo

Abstract:

We found this topic interesting because when people see food, their mind tells them what it tastes like. When you taste a food or drink, your brain has already perceived the taste of it.

Our hypothesis is testing whether color affects how taste is perceived. This will contribute to the study of color affecting taste and how some taste buds can identify flavors more easily than others.

The way we conducted our experiment was testing subjects by having them taste the same flavor of Gatorade that we dyed different colors. We recorded our data and figured out the average of right guesses for each different color. The procedure of our experiment started with Glacier Cherry Gatorade bottles and dyed them each a different color. We had our subjects taste one sample and then eat fresh watermelon as a palate cleanser and repeat this process two times. Then we recorded the results.

We observed how each subject interpreted the flavors of each of the three beverages. For example, our first and most of the subjects guessed that the purple-colored Gatorade was grape. Our third subject guessed that the purple-colored Gatorade tasted like cherry, which was the correct guess. We also observed how most people guessed cherry for red because the color was red, as well as the flavor lemon for the yellow colored drink.The result was that people do perceive taste differently, and some can identify flavors more easily than others despite their deceptive coloring.

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

2024

Word Count	Fair Category	Project Number
251	PT	4021

Title: Automotive CO2 Emissions Bio-Filtration System

Student Name(s): A. Majewski, P. Shah

Abstract:

To begin, we wanted to research the topic of climate change, as it's one of the biggest scientific struggle in the modern era. We landed on CO2 car emissions, as they cause 45% of the world's global warming. We found out that CO2 is not only the second most emitted, making up about 14% of total emissions, gas from automotive vehicles, it's also a major contributor to global warming. We worked to find a prime way to individually capture CO2 and remove it from the atmosphere. We researched and found found that zeolite is a good, cheap asset for capturing CO2. We were also inspired by the Serbian Scientist, Dr. Ivan Spasojevic, who found a way to utilize microalgae as a substitute for trees to quickly remove CO2 from the atmosphere. Then, we created a system that would first filter the CO2, then use photosynthesis in microalgae to eliminate CO2 from motor exhausts. After many designs, we settled on one. It contains two parts, a filter, and a bio-conversion system utilizing microalgae. The filter is fit onto the end of exhaust pipe of a motor vehicle and the bio-converter is stationary at quick and convenient locations such as gas stations and home garages. However we found that the filter will be capturing the CO2 within of few seconds of the vehicle starting up. This is an efficient way to remove CO2 from the atmosphere and has the potential to reverse global warming and change the world in the future!

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

2024

Word Count	Fair Category	Project Number
248	PT	4022

Title: Using Solar to Produce Energy

Student Name(s): K. Cieslak, M. Bielanski, B. Dugas

Abstract:

Using Solar to Produce Electricity

Our school's chicken coop needs a power supply, so the purpose of our project is to address that need using solar energy for a cost effective way to add lights to our coop. It would have cost upwards of $10,000 to run power down to the coop. With this alternative idea, the school spent less than $2,000 and will not have to pay for electrical costs. This will save the school an additional $600 each year. The solar panel that was purchased has a wattage rating of 400 watts, but it is not waterproof. Therefore, the solar panel needed a casing around it to prevent the intake of water, we made a blueprint, and gathered the materials. We built the stand at a 40-degree angle facing south because in the winter, the sun stays in the southern sky. Once the stand was finished, a cord was plugged in reaching from the solar panel to the 1000-watt battery inside the chicken coop. The solar panel is working because the Anker Solix 1000 (the battery) shows how much energy is being inputted.The solar panel ranges from 400 watts on a sunny day to 10 watts on a cloudy day. Future improvements could include Installing a sub pump and a smart fan to cool the chickens during the summer. Our school hopes that eventually the solar panel will be used not only to supply power to the chicken coop but also our school greenhouse.

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

2024

Word Count	Fair Category	Project Number
187	PT	4023

Title: The Effect of Different Strength Magnets on The Charging Speed of a Phone

Student Name(s): K. Wilson, C. Lopes, C. McCollough

Abstract:

The purpose of our project was to see if magnets with different strengths affect a phone's charging speed. It affected the charging speed and could help people if they need to charge their phone faster. The research issue of this project is how a magnet charged by electricity can affect the charging speed of a phone. If the magnet's strength is greater, then the charging speed of the phone will be faster. We charged a magnet with jumper cables. Then we plugged in the phone, put the magnet on the back, and timed it. The time that it took the phone to charge to 100% at a normal was an average of 112 minutes, but when we put the 50-pound magnet on time it decreased to 65 minutes. the 100-pound magnet went down to 40 minutes and the 150-pound magnet took 25 minutes to charge In conclusion, our hypothesis supported our design because the data that was collected proved that the greater the magnet strength was then the phone would charge faster, so now we know a way to help a phone charge faster.

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

2024

Word Count	Fair Category	Project Number
235	P7	5001

Title: Power Shot

Student Name(s): B. Plain

Abstract:

The purpose of my project is to see what flex when shooting would cause the hardest shot so people will have a guide when picking out a stick. First I placed my shooting pad on the grounds face side up 12 ft away from the target subject one will use the 10 Flex first by standing over / next to the shooting pad she will take five shots and do the same for 20 30 and 40 for each shot I will take data and average it out for each Flex and see which Flex causes the hardest shot I will do that for subject two and average hers up to see which Flex causes the hardest shot for her as well I will then do that for subject three and four and make a data table. My hypothesis was that the 20 flex (mph) would cause the hardest shot. My hypothesis was supported by my data that shows. Subject 1's hardest shot average was with the 20 flex stick at 31.8 all of my subjects were similar. Subject 2 at 33.4, subject 3 at 35.6 and subject 4 at 30.8. If I did this experiment again I would change the fact that I was not in the same location for subject 4 as I was for the other subjects. I would also use the same model of stick and the same brand of stick.

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

2024

Word Count	Fair Category	Project Number
198	P7	5002

Title: How do variables affect the enzyme activity and production of gas in elephant toothpaste?

Student Name(s): L. Mercado

Abstract:

The problem being investigated was how do variables affect the enzyme activity and production of gas in elephant toothpaste? The prediction had greater amounts and higher concentrations of the ingredients will increase the volume and temperature of the elephant toothpaste. That hypothesis was supported until the higher amounts of yeast in the trials where the data flattened out and no longer showed increases.

For this experiment different amounts of yeast were mixed with different amounts and concentrations of hydrogen peroxide , dish soap and water. The temperature was measured every minute and the volume of foam produced was recorded.

Amounts of yeast and concentration of the hydrogen peroxide had the most effect on the volume of foam. 30% hydrogen peroxide caused a bigger reaction in the experiment than 6%. Adding water to the soap didn't change the volume much but did lower the temperature recorded. Larger amounts of yeast did affect foam volume, in general, the more yeast the more foam but once you get past 6 grams foam levels off. In conclusion, changing the reactants or added variables in this enzyme reaction did affect the products in the reactions like volume of gas produced and temperature of reaction.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) CH CB 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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
167	P7	5003

Title: GER - Green Energy Reminder

Student Name(s): A. Samat

Abstract:

My project is to see if we can reduce our fossil fuel consumption by telling electric cars when to charge to use green energy instead of fossil fuels, and so that they can act as a conductor to transfer green energy from your home sources to the grid. The people who have electric cars with bi-directional charges can store extra energy in your car battery for days when there are inclement weather conditions. This app would tell you when there are ideal weather conditions for solar panels to make energy, when green energy sources are making a surplus of energy and send you notifications on when to charge your electric vehicle. To create this app I had to code it using CSS, JavaScript and HTML. By conducting this experiment, I found that, to the majority of people it would be useful, and based on my background research, I believe this project would succeed. In the future I would test this to see how effective it was.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) AT CS 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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
195	P7	5004

Title: Which Drink Contains the Most Electrolytes

Student Name(s): L. Chou

Abstract:

When you are playing sports or doing an intense workout, you probably bring a sports drink with you. Millions of athletes drink sports beverages to replenish electrolytes and keep their body's fluid levels in balance after exercising. The purpose of this experiment is to determine if sports drinks contain more electrolytes than other liquids, such as water or juice. Determining which liquid has the most electrolytes is important so that you can optimize athletic performance. I selected three popular sports drinks to test, as well as tap water, coconut water, orange juice, and distilled water. Next, I built my conductance measuring circuit and connected it to a digital multimeter. I placed the end of my circuit into 125mL of each liquid, and measured the currents. Using this data, I then calculated the conductance, which is proportional to the electrolyte concentration. A higher conductance indicates that there are more electrolytes in the liquid. My hypothesis stated that Gatorade would have the most electrolytes because it is a popular sports drink. Gatorade did not have the most electrolytes, disproving my hypothesis. After analyzing the data, it was determined that coconut water had the highest amount of electrolytes.

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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
205	P7	5005

Title: What Design of Mesh Water Filtration Device Most effectively Removes Microplastics?

Student Name(s): J. Godfrey

Abstract:

Plastics are one of the most prevalent pollutants that are found in the different spheres of Earth. There is an increased focus on the pollution that is caused by microplastics in the hydrosphere, which is the total amount of water on the planet. Microplastics are small plastic pieces less than five millimeters long that cause harm to the ocean and aquatic life. Microbeads are a type of microplastic which are manufactured and can easily pass through filtration systems which cause them to end up in oceans and the Great Lakes. This causes a threat to human, aquatic and animal life, worldwide. In 2015, President Obama signed the Microbead-Free Waters Act of 2015, which banned the use of microbeads in health and beauty projects to help free oceans and lakes of microplastics. Microplastics can cause oxidative stress, neurotoxicity, reproductive toxicity, carcinogenicity, and an altered metabolism in humans.

There are ways to reduce the intake of microplastics by using water filters. This experiment tested which filter design can eliminate the most microplastics. An experiment that can test how much microplastics are in water is to design different filters and simulating microplastics going through them. The filters with the most surface area will eliminate the most microplastics.

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

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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
257	P7	5007

Title: Affect of Color on Heat Absorption

Student Name(s): S. Sethi

Abstract:

Objective: To investigate the affect of different colors (seen in Rainbow) on heat absorption by measuring the increase in temperature of the medium undergoing experiment due to absorption of light.

Introduction: This investigation was driven by natural curiosity about what color clothing is best chosen for comfort on a hot summer day.

Procedure: The experiment was conducted for time boxed of 1 hour each across 3 different mediums 1-Different Colored Cotton T-Shirts 2-Different Food Color Gel mixed Water 3-White paper exposed to Different Colored LED Bulbs.

Medium: 1&2 experiments were conducted outdoors under sunlight.Paper under Medium 3 LED light source was conducted indoor in controlled room temperature with A =Baseline temperature B=After 1 Hour Light Source Exposure temperature.

% Increase in Temperature calculated as ((B-A)/A)*100. The temperature is recorded using an Infrared thermometer & Meat thermometer.

Observation: The darker colored medium when exposed to sunlight absorbed more light thus increasing the temperature to a higher degree in comparison to a lighter colored medium. When white paper is exposed to the darker colored LED light source(of visible color spectrum),it emitted more heat energy and increased the surface temperature of the paper.

Conclusion: During the warmer months, choose white, red, and yellow to avoid extra heat absorption. In winter opt for blue, violet, or black to trap more heat. Violet with high energy and red with low energy are opposite ends of the visible light spectrum. White color reflects light,black color absorbs light & light is absorbed as heat energy.

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

2024

Word Count	Fair Category	Project Number
221	P7	5008

Title: Expensive Fails, or Long Lasting Nails

Student Name(s): M. Nicholas

Abstract:

The goal of my experiment is to give nail polish users a better understanding of whether or not it's worth it to pay for expensive nail polishes. With a consistent application technique and a consistent series of tests it should be possible to determine which nail polish will last the longest and be the most durable. Using 3 separate nail polish brands I will create and run 2 procedures to test the durability of the nail polishes. The first test will simulate a day at the beach or a day at home where nail polishes are exposed to water and things that can scratch the nails, in this case sand. The second test is meant to simulate a dry environment where nails are struck in a way to simulate banging them against a hard object. I observed any damage to the nail polish film during the course of the tests and took pictures to show my results. In the end, my results showed that some brands performed best in some circumstances and other brands were best under other conditions, yielding no clear winner. My conclusion was that since so much of our determination of a polish's durability is based on visual observation, it's best to choose a polish color that varies the least from the tone of your natural nail color.

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

2024

Word Count	Fair Category	Project Number
174	P7	5009

Title: The Aura Project: Reusable Rockets at a Model Scale

Student Name(s): K. Addai-Boateng

Abstract:

By using Servos, an Arduino Uno R3, and a joystick, I will be able to control the grid fins on a rocket, allowing me to steer and land it without thrust from an engine or gimbal. Only recently has the field of landing model rockets been explored. Companies like SpaceX use the engines themselves, gimbaling them in a process called thrust vector control (TV). One drawback of TVR is that the engine needs to be active and producing thrust for it to effectively move the rocket. However, by moving the control surfaces like grid fins, the rocket only needs to be moving through the air to be controlled. While Space rockets do have grid fins, they are mainly used for directional and stability purposes rather than completely controlling the rocket itself. Thus, I decided to create a model rocket based on one objective: to be controlled not by TVR, but by grid fin control. My objective was to create a model rocket that can be both remotely controlled and land itself by using TVR.

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

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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

2024

Word Count	Fair Category	Project Number
251	P7	5010

Title: Wireless Power Transfer - Future of Energy

Student Name(s): I. Chugh

Abstract:

Wireless power transfer, or WPT, has become an interesting field with lot of potential applications. This study examines the fundamentals and uses of WPT, incorporating knowledge from research on WPT and electromagnetic induction. WPT is significant because it has the opportunity to completely transform the way we receive electricity at our homes or offices, the way we power our electric cars, electronics, and medical implants while promoting sustainability, efficiency, and ease of use.

Even with the increasing interest in WPT, there is still a lack of understanding on how to improve and put it into practice in real-world situations. The purpose of this study is to close this gap by examining the viability and effectiveness of WPT systems for various applications. This investigation is motivated by the following research question: How can wireless power transfer be enhanced for dependable and effective energy transmission in various contexts? The design and performance assessment of WPT systems will be the main focus of this theoretical modeling and experimental analysis that will be used to address this subject. Preliminary research points out that alignment, distance, and frequency resonance are few parameters that affect WPT systems' efficiency. With focus on energy transfer efficiency, this study tries to give useful information for advancement and application of WPT technologies by methodically examining these characteristics.

As a whole, the aim of this research is to improve our knowledge of wireless power transfer and its possible uses, ultimately maximizing energy transmission for better functioning and sustainability in modern society.

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

2024

Word Count	Fair Category	Project Number
151	P7	5011

Title: Battery Marathon

Student Name(s): E. Virtudes

Abstract:

The purpose of conducting this science fair project is to finally answer the question we all ask ourselves when standing in front of the battery display... which battery is the best value for my dollar? The assumption is the most expensive battery will last the longest under continuous use. I set out to see if my findings would agree with that statement. This experience is simple. I turned four of the same flashlights, turned on for 5 straight hours, each with a different brand battery powering them. I photographed the results hourly. The results were surpising. the most expensive battery of the group finished third. the least expensive was the clear winner. Energizer finished in a respectable second. rayovac dimmed for quicker than the rest, resulting in a last place finish. overall, I was intrigued by the results as a store brand battery outperformed the top names in this specific experiment

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

2024

Word Count	Fair Category	Project Number
231	P7	5012

Title: The Charcoal Affect

Student Name(s): J. Hawkins

Abstract:

Did you ever think about the people in the world with no clean water? I have tested to see if each of the layers in this filter can do their part and help filter out all of the dirty water particles. If the muddy water was run through the different materials listed, then the charcoal filter would filter the dirty particles out of the water. For my experiment, I created two filters side by side so when I tested each of the waters, the process could move faster.I layered each filter with charcoal, sand, gravel, and small rocks. I poured each of the waters in the filter and waited for the water to filter through to get the results. The whole process of the water filtering through took all of about 30-40 minutes. After the experiment, I found out that the charcoal has an effect on the taste. The larger gravel caught more of the leaves and the bigger dirt particles in the water, the smaller gravel picked up what was left from the larger gravel and the sand caught the really small dirt particles. All three of these layers worked well together. When I did my project everything went according to plan and was very successful. If I had to change anything, I would have just added more filters. Besides that, it was fun to do and worked really well.

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

2024

Word Count	Fair Category	Project Number
249	P7	5013

Title: How visual impairments affect daily visual perception

Student Name(s): S. Shen

Abstract:

Visual impairment can be something you're born with or developed throughout life. Either way, visual impairment can affect one's life greatly. The idea for this project started as I was looking toward the human blind spot in the retina. Expanding this, I landed on the topic of visual impairments and the project from a question I got when reading, "How difficult would it be to read and obtain information with monocular vision loss, with any visual impairments?" Following this question I developed a project researching which most common visual impairments: Cataracts, Glaucoma, Macular Degeneration, and Monocular vision loss, would negatively affect visually unimpaired human beings the most in daily visual tasks. To collect data, I created four activities that would simulate daily visual tasks. There are three programmed games, developed by me on a coding platform called Scratch, and one drawing activity. The daily visual tasks that the activities are trying to simulate are Visual Acuity, Motion tracking, identifying objects, and Visual clarity(drawing) and each of these activities would be played with either no visual impairment, glasses to simulate an impairment, or an eyepatch. If I let people play those 4 activities that are daily visual tasks with simulated impairments, then the impairment Cataract which gives an overall blur will affect people playing the activities the most because it reduces the clarity of everything, affecting people the most. Analyzing my data, I can conclude that the visual impairments Cataract and Glaucoma affected participants the most in these activities.

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

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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
252	P7	5014

Title: Radiation Shielding and Plant Growth for Mars Exploration

Student Name(s): D. Karpf

Abstract:

In the setting of Mars exploration, the complex and critical challenges of creating sustainable agriculture while alleviating the extraterrestrial radiation on plant growth has become a crucial need for space exploration.

The first scientific study consisted of two Arabidopsis plants, one involved the exposure of Plant A to Cobalt radiation simulating Mars conditions, and Plant B served as the control. These plants underwent observation and analysis for 31 days. Plant growth observations, conditions, and defects were monitored and controlled daily. The experiment showed clear differences between the exposed Arabidopsis plant and the control plant. Plant A, displayed stunted growth and eventual death and discoloration observed optically microscopically due to lack of chloroplast. However, Plant B excelled under the conditions, showing radiation's extreme effects on agriculture.

In the second experiment, materials were tested to identify an effective radiation shielding product, including lead, foil, composites, and novel compounds. New material and chemical testing demonstrated the top five contenders. The final product exhibited an astounding 56.25% improvement in radiation protection as opposed to current materials, along with a breathtaking 100% final and 38% average distance from the novel shielded to non-shielded plant, showing its potential.

The experiment shows the effects of radiation on plant growth, showing the importance of shielding materials for space agriculture. Effective new candidates like Bismuth(III) Nitrate and Gold Nanoparticles may be solutions for plants in space. The findings of this experiment show the importance of research to develop shielding technologies and create new conditions for food production in space.

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

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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
241	P7	5016

Title: Finding Energy Content In Food By Using Calorimeter

Student Name(s): K. BASKAR

Abstract:

The experiment aimed to investigate the global rise in obesity, attributing it to changes in the food system producing more processed and marketed food. This unintentional overconsumption of energy in market-driven economies necessitates empowering individuals, particularly those with obesity, to make informed daily food choices using a user-friendly home calorimeter. The primary goal was to assess the calorie content of various foods at home, offering a visual representation of energy intake. Recognizing food as an energy source, the study followed the principle that 1 calorie equals 4.2 joules, with energy measured in Joules as per international units.

Experimental Process: Testing involved determining the energy content of home-consumed foods by burning the foods and checking the water temperature and comparing results with nutrition labels. The established formula for energy calculation incorporated mass, heat capacity (4.2), and change in temperature.

Observations and Results: The experiment revealed differences in burning times among foods. Notably, milk and dark chocolates exhibited prolonged burning times with a rapid water temperature increase due to higher energy content followed by bread, oreo, biscoff cookies while apples ,cheese displayed shorter burning times with a slight temperature increase.

Conclusions: In conclusion, visually presenting food energy content through the principle of burning-induced energy release can guide individuals in making choices. For instance, opting for an apple as a snack, discerned visually before consumption, aligns with informed decision-making regarding energy content compared to alternatives like chocolate or biscoff.

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

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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
224	P7	5017

Title: Crusty n' Rusty

Student Name(s): B. Abbamonte

Abstract:

Metal is a fundamental material in modern, industrial society. Consequently, the deterioration of metal through the process of corrosion causes widespread negative effects. Oxidation of the metal surface results in an oxide layer that can protect metals from corrosion. The ultimate goal of the experiment was to determine which metals corrode the fastest. The hypothesis of the experiment was as follows: metals with harder oxide layers will be more resistant to corrosion. The hardness of each metal's oxide layer was then determined. The metals with the hardest oxide were aluminum, nickel, and stainless. After that, each of the metals were measured using a profilometer. The metals tested were 1 inch discs of aluminum, brass, bronze, copper, nickel, mild steel, stainless steel, and zinc. Next, the metal discs were placed in small glass jars with saltwater for two weeks. They were then measured using a profilometer to see how much the metal deteriorated. The least corroded metal was stainless steel, followed by nickel, aluminum, copper, mild steel, bronze, brass, and zinc. This partially supported my hypothesis because the metals with the harder oxide did the best, but the hypothesis did not apply to all of the metals that were tested. Therefore, the hardness of the oxide of the metal in some cases indicated how corrosion resistant was, but is not a reliable predictor of corrosion.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) CH PH 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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
248	P7	5018

Title: What kinds of cereals get soggier in milk?

Student Name(s): S. Shah

Abstract:

My project for the Science Fair is testing how much milk different brands of cereals absorb. The purpose of this is to see what brands of cereals get soggy quicker or faster, along with what types of ingredients and what categories of cereals get soggy faster. I did this by having an experiment where I would put all the cereal in milk and weigh the cereal before and after it absorbed milk. In my experiment, I used 5 brands of cereal which were Cookie Crisps, Trix, Frosted Flakes, Corn Pops and Froot Loops. After finishing the experiment, and gathering my data, I would see what percent of the cereals weight was absorbed in milk. My result was that the Cookie Crisps weighed 4 grams before going in milk, but weighed 7 grams after. This means that they absorbed 3 grams of milk, or 75% of their weight in milk. Trix weighed 4 grams in the start, and absorbed 4 grams of milk. Frosted Flakes weighed 8 grams in the start, and absorbed 7 grams of milk. Corn Pops weighed 4 grams in the start, and absorbed 3 grams of milk, which means that they absorbed 75% of their weight in milk. Froot Loops started out as 4 grams, and absorbed 2 grams of milk. In conclusion, I learned that flaky, and less sugary cereals, along with those with more air bubbles absorb milk faster than crunchy, and sugary cereals that have less holes or air bubbles in them.

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

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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
136	P7	5019

Title: The Fastest Way to Solve a Rubik's Cube

Student Name(s): L. Lazzara

Abstract:

The purpose of this experiment was to test which Rubik's cube solving method is the fastest. If the average time for four different 3x3 Rubik's cube solving methods are compared, then the Hybrid method will be the fastest. I had five participants use each method to solve the cube 10 times and averaged their results. CFOP was the fastest method at an average time of 44.93 seconds. The Hybrid method was the second fastest at an average time of 1:01.63, the Beginner method was the second slowest with an average time of 1:13.75, and Two-Move was the slowest with an average of 3:00.00. I found that CFOP was the fastest method of the four tested. In the future, other methods could be tested; and more people could test the methods to make it more accurate.

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

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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

2024

Word Count	Fair Category	Project Number
247	P8	5501

Title: Determining the Impact of pH on Seashell Dissolution

Student Name(s): A. Cadmus

Abstract:

Since the industrial revolution, carbon dioxide concentrations have been rising in the atmosphere. The carbon dioxide reacts with water creating a series of chemical reactions that cause an increase in hydrogen ion concentrations which causes a decrease in the pH of seawater, called ocean acidification. Many marine organisms use calcium carbonate as part of their shells and skeletons but decreases in the pH of seawater can impact organisms that use calcium carbonate. I hypothesize that decreasing the pH of water will cause more of the calcium carbonate in seashells to dissolve. In this experiment, the acidity of water was lowered by adding white vinegar to determine how much of the calcium carbonate shells would dissolve over time. I conducted experiments on three types of shells. Based on the results of this experiment, the pH solution of 3.7 had the greats impact on the dissolution of the carbonate shells. The results were not the same for all shell types. At the end of 12 days, the scallop shells were 81% of their initial weight. Next, were the slipper shells, which ended with 85% of their initial weight. The least affected were the mussel shells, which ended with 89% of their initial weight. The shells in the pH solution of 3.7, also felt noticeably thinner at the end of the experiment. It is important to understand the impact that pH has on the dissolution of calcium carbonate shells. We also need to know how it will impact various organisms.

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

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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

2024

Word Count	Fair Category	Project Number
259	P8	5502

Title: Shedding Light on the Prevalence of Harmful Butylated Hydroxytoluene Preservative in Artificially Formulated Dog Foods

Student Name(s): M. Wilson

Abstract:

Throughout the U.S., there are 961 types of dog foods. Many include preservatives; however, one has gained notable attention for the hazards that it poses to our canine friends. Butylated hydroxytoluene (BHT) is an historic-use preservative, which is now known to be a carcinogen, and tumor-growth promoter. While its use has not been outlawed, many brands have turned to other preservatives, in light of recent findings. Throughout the industry, however, no dog foods publicize the use of BHT, so that its remaining use is unknown. In this research, three common brands of dog food, Acana, Wilderness, and Wellness, were analyzed for their BHT content, to shed light on BHT prevalence in artificially-formulated dog food. For each, 10g of hard dog food as to a powder, and soaked in 20 ml of ethanol for 24h. For each dog food ethanolic filtrate, 10ul was placed on an FTIR spectrometer Diamond ATR accessory, and dried to a thin-film. ATR-FTIR analyses of the three foods suggested the presence of BHT in the extract, along with other ethanol-soluble components. To better understand BHT content, HPLC was used, with a mobile phase of Acetonitrile and 99%Water/1%Acetic Acid, and 280nm detection. BHT was successfully located at 3.3 minutes retention time, and serial dilutions of a 0.66mg/ml BHT in ethanol were made, to create an HPLC calibration. HPLC analyses of dog-food ethanol extracts highlight BHT presence in all foods tested, with 0.124% BHT in Wilderness, 0.104% BHT in Wellness, and 0.101% BHT in Acana dog food.

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

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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
191	P8	5503

Title: The Bag that Saved the Homeless

Student Name(s): E. Diaz

Abstract:

The purpose of this project is to make a waterproof and fireproof fabric which will be used to make a bag for homeless people because they can be in a rainstorm or heat accidents. The first solution that was made for waterproofing was turpentine and soybean oil. The second solution that was made for fireproofing was boric acid, borax powder and water. One sample was soaked in the waterproofing liquid for 5 minutes and then soaked in the fireproofing liquid for 5 minutes and allowed to dry. The second sample was soaked in the fireproofing liquid for 5 minutes and then soaked in the waterproofing liquid for 5 minutes and allowed to dry. The fireproof solution was successful in retarding fire on the material, versus the untreated material. The waterproof solution was not successful. When pouring water on the prototype it did 'bead up' and slide off but when soaking it in the water it was damp and at the same time it was filled with water. In conclusion, the experiment worked for the fireproof solution but not for the waterproof solution and only partially for the combined fireproof and waterproof.

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

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

2024

Word Count	Fair Category	Project Number
252	P8	5504

Title: Title: Low-Cost Water Filtration Device Via Phosphate and Nitrate Absorbency Pads In Combination With A Generic Paper Filter

Student Name(s): C. Stowe

Abstract:

Globally, many people do not have access to clean drinking water. Over 2-billion people do not have safe drinking water, while as many as 3.6-billion don't have access to proper sanitation sources. For many, agricultural chemicals deposit nitrates and phosphates into the surrounding soil, and are washed into watersheds by falling rain. Particularly for areas that lack infrastructure, a portable and simple water filtration system is needed, to remove these ion contaminants. Herein, a low-cost filtration device was constructed, containing phosphate and nitrate specific filter materials, for the targeted removal of these agricultural ions. Two SeaPora nitrate absorption pads and two Aqueon phosphate absorption pads were alternately placed in a 4cm-OD glass tube, separated by three layers of common sand. To measure nitrate filtration, 100ml of 100ppm solution of nitrates was passed through the filter, without pressurized assistance. In one pass, nitrate concentration was reduced to 21.8ppm, and 4.81ppm after two passes, which is below the EPA Nitrate Water Action Level, and thus potable. For phosphate filtration, 100ml of a 100ppm solution was reduced to 27.3ppm, and 0.5ppm, after two passes. Since the phosphate EPA WAL is 40ppm, the new filtration device created potable water in one round of filtering. Summarizing, the new, low-cost filtration device removed ~95% of nitrates in two filtration passes, and ~99% of phosphates under the same conditions. SEM and EDS analyses of the used filter materials highlighted the stability of the nitrate and phosphate specific filter layers, providing evidence for prolonged use.

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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
202	P8	5505

Title: How Do Different Substances Affect the Amount of Degrees Light Is Bent

Student Name(s): J. Joseph

Abstract:

For my project I shined a light through a refraction dish, and put different substances in the dish, which substance would bend the light the most. I chose this project because when I was in fourth grade, we went to Dr. Cote's room and did an experiment where he put water in a box and shined a laser through it, and the light split into 5 beams. My hypothesis was that if water, hair gel, rubbing alcohol, vegetable oil, Sprite, and maple syrup are used to find the refraction angle of a violet laser, then water will bend the light the greatest because of its low density. I poured my substances into a semicircle refraction dish, shined a light through the dish, wrote down the angles, and used the formula $\sin\theta 1/\sin\theta 2$ = Refractive index. Then I compared the differences. The substance that caused the light to refract the most was maple syrup. I believe this was because light moves slower in denser items, this is also why Sprite bent the least. This experiment benefits ophthalmologists who make products that reflect light, as well as microscopologists (those who study microscopes). It will help know what materials are more effective to bend light away.

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

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

2024

Word Count	Fair Category	Project Number
143	P8	5506

Title: From Ocean to Tap

Student Name(s): S. Previty

Abstract:

There is a growing global water scarcity problem, and a potential solution is desalination. In this project, I aimed to test the effectiveness of desalination and understand the importance of it. I constructed a solar-powered desalination device and placed it outside for 4 hours, checking it every hour. Even with challenges, such as cold weather, I measured the freshwater produced and recorded the data. Results showed that the device did not perform well overall, yielding 0 ML of water in trial one, 13 ML in trial two, and 0 ML in trial three. The cold weather impacted the device's effectiveness. Despite these challenges, one trial succeeded, suggesting the potential for improvement. To make the project better for future experiments it should be conducted in warmer weather with more sunlight, taking into account weather conditions as an important factor in the desalination process.

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

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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
109	P8	5507

Title: Effective and Safe Removal of Stickers

Student Name(s): L. Carew

Abstract:

Many people have trouble removing stickers and sticker residue from a variety of surfaces. This experiment was created to help easily remove the stickers and glue without damaging the surfaces.

There were three mixtures tested, each on three different surfaces with multiple stickers. The mixtures were developed to be non-toxic and heat generating, creating a safe solution for everyone to use. One out of the three mixtures was successful, with minimal

residue remaining and little to no damage to the surfaces. On top of working the best, this mixture is the most readily available out of the three and are products people can easily find around the house.

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

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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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
248	P8	5509

Title: The Irrigator- One Solution to Save the Environment

Student Name(s): O. Dixon

Abstract:

Climate change is affecting weather patterns around the world because the earth is getting warmer. Humans need new ways to continue farming in an increasingly hot environment. The irrigator is designed to be a non-toxic garden wetting tool. Three experiments were conducted. The first was proof of concept by creating a controlled environment for power and current, while measuring the amount of water generated, and observing parameters for temperature and relative humidity. A fan, two heat sinks and Peltier module were combined and powered using 12V and 4 amps. When energized, the air froze and the lowest temperature taken was 20 deg F. Melted, water droplets were measured at 1.75 ml after 4 hours. The second experiment compared light exposure and power produced by solar cells that would eventually power the electronics and create water. As light increased, so did the power. Results showed greater power (V) across a series arrangement and lower power across a parallel configuration. Highest volts for series were 19V and for parallel were 6.3V. We noticed that we needed a large solar array to provide the amperage needed for the system to run. The third experiment was to create a housing for the electronics. This was created in four parts with overall dimensions of 270mm H x 175mm W. The project was partially successful as it proved that water can be produced without refrigerants and a suitable housing can be designed for the application, but the solar supply needs some more work.

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

2024

Word Count	Fair Category	Project Number
262	P8	5510

Title: Burnt: Coding a web-based application to help adolescents self-assess and seek help for stress and poor mental health

Student Name(s): J. Norful

Abstract:

Roughly 20% of teens have major depression disorders and 40% will have a mental health condition by age 18. In Connecticut alone, of 49,000 adolescents with depression, half do not receive care. Untreated symptoms may lead to higher suicide risk, anxiety, or poor school performance. Pediatricians recommend early treatment; however, adolescents may not recognize their own symptoms. The purpose of this project was to code a novel web-based application for adolescents to self-screen and track their risk for stress, depression, or anxiety. I used HTML, CSS, and JavaScript coding languages to create the application consisting of an individualized dashboard and three valid and reliable screening pages for depression (Patient-Health-Questionnaire-2), anxiety (Generalized-Anxiety-Disorder-7), and stress (Perceived Stress Scale-4). It graphically interprets scores allowing users to track changes over time; also including mental health resources (e.g., SpeakUp, NAMI, 988). The application was hosted on Amazon S3. Next, I recruited a random sample of participants to complete a 5-question survey to evaluate acceptability and feedback. Following user testing, 91.7% of respondents found the design satisfying, 100% reported ease of navigation with useful information, and 83.3% would use the site to monitor mental health. In conclusion, this new application may help adolescents identify when and where to seek help if their mental health is changing. In the future, I envision building the app into school websites (e.g., Schoology or PowerSchool) for students to use every day. I would also embed AI capabilities to provide up-to-date recommendations to reduce symptoms of the corresponding mental health issue.

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

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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

2024

Word Count	Fair Category	Project Number
221	P8	5511

Title: Creating Cost Effective Eco-Friendly Insulation

Student Name(s): A. Daukas

Abstract:

The purpose of this investigation is to create co-friendly insulation to retain the most consistent temperature in a way that would reduce carbon emissions from heat sources . The hypothesis was that the insulation with honeycomb cut-outs combined with solid insulation would be the overall best for maintaining a consistent temperature in an enclosed space. This experiment was tested by creating a box out of wood and sheetrock, the enclosed space. The ambient room temperature was recorded and one of the three types of insulation was inserted, and the enclosed space was sealed. The heat was applied to the outside of the enclosed space and the data was recorded and the process was repeated for each insulation method. The data shows that the best overall insulation was insulation cut with honeycomb shapes combined with solid insulation. This is because the overall temperature remained the same for all 3 periods of time. The air circulating in the box was insulating and thus worked better than just the standard foam insulation. This is because the amount of radiant heat was reduced from the insulation thus resulting in a more stable, better overall temperature. This data provides an opportunity to try a new type of insulation that has cutouts in it versus insulation that does not offer the benefits of the cutouts/honeycomb.

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

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
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☒ Yes ☐ No

CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
208	P8	5512

Title: Dairy-Free Delights

Student Name(s): G. Fratoni-Jaskiewicz

Abstract:

The purpose of this experiment is to compare three different milk substitutes and determine which is the best to use in baked goods, promoting safe and enjoyable alternatives for those with diet differences. Hypothesis: If oat milk is used as a dairy alternative, then it will produce the most favorable height, moisture, and color than both almond and coconut milk because oat milk has the highest protein content, adding structure to the batter and encouraging browning while moistening the mixture. A dozen muffins were tested for the quality of previously mentioned traits. Muffin rise was calculated using quantitative data while moisture and color was calculated using a visual analog scale (see "Procedure" for further details). Results of data collection demonstrate that oat milk had the most favorable height and color while almond milk produced the highest moisture rating. In summary, the hypothesis was proven partially correct, as oat milk produced the most favorable height and color with a color average of 3 and a high average rise of 1.015 in; however, oat milk did not yield the most favorable moisture rating. Small business owners should consider these results while choosing allergy-free alternatives for their valued customers, guaranteeing the most favorable height and color in their baked goods.

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

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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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CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
203	P8	5513

Title: How will temperature and volume affect the mass a helium balloon can lift?

Student Name(s): K. Bitgood

Abstract:

The purpose of this project is to investigate how different levels of temperature affect the volume of a balloon and the mass that the helium can lift. The final procedure in phase 3 was to put the balloons in four different temperature environments for 30 minutes, measuring the amount it could lift on an electronic balance and using the equation for the volume of an ellipse to estimate the volume of the balloons before and after the different temperatures. The average lift in hot temperatures was 1.44g, while the freezing temperature lift was 0.68g. The hypothesis was supported by the data that was collected. If a helium balloon was at warmer temperatures, it was able to lift more mass because the particles in the balloon heated up and moved faster and farther apart (creating a larger volume) than if it were at colder temperatures. The warmer balloons are less dense and have more lift. Volume data is more difficult to link accurately to the amount of lift since the helium tank had no gauge. Determining volume using a displacement method was not feasible, and the Ellipse Volume Formula only provided an estimate of volume because of the varying shapes of the inflated balloons.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) MA EA 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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CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
256	P8	5514

Title: The Synergistic Improvement of Indoor Air HEPA-Filtration using Concurrent Dehumidification

Student Name(s): M. Kaalund

Abstract:

Over 6.7 million people die prematurely per year because of poor air quality. One leading cause of poor air quality is second hand smoke (SHS), brought about by cigarette smoking. Although this issue is often neglected, dehumidification and low-cost filtration may offer an inexpensive and simple solution to remove SHS. This research will investigate the process of low-cost dehumidification, along with the simple addition of an equally-inexpensive charcoal filter, at effectively removing indoor air pollutants, using a SHS model contaminant. Initial gas chromatographic analysis of SHS identified the primary components as methane, ethane, propane, and butane. To measure removal of these contaminants from room air, 2 cigarettes were burned within a 21L gas-tight box at 45%-RH, and the resulting headspace filtered with simple dehumidification. Hourly GC-FID analysis of the headspace gasses demonstrated that 74.4% of SHS was removed in 7h., while addition of a charcoal filter increased SHS-contaminant removal to 86% in the same period. SEM and EDS analyses highlighted increased carbon and oxygen content on the used charcoal filter, providing evidence for its absorption of SHS. Finally, GC-FID analysis of each experiment's captured-water highlighted the presence of nicotine, where 97% was recaptured from burning cigarettes using dehumidification, while 95% was recaptured with the dehumidifier and filter. This suggests that nicotine removal was primarily via dehumidification. The combined results demonstrate compelling evidence that a $20 dehumidifier, combined with a $1 charcoal filter, can simply and efficiently remove indoor air pollutants, particularly SHS, which is a significant component.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) EM EN 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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CSEF Official Abstract and Certification

2024

Word Count	Fair Category	Project Number
181	P8	5515

Title: How Does the pH Level of a Liquid Affect Its Spherification?

Student Name(s): G. Cioppa

Abstract:

My project addresses how the pH levels of orange juice, water, milk, and lemonade affect the amount of spherification. My hypothesis is that the lemonade might not work because it is too acidic for the spherificstion process to work, that the water might not contain enough acidity, and that the orange juice and milk will work the best. The process was that each liquid was combined with sodium alignate, and then individually placed into a bowl containing calcium chloride. The only liquid that formed as a sphere was water. All the others just stayed a liquid and did not spherify. The pH of a liquid affects its spherification because, if the liquid is too acidic the spherification process will not work. Most likely the pH of the milk would have been able to form a sphere-like shape if it was not for the calcium interfering. This is because the sodium alginate and calcium should not touch before starting the spherification process. This project can benefit people in the food industry who want to add a fancy touch to their meals.

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

2024

Word Count	Fair Category	Project Number
250	P8	5516

Title: Waste in the Water

Student Name(s): C. Anderson

Abstract:

Have you ever thought about what might be in your water? How different it might be from other water sources close to you? I decided to find out what might contaminate the source of our drinking water at my house, the Pawcatuck River. After researching for a while, I learned that many substances may be in your water and they can vary in different amounts. I decided to use a Drinking Water Test Strip for this experiment as it tests for 16 different contaminants that may be found in your drinking water. For my hypothesis, I think that if water is tested from both sides of the water treatment plant, the amounts of contaminants will be much higher downstream closer to my house versus upstream before the water treatment discharge. To test my hypothesis, I found ten spots to test that would have some spots on either side to get good results. After gathering my results, I found that only the hardness of the water greatly varied throughout all the tests, ranging from fifty to two hundred fifty. A few other substances varied in small amounts like the content of Bromine, Ammonia Chloride, and Total Alkalinity throughout the results. After completing the project I found that my hypothesis was proven wrong because all the results were very similar and there was no large difference between the results. It appeared that the discharge did not have a large effect on the amount of contaminants in the water of the Pawcatuck River.

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

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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