CONNECTICUT SCIENCE & ENGINEERING FAIR

77th Annual Fair
March 3-15, 2025

Student Abstracts

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
250	PT	4001

Title: Testing the Strength, Flexibility, and Biodegradability of a Watermelon Rind-Based Bioplastic

Student Name(s): S. Galvez, B. Ukperaj, M. Cartagena

Abstract:

This project tested the use of watermelon rinds to create strong, flexible, and biodegradable bioplastics that can serve as eco-friendly alternatives to traditional plastics. This is important because there is the need to reduce the amount of plastic that is being made throughout the world, and to provide an easier alternative to making plastic at home. It will also take watermelon rinds out of the waste stream. It was hypothesized that bioplastics made out of watermelon rinds will exhibit favorable strength, flexibility, and biodegradability, making them viable alternatives to traditional plastics. We tested our hypothesis and although our initial formulation did not work, our second one with added glycerin did work, and we discovered that watermelon rind bioplastics can be strong and flexible. Our background research helped because we knew we needed to add the glycerin for flexibility in our second recipe. To test how flexible the bioplastic was, we twisted it and to test how strong it was, we placed hanging weights on it until the bioplastic ripped. Then we compared both tests to traditional plastics. Finally we tested the biodegradability of the watermelon rind bioplastics and compared the data to traditional plastic. The second watermelon bioplastic experienced strength and flexibility that were comparable to traditional plastic, and a loss in mass after being in water for two weeks that the traditional bioplastic did not. Next we hope to test banana peel-based bioplastics to see if we get the same or better results as the watermelon rinds.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
183	PT	4002

Title: Increasing the Flight Distance of a Football by Changing its Characteristics

Student Name(s): B. Denema, S. Kennedy, M. Sanchez

Abstract:

The project aims to design a football that flies farther than modern footballs by modifying its characteristics to create the most aerodynamic ball possible. The goal is to identify the factors that contribute to the maximum flying distance of a football. The proposed solution involves creating a thinner football that reduces air resistance and drag, allowing the ball to cut through the air more effectively and, consequently, travel farther than today's footballs. To test this, the footballs were launched using a slingshot, and the distance each ball traveled was measured under the same force.

During the experiments, various types of footballs were tested. The thicker one landed closest to the launch point, averaging 26 meters per flight. In contrast, the thinner football and the ball without laces flew significantly farther, averaging around 32 meters per flight. This indicates that the thinner the football, the farther it travels.

In conclusion, the thinnest football design demonstrated the best performance in flight distance. This suggests that the thinner football may serve as the most effective replacement for modern football, providing greater flight distance and optimal grip.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) 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
2025

Word Count	Fair Category	Project Number
250	PT	4003

Title: Evaluating the Effectiveness of Rainwater Filtration

Student Name(s): L. Caswell, M. Czerwiec, A. Plaz

Abstract:

Our experiment was to make healthier and more drinkable water for our chickens at our school. This idea was inspired by the rising infections of the avian flu in our area. Currently, our rain barrel system runs off of a roof and we hope to filter out any contaminants other birds may have left behind and washed into the barrel. To accomplish this, we designed and built a sand filtration system which cleans the water from the rain barrel. We took water samples before and after filtration.

The first difference noticed between the two samples was the turbidity of the water. The unfiltered water, or the control, was filled with visible particles of dirt, leaves and a slight yellow color, while the filtered water was much clearer. We also tested for the amount of total dissolved particles using an electrical conductivity (EC) and parts per million (PPM) testers. The control had an EC level of 34 and a PPM of 17, while the filtered had an EC of 20 and a PPM of 11. After further research, we determined the results were proof that the filter was better at washing out large organic particles, rather than smaller ones. After, we looked into what was considered a large organic material, which the avian flu virus happened to fall under. As the virus has a length of 80-100 nanometers, the sand, with pore sizes of 5-50 nanometers would easily trap the virus.

We are currently looking into testing further with charcoal instead.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) AT EA 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
2025

Word Count	Fair Category	Project Number
236	PT	4004

Title: CO2 Emissions Bio-Filtration System

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

Abstract:

Last year, we found out how to convert CO2 from an automobile using algae. To summarize last year's project, after searching for the correct topic, and researching. We designed a procedure to capture, then convert CO2 into Oxygen. This year, we decided to redesign and rethink our procedure. Once again, after much research, we landed on an article describing a way to utilize alternating electric fields to convert CO2 into Oxygen. Along with Oxygen, it also outputs Carbon and Carbon Monoxide. If you want more Carbon or more Carbon Monoxide to be released, you must change the rate at which the electric field is modulated. Our approach is to have many of these devices mounted atop smokestacks of factories and/or power plants in order to handle the massive amount of CO2 being emitted (Average of 10 kg per second). The Oxygen and Carbon Monoxide will be released into the atmosphere while the Carbon will precipitate as a solid, meaning it will need to be contained and sent off where it could be of use. This design, however, can not be utilized on moving objects as it needs a lot of power and deposits Carbon meaning it could only be built on a building, in this specific case, a smokestack of a factory or power plant. The power for the device will be either supplied externally with powerlines or from the power plant it's mounted upon.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) AT EM 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
2025

Word Count	Fair Category	Project Number
252	PT	4005

Title: Don't Quake, Choose the Right Shape!

Student Name(s): K. Negron, L. Brioso

Abstract:

The purpose is to discover the properties of the strongest building structure to withstand an earthquake. Understanding the strongest geometric shape is critical in designing an earthquake resistant building. This study evaluates three common geometric shapes: triangle, square, and hexagon to determine which offers greater structural strength. Well-designed buildings can absorb and dissipate seismic energy to minimize structural damage. It was hypothesized that the triangular structure is the strongest because of its ability to maintain rigidity under applied force. We tested structures by using our shake table and measuring the time taken by each structure to withstand the seismic acceleration with the google Arduino app. After testing our project, we found that our hypothesis was correct; the triangular structure was best. The triangular structure stood for an average of 4.54 seconds with a seismic acceleration of 19.4 m/s². The square structure stood for an average 4.42 seconds with 15.6 m/s², and the hexagonal structure stood for an average 3.596 seconds with 12.4 m/s². Unlike the square and hexagonal structures, triangular structures cannot be deformed without changing the length of one of their sides, making them ideal for distributing load more evenly. The integrity of the building helps maintain and reduce the need for repair and save lives. Buildings that are designed well contribute to the overall resiliency of communities and will ensure the safety of people. In conclusion, the triangular structure was able to absorb and dissipate more seismic energy and would save lives if an earthquake occurred.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
122	PT	4006

Title: How Different Types Of 3D Printer Filament Is Strong And Works With 3D Printers

Student Name(s): C. Fretz, E. Decesare

Abstract:

The purpose of this project is to see what type of filament is the strongest. The goal is to figure out which filament is the most useful for different purposes. The hypothesis is that PLA filament will look the best, TPU filament will be the one that holds up the longest due to its flexibility, and PETG will be the strongest filament when it gets put outside. PLA filament is very commonly used as a starter filament while TPU filament is more flexible and PETG is manly used for things outside. The strength of the filaments and the look of the models was tested using two different 3D printers. We discovered that TPU followed by PLA followed by PETG was the strongest.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
236	PT	4007

Title: The Effects of Different Amounts of Phosphorus on the Growth of Algae Beads.

Student Name(s): J. Walia, M. Silva, I. Brito

Abstract:

This project investigates how different amounts of phosphorus affects the growth and buoyancy of algae beads. Understanding this can help determine a phosphorus amount that does not cause excessive algae growth and lower the oxygen levels in the water. The research question is: How do different amounts of phosphorus affect the growth of algae beads?

It was hypothesized that higher phosphorus levels will lead to faster algae growth, as phosphorus is a key nutrient for algae development. To test this tap water was put into 4 containers and rested for 24 hours. Three containers with algae beads had different phosphorus levels while the fourth container, with no phosphorus, served as the control variable. The trials were checked each week to see the distance in cm and the amount of algae beads had risen. By the end of the experiment, the algae beads floated to the water's surface. The trial with 61 % phosphate had a higher growth compared to the other trials that took place. As the weeks progressed, algae growth consistently increased across all trials with added phosphorus.

In conclusion, different amounts of phosphate directly affect the growth of algae beads. These findings help determine the safest phosphorus levels for the algae beads and the environment, preventing too much growth and not lowering the oxygen level in the body of water. Identifying a safe phosphorus level can help balance algae growth and maintain healthy water conditions.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
252	PT	4008

Title: Step Power: Walking towards a sustainable future

Student Name(s): M. Quinby, N. Kelly

Abstract:

Every day billions of people walk to their job, shopping, errands, or out for a run. What

if we turned this kinetic energy into electrical energy? Our objective was to make a tile that, when stepped on, would activate an electromagnetic generator that creates electric energy which then can be stored to light up a LED. This was achieved using an 600-turn coil around a tube with 4 springs and 16 magnets generating an AC current. A terminal block combined 8 wires into a positive and negative output wire. We then stored the energy in a 220 microfarad capacitor by hooking it up to a breadboard and using a Schottky diode, capacitor, and a 125-ohm resistor. After, with the press of a button the energy was released to the LED, lighting it up. During the experiment, we were challenged to change several different variables, including the type of material for our tube and the size of our coil. We started by 3D printing a tube but found it was ineffective as our volume to height ratio was too small. We tried two different plastic tubes and found one that worked well, providing stiffness while having thin walls. By increasing the number of turns in our coil we also found we could generate more electricity. Ultimately, we found that we could generate .765 volts of energy and consistently light up several different color LEDs. When put in a tile, this can be used for lighting sidewalks, roads, sports arenas, and more.

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):

☐ 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
2025

Word Count	Fair Category	Project Number
251	PT	4009

Title: Advanced Water Purification using Activated Charcoal and Biochar

Student Name(s): E. Antenucci, M. Malouin

Abstract:

For our project we tested biochar and activated carbon in separate and then combined filters to see which would do a better job of filtering water. The project compared their filtering effectiveness to determine whether biochar could serve as a cost-effective alternative to activated carbon. We tested this by making two identical filters except one of the filters had a layer of biochar while the other had a layer of activated carbon. We found that for the first batch dirty water using the biochar filter, there was a 60% decrease (250 to 100 ppm) in the level of nitrates and for the second batch using the activated carbon filter, there was a 100% decrease (50 to 0 ppm) in the level of nitrates. Since the level of nitrates was not existent with the activated carbon filter, that water ended up cleaner, although there were more nitrates to begin with using biochar. The biochar water appeared much cleaner after filtering, therefore biochar was better at removing the visible dirt while on the other hand, the activated charcoal was better at removing dissolved contaminants. This project is important because there are many bodies of water that have chemicals that are harmful to humans and animals. We will test both biochar and activated carbon together next, and hopefully that filter removes most of the contaminants in water. We would like these filters to be used in natural bodies of water to filter out toxins, such as fertilizer, that run into bodies of water.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) EV EM 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
2025

Word Count	Fair Category	Project Number
121	PT	4010

Title: Harvesting Kinematics through piezoelectrics

Student Name(s): A. Subramanian, A. Routhu

Abstract:

In this project we learned that using piezoelectrics underneath walking surfaces can be used to harvest energy. This project should test the ability of harvesting a person's mechanical energy of walking or running to produce energy. We need to find better forms of energy so we can sustain ourselves and keep the earth clean.We want to use a person either walking over or running over a piezoelectric and convert that to usable energy so that it could be used to power devices. These would be really useful places with a lot of foot traffic such as airports, train stations, schools. Having a good source of energy close to where energy is being used also cancels out the wasted energy in transportation.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) ET 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
2025

Word Count	Fair Category	Project Number
250	PT	4011

Title: What Impact Will Different Sphere and Track Variables Have on the Performance of a Model Roller Coaster?

Student Name(s): B. Savoie, I. Negron-Rygielski

Abstract:

This project's purpose was to build a model roller coaster and to mathematically investigate the impact of sphere and track variables on the speed of spheres. This project used seven marbles of different sizes and masses that were tested on a model roller coaster track loop made of insulation piping. Over 500 trials were conducted. Ten trials each at ten different track release heights were conducted for each sphere. Speed, completion percentage and track angles were measured and calculated. Track height of less than 50 cm had a zero percent completion rate. Pythagorean theorem and the sine function were used to verify track angles and lengths, and the relationship between angles and the sides of a triangle. Several timing methods were attempted. A stopwatch was used, but to evaluate human error, videos were recorded to examine the trials frame by frame for a more accurate time reading. Some of the trials were repeated when marble drop delays were identified in video frames. Based on data graphs and calculations, it was concluded that in general the overall speed of the heavier marble was slower. It takes longer to build up speed due to friction and wind force. A consistent trend supported by the graphs was the higher and steeper the track the faster the spheres went. Three different methods were used to measure the volume of the marbles: ruler volume, displacement volume, and calipers. The calipers method was the most accurate volume method to measure the radius used in the calculations.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) MA 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
2025

Word Count	Fair Category	Project Number
240	PT	4012

Title: How does the type and brand of a battery affect how much voltage it loses over time?

Student Name(s): L. Schneider, D. Sposato

Abstract:

The purpose of this project is to determine which type and brand of AA battery has the highest starting voltage, loses the least voltage over time, and is the most cost-effective. This study answers the investigative question: Which AA batteries decrease the least in voltage over time?

The hypothesis is that the Panasonic Eneloop Pro will have the lowest voltage decrease because it is a Nickel-Metal Hydride (NiMH) battery. To test this, different brands of AA batteries were put on the testing station and the light was turned on. The voltage readings were recorded every 15 minutes for 150 minutes to track how much voltage dropped.

The results showed that Duracell Optimum had the highest beginning and ending voltage, both with and without load. However, it is not chargeable and Duracell Optimum is $22 for an 8-pack. The Panasonic Eneloop Pro does have a lower voltage beginning and end but is rechargeable and is $36 for an 8-pack. It can be used more times than Duracell Optimum.

In conclusion, even though the Duracell Optimum has the highest voltage from beginning to end, the Panasonic Eneloop Pro Nickle Metal Hydride battery met our requirement by being a rechargeable battery with not a crazy price at $36. It only went down 0.09 of a volt which was the best by far. This supported our hypothesis that the Panasonic Eneloop Pro would maintain its voltage the best over time.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
226	PT	4013

Title: What is the Best Way to Remove Rust?

Student Name(s): G. Lowe, A. O'Reilly

Abstract:

The purpose of this experiment was to investigate the effectiveness of various rust removers, and to help our dads on their search to find the best way to remove rust. The hypothesis we created was "If the concentration of Citric and Tannic acid increases, then the effectiveness of the rust remover will increase."

To test this hypothesis, we rusted seven steel plates, weighed them, and then treated them with seven different rust removers. The rust removers we used were: IronOut, Rust-Oleum, Evaporust, Rust-Kutter, Vinegar and Baking Soda, Coca-Cola, and Water with a Brush. After each treatment, the plates were weighed again to see how much rust was removed, then the plates were ranked on a scale we made from zero to ten, with ten representing the highest amount of rust removed.

Our experiment showed significant differences in scores across all the rust removers. The highest score was Evaporust with a score of 10, and a weight reduction of 12 grams. The lowest score was Ironout, with a score of 1 and a weight reduction of 2 grams. Evaporust was closely followed by Coca-Cola, and Rust-Kutter.

This experiment contradicted our hypothesis because Evaporust, which won the competition, contains no critic or tannic acid. This experiment also highlights that simpler options like Coca-Cola can be effective alternatives to more corrosive rust removers.

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
2025

Word Count	Fair Category	Project Number
117	PT	4014

Title: Radiation in household appliances

Student Name(s): D. Disibio, M. Bielanski, C. Counter

Abstract:

Our science fair idea was motivated from household appliances of possible brain cancer cases linked to high exposure to EMR. According to the International Agency for Research on Cancer. Using a magnetometer, we scanned multiple appliances in the average household, such as microwaves, wires in the wall, TVs, and to test the EMR rating on them. Our research as of currently has shown that EMR is rampant in houses, as the very phone that millions of people hold to their faces each day, emits EMR, and the wires that charge your house's many pieces of technology, also can emit EMR. Basic, cheap, and reusable resources such as cardboard and tinfoil can be used to block EMR signals.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) AT 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
2025

Word Count	Fair Category	Project Number
249	PT	4015

Title: Medassist: smart medicine storage

Student Name(s): A. Perekhodko, B. Ballester, J. Bowles

Abstract:

Medics are under a lot of stress. This can cause problems, such as lack of sleep or burnout. To try to alleviate some of this stress, we have created Medassist.

Medassist is a smarter way to store medicine that reminds users to buy more medicine when they run out of it, reminds users to replace the medicine when it is expired, and has a locking mechanism that uses servos, which are a type of motor, and a password entered in on a keypad. We first tested all the components so that we can figure out how to wire and program it. We then used a website called Circuito.io to create a wiring schematic of all the components together. This wiring schematic would serve as a reference so that we don't wire it wrong and create a short circuit. After wiring everything, we moved on to programming, during which we used the Arduino IDE to upload the code to our project. After all of this was done and tested, we 3D modeled an enclosure for it, and 3D printed it. We intended to use force sensitive resistors to weigh the medicine to know if it needs to be replaced, but they turned out to be too unreliable for constant force, so we opted to use load cells instead. After overcoming some minor technical difficulties, we managed to create a prototype that can demonstrate a basic version of this project, that can be easily improved on if actually patented and sold.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) EE AT 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
2025

Word Count	Fair Category	Project Number
243	PT	4016

Title: A Study of the Impact of Slope, Materials, and Lubrication on Friction

Student Name(s): E. Kobelski, H. East, S. BunkerCai

Abstract:

The purpose of this experiment was to mathematically analyze what impact slopes, materials used, and types of lubricants would have on friction coefficients. The procedure essentially consisted of pulling a block up slopes with different angles, and measuring the amount of force it took to do so with a spring scale. This was repeated with all materials and angle combinations, as well as using different weights, types, and surface areas of blocks. For phase two, the spring scale was switched to digital to be more accurate. At the end of the first phase, many materials were removed for efficiency. During the third phase, lubrication was added and decreased the coefficient of friction. In total, over 500 trials were conducted to complete this experiment. The hypotheses were generally supported: the rougher the material, the higher the friction coefficients. Heavier and larger surface area objects had higher coefficients. The lubricants tested lowered the friction coefficients, because they create more fluid action as sliding or rolling friction. Overall, clipboard and wax paper needed the least amount of force, with foam and sandpaper needing the most. In upward tests, the higher the angle, the more force needed to move the object up and on downward tests the opposite is true due to the force of gravity being in the same direction as the applied force. During this project the following math was utilized: Pythagorean Theorem, sine, cosine, coefficient of friction equation, summation of forces, and unit conversions.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) MA 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
2025

Word Count	Fair Category	Project Number
209	PT	4017

Title: Which Nail Polish Brand Resists Chipping

Student Name(s): G. Occhino, C. Dains

Abstract:

The purpose of this project is to see if nail polish ingredients have an impact on the durability of the nail polish. This topic was chosen because finding nail polishes that last longer without chipping can be very useful, especially for those who don't have time for frequent touch-ups. The hypothesis is that nail polish with one layer will chip more easily, and polish with more layers will last longer and be more durable. If multiple layers are added, they need to be thin or the polish might peel off. To test this, everyday activities will be done to see if the polish will chip. The nails will be put under water, scraped on rough materials outside, and typed with on a Chromebook. The results showed that the Insta Dry chipped after it was thrown down the stairs. After testing with water and typing, some of the polishes chipped, such as OPI, SM, and Ella + Mila. Good Kind Pure did not chip at all after typing. Nails with more layers were stronger, and some brands or ingredients helped the polish last longer. Overall, the experiment demonstrated that both the number of layers and the specific formula of the nail polish significantly impact its durability and performance under stress.

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

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

☐ 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
2025

Word Count	Fair Category	Project Number
116	PT	4018

Title: The Effect of Delta Wing Dimentions of Flight Distance

Student Name(s): P. Hannan, J. Nanyame

Abstract:

The project is about how the size of a plane's wings affects how far it can fly in feet. The experiment tests foam gliders with different wing shapes. The problem statement is how delta wing dimensions affect flight distance. The theory was that wings longer than wide would help the glider fly farther because they would create less drag. However, the experiment showed that gliders with wings about the same size flew the farthest, meaning wings with similar length and width worked better than expected, which did not support the hypothesis; that the wings that would be longer and thinner would fly the furthest. This project will help the community by helping flight quality in planes.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
255	PT	4019

Title: Operating a Hydroponic System Using Rainwater

Student Name(s): Z. Shamsi, A. Borodii

Abstract:

Our school's greenhouse needed a sustainable water supply, so we designed a project to utilize rainwater harvesting and solar energy. The original plan was to extend the water pipeline to the greenhouse, which would have cost over $30,000.

Instead, a rainwater harvesting system that collects water from the chicken coop, located approximately 100 feet away from the greenhouse was installed. The collected rainwater is stored in a 250-gallon water tank. A ⅛ horsepower pump, powered by an existing solar panel installed outside the greenhouse, pumps the water from the tank to the greenhouse. The pump operates at an energy-efficient 20 watts per minute. Upon reaching the greenhouse, the water is transferred into a 55-gallon barrel, which automatically distributes the water into the 14-gallon bucket filled with nutrients. This nutrient-rich water is then pumped into the school's hydroponic system, which was installed by Levo International, using a timer-controlled pump. To prevent overflow, a float-valve system is installed in the bucket. This comprehensive system ensures a reliable and efficient water supply for the greenhouse.

This innovative solution saved our school approximately $30,000 in water pipeline costs. Additionally, by using rainwater harvesting, we reduced our reliance on municipal water supplies, minimizing our environmental footprint.

Future improvements could include expanding the rainwater harvesting system to supply water to other areas of the school such as our garden beds outside of the greenhouse or to supply an irrigation system for other plants in the greenhouse that are not installed in the hydroponic system.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) AT EM 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
2025

Word Count	Fair Category	Project Number
243	PT	4020

Title: Using Clay Flocculation to Reduce Algae in a Body of Water

Student Name(s): V. Vanderwilt, A. Almonacy, N. Mulcahy

Abstract:

Harmful algae blooms have been affecting bodies of water all over the world and damaging major ecosystems. Algae can block sunlight from reaching underwater plants and can also reduce oxygen from the water when the algae decays. Our hypothesis is that clay flocculation can be used to remove algae from bodies of water, and that bentonite clay will be the most successful. To test out our hypothesis, we used different types of clay such as kaolin, olivine, and sodium bentonite in algae water and studied our results. We used a spectrophotometer to test for light transmittance through each algae sample after it was mixed with clay. The control was algae with no clay added. The greater the light transmittance, the more clay flocculation had occurred. We also used water testing strips to measure various things like nitrites, nitrates, total hardness, free chlorine, total alkalinity, carbonate, and pH as a test of effectiveness. After studying our data, we learned that sodium bentonite is the most effective clay for removing algae with 97% light transmittance in the spectrophotometer compared to 44% for the algae control with no clay. From the water quality testing strips results, it was noted that olivine, sodium bentonite and kaolin reduced total hardness, and olivine and kaolin reduced nitrates from the algae water. Our hypothesis was supported in that clay flocculation, especially using sodium bentonite, can remove or reduce algae in order to protect bodies of water from its harmful effects.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) EM EV 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
2025

Word Count	Fair Category	Project Number
146	PT	4021

Title: Jell-O Lotion Lab

Student Name(s): N. Baldwin, G. Connole, S. Gorog

Abstract:

Skin protects the body but is susceptible to becoming dry especially in harsh winter weather. When this happens many people turn to expensive luxury brand lotions to moisturize their skin because they believe these lotions will work better than cheaper brands. The purpose of this project was to determine if cheaper lotions would work as well as more expensive versions. This experiment used JELL-O as a stand-in for human skin and tested the lotions against each other. During this experiment data was collected on a daily basis for one week. The data included the weights of the petri dishes to determine how much moisture evaporated from each dish. In general our hypothesis was confirmed. The results of the experiment showed that using any lotion was better than not using lotion at all, and some inexpensive lotions can work just as well as expensive ones.

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):

☐ 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
2025

Word Count	Fair Category	Project Number
165	PT	4022

Title: Density and Dissolving rates of Sweeteners

Student Name(s): A. O'Connor

Abstract:

The density of Sucralose is 1.63g/cm^3. The sweetener appears to be the color white or off-white and is in a form of powder. Research shows that this sweetener doesn't have an effect on long term weight loss or body mass index but some cohort studies show a minor effect on weight gain and heart disease risks. Some of the products sucralose is used in include: candy, breakfast bars, and coffee pods. Sucralose is usually found in yellow packets at diners, etc.The density of the monkfruit is 0.81 g/cm^3. Monkfruit is notable for its sweetness which can be concentrated from its juices Monfruit contains 25 to 38% of carbohydrates which are mainly fructose and glucose. This plant is most prized for its sweet fruits as a sweetener yet can also be dried and used in herbal teas and soup. When rat studies were performed it showed reduced dental caries in the teeth of rats given the concentrated mogrosides from this plant.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) CH CB 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
2025

Word Count	Fair Category	Project Number
232	PT	4023

Title: How do different RC spoiler shapes affect battery discharge?

Student Name(s): S. O´Marra, A. Santiago-Stra, N. N/A

Abstract:

This project aims to save battery life in an RC car by using different spoiler shapes. Our study answers the investigative question of which type of RC spoiler provides the least battery discharge. The procedure is as follows. Cut out sheet plastic shapes of spoilers, and install them on the RC car. Bring to the road and test the battery drainage of each spoiler by driving the RC car 300ft back and forth and testing after each run with a battery tester. The conclusion that has been come to is that using spoilers decreases battery discharge and the high-wing spoiler performed best out of the three spoilers. The hypothesis made was proven correct after testing as the high-wing spoiler decreased the battery discharge, the butterfly spoiler came in second, and the lip spoiler performed the worst. We know that this data is correct because the high-wing had an average battery drainage per run of 4.30%. On the other hand, the lip spoiler had an average battery drainage per run of 8.30%. In addition, the spoiler that came the closest to the high-wing spoiler was the butterfly spoiler. This came to an average of 6% drainage. The goal was to create a spoiler that slowly drains the battery and provides less drag. After testing we found that we can apply the high-wing spoiler to real-world electric vehicles.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☐ Yes ☒ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
252	PT	4024

Title: Original Xylem Water Filter Spigot for Reusable, Universal 5-Gallon Water Jug (XFS)

Student Name(s): A. Petrov, A. Senajani

Abstract:

Worldwide, more than 2 billion people lack access to clean drinking water. There are many methods of water filtration, but few are easily available and affordable. We focused on xylem filtration because it uses a common natural resource. Xylem is the vascular tissue of plants and trees that carries water upward from the roots. The xylem of some softwood trees, like pine, has tiny pores that can filter out more than 99% of bacteria from water. Our xylem filter is unique: it's the only one designed to work with 5-gallon water jugs. Millions of 5-gallon water jugs are manufactured annually and most people can get one cheaply or for free. The Original Xylem Water Filter Spigot for Reusable, Universal 5-Gallon Water Jug (XFS) gives these jugs new purpose and reduces pollution. (We also designed an alternative version of the XFS using a 3D-printed xylem holder). We made the original XFS with only a few parts: a piece of Eastern White pine branch, a plumbing coupling, and 2 screw clamps. We paid about US $3 for these supplies. To test the filter, we added 4 probiotic packets to about 2 gallons of water and ran it through the filter by turning over the jug and the letting filtered water drip out (by gravity). Bacterial tests showed that the unfiltered water had bacteria and the filtered water had none, so the XFS is a successful way to remove bacteria from water using a natural resource and reusing a common object.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) EE AT 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
2025

Word Count	Fair Category	Project Number
134	PT	4025

Title: How Can Sea walls Prevent Erosion?

Student Name(s): R. Sardana, T. Mickelborough

Abstract:

Our projects purpose was to protect the beaches and land from farther destruction, because we think that erosion is a big problem that many people seem to overlook. For our proceed we took a model beach and altered it to our liking, inside of the model beach we placed a house along with a miniature sea wall. We then continued to flood our diorama with water to represent waves and sea activity eroding away the beach scene. We then collected our data by observing how much the house had sunk into the sand breaking many important factors of our house. We also measured how erosion the much water the sea wall prevented. The conclusion the we came to an agreeance on was that the sea wall will significantly prevent erosion on a beach scene.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☒ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
144	PT	4027

Title: The Test of Time:

What Markers are the Most Lightfast?

Student Name(s): A. Tran, S. McPadden, Z. Stone

Abstract:

Our experiment was testing the lightfastness of alcohol markers, alcohol markers currently are growing in the market as some of the most popular art supplies for anyone. But one major issue is that they will fade when exposed to light for long periods of time.

We tested which markers would last the longest in the sunlight or UVC without fading. We tested markers from the cheapest to the most expensive to determine if the more expensive markers are worth the money and work the best. What we did was expose 5 markers to UVC light and sunlight for varying amounts of time. Then we wrote down observations after said time and wrote and rated how much it faded from 1-10. 10 is no fading, 1 is most faded. Whichever brand had the highest average would be deemed “the best” when it came out lightfastness.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
230	PT	4028

Title: The Effect of Different Salts in a Water Softener on Calcium in Drinking Water

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

Abstract:

This project aims to find the most effective water softener salt for removing calcium from water. This will benefit the community by helping to prevent plumbing issues, which take a lot of time and money to fix. The research question is: How do different salts in a water softener affect the amount of calcium in water?

It was hypothesized that if evaporated salts are used in a water softener, they will be the most effective for cleaning the water because they are the most widely used. Evaporated salts are the most commonly used possibly because it being more effective than most other softener salts. Solar salt, rock salt, evaporated salt and potassium chloride to determine which would most effectively remove calcium from Danbury City Water.

The results showed that rock salt was the salt most effective for cleaning calcium out of water while the least effective salt was potassium chloride. Solar salt ranked second in effectiveness and evaporated salt was the second least effective.

In conclusion, the investigation's hypothesis was not supported, as rock salt removed the most calcium instead of evaporated salt. These findings show that rock salt is the most efficient salt, requiring the lowest amount of salt to achieve the desired softening effect. Understanding the effectiveness of different salts can help people make informed choices when selecting a water softener, ultimately improving water quality and reducing costs.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☒ Yes ☐ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
154	P7	5001

Title: What Materials Cause the Most Static Electricity to Light an Incandescent Light Bulb?

Student Name(s): L. Johnson

Abstract:

Static electricity was chosen because it is fascinating to learn how static electricity is created and what it can potentially do. The research question being explored is: "Which materials are most effective at generating static electricity to light a 15-watt incandescent bulb?" It is hypothesized that silk and carpet will be the most effective materials in generating enough static electricity to power the 15-watt light bulb. Previous research suggests that these two materials produce the highest levels of static electricity when rubbed against other objects.

The experiment will involve testing a variety of materials, starting with the lowest wattage bulbs and gradually progressing to higher wattage bulbs. The method will involve testing different materials with each light bulb to observe the results and determine which material generates the most static electricity. This experiment showed that silk rubbing against silk made the most static electricity to make a 15 watts incandescent bulb flicker.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) EE PH 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
2025

Word Count	Fair Category	Project Number
240	P7	5002

Title: Water Rocket

Student Name(s): R. Clune

Abstract:

Background:
Rockets are important because they can get objects and equipment into space. However, one issue that occurs when rockets take off is fuel. For example if there is too little gas in a rocket then it will not take off, if there is too much then it will be too heavy and it wont launch. Air also plays a big role in this because the rocket needs to have a good amount of gas and be aerodynamic at the same time.

Aim:
The goal of this project is to identify the ideal air and water mixture in the rocket to achieve maximum height.

Approach:
A two liter soda bottle is used as the rocket. A launcher fills the rocket with pressure and locks it in place, a string is attached to the lock and when pulled the lock releases and the rocket shoots upwards. One quarter of a liter was then added and then one half a liter of water was added after each launch and flight time was calculated.The rocket was launched three times before adding more water to ensure the average was accurate.

Results:
The average flight time for one quarter of water was 5.79 seconds followed by 4.80 seconds for ½ Liters, 5.23 seconds for 1 Liters, 4.31 seconds for 1.5 Liters and finally .92 seconds for 2 Liters.

Conclusion:
We found that the rockets with a lesser amount of water had the longest flight times.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☒ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☒ Yes ☐ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☒ Yes ☐ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
249	P7	5003

Title: Acids and Rates of Corrosion: Experiments of Acid Rain on Building Materials

Student Name(s): B. Machado

Abstract:

Many people go about their day without knowing how their car is rusting or how their house is corroding, and not knowing what to do about it. However, it is important to know what is causing these disasters because they will otherwise only get worse. This project involved a series of experiments to focus on which acid corrodes a material more, and which material gets most affected by acid. One experiment tested the effect of different acids on steel wool by recording the temperature generated as a marker of the exothermic reaction of the particular acid. The experiment tested five acids: lemon juice, tomato juice, orange juice, vinegar, and distilled water. The most corrosive was lemon juice, turning the steel pieces into dust in just a couple of days. Another experiment involved testing two solutions, distilled water and sulfuric acid, on typical building materials as a marker of the effect of normal rain and acid rain, respectively, on said materials. These materials were limestone, brick, granite, marble, sandstone, steel, copper, and zinc. These are used to build monuments, bridges, and buildings around the world, and at the same time are susceptible to corrosion. The materials that were most impacted by sulfuric acid corrosion were steel, brick, and marble which were noted to have lots of bubbles, rust, or even dissolution. The effects of acid rain can be very detrimental, so it is better to understand these effects and be ready for them than to be caught in the rain.

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

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

☐ human subjects ☒ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
209	P7	5004

Title: Metal Vs. Alloy: Which is Stronger

Student Name(s): j. keeler

Abstract:

My science fair project, Metal Versus Alloy: Which is Stronger, involves a series of tests to determine whether metals or alloys are stronger, and which is superior in daily use. From architecture to phones, different metals are used and hidden in plain sight. going into this I hypothesized that the alloys would be stronger. Though some people don't notice. Metals are used in almost everything nowadays. The series of tests ensured equality and fairness with no bias. The tests were file ability, melting time, bend-ability, and chiseling. Each chisel would be equal pressured and the stopwatch for melting time would begin as soon as the pot was at melting point, and finally file ability would be an equal number of strokes. The purpose of the tests were meant to see what each could withstand in daily practice and use Each metal was put into an equal-sized ingot. After each test, the metal was scored 1 through 3, with 3 being the highest and 1 being the lowest. The metal(s) that scored the highest would be fundamentally superior in daily usage. The results proved my hypothesis to be correct. In conclusion, I tested whether metals or alloys were stronger by everyday tests, and alloys were ultimately stronger.

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):

☐ 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
2025

Word Count	Fair Category	Project Number
128	P7	5005

Title: Leidenfrost effect, How Flame Resistant are Pineapples?

Student Name(s): K. Linsley

Abstract:

This project is attempting to determine what makes pineapples flame-resistant and how that property can be harnessed to help the world by understanding how it works.

This experiment will work with an oven, the prediction is the pineapple will withstand the oven temperature. To investigate this property, the pineapple skin will be placed in an oven at varying temperatures. Then the researcher will test how the pineapple skin reacts at different temperatures and times. From the results, the researcher found that pineapple skin can withstand heat for a more than 10 minutes at a high temperature before burning, as seen in the observations.

In conclusion, the researcher was able to demonstrate that pineapple skin is flame-resistant up to a certain point before it begins to burn.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☒ Yes ☐ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
238	P7	5006

Title: Green Hydrogen : for the future

Student Name(s): V. Vijay Shankar

Abstract:

This project is about reducing the cost of manufacturing green hydrogen. I performed experiments with 3 different electrolytes namely baking soda, salt and liquid drain cleaner to identify the best source for green hydrogen production. The initial idea was to use a PEM fuel cell along with cost effective materials such as copper and aluminium as electrodes. This idea was discontinued due to time constraints and the potential ill-effects of using copper and aluminium. I purchased a PEM fuel cell with 1 input to receive the green hydrogen produced out of freshwater along with one of the electrolytes mentioned previously. After the experiments, I observed that baking soda had a more controlled reaction than salt. The liquid drain cleaner was not effective. I used a tube to transport the hydrogen to the PEM fuel cell and the fuel cell converted hydrogen into electricity. The salt based experiment produced .178 V, baking soda produced .191 V, and liquid drain cleaner produced .058 V. I will continue my research with a new PEM fuel cell with 2 inputs for hydrogen and oxygen to generate more electricity. Additionally, I did a soap bubble test where hydrogen was transferred through a tube to a soapy solution. I observed the bubbles getting bigger which is proof that hydrogen was produced in a cost effective manner. Based on my experiment, baking soda is a reliable and cost effective source for green hydrogen production.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) EM 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
2025

Word Count	Fair Category	Project Number
238	P7	5007

Title: Do dimple patterns on a golf ball affect the way it flies?

Student Name(s): D. Esposito

Abstract:

Backround: The dimple patterns on a golf ball matter because it can impact important parts of your game such as ball flight, ball height, spin, or how quickly the ball stops if trying to land in a tight area. Drag(air resistance) on the golf ball can impact how the golf ball behaves in the air and we know that the dimple pattern can impact the drag.

Problem: What I was trying to find out in the experiment was to test the patterns of the ball dimples and how they affect the balls flight.

Hypothesis: If you have more dimples, then spin rate and consistency will increase Because the drag on the ball during its flight changes the aspects of the ball flight and it will cause it to stay oriented in the air better.

Procedures: In my project I created a model to launch the golf balls. The launcher was a consistent way to launch golf balls so there was consistency in the swing.I set up the ball in the same spot and same tee length for every shot before the launcher hit it.

Results: My results show that dimple patterns do in fact matter because it affects spin rate.

Conclusion: My hypothesis was mostly correct. The golf balls with a higher dimple count seemed to have a more consistent spin rate. This leads me to the question of what would happen if the ball was smooth?

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☒ Yes ☐ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
248	P7	5008

Title: How To Use Windows To Get The Optimal Air Flow In A Room

Student Name(s): J. Puryear

Abstract:

I am studying how to get the optimal air flow in a room to bring fresh air in. Fresh air has plenty of oxygen and good air flow takes away the carbon dioxide that builds up when people breathe out. When my mom is cooking, we have noticed that the particulates get very high; good air flow can bring in fresh air.

I think that the best air flow will result from having the sky lights and windows open on opposite sides of the room.

My experiment used openings in a box to represent windows. The cardboard box was closed in on 3 sides. The open side was sealed with a sheet of plastic to enable me to see in. On the other sides, I made 8 holes which represent windows and skylights. I experimented by opening different holes. I calculated differences in air flow by using a candle (which burns better with more oxygen) and measuring the height of the flame. I used corks to fill in the holes I was not using at a given time. I opened up to 4 windows at a time and recorded the height of the candle flame for each arrangement.

I found that having widows and skylights open across the room from each other gave the best air flow. My candle flame was highest when the most windows and skylights opposite from each other were open, so I think that having more windows open contributes to good air flow also.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) 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
2025

Word Count	Fair Category	Project Number
240	P7	5009

Title: Acid Rain: How different materials dissolve in different materials?

Student Name(s): L. Anderson

Abstract:

Have you ever looked at old monuments, gravestones or buildings and wondered how do they last as long as they do when exposed to rain all the time? This made me wonder why sculptors and builders pick certain materials to make monuments out of versus other materials. I decided to focus on the idea of acid rain and the effects it would have on different building materials. After doing some research I learned that common vinegar has a similar PH to acid rain. So, I decided to model that effect by doing different types of vinegar. My hypothesis is that the brick will dissolve in the white distilled vinegar the fastest because of the low PH that white vinegar has. To test my hypothesis I used three building materials, brick, marble, and granite and three vinegars, white distilled vinegar, rice wine vinegar and apple cider vinegar. I put a piece of each material in a plastic container with 150 grams of each of the vinegar. I checked them every other day, measured them on a kitchen scale and described what had happened to the different materials. I checked them over 10 days. My hypothesis was proven incorrect as the marble in the white distilled vinegar and the apple cider vinegar dissolved the most. The marble dissolved the most because it is very porous and the white distilled and apple cider vinegar have a very low PH which affected this process.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) 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
2025

Word Count	Fair Category	Project Number
189	P7	5010

Title: Brew Time: Tea and Strength

Student Name(s): J. Major

Abstract:

This project investigates how longer brewing times could affect the strength of tea. The goal is to build a device that determines how steeping time affects the electrical strength of tea. It is recognized that there is increased electrical strength the longer the tea is brewed. This may vary on the type of tea that is used for the experiment. This project was chosen because tea is the most consumed beverage in the world, besides water. The aim of this project is to investigate the chemical reaction that is called diffusion. During this whole process, a small amount of elements dissolve into the water converting its taste, color and flavor between tea and hot water. It was hypothesized that the tea would become stronger with longer brewing times. To prove that longer brewing times equal darker tea, the use of a photoresistor and a multimeter were used as well as using various brewing times. Tea companies would benefit from these results because they would possibly be able to become #1 in the tea industry. A key concept is the tea will have a stronger flavor the darker it is.

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
2025

Word Count	Fair Category	Project Number
250	P7	5012

Title: Which color will allow water to get and stay the warmest over time?

Student Name(s): J. Cabral

Abstract:

Insulation is very important to those who live in cold climates. Color can help insulate and absorb heat for buildings. It also is very energy efficient and counter global warming. Water is a great material to test the ability of color to insulate it because it is very accessible and easy to use. The question I am trying to answer is which color absorbs the most heat and allows water to get the hottest over a period of time. My hypothesis is that if I test a darker color felt, then the water will increase in temperature the most because darker colors such as black absorb the wavelengths and turn it straight into thermal energy while lighter colors reflect the light and absorb less heat. When conducting the experiment, I cut and glued felt into the shape of the flask in order to cover the whole thing. I filled it with 200 ml of water and put it under a 100-watt heat lamp for 15 minutes. After 15 minutes I used an infrared thermometer to check the temperature of the water. The experiment showed that darker colors allowed the water to get the hottest. The water surrounded by dark felt increases by 12° Celsius but yellow, a lighter color only increases by 6° Celsius. To conclude darker colors are the best to insulate buildings because of their ability to absorb the wavelengths and convert it straight into thermal energy that will then be used to heat up its surroundings.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
266	P7	5013

Title: Cell Shield: Investigating materials to block non-ionizing radiofrequency radiation in common cell phones

Student Name(s): B. Norful

Abstract:

Problem:Cellphones emit non-ionizing radiofrequency (RF) radiation, which may impact health. A study found rats exposed to RF radiation from 2G/3G cellphones developed tumors. The National Cancer Institute and FDA reports no consistent evidence that cellphone-emitted radiation increases cancer risk. However, International Agency for Research on Cancer classified RF radiation as a "possible human carcinogen". Almost 95% teens use cellphones by age 18. Until longer term studies are conducted, protecting teens from harmful RF radiation is crucial

Objectives:•Measure RF radiation from common wireless devices.•Test materials that reduce/block RF radiation.•Develop a protective device.

Methods: First, an EMF meter measured RF radiation from an iPhone, AirPods, and wireless headphones, independently and while charging, and controlling for other radiation in the room. In phase 2, RF radiation blocking materials (copper, aluminum, steel, radiation-blocking cloth, EMF stickers) were tested. Next, a protective pouch was engineered using the most effective material.

Results: The iPhone emitted the highest RF radiation (324.7 mW/m2), exceeding a microwave (307.6 mW/m2). Charging slightly reduced levels. AirPods emitted 88.3 mW/m2, increasing to 112.5 mW/m2 when charging. Wireless headphones emitted 78.5 mW/m2, dropping to 50.6 mW/m2 when charging. Copper, aluminum, EMF stickers reduced radiation but remained high. Steel blocked all radiation but affected reception. The radiation-blocking cloth reduced radiation to 0 mW/m2. A cost-effective protective cloth pouch was engineered and appears feasible, protective, and cost-effective. Conclusion:As cellphone use increases, shielding users from radiation is vital. Until long-term studies determine health risks, this pouch offers an effective protective solution.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) AT EN 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
2025

Word Count	Fair Category	Project Number
232	P7	5014

Title: EMFasis on EMFs

Student Name(s): L. Scariati

Abstract:

In our modern lives, we are constantly surrounded by electromagnetic fields (EMFs). They are emitted by our cellphones, televisions, refrigerators, lamps, and even the computers on which we use to do our science fair projects. However, high levels of EMFs can be harmful to our health. At dangerous levels they can cause cancer, fatigue, heart palpitations, dizziness, nausea, and burning sensations. If an appliance is in use, then it will emit more EMFs than when it is not in use. If an appliance is 20 years or older, then it will emit more EMFs than a newer appliance. I think most of the appliances will not be dangerous. I used an EMF detector to measure the EMFs given off by various appliances, such as refrigerators, televisions, cellphones, and much more at my house and grandmother's house. I recorded my data and compared the results.

My project went according to plan. My hypothesis was proven incorrect. Most appliances were dangerous to be near or around. The highest emitter was the television at both houses. The television was the worst in V/m (volts per meter) but not uT (microteslas). Almost every appliance I tested, the EMF detector screen was red, which indicates that the appliance is hazardous to be around. If I could do this project again, I may test more appliances and check extra buildings, such as apartments, offices, and private houses.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
192	P7	5015

Title: Extracting and Separating DNA

Student Name(s): D. Cajuste

Abstract:

The purpose of this project is to identify and understand the genetic micro-components of a crime scene. The word micro comes from the Greek word meaning "extremely small." Examples macro-molecules include, carbohydrates and nucleic acids. Things that you can't see with the naked eye. These genetic micro-components play an important role for forensic Scientists to pinpoint the person behind the crime. This topic was chosen because crime investigation is something that should be scientifically thorough as it is important to make sure the right people are investigated and that criminals are brought to justice. In order to complete this task, this project is called, " Extracting And Separating DNA". After conducting such an experiment its has been proven that a gel electrophoresis can separate molecules of different types. Whether it was using food coloring as the molecule being tested or it was different DNA from fruits such as strawberries, kiwi and bananas. This study suggests that when separating molecules it would be the easiest and most accurate way to study those given clues to give a correct and unbiased answer to the actual people in charge of the given case.

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

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
2025

Word Count	Fair Category	Project Number
88	P7	5016

Title: Note Taking App

Student Name(s): H. Clark

Abstract:

The project that I have created focuses on the idea of using my coding skills to design a simplistic, simulated note-taking app to test and showcase what I've learned about coding. I wrote the code using an Apple software developer with its own type of coding language (like JavaScript or CSS) called Swift and showcased my app using a type of simulator. And what my project demonstrates overall, is that coding can be used to solve real-world problems by creating practical, simple tools for everyday use.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
263	P8	5501

Title: Evaluating the Toxicity of Eco-Friendly versus Conventional Laundry Detergent Water Runoff via Eisenia Fetida Mortality Rates and GC-FID Analysis

Student Name(s): Z. Haque

Abstract:

Household detergents are often released into residential areas in rural regions when homes are not connected to city sewage lines. Pre-existing research on the health effects of inadvertent release of effluent pollution into the environment is limited. Thus, this research identifies the level of toxicity present in three widely used household detergents (Tide, Dreft, and Seventh Generation) to determine which of these detergents is most harmful. In phase 1, this research investigated the mortality rate of red worms (Eisenia fetida) exposed to several different concentrations (25%, 50%, 75%) of each detergent, finding that red worms in almost all concentrations of Tide detergent were dead within two days of exposure. Gas Chromatography with Flame Ionization Detector analysis of all three detergents identified 1,4-Dioxane as a component of the detergents. 1,4-Dioxane is a known carcinogen in animals (causing hepatic cancer in rodents) and is "reasonably anticipated to be a human carcinogen" by the National Institute of Health. After calibration of the GC using a previously-heated, free-of-1,4-Dioxane detergent, the amount of 1,4-Dioxane in each detergent was quantified. Tide had the highest concentration of 1,4-Dioxane, with 173.13mg/L, followed by Seventh Generation with 66.40mg/L and Dreft with 61.16mg/L. These results coincide with the previously determined mortality-rates of the red worms, and reveal the significant toxicity of common household detergents, which may seep into the soil or drinking water, posing a significant health risk. This demonstrates the importance of creating more consumer awareness about the presence of toxic chemicals in detergents, even those marketed as eco-friendly.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) EM EV 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
2025

Word Count	Fair Category	Project Number
261	P8	5502

Title: Integration of Photoluminescent Manganese-doped ZnS Nanocrystals for Improved Solar Cell Response

Student Name(s): A. Rothstein

Abstract:

The number of solar-equipped roofs have increased as a result of the cost of photovoltaic (PV) solar cells declining. Poor performance in PV cells is mainly the outcome of high reflectivity, and the fact that the cell is inefficient in the conversion of incident light to energy that can be used. Previous research suggests that the photoluminescent properties of zinc sulfide, doped with Mn+2 ions (ZnS:Mn+2), which are highly transmittant, as well as having low reflectivity, can be more useful to current photovoltaics. This material red-shifts UV light into the visible regions, allowing a solar cell to respond to UV wavelengths. The objective of this research is to increase the efficiency of typical solar cells, so that it would produce energy from an expanded range of wavelengths. Two ZnS:Mn+2 coated solar cells were created, one with a gridded overlay of ZnS:Mn+2, and one with full coverage. Through numerous evaluations that measured the reflectivity, transmittance, current, and power of the two ZnS:Mn+2 solar cells as well as the "standard" cell, the gridded cell was proven to be the best. During open circuit testing of the ZnS:Mn+2 solar cell with Mercury lamp (0.67Lux) illumination, the gridded solar cell produced around 0.968 volts, while the standard cell produced 0.681 volts under the same conditions. With simultaneous illumination with 0.2-Lux Hg-lamp, and 2000-Lux halogen visible lamp, the gridded ZnS:Mn+2-cell demonstrated an 8% increase in current, and 74% increase in power, relative to a conventional solar cell.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) EN ET 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
2025

Word Count	Fair Category	Project Number
243	P8	5503

Title: How do the ingredients in ice cream affect the ice cream's melting rate?

Student Name(s): I. Silvestri

Abstract:

The purpose of my project is to test how the ingredients in ice cream affect its melting rate. My hypothesis was that the ice cream with extra salt would melt the fastest. I first made the ice creams. I doubled the amount of salt for the extra salt, I doubled the amount of sugar for the extra sugar, and I doubled the amount of milk for the extra milk ice cream. Once the ice cream was made and frozen, I scooped the ice cream onto the strainer. Once half of the 125 milliliters of ice cream dripped through the strainer and into the measuring cup, I stopped the stopwatch. I did three trials of each of my four ice cream types. My hypothesis was contradicted by the results of my experiment. The extra sugar ice cream melted the fastest with an average melting time of 43 minutes and 45 seconds. The extra salt ice cream melted the next fastest with an average melting time of 1 hour, 11 minutes and 39 seconds. Next was the control with an average melting time of 1 hour, 18 minutes and 8 seconds. The extra milk ice cream melted the slowest with an average melting time of 1 hour, 38 minutes and 20 seconds. Overall, sugar and salt increase ice cream's melting rate, and milk decreases ice cream's melting rate. These results could help ice cream companies make ice cream that takes a long time to melt.

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
2025

Word Count	Fair Category	Project Number
251	P8	5504

Title: Tracking Microplastics at Tod's Point Through Wastewater Weather and Ocean Currents with Scanning Electron Microscopy Analysis

Student Name(s): C. Henske

Abstract:

Microplastics are defined as synthetic polymer particles with diameters less than 5mm, originating from industrial processes, consumer products, and the decomposition of larger plastic debris. These are widely spread in aquatic systems via wastewater discharges, stormwater runoff, and atmospheric deposition. This study examines the distribution of microplastics across Long Island Sound between a wastewater treatment plant and Tod's Point Beach in Greenwich, CT, relative to wind speed and currents. Water samples were collected adjacent to the treatment plant at two points and at three points at Tod's Point (each differing in exposure to the GIWTP. For microplastic analysis, particles were counted and identified with the use of a scanning electron microscope. The results indicated there was a big increase in both locations with regards to the wind speeds increased starting from 5 mph up to 20 mph. Microplastic levels at the treatment plant increased from 280 to 5,612 MPs at location one and up from 0 to 2,591 MPs at location two. At Tod's Point similarly, concentrations went up from 3,367 to 8,435 MPs at one place and from 5,450 to 8,643 MPs at another point. These results suggest that microplastics from the treatment plant might be delivered via wind driven water circulation to the beach area at Tod's Point-an area frequently populated by humans. This relationship of wind speed with the accumulation of microplastics has implicated the potential role of atmospheric and hydrodynamic forces in the distribution of pollution and requires further research on transport mechanisms and mitigation strategies.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
250	P8	5505

Title: Lemon Power

Student Name(s): A. Hill

Abstract:

The purpose of my science project was to find a way to generate electricity with a lemon. After doing research, I hypothesized that a lemon or any citric fruit can act as a power supply. Because the chemical reaction of the zinc of the nail and penny will react with the citric acid of the lemon. I believe that this chemical reaction will result in the lemon generating electricity.

I started by gathering all the materials, then I rolled the citric fruit on a hard, flat surface to release the juice. Then I inserted a galvanized nail into one side of the fruit and a penny on the other side. I did this three times and then connected all the fruits using alligator clips and lastly connected all the fruits to the voltmeter.

After connecting the Fruits to the voltmeter I found that it could generate a certain amount of volts and amps depending on how many fruits you use. This resulted in it generating a noticeable noise when connected to a small speaker.

In conclusion, after conducting my experiment and doing research I found that lemons or any citric fruit can be used as a power source. This comes from the chemical reaction from the zinc in the nail and penny when it comes in contact with the lemon juice. But even when the volts are the same the fruit can't generate the same amount of electricity as a battery because they don't have the same amount of amps.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) PS 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
2025

Word Count	Fair Category	Project Number
251	P8	5506

Title: The Effect of Wing Shapes on the Flight Characteristics of Planes

Student Name(s): B. Kiev

Abstract:

Understanding how different wing shapes impact flight characteristics is important for plane efficiency and safety. This project aims to understand how wing shapes can affect flight characteristics. Paper airplanes with three different wing shapes were used to collect data on how each shape affects the speed and maneuverability of the plane. Each plane was launched manually and then operated with a special flight motor via a phone app to prolong flight times and allow some level of control over the plane's trajectory. The powered paper airplanes were flown in a straight course in an indoor gym. Different qualitative and quantitative data were recorded (i.e. flight time, time to fly 20 feet, and various maneuverability characteristics).

The Invader plane design had difficulties descending (meaning it was the most "floaty") and was the overall slowest, having the widest wing compared to its length. The Emperion plane design had the single highest speed and the highest descending rate (meaning it was the least "floaty"), having large vertical stabilizers, and mid-range proportions compared to the other two shapes. The A9 Eagle plane design had the fastest average speed and was the most responsive, having the longest body compared to its width. The results show that the wider the plane is compared to its length, the more "floaty" it feels, making it stay in the air longer while gliding at a lower speed. In addition, the longer the plane is relative to its width, the faster it flies and the more responsive it is overall.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) EE PH 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
2025

Word Count	Fair Category	Project Number
207	P8	5507

Title: Bus Notification System with Raspberry Pi

Student Name(s): V. Prabhu

Abstract:

This project introduces an automated bus arrival notification system designed to enhance the chances of students not missing their school buses during dismissal. Utilizing a Raspberry Pi paired with a Huskylens AI camera, the system detects and records bus arrival times by identifying designated tags affixed to each bus. The captured data is then transmitted to Amazon DynamoDB, a cloud-based NoSQL database, for storage, retrieval, and display.

A web-based interface built using a Svelte framework provides real-time bus arrival information to students and school staff. Furthermore, an SMS notification system using Twilio delivers personalized arrival alerts directly to students' mobile devices. The system incorporates a MySQL database for users to create and store user account data, ensuring secure access to the web interface.

The AWS Management Console enables manual access to the DynamoDB database, while the DynamoDB displays the arrival of data to the web interface. Test scripts were written before DynamoDB was implemented into the project to see if the Raspberry Pi and Huskylens could successfully display the output of the data collected.

This project demonstrates the concepts of using computer vision, AI, and cloud-based technologies to automate school bus arrival notifications, improving student preparedness and reducing dismissal-related chaos and problems.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
184	P8	5509

Title: Shake It To Make It

Student Name(s): L. Gillis

Abstract:

My science experiment was to test the effects of different levels of salt in the ice cream making process. I filled each of the smaller bags with the same amount of sugar, vanilla, extract, and half-and-half. I filled each of the larger bags with the same amount of ice and the varying levels of salt. I put the smaller bag into the bigger bag and sealed the bigger bag. I then shook the bags for 8 minutes. I took the ice cream out of the bag and then I observed it and ate it. I then repeated this process for each amount of salt I was testing. I thought that the most amount of salt would give the ice cream the best texture but the lowest amount of salt actually gave the ice cream the best texture. I did this experiment because I really like ice cream and I wanted to know what amount of salt would give it the best texture. Now every time I make homemade ice cream I will know what the right amount of salt to add is.

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
2025

Word Count	Fair Category	Project Number
249	P8	5510

Title: Hydration Hero: Which Skin Moisturizer Works Best

Student Name(s): O. Caserta

Abstract:

The purpose of this experiment was to determine which skin moisturizer and ingredients, most effectively slowed the process of transepidermal water loss in order to keep skim moisturized. My hypothesis for this experiment was that Aquaphor, which has both humectant and occlusive ingredients, would most effectively slow the process of transepidermal water loss.

I created skin models with gelatin in petri dishes for this experiment. Gelatin was used to mimic skin because it is derived from collagen, a fibrous protein found in the dermis layer of the skin. I covered the gelatin with two tablespoons of moisturizer, using three petri dishes per moisturizer, and leaving three control samples without a moisturizer. After applying the moisturizers to the gelatin samples, I measured the height and weight of each of the samples at hours: 0, 1, 2, 3, 12, 24, 48, 72, 96, 120, 144, and 168. After 168 hours, I calculated the percent of initial weight and percent of initial height and then averaged the three results per moisturizer.

During the experiment I observed that the occlusive based moisturizers maintained the highest percent of their initial height and weight, and had a layer of water between the gelatin and moisturizer. These results and observations showed that the occlusive based moisturizers were more effective than the humectant based moisturizers. Further, the results of my experiment proved my hypothesis that Aquaphor, with humectant and occlusive ingredients, would most effectively slow the process of transepidermal water loss and keep skim moisturized the best.

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

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
2025

Word Count	Fair Category	Project Number
252	P8	5511

Title: Field and Lawn Runoff Removal of Nitrates and Phosphates via an Iron and Calcium Fortified Biochar Filtration Pouch

Student Name(s): E. Mao

Abstract:

This research introduces a novel solution to combat eutrophication that is destroying aquatic systems through a filtration device using fortified acorn biochar (FAB) in a water-permeable fabric bag. Dried and crushed acorns were fortified with 15% ferric chloride and 15% calcium oxide before pyrolyzing at 600°C. The FAB bag is placed in the path of runoff, preventing entry to watersheds. Initial experiments in free-standing water showed 92.7% nitrate removal and 76.8% phosphate removal, or 11.6 mg-$NO3^-$ and 2.9 mg-PO_4^{3-} per gram of FAB. When placed in a pouch, simulated runoff experiments illustrate that nutrient removal improved as flow rate slowed. At typical suburban lawn flow rates (~1.7ml/min), ~75% nitrate removal and ~70% phosphate removal were achieved. Slower flow (0.9ml/min) increased removal rates to ~82% for nitrates and ~74% for phosphates. Lifetime studies demonstrated consistent adsorption of 1.44mg of nitrates and 1.35mg of phosphates per gram of FAB. For lawn use, a 50lb FAB bag can remove 32.4g of nitrates and 29.3g of phosphates. In the worst-case scenario, where fertilizer is spread on a typical 0.2-acre lawn before immediate rain and 22% runoff of all fertilizer, one 50lb bag can remove all runoff nitrates (~30g) from Scotts Turf Builder with 1.4% nitrates, while two bags are required for root growth fertilizer of 2% phosphates with a 44g phosphate potential. However, it is more likely that periodic runoff, well after fertilizer is applied, would require changing the 50lb FAB pouch 1-2 times per spring season.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) 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
2025

Word Count	Fair Category	Project Number
205	P8	5512

Title: Investigating the Chemical Properties and Efficiency of Homemade Batteries: A Focus on Voltage, Energy and Chemical Reactions

Student Name(s): A. Silverman

Abstract:

Pollution from batteries has become a serious problem. It is essential that we figure out an eco-friendly alternative to the toxic chemicals from batteries that pollute our earth. That is why I conducted an experiment where I made prototypes of eco-friendly batteries that will not harm the earth if disposed of improperly. I hypothesized that batteries that use stronger electrolytes would produce a higher voltage than weaker electrolytes. I also hypothesized that the batteries that produce a higher voltage will illuminate an LED brighter than weaker voltage batteries. I created homemade six-cell electrolyte batteries using 11 different electrolytes of different strengths. I recorded the voltage and LED brightness produced by each battery. For the most part, batteries that used stronger electrolytes produced higher voltages, with a few exceptions. There was also a moderate relationship between the voltage of the battery and how brightly the LED was illuminated, but there were many exceptions. There may be more factors that affect voltage and LED brightness that did not get tested, such as current and resistance, which could be tested in future research. Hopefully this research can be developed further so we can start mass producing more eco-friendly batteries and reduce battery pollution globally.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) CH 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
2025

Word Count	Fair Category	Project Number
297	P8	5513

Title: Neutralization of Ocean Acidification and Promotion of Additional Atmospheric CO 2

Student Name(s): T. Chen

Abstract:

Ocean acidification is a well-recognized problem by multiple organizations and environmentalists, which has led to reduction in fish populations, and disruption of the ocean's ecosystem. The research presented herein provides an easily-applied and maintained solution to correct rising H+ concentrations and decreasing pH, through the creation of an MPM-Sponge. As a floatable device made from melamine foam, PTFE (polytetrafluoroethylene) adhesive, and 20mg of Mg(OH)2, the MPM-Sponge contains a basic, non-soluble reagent that can neutralize oceanwater H+ to increase the ocean's pH, while simultaneously shifting ocean acidification equilibrium, so that oceanwater can safely and spontaneously sequester more excess CO2 from our atmosphere. In experiments comparing the floatable MPM-Sponge performance to equivalent (20mg) mass of free-standing, stirred Mg(OH)2 in 400ml of seawater, the MPM-Sponge neutralized 3.40E-7mg-H+/mg-Mg(OH)2, compared to free-standing, stirred-powder neutralization of 3.44E-7mg-H+/mg-Mg(OH)2. Regarding the device's ability to cause spontaneous and environmentally-friendly sequestration of additional atmospheric CO2, the MPM-Sponge outperformed free-standing Mg(OH)2 by 1.6-times, sequestering 3.36E-10mg-CO2/mg-Mg(OH)2, as compared to 2.08E-10mg-CO2/mg-Mg(OH)2 for the powder. SEM, EDS, and ATR-FTIR analyses of the MPM-Sponge after prolonged use demonstrates that the device is stable and safe for marine-life, as it maintains its structural integrity during prolonged use. Further, ATR-FTIR analysis of MPM-Sponge "used-water" was found to be free of the device's structural components, again pointing to its stability as a prolonged-use, floatable device. The MPM-Sponge is an ideal design to simply and easily reduce ocean acidity, while concurrently sequestering additional CO2 from our air, to benefit both our atmosphere and oceans.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
250	P8	5514

Title: Hot or Cold? How Temperature Affects the Bounce of a Ball

Student Name(s): L. Chou

Abstract:

I conducted this science experiment to find out which type of sports ball is most affected by temperature change. I did this experiment because I play tennis year-round and I observed a change in the ball's behavior during different weather conditions. I have also played squash and know that you have to warm up the ball before you play. Otherwise, the ball will barely bounce. This led me to test the bounce height of different sports balls and see how they are affected by differences in temperature. The purpose of this experiment is to determine which sports ball is most affected by temperature change. Determining how different balls are affected by temperature is important to optimize athletic performance and strategies. I selected four different types of balls: squash, tennis, soccer, and basketball. Next, I brought each ball to three different temperatures (cold, room temperature, and hot). At each temperature, I dropped them from a two meter height. I reviewed the video footage to see how high each ball bounced. Using this data, I calculated the average percent change from cold to hot. My hypothesis stated that if I change the temperature of four different sports balls, then the bounce height of the squash ball will be most impacted. The squash ball was most affected, proving my hypothesis. In general, the ball will bounce lower in colder temperatures, and in hot temperatures the ball will bounce higher. Players will have to adjust to the different heights depending on the weather.

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
2025

Word Count	Fair Category	Project Number
229	P8	5515

Title: Blacklight Flashlight Versus Normal Flashlight Through A Glass Prism

Student Name(s): S. D'Aquila

Abstract:

The purpose of this experiment is to try and discover what happens when you refract blacklight using a glass prism and to compare those results with the refraction of normal light through a glass prism. The hypothesis being tested is if I were to shine a blacklight flashlight through a glass prism, then the light would be broken up into blue and red light. If I were to shine a normal flashlight through a glass prism, then similar to the blacklight, the light would be broken up into the colors of the rainbow. This experiment was conducted by first making sure the prism was at the correct angle to properly refract the light by shining the normal flashlight through it and adjusting the angle as needed. I noticed that after refraction, the normal light created a rainbow. The blacklight flashlight was then shined through the prism. I discovered that the black light formed the same pattern as the normal light, only the color of the blacklight stayed the same after refraction. This experiment shows that after refracting blacklight, the color will not change. This may be because blacklight is at the very end of the visible spectrum, so when undergoing refraction, the color cannot visibly change. The light is still being refracted and changing, our eyes just cannot detect that change as it is beyond the visible light spectrum.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☒ Yes ☐ No
4. Is this project a continuation? ☒ Yes ☐ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☒ Yes ☐ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
175	P8	5518

Title: The Most Efficient Way to Solve a Rubik's Cube

Student Name(s): L. Lazzara

Abstract:

Speedsolving is the worldwide phenomenon gaining popularity over the past decade. In speedsolving, people solve Rubik's cubes very quickly. The speed of turns is not the only reason a Rubik's cube solve is fast, the number of moves is also important. The less moves, the faster the solve. The purpose of this science fair project was to test the Petrus, Roux, and ZZ methods against the most popular speedsolving method, CFOP, to see which method is the most efficient. The cube was solved 5 times using each method to see which had the least move count. Roux was the most efficient method with an average 48.2 moves. The ZZ method was second most efficient with an average of 52.8, CFOP was the second least efficient with an average of 60.6, and Petrus was the least efficient with an average of 72 moves. This project gives further evidence that block building is more efficient than layer-by-layer solving. It also supports the hypothesis that, out of the four biggest methods, Roux is the most efficient.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) MA PH 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
2025

Word Count	Fair Category	Project Number
247	P8	5519

Title: The Effect of Screen Time on Sleep Quality and Circadian Rhythm Regulation

Student Name(s): K. Baskar

Abstract:

Circadian rhythm is the body's natural 24-hour sleep-wake cycle, influenced by environmental cues like light and temperature. It regulates essential functions such as sleep, energy levels, and metabolism. Modern habits, such as excessive screen time, irregular sleep schedules, and physiological disruptions, have been linked to adverse health effects, including poor sleep quality, mood disturbances, and diminished physical and mental performance. This project explores the relationship between screen exposure and its impact on circadian rhythms, focusing on physiological markers like heart rate, body temperature, sleep patterns, mood, and energy levels.

Participants from diverse age groups contributed demographic data, self-reported screen usage, and detailed sleep habits. Using smart devices, participants recorded their heart rate twice daily and shared insights on how screen time influenced their mental and physical wellbeing. Preliminary findings indicated that increased screen time, during day time and before bedtime, significantly disrupted sleep quality and heart rate variability, suggesting a strong association with circadian misalignment. However, no significant correlation was observed between screen exposure and mood disturbances or energy levels.This study underscores the importance of managing screen time to support healthy circadian rhythms and overall wellbeing. Additionally, the findings highlight the potential of chronotherapy—aligning medical treatments with the body's natural rhythms—to enhance clinical outcomes. By timing interventions to coincide with physiological cycles, different medical conditions can be treated more effectively. These insights emphasize the need for a holistic approach to health that incorporates circadian principles into both lifestyle choices and medical strategies.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) BI ME 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
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
240	P8	5520

Title: Wool's exceptional warmth, even when moist

Student Name(s): S. Sethi

Abstract:

Objective: The Objective of the science project is to evaluate wool's ability to regulate body temperature effectively, even when wet, in both winter and summer.

Introduction:Which fabric ensures comfort without exposing the wearer to the harsh effects of the surrounding climate? This question evaluates the project for how wool fabric helps regulate optimal body temperature compared to other materials.The experiment is based on understanding wool's ability to regulate temperature, which can be explained through characteristics of air trapping,moisture absorption,insulation,breathability,thermal regulation.

Procedure:Fill 4 identical glass cups with the same amount of hot water.Wrap each glass cup with different fabrics (cotton, fleece, polyester, wool, wet wool)Measure and record the initial temperature of the water in each glass cup & the room temperature.After every 5 minutes interval, measure and record the temperature drop. Continue for 30 minutes and compare the results.

Observation: The comparison of temperature difference for each of the fabrics regulated water surface, and liquid temperature indicates that Wools is the best fabric to regulate temperature with minimum heat loss and maximum heat retention.

Conclusion: In conclusion, wool is the best fabric for regulating body temperature. It is lightweight and provides superior insulation due to its natural properties. Wool's crimped fibers trap heat in air pockets, and it can absorb up to 30% of its weight in moisture, releasing heat as it does. This experiment highlights wool's versatility, proving that it is effective year-round.

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

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
2025

Word Count	Fair Category	Project Number
239	P8	5521

Title: What Ingredients Keep a Cereal Crunchy?

Student Name(s): S. Shah

Abstract:

My project and experiment is testing how much milk plain Cheerios absorb when they are coated in different coatings. The purpose of this is to see what kinds of ingredients/coatings get cereal soggy, and what are their characteristics. This include how dense it is, how compacted the molecules are, what state of matter the thing coating the cereal is, and what ingredients are in it(sugar, milk, water, chocolate etc). I did this by having an experiment where I coated plain cheerios in different things, which were caramelized sugar water, maple syrup, milk chocolate, and no coating, which was the control group, and putting them in milk. Before and after putting them in milk, I would weigh the cereal to see what percent of its weight it absorbed in milk relative to its weight before going in milk. Before going in milk, the plain cheerios were 17.1 grams, and weighed 33.3 grams after being in the milk for 1 minute, and 40.7 grams after 2 minutes, meaning they absorbed 95% of their weight in milk in the first minute, and 138% of their weight at the end. Sugar-syrup coated cheerios gained -4% of their weight in the first minute, and 46% in the second. Maple-syrup covered cheerios gained 21% of their weight in the first minute, and 39% in the second while the chocolate covered cheerios gained -11% in 1 minute, and 67% in the second.

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

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
2025

Word Count	Fair Category	Project Number
207	P8	5522

Title: The Strength of Bridges

Student Name(s): E. Deshotel

Abstract:

The reason I chose this project is because I always wondered if there are so many bridge designs, why don't engineers use one, all-encompassing bridge design? So, I wanted to find out what the strongest bridge design is. So, I built two bridge designs, the cable stay and the suspension. The reason I chose these designs is because they are often referred to as "sister" bridges. I ran 20 tests on each bridge, going up in 100 grams until I reached 3600 grams (about 7.94 lb.), but none of the designs broke. So, I concluded that time must be a factor in the structural integrity of the bridges. So, I put 2345 grams (about 5.17 lb.) of weight on each bridge for 4 hours each. But the cable stayed bent erratically during both tests, so it led me to believe that if I had more weights and more time, the cable stay would have broken first. However, I do not have enough evidence to state which design is stronger, so my project is inconclusive. I hope other people continue this project so they can learn what the strongest bridge design is because this project, if finished, could help a lot of people with connectivity and safety.

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):

☐ 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
2025

Word Count	Fair Category	Project Number
266	P8	5523

Title: Investigating Modified Dental X-Rays in Novel Digital Computed Radiography Imaging for Emergency Medical Services

Student Name(s): D. Karpf

Abstract:

In the setting of emergency medical services, the need for rapid internal diagnostics in pre-hospital environments is crucial for saving lives. Life-threatening injuries, such as internal bleeding, often go undetected without imaging, leaving EMTs at a disadvantage and the patient without an air ambulance, instead riding as a low-priority patient without lights and sirens on the ground. A patient with severe internal bleeding will die during this 30-minute transport, while the patient may survive in an air ambulance transport. This study investigates the feasibility of using a modified dental X-ray system for portable medical imaging in ambulances.

A CAD model of the Azdent dental X-ray was designed and tested for ambulance compatibility. Experimental imaging was conducted on a simulated circulatory system made of 3.5 kg of iodine-infused gelatin and surgical tubing, as well as a pig pelvis with active IV iodine contrast. X-rays were taken at 60 kVp and 70 kVp with 2-second exposures, with results recorded on a PLA sheet and smartphone long-exposure imagery. Strong outlines were visible at 70 kVp for bone structures and 60 kVp for soft tissue contrast, demonstrating the system's potential effectiveness. A custom software solution was developed to enhance/analyze images from CRT monitors.

The results suggest that a modified dental X-ray could provide emergency responders with rapid, low-cost imaging for pre-hospital diagnostics. Within one week, further research will incorporate CRT screens to refine imaging techniques. This study highlights the potential for compact, field-deployable radiography, which bridges the gap between pre-hospital care and hospital diagnostics.

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

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

☐ human subjects ☒ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
215	P8	5525

Title: Maze Craze

TEACHING AI HOW TO SOLVE MAZES EFFICIENTLY

Student Name(s): A. Abdulkarim

Abstract:

This project studies the effect of training on the efficiency of an AI agent on solving mazes. The AI agent uses reinforcement learning which is a subcategory of Machine Learning that trains a model via trial and error. Every time the agent solves the maze is called an episode. The training is measured by the number of episodes that the AI attempted. To evaluate the AI agent's efficiency, we tested it for a specific number of times (1000 cases) and recorded how many times it will complete the maze in the smallest number of steps (the shortest path). Efficiency in this project is measured by the percentage of times out of the thousand cases that it solved the maze in the smallest amount of steps. I used different numbers of episodes ranging from 0 all the way to 300 to figure out how many episodes of training the AI needs to consistently learn how to solve the maze efficiently. From the results, I found out that at the beginning, the AI is completely clueless and goes in random directions, then it suddenly improves significantly. Once it reaches a high percentage (around 90%) it slowly inches towards perfection. This is eventually achieved when the AI agent consistently completes the maze in the smallest amount of steps.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
186	P8	5526

Title: Impact of Hydro-Turbines on Water Temperature

Student Name(s): A. Balajee

Abstract:

In 2023 hydro-turbines globally made up to 14% of renewable energy production. Surpassing wind and solar. Hydro-turbines have a lot of potential, and maybe in the future we'll find solutions to the problems that surround it. This project is addressing one of the major issues with hydro-turbines, its effects on water temperature; it will test the variables in a turbine that affects the temperature, to find the variables that have the bigger effect on the temperature and the ones that have a smaller effect. How the experiment will take place is; first, I'll have to hook up the GOLink, thermoprobe to the computer and pull up the data collection website and collect the initial temperature. Then, the set up, one of the turbines will be on a ring which will be held up in the container as well as the thermoprobe. Finally I'll turn on the sink water and it will go through the turbine makes it spin, then the water ends up in the container where after one minute, then I'll stop the water, measure the post temperature and collect the data.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
260	P8	5527

Title: Smart Eye: Affordable Assistive Glasses for the Visually Impaired

Student Name(s): I. Chugh

Abstract:

Background: In the USA, approximately 20 million people have visual impairments, facing daily challenges in navigating their surroundings safely and independently. Despite advancements in technology, there's still a lack of affordable solutions for these individuals. There is a need for devices that better support visually impaired populations. The purpose of this project was to create a simple, cost-effective wearable device to enhance mobility for the visually impaired.

That's where Smart Eye comes in. For under $30, it uses vibrations and sound to alert users for obstacles in their path, offering a practical, affordable tool for daily life.

Methods: The lightweight prototype was built using low-cost components like an Arduino board, a vibration motor, and a buzzer. Programmed in C++ using Arduino IDE, it detects obstacles and provides instant feedback through vibrations and sound patterns. Testing was conducted in various real-world environments, such as indoors/outdoors, sidewalks, and on the street to ensure its practicality.

Results: Smart Eye responds quickly to detect obstacles with detection times as low as 0.58 milliseconds at 10 cm and 23 milliseconds at 4 meters, ensuring timely alerts to avoid collisions.

Conclusion: Smart Eye is highly effective, cost-efficient, and far cheaper than devices like the $300+ WeWalk Smart Cane or $3,000+ OrCam MyEye, making it accessible to more people. Future upgrades include AI-powered object detection, text-to-speech, language translation, and Bluetooth connectivity for smartphone pairing, allowing users to identify objects, read menus, or translate languages on-the-go. Smart Eye shows that assistive technology can be both impactful and affordable.

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):

☐ 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
2025

Word Count	Fair Category	Project Number
148	P8	5528

Title: The Benefit of A Coded Device To Water Plants Automatically

Student Name(s): M. Cooper

Abstract:

The project aims to design a coded water pump and soil moisture sensor to decrease the number of plants that die over time and make it easier and more efficient to water plants. The proposed solution was to create a coded soil moisture sensor and water pump. A model was created to test the amount of water pumped into the plant over time. The Study determined how can a moisture level sensor and water pump be built using an Arduino board? The procedure of the project required connecting a lot of wires and testing the project many times. As a result of the data collected as the amount of time was increased the amount of water pumped into the plant was increased. In conclusion the soil moisture sensor and water pump prototype was successful because it has the potential to be used by farmers in their daily lives.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No