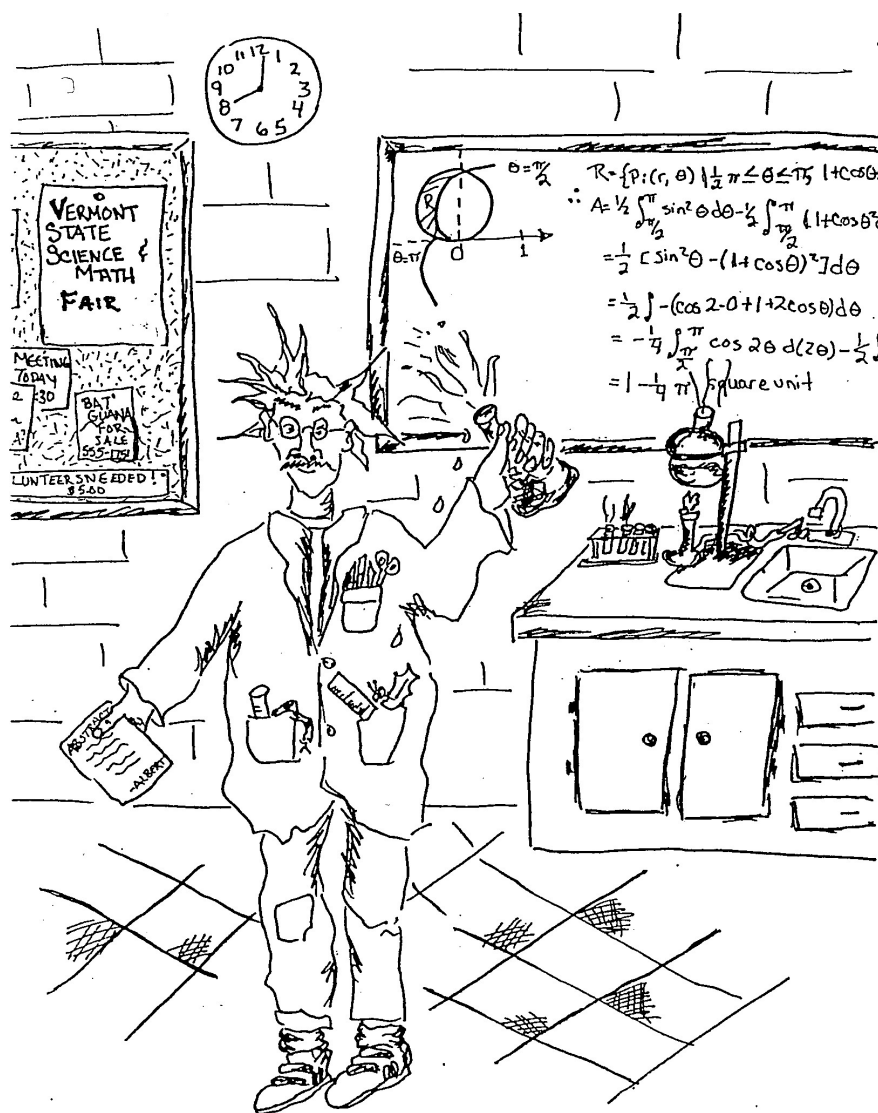


# 2011 Vermont State Science & Math Fair

*"Inspire and reward Vermont middle and high school students doing high quality research"*



Saturday April 2, 2001

Norwich University, Northfield, Vermont

# 51<sup>st</sup> Annual Vermont State Science and Mathematics Fair

## Awards Ceremony Program

Opening words by Professor Scott Page, Norwich University

Presentation by Matthys Levy: "The four I's, "Ideas, Imagination, Inspiration and Invention"

Acknowledgements of people and organizations

Presentation of certificates of participation and recognition by Tricia Finkle

Presentation of VPA medals and scholarship by Tricia Finkle

Presentation of Next Generation Scholarships by college representatives and Carl Pinkham

Presentation of Vermont Sponsor Awards and national awards by Carl Pinkham

Presentation of ISEF Affiliation awards by Alan Giese

Presentation of US Government and US Military awards by Carl Pinkham and US Military representatives

ISEF Finalist announcement by Carl Pinkham and Alan Giese

Acknowledgement of organizations who made this event possible

In addition to the Vermont Principals' Association, organizations across Vermont partnered with us to provide the awards and scholarships presented at the Awards Ceremony. (see the next page) Many more companies and universities are represented by the volunteer judges we had this morning.

Acknowledgement of people who made this event possible -- Way too many to get them all, but,

Co-directors Tricia Finkle and Carlos Pinkham

Tamara Jones, responsible for facility arrangements, set up and signage, and student volunteers

Alan Giese, responsible for many aspects of ISEF, including SRB work and ISEF prizes

Cathy Frey and Elizabeth Mathai, responsible for scoring supervision and reporting

Chico Hernandez, Executive Aide and facilities assistant

Louisa Tripp, who hosts on line forms

Scott Page, the Award Ceremony MC and producer

Jon Scherbatskoy, fair day media support specialist

All the judges

And Bob Johnson, Wendy Scott and others at the Vermont Principals' Association

## **Awards Program, April 2<sup>nd</sup> , 2011**

### **VPA Awards**

VSSMF Silver Medalists  
VSSMF Gold Medalists  
Vermont Principals' Association

### **Next Generation Scholarships**

St Michael's College  
Vermont Technical College  
Announcement about Green Mountain College  
and Norwich University's NG Scholarship  
winners  
Norwich University - top 5 juniors

### **VSSMF Local Awards**

American Chemical Society, Green Mountain  
Section  
Dufresne Group  
Entergy Vermont Yankee  
Ethical Science and Education Coalition  
Green Mountain Water Environment  
Association  
GroSolar  
Haematologic Technologies  
Kalow Technologies  
Nathaniel Group  
New England Institute of Food Technologists  
Northeast Branch, American Society of  
Microbiology  
NRG Systems  
Society of Manufacturing Engineers, Green  
Mountain Chapter  
Society of Women Engineers  
Sovernet  
Stockholm Junior Water Prize  
Tau Beta Pi  
Tcorp  
Ted Marsden Memorial Award  
Vermont Academy of Arts and Sciences  
Vermont Chapter, Sigma Xi  
Vermont Organization of Nurse Leaders

### **National Awards**

Grades 5-8  
Broadcom Masters  
  
Grades 9-12  
I-SWEEEP  
Genius Olympiad

### **ISEF Affiliation Awards**

Grades 5-8  
U.S. Marines  
  
Grades 9-12  
American Meteorological Society  
American Psychological Association  
American Society of Materials  
Association of Women Geoscientists  
Intel Excellence in Computer Science  
Mu Alpha Theta  
National Society of Professional Engineers  
Ricoh Sustainable Development  
Society for In-vitro Biology  
United States Metric Association  
Yale Science and Engineering Association

### **U.S. Government Awards**

National Oceanographic and Atmospheric  
Association  
Department of Health & Human Services

### **U.S. Military Awards**

U.S. Army  
U.S. Navy  
U.S. Air Force

### **ISEF Finalists**

The VSSMF is an all-volunteer organization. Over 80% of the money raised goes to students and their teachers. The remainder goes to operating costs. The money raised comes from 52 financial partners in Vermont who provide gifts or grants from \$50-\$1000. This year, these partners provided over \$14,000 in support. Money also comes from 25 award sponsors in Vermont who provide over \$6000 in prizes. In addition to the above money raised by VSSMF, four Vermont colleges provide Next Generation Scholarships totaling over \$800,000. Finally, our affiliation with competitions beyond Vermont provides another \$14,000 to Vermont students and their teachers.

The following lists the above Vermont stakeholders who as partners and sponsors, consider investing in YOU NOW to be a wise move so they can employ you in the future when you finish your education!

## VERMONT PARTNERS

Abacus Automation Bennington	Environmental Compliance Services Brattleboro	Med-Associates St. Albans
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Ascension Technology Milton	FairPoint Communications South Burlington	Norwich University Northfield
ATC Associates Williston	General Dynamics Armament and Technical Products Burlington	Norwich University Applied Research Institute Northfield
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Castleton State College Castleton	Haematologic Technologies Essex Junction	PKC Corporation Charlotte
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EF Wall Barre	Kalow Technologies North Clarendon	Rock of Ages Graniteville
Engleberth Construction Colchester	Lyndon State College Lyndonville	Saint Michael's College Colchester
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Burlington

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Vermont Systems, Inc  
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Microbiology  
Northfield

NRG Systems  
Hinesburg

Polhemus  
Colchester

Society of Manufacturing Engineers  
Green Mountain Chapter  
Grand Isle

Society of Women Engineers, North  
Country Section  
South Burlington

Sovernet  
Bellows Falls

Stockholm Junior Water Prize  
Montpelier

Tau Beta Pi, Norwich University Chapter  
Northfield

Tcorp, Inc.  
Colchester

Ted Marsden Memorial Award  
Northfield

Vermont Academy of Arts and Sciences  
Northfield

Vermont Chapter, Sigma Xi  
Northfield

Vermont Organization of Nurse Leaders  
Montpelier

## **SCHEDULE OF EVENTS**

April 2, 2011

<b><u>TIME</u></b>	<b><u>EVENT</u></b>	<b><u>LOCATION</u></b>
7:45 am - 9:00 am	Students Set Up Projects	Science Complex
9:00 am - 12:30 pm	Judging of Projects - Open to the Public	Science Complex
10:00 am - 10:30 am	Break - No Judges scheduled	
12:30 pm - 1:20 pm	Luncheon	Harmon Hall
1:20 pm - 3:00 pm	Awards Ceremony	Dole Auditorium in Webb Hall

**Projects must remain in place at least until 12:30 pm to be eligible for monetary awards.**

NAME(s)	<b>Aya AL-Namee</b>	PROJECT NUMBER	<b>C01</b>
SCHOOL	South Burlington High School	GRADE	<b>12</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Periodic trend in Dehydrocoupling Catalysis</b>		

## ABSTRACT

Dehydrogenative coupling of main group elements is an area of ongoing interest as an environmentally benign alternative to Wurtz-type reactions. The catalytic dehydrocoupling of primary and secondary phosphines by homogeneous, triamidoamine-supported zirconium complexes has been reported in the literature. We hypothesized that the catalytic activity of triamidoamine-supported group 4 metal complexes would follow a periodic trend and increase with the metals electronegativity (Ti>>Zr>Hf).

Herein, we report the synthesis of triamidoamine-supported Ti (IV), Zr (IV), and Hf (IV) catalysts and their activity for the dehydrocoupling of phenylphosphine. We used the Waterman procedure to make the Zr (IV) and Hf (IV) complexes and the Shrock procedure to make the Ti (IV) complex. After making the complexes, we are going to compare their reactivity by measuring the rate of each reactions and the activation energy for each complex.

NAME(s)	<b>Matthew Andrew</b>	PROJECT NUMBER	<b>S01</b>
SCHOOL	The Renaissance School	GRADE	<b>6</b>
TEACHER	Eve Dubois		
PROJECT TITLE	<b>Chew to Remember? Walk Backwards to Sharpen Thinking?</b>		

## ABSTRACT

Will physical movements such as chewing gum and walking backwards help improve attention, concentration, and memory?

I predicted that physical movements help everyone improve focus and learning, some much more than others, as there is a mind-body connection.

I first administered an auditory test to determine how many words my classmates were able to recall and write down after I read out a list of 20 words. Then I asked everyone to chew gum before I read another 20 words and had them write down those they remembered.

The second experiment I did was a visual test to figure out whether focus and attention improved after walking backwards. First I asked my friends to sit and take the Stroop test, a list of names of colors printed in various colors of inks. The word black, for instance, might be printed in green. The challenge is to say the name of the ink color (green) you see as fast as possible and inhibit (disregard) the actual word (black) you read. Then they walked 6 steps backwards before taking the Stroop test again.

Chewing gum worked great for some kids while it posed a potential distraction for others. Three students had a 5-20% improvement in their scores. Two students had no change. However, two did significantly worse--a 10-35% decrease, and quite surprisingly, as they were the top scorers when they didn't chew gum!

I anticipated that scores would vary because kids learn differently. (Chewing gum helps me focus. When I took the test without the use of chewing gum I got just 45% of the words--nevertheless, I got 90% when chewing gum.) But I envisioned chewing gum would be helpful for all. What I failed to realize was that it really deteriorated the scores of some. It might be that chewing gum distracted them rather than causing them to focus!

NAME(s)	<b>Chelsea Aube'</b>	PROJECT NUMBER	<b>C02</b>
SCHOOL	Hinesburg Community School	GRADE	<b>8</b>
TEACHER	Stephanie Konowitz		
PROJECT TITLE	<b>Paint Vs. Rust</b>		

## ABSTRACT

Most people have a problem with rusty cars throughout Vermont. This causes large bills for repairing the damage. My experiment was designed to see what kind of paint would prevent rust the most. The results may help to lower the amount of damage caused by rust.

Three out of 4 groups of 3 pieces of metal were each painted with a different type of paint. The 4th group was left plain. The metals were then soaked in salt water over night then hung to dry all day. I did this twice. The amount of rust on the metals was then estimated.

The percentage of rust on the metal painted with rust prevention paint was less than the percentage of rust on any other piece of metal. The paints really worked there was less rust. This proves that rust prevention paint and some other paints help protect metal from rust damage.

NAME(s)	<b>Cassidy Auger</b>	PROJECT NUMBER	<b>B01</b>
SCHOOL	Fair Haven Union High School	GRADE	<b>10</b>
TEACHER	Michael Schwaner		
PROJECT TITLE	<b>Buffers</b>		

## ABSTRACT



NAME(s)	<b>Anna Baker</b>	PROJECT NUMBER	<b>B48</b>
SCHOOL	Mill River Union High School	GRADE	<b>10</b>
TEACHER	Mrs. Raiford		
PROJECT TITLE	<b>Effects of Radiation on Spirogyra</b>		

## ABSTRACT

Effects of different forms of radiation on spirogyra was performed with a UVA (black light), a microwave, and natural sunlight on common clear water algae. The main idea of this experiment was to determine to what degree does radiation we encounter every day affect a simple unicellular organism. First, the spirogyra was placed in six different test tubes, two of which were exposed to UVA light for a controlled amount of time, then two which were exposed to microwave radiation for a controlled amount of time, then the last two which were continuously exposed to natural sunlight. Once the organisms were exposed for the certain amount of time, they were taken out of their test tubes and placed on a slide underneath a microscope. From here, they were examined and observed for any changes in the chloroplast within the organism. After examining each set of data, conclusions were made. First and foremost, major changes in chloroplast were observed. The spirogyra exposed to microwave radiation appeared to be scrambled and altered. The chloroplast became unorganized and scramble. Then when observing the spirogyra that was exposed to UVA radiation, the alteration was even greater than that exposed to microwave radiation. The UVA lighth seemed to break down the cell wall in each of the cells of spirogyra. The radiation also scrambled the chloroplast, just as the microwave radiation did as well.

NAME(s)	<b>Sarah Baker</b>	PROJECT NUMBER	<b>P01</b>
SCHOOL	Green Mountain Union High School	GRADE	<b>7</b>
TEACHER	Karen Surma		
PROJECT TITLE	<b>Baker's Ovens</b>		

## ABSTRACT

### Abstract

○My topic was making an Baker's Ovens. I wanted to see if i could make an oven out of a cardboard box and a heat lamp. My hypothesis is if I make an oven with a heat lamp then I will be able to cook an egg and other common foods. I took a cardboard box and lined it with insulator tape. I cut holes for the thermometer and heat lamp. I cooked different foods for ten minutes in the oven.I recorded the temperature. My results were that my oven cooked everything I tested. I think my oven could cook mostly anything. I found out that a heat lamp can heat an oven hot enough to cook an egg and other common foods.

NAME(s)	<b>Micaila Baroffio</b>	PROJECT NUMBER	<b>C03</b>
SCHOOL	Northfield Middle/High School	GRADE	<b>11</b>
TEACHER	Cynthia Tomczyk		
PROJECT TITLE	<b>The Effect of Temperature on the Amount of Vitamin C in Lemon Juice</b>		

## ABSTRACT

This science fair project dealt with the effect of temperature on vitamin C content in orange juice or lemon juice, using the titration of an indicator. The final hypothesis was: If 10 milliliters of dichloroindophenol is used to titrate lemon juice at 0°C, 15°C, 37°C, and 60°C with three trials each compared to the titration of 0.2% vitamin C solution, then the higher the temperature of the lemon juice, the more drops of lemon juice will be used to reach the titration endpoint and the more decreased the vitamin C content will be. 250 milliliters distilled water and 0.125 grams dichloroindophenol is added together; 500 milliliters distilled water is added to 1000 milligrams (two crushed 500 milligrams tablets) of vitamin C to create 0.2% vitamin C solution. Using a graduated cylinder, 10 milliliters 0.05% indicator is measured into a test tube. An eyedropper is then used to add drops of lemon juice one by one to the test tube, stirring after every drop. This process is repeated twice more for three trials; the entire process is then repeated for three trials of each temperature. The formula: drops standard multiplied by concentration standard equals drops unknown multiplied by concentration unknown is then used to discover the milligrams of vitamin C per 100 milliliters juice. The data for the third experiment was an average of 59 drops for 2.6°C, 51 drops for 21.9°C, 60 drops for 38.0°C, and 69 drops for 60.2°C; for the concentration it was 64 milligrams per 100 milliliters for 1.9°C, 86 milligrams for 21.9°C, 73 milligrams for 39.1°C, and 70 milligrams for 60.4°C. The principal findings for this experiment showed an increase in number of drops with the increase in temperature, supporting that higher temperatures break down the vitamin C and cause an increase in number of drops.

NAME(s)	<b>Sam Barritt</b>	PROJECT NUMBER	<b>B53</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Hearing Loss in Teens</b>		

## ABSTRACT

The purpose of this experiment is to see if teens listening to loud music can result in Noise Induced Hearing Loss. Heavy Listening will be defined as listening to music for more than 60 minutes at once at more than 60% volume. Before experimentation, a survey was conducted on a sample of the student body, 85 sophomores. This survey concluded that 37 out of the 85 students listened to music at over 60% volume, about 43%, and that 45 of them listened to music for more than 60 minutes at a time, about 53%. From these numbers we can conclude that 27 in 119 students are “heavy listeners”, or about 23%. The next step, which is in progress, is to actually test a number of students on the school’s hearing test machine, making sure to survey them on their listening habits first. In testing 20 subjects, there should be about 4 or 5 “heavy listeners” among them. The data so far has revealed that nearly all subjects have been testing perfect, or passing on the nurse’s standards. There are very few outliers, but they have informed me of previous diagnoses. It looks as if my hypothesis will not be supported and no correlation will be found between “heavy listening” and Noise Induced Hearing Loss. This project’s contributions will include informing teens and adults alike on what the consequences of listening to loud music really are.

NAME(s)	<b>Justin Beaudoin</b>	PROJECT NUMBER	<b>P02</b>
SCHOOL	St, Francis Xavier School	GRADE	<b>7</b>
TEACHER	Mary Ellen Varhue		
PROJECT TITLE	<b>The Pow in Power</b>		

## ABSTRACT

Harnessing the power of the wind may be the answer to our future energy problems. My research question was how does the amount of blades affect the power of the wind turbine? My hypothesis was I thought that 3 blades would be better then 2 or 6 blades. What I did to try and test my hypothesis was to build a set of a wind turbine blades and use them to lift a weight. The less powerful the turbine, the longer(in seconds) it would take to lift the weight. I tested 3 blades, 2 blades, and 6 blades; all five times each. Each time the fan was on speed 3 and 1 yard away. Two strips of tape told me when to start timing, and when to stop timing. The weight was 50 grams each time. My test results disproved my hypothesis completely. 6 blades did the best, then 2 blades, and then last was 3 blades. There were a couple of problems. First the turbine blades were thin and not very strong. I had difficulty keeping each blade consistent. I also think that if my blades were closer to full scale and the wind moved and changed speeds it would test the turbine more realistically. I would like to try this experiment with blades that more closely model an actual turbine blade.

NAME(s)	<b>TJ Beaumier</b>	PROJECT NUMBER	<b>P03</b>
SCHOOL	Avalon Triumvirate Academy	GRADE	<b>8</b>
TEACHER	Amanda F. Gifford		
PROJECT TITLE	<b>Up, Up, and Away</b>		

## ABSTRACT

I wondered how the different shapes and angles of airfoils would change the amount of lift that the airfoils made.

My thought about this was that flat-bottomed airfoils would create more lift then the symmetrical ones. I also thought that the symmetrical ones may not make as much lift. But they would make it easier to go up or down.

Foam airfoils were used in this experiment because they are light and somewhat strong. A small fan was also used to represent the wind. In this experiment the fan was pointed at the airfoils which were situated in a holder that let them move up and down but did not let them change angle. I tested the three different wind speeds that I could and different angles of two shapes of airfoils.

I saw that at some angles, both airfoils worked pretty much the same. But at some angles they worked very differently.

I think that depending on where, what angle, and how you use them different airfoils are good for different things.

NAME(s)	<b>Maia Bertrand</b>	PROJECT NUMBER	<b>P04</b>
SCHOOL	Hinesburg Community School	GRADE	<b>8</b>
TEACHER	Maria Duryea		
PROJECT TITLE	<b>Particles and Light Waves: The Blue Sky</b>		

## ABSTRACT

Particles and Light Waves: The Blue Sky

What at first seems like a simple question is really not so simple and worth further study. What actually causes the sky to appear blue to us and a sunset red? Philosophers such as Socrates, Plato and Aristotle tried to answer this question over 2400 years ago. This study tests how suspended particles effect the scattering of different colors of light.

To test my experiment, a light was beamed through a three foot long test chamber filled with various substances. At the end of the test chamber was a camera with a diffraction grating attached to the lens to capture the light spectrum. A computer program analyzed the spectrum and produced an intensity plot showing the brightness of each color. From the data, the amount of light scattered by color can easily be determined.

Blue light was scattered more than red light by the particles. These results confirm what is seen in our sky. When the sun sets the light travels through more particles causing even more blue scattering which makes the sun appear red and the overhead sky a deeper blue. The data also showed that the smaller the suspended particles are, the more blue light is scattered.

NAME(s)	<b>Lucie Bodnar</b>	PROJECT NUMBER	<b>G01</b>
SCHOOL	Windsor High School	GRADE	<b>11</b>
TEACHER	Jennifer Townsend		
PROJECT TITLE	<b>Effects of snow melting substances on grass growth</b>		

## ABSTRACT

○I researched how snow melting substances, such as sand, calcium chloride, and potassium chloride, affect grass growth. After exploring background research I found out that chemical salt prevents osmosis from occurring. From learning this, I hypothesized that the tray containing sand and soil would produce grass, because sand is a naturally occurring resource and does not stop osmosis from happening. I poured an equal amount of soil and grass seed into four equally sized trays. I then scattered sand onto the soil in one tray, calcium chloride onto the soil in another tray, and potassium chloride onto the soil in the third tray. I had my fourth tray contain just the soil and grass seed; this tray served as my control in the experiment. I made multiple trials of each tray, so there was two of each sample. I kept the soil moist and made sure that each sample received four hours of direct sunlight everyday. I observed my trays for twenty-two days and recorded my data. I concluded at the end of the twenty-two days that the chemical salts that were on the soil prevented grass from growing completely, while the sand on the soil was able to produce grass at a slightly slower rate than that of the control. I concluded that sand is a healthier, more efficient way to prevent slippage, because it does not harm grass growth.

NAME(s)	<b>Michelle Bolger</b>	PROJECT NUMBER	<b>B02</b>
SCHOOL	St. Francis Xavier School	GRADE	<b>8</b>
TEACHER	Mary Ellen Varhue		
PROJECT TITLE	<b>Wreckless Runoff</b>		

### ABSTRACT

Purpose- The purpose of my experiment was to make people aware of the harmful effects of pollution. I wanted to show them the effects of over use of phosphates on water life.

Hypothesis-If the amount of phosphates in the solution increase, the time it takes for the daphnia to die will decrease.

Procedure- Label glasses with # 1-5. Fill glass # 1 with 1 cup of bottled water. With your dropper, suck up 5 daphnia and place them gently in glass #1. This is your control, set aside and keep a close eye on them. In glass # 2, place a cup of bottled water. Measure out a ¼ teaspoon of Miracle Grow and place it in glass #2. Stir with a plastic spoon. With your dropper, suck up 5 daphnia and place them gently in glass #2. Place near your desk lamp so that the daphnia are easier to view. Start the timer and watch the daphnia. Every 2 minutes record how many are still alive.(you can tell if they are dead if they stop moving and float to the bottom of the glass). Keep checking and recording results until you can strongly conclude that all are dead. Then move onto Glass # 3, #4 and #5 increasing the amount of Miracle Grow in intervals of 1/4 teaspoon.

Results/Conclusion-My results showed that the more Miracle Grow I put in, the quicker it took for the daphnia to die. When I put a ¼ teaspoon in, it took about 14 minutes for all 5 of the daphnia to die. When I put a full teaspoon in, it took under two minutes. My original research question was, “What is the effect of water pollution, (over use of phosphates), on water life?” My conclusion was that they can quickly kill aquatic life.

NAME(s)	<b>Morgan Boss</b>	PROJECT NUMBER	<b>B63</b>
SCHOOL	Hinesburg Community School	GRADE	<b>8</b>
TEACHER	Stephanie Konowitz		
PROJECT TITLE	<b>Flavor Savor</b>		

### ABSTRACT

People do not typically take into consideration whether children or adults are better at identifying tastes. When you are young, you have more taste buds, and as you age these begin to fade away. You also have keen hearing, and good eyesight when you are younger. As you age these strong abilities begin to weaken. Does the same apply to taste?My experiment was designed to find out if and how age makes a difference on ability to identify simple tastes.

Strawberry, Orange, Grape, and Cherry flavored gummies were eaten by twenty people in the age range of 20-30, and twenty more people in the age range of 7-14, while blindfolded. They proceeded to guess a flavor, which was recorded. After each age group was tested, I calculated how many people guessed correctly.

I concluded that children are better at identifying these flavors vs. adults. I figure this because children do have better hearing and sight. Less than half of adults guessed correctly, and 80% of children had guessed the correct flavor. The results were not close at all, so it is easy to conclude the younger subjects are better capable of identifying the tastes.

NAME(s)	<b>Alexis Boyd</b>	PROJECT NUMBER	<b>B54</b>
SCHOOL	Avalon Triumvirate Academy	GRADE	<b>7</b>
TEACHER	Amanda F. Gifford		
PROJECT TITLE	<b>Let the Music Play</b>		

## ABSTRACT

Some people have very different music likings. Some people get angry or hyper when listening to music they do not like, and more calm when listening to music they do like.

This project tests what effects different types of music have on the blood pressure of different test subjects. Different people were tested with classical music and then with hard rock. I took everybody's resting blood pressure than I took everybody's blood pressure after listening to rock than classical music for about 20 minutes. I did this over multiple days to make sure that my data was accurate.

Materials used were: music of different genres, blood pressure cuff, test subjects, and pencil.

My hypothesis is that a person who prefers rock music will be affected differently than someone who prefers classical music, their blood pressure will either go up or down.

I observed that each subject's blood pressure went down when listening to classical music and after listening to hard rock their blood pressure went up. My hypothesis was supported.

This research shows that classical music will bring your blood pressure down and rock music will raise your blood pressure.

NAME(s)	<b>Paige Brigham, Christina Tang</b>	PROJECT NUMBER	<b>GP01</b>
SCHOOL	Main Street Middle School	GRADE	<b>8</b>
TEACHER	Amy Kimball/Jesse Wolfe		
PROJECT TITLE	<b>How does deforestation affect temperature?</b>		

## ABSTRACT

Our testable question was how does deforestation affect temperature? We wanted to test this question because deforestation is a huge problem on Earth and deforestation causes global warming which is another big problem that needs to be dealt with. To test our question, we conducted our experiment. We took two containers, one container has plants and the other does not. We inserted a thermometer in each container and put it into the shade for two weeks. After two weeks, we put both containers into the sunlight and put two heat lamps, one on each side of the containers, and then recorded the temperature of each container every three minutes for an hour.

We did the experiment two more times and averaged the data. Our hypothesis was that the container with plants would have a lower temperature than the container without plants because the container with plants will provide shade, which will decrease the temperature. The data showed that the container with plants had a lower temperature than the container without. The final average temperature of the container with plants was 122 degrees Fahrenheit, and the container without plants had a final average temperature of 141.8 degrees Fahrenheit. Therefore, we can conclude that deforestation has an impact on temperature-making it increase. We think when CO<sub>2</sub> levels increase, it causes temperature to increase. The data supports our hypothesis, but after researching more, we learned that shade and green house gasses also has an impact on temperature because of the atmosphere. People can use this information to understand how deforestation impacts the Earth and they can plant trees and try to prevent deforestation.

NAME(s)	<b>Celina Bronson, Dustin Lewis</b>	PROJECT NUMBER	<b>GP02</b>
SCHOOL	Fair Haven Union High School	GRADE	<b>11</b>
TEACHER	Ben Worthing		
PROJECT TITLE	<b>What Is In Your Mouth?</b>		

### ABSTRACT

As many athletes will concur, mouth guards are kept in many odd places, from the bottom of a shoe to behind one's ear. To learn more about what exactly could be making a home in mouth guards it was decided to design an experiment to decipher just that. The purpose of this project was to unveil what is growing on these mouth guards and what could possibly infect America's athletes, and to raise awareness about these dangers.

The hypothesis was: if exposed to common areas athletes keep their mouth guards, then microorganisms will grow, and the area behind the ear would grow the least. The mouth guards were moistened with saliva (mouths were sanitized) and placed in common situations such as: in a shoe, a gym bag, behind an ear, dropped on the ground, in a soccer sock, and a control (not moistened). They were swabbed and cultured. After seven days of observation it was concluded that the ear had the least growth, thus, proving the hypothesis to be correct. After careful examination, identification of the growths was attempted. It was decided that some of the growths were mold, fungi, and some were indeed bacteria. If this experiment was to be repeated, the cultures could have been kept at a steady temperature. To expand on this idea, one could test the popular antimicrobial mouth guard cases to see if they are actually antimicrobial or not.

NAME(s)	<b>Marjorie Brown</b>	PROJECT NUMBER	<b>S02</b>
SCHOOL	Hinesburg Community School	GRADE	<b>6</b>
TEACHER	Stephanie Konowitz		
PROJECT TITLE	<b>The Apple Doesn't Fall Far From the Tree</b>		

### ABSTRACT

Most religions consider homosexuality to be against the natural order. A person's view on homosexuality is also influenced by the people they grew up around, especially their parents. People who graduate from high school and attend at least some college seem to have a more open-minded view on such things. I am a strong supporter of equal rights for people of any sexual orientation, so I thought it would be interesting to see why people have certain opinions on the issue, and if kids are mostly influenced by their parents, or tend to disagree with their world view. I asked the question, "does a person's parent's religious and educational background and opinion on homosexual rights affect their own view on homosexual rights". To get an objective answer, I developed two surveys that I administered to 38 students in grades 7-8. One was to collect basic demographic information. The other was to collect emotional reactions to a series of photographs displayed in a slideshow. The student's parent's education and religion did not affect the student's view on homosexuality as much as parental influence. Most students agreed with their parent's views on homosexual rights.

NAME(s)	<b>Christian Brunelle</b>	PROJECT NUMBER	<b>P05</b>
SCHOOL	St. Francis Xavier School	GRADE	<b>7</b>
TEACHER	Mary Ellen Varhue		
PROJECT TITLE	<b>Got Insulation?</b>		

## ABSTRACT

Purpose: The purpose of my experiment was to see which kind insulation will work best: Foam, Fiber glass, or Rock wool.

Hypothesis: I thought fiber glass would have the smallest temperature drop.

Materials: Three equal sized buckets with the three types of insulation placed around a smaller container.

Procedure : First, heat hot water to a temperature of 177.8 F. Next, measure the temperature of the air at room (70F). Third, put the 1  $\frac{1}{2}$  cups of hot water in the insulation buckets. Fourth, measure the water temperature in the insulation buckets every 5 minutes. Finally, record all the results. This experiment was then repeated measuring the temperature every 10 minutes and with an insulated cover added.

Results/Conclusion: Fiber glass ended up being the best type of insulation and it is also the easiest to handle. That means that my hypothesis was right. Rock wool and foam were nearly identical. Heat rises, so adding the insulation covers to the top of the water containers, significantly reduced the rate of heat loss by more than 2  $\frac{1}{2}$  times and 3 times.

Sealing in the covers with 3 thermometers, one in each container would significantly reduce the rate of heat loss even more. Improving the accuracy of the materials used in the set up would have some positive effect.

NAME(s)	<b>Nathan Budgor</b>	PROJECT NUMBER	<b>B03</b>
SCHOOL	Northfield Middle High School	GRADE	<b>11</b>
TEACHER	Cynthia Tomczyk		
PROJECT TITLE	<b>The Effect of Different Amounts of Light on the Decay Rate of Bananas</b>		

## ABSTRACT

This project determined the effect that different amounts of light had on several bananas' decay rates compared to the decay rate of bananas in darkness. If a banana is placed under a 40 watt light bulb, a second under a 60 watt light bulb, and a third banana under a 100 watt light bulb, and is compared to the results of a banana in no light at all, then the more light the banana is given the slower the rate of decay because fruit needs sunlight to grow when attached to the tree, and the artificial light could preserve the fruit for a while after it is picked.

I placed four unpeeled bananas in a dark, small room with a closed door and put a thermometer in each to measure the temperature. In three of these rooms I placed lamps above the bananas with different watt light bulbs. In the fourth room, four bananas lay in darkness and were the control. I waited about 5 days and observed the rate of decay until the bananas were all yellow and recorded the data. The decay rate for the bananas in darkness was 157 hours and 17 minutes. The decay rate for the bananas under 40 watts was 162 hours and 24 minutes. Decay rate for bananas under 60 watts was 169 hours and 12 minutes. The decay rate for the bananas under the highest amount of light, 100 watts, was 190 hours and 22 minutes. Using the highest and lowest amounts of light show the full range of how the bananas were affected. My conclusion, based on this data, is that the higher amounts of light preserved the bananas from decaying fast while the bananas in darkness show how much faster the absence of light affects freshness.



NAME(s)	<b>Noah Bugbee</b>	PROJECT NUMBER	<b>B36</b>
SCHOOL	Noah Bugbee	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Which Plants to “Root” For?</b>		

## ABSTRACT

This project is designed to give us information on rooting success for stem cuttings of different species of plants under certain conditions. Rooting is a key aspect in cloning plants. This lab will provide results on the rooting success of Coleus, Plectranthus, Christmas cactus, and beefsteak begonias. I am trying to find whether different plant species root better, whether amount of light makes a difference, and whether or not the plants will root successfully with or without rooting hormone.

Each of the four plant species mentioned represent very different types of plants.

Stems approximately 1 inch in length with a few leaves were cut from fully grown plants of each species. Cuts in leaves were needed to be made to some species while others only needed to have their stems put into the soil. The cuttings are currently rooting in 50/50 perlite-vermiculite soil in a growth chamber at 23 || C. The growth period began on 2/20/11 and will end 3/27/11. Once the stems have been given ample time to grow in these environments, the rooting success for each species will be measured.

I will measure rooting success by removing plants from the growth media and measuring the lengths of the roots formed. Additionally, I will take note of how many roots form and measure the root mass for three of the five replicants of each species for each treatment involved.

NAME(s)	<b>Maria Burt, Michael Gose</b>	PROJECT NUMBER	<b>GP03</b>
SCHOOL	Fair Haven Union High School	GRADE	<b>11</b>
TEACHER	Shaun Ketcham		
PROJECT TITLE	<b>"Wood" You Like Whiter Teeth?</b>		

## ABSTRACT

In this project, we used eggs (whose shells provide a substance similar to that of tooth enamel) to discover if wood ash is able to naturally whiten teeth and compare its power to other methods of whitening. The other methods used were hydrogen peroxide, sodium bicarbonate (baking soda), salt, and Crest whitening toothpaste. We thought, after performing a significant amount of research, that wood ash would be the most effective, natural whitener. In order to test this, we soaked hard-boiled eggs in coffee to simulate staining teeth. Then we brushed a set of two eggs with a total of five different whitening methods. After a period of seven days had passed, with us consistently brushing the eggs every other day, we determined which method was the most efficient. Over the week-long period, hydrogen peroxide performed the worst, followed closely by wood ash, and then salt. The Crest whitening toothpaste and baking soda performed very well. Overall, the whitening toothpaste was the most effective at reducing the stains on the eggshells. However, taking into consideration the fact that we wished to find the most natural method of whitening teeth, one must also declare baking soda the best natural whitener. Furthermore, for practicality's sake, one must take into account that salt performed the best naturally and was the, according to research, the least intrusive to enamel.

NAME(s)	<b>John Cahee</b>	PROJECT NUMBER	<b>P06</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Susan Ponto		
PROJECT TITLE	<b>Which Light Color Increases the Effectiveness of Night Vision Goggles</b>		

### ABSTRACT

Night vision is a revolutionary technology that allows a human to see in utter darkness. As it is still young, testing is still going on to improve the sight. For this experiment, the effect of different wavelengths of light is being tested. Lights used were infrared rays, green light, red light, and blue light. The control was no outside light. The hypothesis was that the infrared rays would work best, as the camera was designed for this light. Three volunteers took an Infrared camera into a small course to find an object- in this case, a gray bottle. Each were timed by a non-participant, and these times were averaged and compared to find out which of these lights yielded the best visibility.

As for results, it turned out that green light was the best, yielding an average of 48 seconds. The worst vision was actually the one using the Infrared Rays, with an average time of 2 minutes and 30 seconds. There were a few areas of possible error. These included the random placement of the object, the person's eyesight, equipment malfunctions, and obstacles in the course that may have hindered movement. It was surprising that the infrared light took the longest time. This would be useful information because, for example, those who search for objects, animals, or people and must do this in dark areas or at night would know that this technology could work without an infrared light.

NAME(s)	<b>Kate Candon</b>	PROJECT NUMBER	<b>B55</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Dawn Adams		
PROJECT TITLE	<b>I Scream, You Scream, We All Scream For... Salt?: The Effect of Different Salts on Homemad</b>		

### ABSTRACT

Making homemade ice cream is a task that people think is difficult, but with the right freezing agent is actually quite easy and yields a delicious product. In this project, different salts were used in the freezing agents for ice cream to see the different effects salts would have on ice cream. The temperature of the freezing agent was measured and the texture of the ice cream was analyzed to determine which type of salt produced the smoothest ice cream. In this experiment, two Ziploc bags were used to make ice cream in only five minutes. After putting the ice cream mixture into a smaller bag, ice and salt were added to a larger bag. The small bag was put in the large one and the two were shaken. Ice was present in all of the freezing agents, and different salts were added to seven of the eight. Just ice was the control, and rock salt, table salt, iodized table salt, kosher salt, no sodium salt substitute, sea salt, and driveway salt were also tested. The hypothesis stated that the rock salt would produce the smoothest ice cream. This hypothesis was accepted because in all three trials, this salt created a melt-in-your-mouth ice cream that was smoother than the other ice creams, yet still frozen. The quality of the ice cream, the dependent variable, was altered by changing the type of salt used, the independent variable. This project gives a greater understanding of freezing point depression and allows people to make high quality ice cream with simple materials.

NAME(s)	<b>Reilly Candon</b>	PROJECT NUMBER	<b>C04</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Tim Gilbert		
PROJECT TITLE	<b>Which Cleaning Substance is Best on Teeth?</b>		

### ABSTRACT

Twelve molars were placed in separate Petri dishes. Six were placed in soda and six were placed in lemon juice. Each tooth was brushed daily with one of the cleaning substances. Two of the teeth, one from the lemon juice and one from the soda, were washed with water and were the controls. Every three days I observed, recorded and took pictures of the changes I saw. After three weeks I was able to determine which cleaning substance was best in protecting teeth from acid and sugar. My experiment concluded that the best cleaning substance against the discoloration and decay of teeth due to acid and sugar was baking soda. Baking soda thoroughly protected the tooth in the sugar against discoloration and decay, and it did the best in protecting the tooth against acid. Baking soda is especially effective against discoloration. It is abrasive and therefore scrapes off stains and breaks down discoloration. The next best cleaning substance was fluoridated toothpaste. It was very successful in protecting the teeth against sugar and acid. Tartar protection was third. While it did do a good job in protecting the tooth against sugar, it was not as effective against acid. Fourth was water, the control. Nonfluoridated toothpaste was fifth. Both the teeth in the sugar and the acid had some discoloration and the beginnings of decay. Last was mouthwash. The mouthwash was the least effective against acid and sugar. Both teeth had multiple cavities and were discolored. Both of the teeth also let off a strong odor of decay. Overall, this experiment taught me to use baking soda and toothpaste with baking soda to clean my teeth.

NAME(s)	<b>Morghan Charron</b>	PROJECT NUMBER	<b>B56</b>
SCHOOL	Mill River Union High School	GRADE	<b>10</b>
TEACHER	Carolyn Raiford		
PROJECT TITLE	<b>"Digging Away"</b>		

### ABSTRACT

This project was designed to compare the tunneling behaviors of harvester ants, often known as "grass clippers", in two microgravity chamber which were placed in varying conditions of light and dark. Two microgravity changers were used. 50 harvester ants were placed in each one. Over a period of several weeks these ants were observed in these microgravity chambers. The two units were divided, with one being kept in the light and the other one had a black plastic bag over it. This will show the difference between how ants tunnel in the light and how they tunnel in the dark. Data included the differences between the two units, detailing such things as tunnel shapes, lengths and directions. There were many differences, but the most prominent difference was the directions of the tunnels. The ants that tunneled in the light tunneled towards the top of the unit. The ants that tunneled in the dark did so more toward the sides, almost as if they thought they were further underground. This project was initiated by NASA originally, and placed aboard the space shuttle Columbia; however with the loss of that spacecraft all data was also lost. In conclusion there was a difference in tunneling behaviors between the ants int hemicrogravity changers kept in the light and the ones kept in the dark.

NAME(s)	<b>Molly Clark</b>	PROJECT NUMBER	<b>B37</b>
SCHOOL	Northfield Middle High School	GRADE	<b>11</b>
TEACHER	Cynthia Tomczyk		
PROJECT TITLE	<b>Effect of Music on Plant Growth</b>		

## ABSTRACT

○This project tested different amounts of classical music (no music, 3 hours, 7 hours, and 12 hours per day) on the growth of four sets of five of the same bean plant. The hypothesis stated that the plants that were exposed to more music would grow taller. After germination, the plants were separated into different rooms, given their own light source, and the testing began. Each plant was a different height, depending on how well they grew during germination. Each plant received the same amount of water and light each day and soil to grow in. Every few days the plants were measured to record their height. After three weeks of testing, the final results showed no trend, the music did not appear to have any affect on the growth of the bean plants. The average height for the plants that were not exposed to music was 14.2cm, the average height of the plants exposed to 3 hours of music was 5.5cm, the height of the plants exposed to 7 hours of music averaged at 13.4cm, and the plants exposed to 12 hours of music had an average height of 20.5cm. This data showed no trend; therefore the hypothesis was not supported by the data collected.

NAME(s)	<b>Emily Coffin</b>	PROJECT NUMBER	<b>G02</b>
SCHOOL	Hinesburg Community School	GRADE	<b>8</b>
TEACHER	Stephanie Konowitz		
PROJECT TITLE	<b>A Breath of Fresh Air... or Not?</b>		

## ABSTRACT

Air pollution is a major environmental threat to humans as well as our earth. This is due not only to prosthetic pollutants, but natural ones as well. People deserve to be able to breathe fresh air that contains a minimal amount of pollutants, if any at all. However, pollution can be present anywhere, even in areas that are thought to be quite sterile or pollutant free. This experiment was designed to determine the amount of pollutant particles in commonplace areas as well as determine whether or not they are inorganic or organic, (man made or natural). Inorganic pollutants such as carbon dioxide, carbon monoxides, and sulfur dioxide, continue to harm our planet's atmosphere, and are mainly caused by cars and other forms of transportation that are a mandatory aspect of modern day human society. Organic pollutants such as mold spores, pollen, and radon seem to be more harmful to humans themselves and are more commonly found in outdoor locations as well as households.

○My experiment consisted of two parts. I first collected and measured the amount of air pollutant particles for each location tested and then I determined whether the pollutant(s) were organic or artificial (man made). I made and hung "catchers" in each location to collect particles in the air. My tested locations include indoor rooms with open fireplaces versus wood stoves, roadside areas, driveways, open fields, woods, and upstairs rooms versus downstairs rooms.

I then examined them and determined the amount of particles that would be inhaled per average human breath for each location. To determine whether the pollutants were organic or artificial, I set containers of water in my indoor locations and allowed them to sit until the water had evaporated and then swabbed the containers and proceeded to see if the pollutant would grow on petri dishes. Because of the weather conditions and it being winter outside, I took samples of the snow, allowed them to melt, evaporate, then carried on normally with the rest of the experiment.

NAME(s)	<b>Jessica Collins, Beth Maguire</b>	PROJECT NUMBER	<b>GP04</b>
SCHOOL	Main Street Middle School	GRADE	<b>8</b>
TEACHER	Amy Kimball / Jesse Wolfe		
PROJECT TITLE	<b>Microwaved Beans</b>		

### ABSTRACT

Microwaves use electromagnetic waves to heat food. These waves can be dangerous to your health if you experience them first hand. This experiment was conducted to see if microwaving beans would affect their growth. If the electromagnetic waves are dangerous to your health, then they may have a negative effect on the bean's growth. The prediction was that microwaving beans would impact their growth, and the beans that have been microwaved for longer will take longer to grow than the other beans, if they grow at all. In the experiment, the beans were microwaved for 0, 10, 20, 30, 40, or 50 seconds. After they were planted, the beans were watered daily, and observations about their health were made. The data matched the prediction because the 0 second plants grew 20 <sup>1</sup>/<sub>2</sub> centimeters, the most out of all the plants, and the 30, 40, and 50 seconds plants didn't grow at all. From this, it can be concluded that the electromagnetic waves used in microwaves to heat food do have an effect on the growth of the beans.

NAME(s)	<b>Caroline Corsones</b>	PROJECT NUMBER	<b>C05</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Dawn Adams		
PROJECT TITLE	<b>Curly V. Straight: It's All About pH</b>		

### ABSTRACT

Curly hair is chemically made straight by changing its pH, which means changing how acidic or basic the hair is. My experiment answered the question as to how the pH of a hair-straightening solution affects how well it straightens hair. Curly-haired people around the world will benefit from this experiment. The hypothesis was that the more acidic a solution is, the more effective it is at straightening hair. The experiment involved using pH paper to determine the pH of ten different hair-straightening solutions, measuring ten locks of curly human hair from the same head, applying a different solution to each lock of hair, and measuring by how much each lock elongated. The hypothesis was rejected because the neutral solution, having a pH of seven, by far, gave the best results by elongating the hair by an average of 90.15%. The next most effective pH of a solution only elongated the hair by 34.05%. The most acidic solution, with a pH of four, gave the worst results by only increasing the length of the hair by an average of 14.65%. The expectations of this project were met, because now, curly-haired people who have seen my experiment know to choose the most neutral hair-straightening solution for the best results.

NAME(s)	<b>Jeremiah Cory</b>	PROJECT NUMBER	<b>C06</b>
SCHOOL	Hinesburg Community School	GRADE	<b>7</b>
TEACHER	Ms. Maria Duryea		
PROJECT TITLE	<b>Insulating Science</b>		

## ABSTRACT

○My question focuses on different insulators of heat, Polystyrene, Cotton, and Shredded Paper. None of the three insulators I am using are used for actual house insulation. But I know many of the qualities it takes to make a good insulator. This experiment might help determine how insulation helps, and what qualities are the best at keeping heat in and cold out.

I put one of the three materials, Polystyrene, Cotton, and Shredded Paper in a bin. I took a thermometer, and put that in the bin to determine the temperature of the material while in the freezer for a 90 minute period. I then took it out and tested my other three materials Polystyrene, Cotton, or Shredded Paper.

The average temperature difference from starting temperature to ending temperature of all the materials I tested varied from 32.2 difference with Shredded Paper to 49.3 difference with Polystyrene. Cotton was very close to Polystyrene with a 49 temperature difference instead of 49.3 temperature difference. From this information I concluded, Shredded Paper is the better insulator of heat and also this information has showed me some insight on what good qualities for an insulator of heat are.

NAME(s)	<b>Lindsey Cox</b>	PROJECT NUMBER	<b>P07</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Deborah Rodolfy		
PROJECT TITLE	<b>The Height of the Bounce</b>		

## ABSTRACT

When a gymnast is practicing a skill on a trampoline, it is important that they know they will get the proper height to safely execute the skill they are trying to learn. The purpose of this experiment is to determine if the springs, weave, and size of the bed of a trampoline effect the height of a bounce. If the height of the bounce, without doing a skill, is high enough, a gymnast or coach will know they are safe and can execute the skill. I hypothesize that the trampoline with the largest spring's and tightest and largest bed will give a gymnast the highest bounce. When the gymnast is bouncing on the four different trampolines (rectangle, tumble trax, and two mini-tramps) they will get a different height result based on the trampolines factors because of the springs, weave, and size of the trampoline. For this experiment a gymnast bounced on four different trampolines, and the height of there bounce was recorded. While the gymnast bounced they used two feet, and circled there arms up and back as they bounced. At the end it was discovered that the rectangle trampoline produced the largest bounce. The hypothesis was proven correct, the trampoline with the largest springs and tightest weave did produce the largest bounce. However, the trampoline with the largest bed did not produce the largest bounce, the medium sized bed produced the largest bounce. The rectangle trampoline provides the best for a training gymnast to practice on.

<b>NAME(s)</b>	<b>Alexandra Dansereau</b>	<b>PROJECT NUMBER</b>	<b>C07</b>
<b>SCHOOL</b>	Mill River Union High School	<b>GRADE</b>	<b>10</b>
<b>TEACHER</b>	Carolyn Raiford		
<b>PROJECT TITLE</b>	<b>A Bowl of Potato Chips</b>		

### ABSTRACT

Tenth grade biology students know that come February they will have to have completed science experiments and definitively answered a question of their choice. The central question of the project was: How much grease do cooking oils produce? For the experiment potatoes were sliced to uniform thickness with a mandolin and then washed and dried before frying. Whichever substance being used for the particular trial was heated to 350 degrees and then the slices were fried for approximately 4 minutes. The chips were then allowed time to cool before they were crushed down into concise tablespoons and put on a paper towel. As much grease as possible was blotted off the chips before they were thrown away, so that the grease that had been added to the towel could be weighed. Bacon grease, Crisco, safflower oil, canola oil and olive oil were used for the experiment. Canola and olive are the most generally used oils and safflower isn't really an abnormal oil, and it's used to make Lays potato chips, so these oils were chosen. Three trials per substance and two collections of data were done. Both collections and their averages were compared for the conclusion of the experiment. The result of the experiment is that Crisco actually produces the least residual grease on the potato chips, but since it is hydrogenated and has more saturated fat than the cooking oils, the concluded explanation for this is that the potato absorbed the Crisco as it fried. If the Crisco was absorbed then not as much grease would come off of the chips. Another explanation could be that Crisco is solid at room temperature and as the chips cooled, it could have begun to solidify again, resulting in less residual grease. Canola, olive and safflower oil are the three substances that are most nutritious due to the fact that they have higher amounts of monounsaturated and polyunsaturated fats (as seen on product labels), which lower bad cholesterol levels and raise good cholesterol in the body.

<b>NAME(s)</b>	<b>Neel Desai</b>	<b>PROJECT NUMBER</b>	<b>C08</b>
<b>SCHOOL</b>	South Burlington High School	<b>GRADE</b>	<b>10</b>
<b>TEACHER</b>	Curtis Belton		
<b>PROJECT TITLE</b>	<b>The Wonders of Aeroponics</b>		

### ABSTRACT

The purpose of this experiment is to determine which method is more efficient for growing lettuce and peppers: Hydroponics or Aeroponics. Using two conventional hydroponic systems, the Eben Flood and NFT system; and a homemade aeroponic chamber to grow the plants, we desire to compare the results. Initially, the aeroponic system was going to have to be adjusted frequently as it was built for the first time. The duration and amount of mist on the roots were just a few of the variables that could effect the growth. Ultrasonic humidifiers will generate the mist that sprays the roots. These are capable of releasing of controlled fog. The Eben flood and NFT systems were being used commercially so we had a sense of what to expect. These plants will all be growing in a monitored green house with 15 hour light cycles. Additionally, they will be given a nutrient solution that the green house uses on all plants. After a couple weeks of growing the plants, those that were in the hydroponic setup were doing much better than those in the aeroponic chamber. The biggest challenge encountered in the aeroponic setup was keeping the roots moist at all times, and how often to spray them. This took some trial and error, as it had not been done before. After 6 weeks of growth, plants will be tested for leaf density, area, water consumption, and energy usage. This will determine which method of growing the plants was the most efficient.

NAME(s)	<b>Nevil Desai</b>	PROJECT NUMBER	<b>G03</b>
SCHOOL	Fredrick Tuttle Middle School	GRADE	<b>7</b>
TEACHER	Amelia Lutz		
PROJECT TITLE	<b>The Effect of Propane Gas Burning Rate on the Efficiency of Heating</b>		

## ABSTRACT

My experiment is “The Effect of Propane Gas Burning Rate on the Efficiency of Heating.” The Question is, “Would the amount of propane burnt affect the speed of heating.” This project was struck by my interest when I was watching my parents trying to fill up their gas tanks in search for the lowest cost. All the prices were very high making it touch on a regular family. That made me think and the first thing that struck me was barbecuing, the grill needs a propane tank to keep the grill and fire going. In some houses, the main heating supply is a propane generator. So the real world application is that if you wake up in the morning but forgot to turn on the propane generator at night the house would be cold. So if you turn the tank on full, meaning that the propane is letting out the most propane, would it burn more gas but take less time to heat? My hypothesis is that if you turn the tank on low, then you will save more gas but it will take longer. I would do the test by taking 1 propane tank and use a bunsen burner to heat water. The time and the amount of gas would be recorded and the one that has the best efficiency will be the best way to heat water through a propane gas tank.

NAME(s)	<b>Nick Diak</b>	PROJECT NUMBER	<b>C09</b>
SCHOOL	Weathersfield School	GRADE	<b>8</b>
TEACHER	David E. Lambert		
PROJECT TITLE	<b>Accuracy of potato gun propellants</b>		

## ABSTRACT

I studied whether or not different propellants affect the accuracy of a potato gun. I thought it would be a fun project that I would enjoy. I researched a number of propellants found in common household items, such as cooking sprays, hairsprays, grease sprays, and rubbing alcohol. I discovered that grease sprays usually have a higher rate of flammability than either cooking sprays or hairsprays. Cooking sprays, for example, usually contain only one propellant as compared to the three propellants found in grease sprays.

My hypothesis was the multiple propellants of grease sprays combined with the high flammability of those propellants indicated these products will ignite faster and more powerfully than other spray products and improve the accuracy of the potato gun. To test this hypothesis, I gathered the various spray propellants, a large bag of potatoes that I cut into equal sized pieces, and a potato gun. I set up a target on our hill, and used a ladder to hold the gun steady and at the same angle for each firing. With each of the propellants, I fired the gun multiple times and recorded the distance between the potato and the target. I observed I needed to wait 3 seconds to give time for the propellant to combust and kept that number as a constant in my experiment. The hairspray was the best propellant, as it fired every time I used it.

My experiment didn't support my hypothesis. Flammability can be a drawback, as when the cooking oil sent flames out the back of the gun. My hypothesis didn't take into account the other ingredients in products, such as the oil in cooking spray. These substances caused a buildup of oil in the potato gun and prevented a spark from occurring. If I were to do this experiment again, I would start with a new hypothesis, one that takes into account the ingredients of the products that contain the propellants. I would find better means of getting a consistent spark. This was an issue with the potato gun that I used. I would definitely build a better ignition system.



NAME(s)	<b>Fleur Diambou</b>	PROJECT NUMBER	<b>C10</b>
SCHOOL	St. Francis Xavier School	GRADE	<b>8</b>
TEACHER	Mary Ellen Varhue		
PROJECT TITLE	<b>Eggs On Break</b>		

## ABSTRACT

Household detergents frequently contain enzymes that help in the removal of stains by breaking down protein molecules. My project was to determine the effect of temperature and concentration of detergent enzymes on protein molecules. I thought that the detergent with enzymes would work better than the detergents without the enzymes. My hypothesis was that if the temperature increased then the rate of chemical reaction in the system would also increase and if the concentration of the detergent increased, the rate of chemical reaction in the system would increase. The rate of chemical reaction was measured by the extent to which an egg white disintegrated. I cut eggs into 12 one centimeter cubes. Each cube was placed in a test tube with different concentrations of detergents with and without enzymes. I put half of those test tubes in the refrigerator and half at room temperature and observed for 48 hours. In my results I found that at first the low concentration at room temperature worked better than the higher concentration, but in my second experiment I weighed the eggs before and after and I found that the higher concentration worked better. My experiment proved my hypothesis. The egg disintegrated better at higher temperatures and in the detergent with enzymes at higher concentrations.

NAME(s)	<b>Alexander Duchac</b>	PROJECT NUMBER	<b>C11</b>
SCHOOL	The Renaissance School	GRADE	<b>6</b>
TEACHER	Eve Dubois		
PROJECT TITLE	<b>Abating Phosphorus Runoff</b>		

## ABSTRACT

In Vermont, phosphorus runoff is a big problem for our watersheds, causing algae blooms that lead to dead zones: places with no living organisms. My project aims to discover if the runoff from farms and developed areas could be reduced through selective plantings.

I measured the phosphorus uptake of five different plants: Vinca minor, Cornus sericea, Viburnum tribolum, Rubeckia fuliga, and Gramineae. The reasons I chose these particular plants are: flowering and fruiting plants need a large amount of phosphorus for optimal growth; the quickness with which they reproduce through their root systems makes them cost effective and helps stop erosion near waterways; they are ornamentals that provide shelter and food for wildlife. Since the amount of phosphorus a plant absorbs is influenced by flowering, fruiting, and size, I predicted absorption would be highest for shrubs and lowest for soil.

I planted two of each of the above plants. I performed the initial phosphorus tests on the soil of each plant, as well as on two pots of bare soil. Phosphorus in the form of wood ash was added to one pot of each type of plant and one of soil. Additional tests were performed one week and two weeks later.

My hypothesis was partially correct. The phosphorus levels of the plants went up after phosphorus was added, but then decreased in the third series of tests. The phosphorus levels of the plants without added phosphorus went down, but then remained the same for the third series of tests. The initial drop could have been due to their rapid growth after coming out of dormancy.

I plan to retest the Viburnum and the bare soil, which didn't follow the pattern set by the others. In addition, I will complete one more series of tests, five weeks after the initial test.

NAME(s)	<b>Louis Dufresne, Al Ashe</b>	PROJECT NUMBER	<b>GP05</b>
SCHOOL	Green Mountain Union High School	GRADE	<b>7</b>
TEACHER	Mrs. Surma		
PROJECT TITLE	<b>The Stainbusters</b>		

## ABSTRACT

○Our topic is about what household products remove stains the best. We were trying to find out that out of a few household products, which was the best for cleaning different stains. Our hypothesis was that the bleach was the best and just plain wiping it was the worst. We got all the anti-staining equipment and applied them to the stains for 1 minute. We then wiped them all off with a napkin and analyzed the data. We found out that for different stains, different products were necessary. E.G. toothpaste was great for removing curry stains. So depending on the stain, different products are best.

NAME(s)	<b>Danielle Dulac</b>	PROJECT NUMBER	<b>P08</b>
SCHOOL	Windsor High School	GRADE	<b>11</b>
TEACHER	Jennifer Townsend		
PROJECT TITLE	<b>Mass and Surface Tension</b>		

## ABSTRACT

One unique property of water is its elastic surface. After learning about water's surface tension just a few weeks before science fair, I decided to do my experiment on how changing the temperature of water affects the amount of mass its surface tension can hold. My hypothesis was that as the temperature increased the amount of mass the surface tension could hold would decrease because the water's molecules would move faster letting the surface tension break more easily. To do this experiment I used a hot plate to heat the water then placed a bottle cap on the surface of the water and added BB gun pellets to the cap until the surface tension broke and the cap was completely submersed. I then took the cap and BBs out of the water and counted how many were in the cap, then found the mass of the cap and BBs using an electric scale. I did this for water at 20 degrees Celsius, 40 degrees Celsius, 60 degrees Celsius, and 80 degrees Celsius. The data I collected from this experiment supported my hypothesis; as the temperature increased the amount of mass that the water's surface tension could hold decreased. This would be important to know especially if you were someone whose job is to move cargo by boat from country to country. Most boats have a listing on their side that show how low the boat can be weighed down in certain temperatures of water. When traveling from north to southern oceans one would not want to weigh the boat down with cargo to the colder temperatures mark knowing the ocean will heat up; this would cause the boat to sink even lower in the warmer water, possibly scraping the bottom of the boat.

NAME(s)	<b>Samantha Dulaney, Austin Barrows</b>	PROJECT NUMBER	<b>GP06</b>
SCHOOL	Green Mountain Union High School	GRADE	<b>8</b>
TEACHER	Mr. Allan Garvin		
PROJECT TITLE	<b>Are Animals Colorblind?</b>		

### ABSTRACT

Our project was to see if animals are colorblind. We tested horses, cats, dogs, and fish. Our hypothesis was that cats wouldn't be colorblind, dogs would, fish would be, and that horses wouldn't be. We put two jars in front of an animal, and trained them to go to a jar that has a different contrast than the other. Then we put in a jar that had a similar contrast to the jar it was trained to go to. We tested two of each animal, and each animal was tested 50 times.

NAME(s)	<b>Emily Dumas</b>	PROJECT NUMBER	<b>C12</b>
SCHOOL	Northfield Middle High School	GRADE	<b>12</b>
TEACHER	Cynthia Tomczyk		
PROJECT TITLE	<b>The Effect of Oxygen on the Oxidation of Apples</b>		

### ABSTRACT

When left out, cut and unwrapped apples' enzyme polyphenol oxidase (PPO) reacts with oxygen in the air and causes the apples surface to turn brown. This experiment was addressing how to use Saran wrap to effectively reduce the rate at which the apples oxidize. The apples were monitored, and the oxidation rate of the apples surface was recorded every five minutes. It was hypothesized that as the layers of Saran wrap increased, the oxidation rate, or the amount of time it took for the apples exposed surface to turn brown, would also increase. To test this, the apples were cut in half and wrapped in layers of Saran wrap, 1-5, with one unwrapped apple as the control. Each apple was handled with gloved hands, and set face down on a clean surface, then wrapped with the appropriate layers, leaving them exposed for the least amount of time possible. One set of apples was in the refrigerator, and the another was placed at room temperature on the counter. The apples were checked every five minutes until their exposed faces turned brown. What was discovered through this process was that the Saran wrap did help to preserve the apples, by reducing their exposure to the air and the oxygen in the air around them, and decrease their oxidation rate. The amount of time it took for 0, 1, 2, 3, 4, 5 layers of Saran wrapped apples to oxidize in the refrigerator was 3:39, 3:54, 4:01, 4:15, 4:23, 4:52 respectively. The amount of time it took for the apples to oxidize on the counter with 0, 1, 2, 3, 4, 5 layers was 3:00, 3:06, 3:20, 3:39, 4:00, 3:50 respectively. The results demonstrated that the Saran wrap is an efficient method of keeping apples fresher, longer.

NAME(s)	<b>Abigail Elliott</b>	PROJECT NUMBER	<b>P09</b>
SCHOOL	Mill River Union High School	GRADE	<b>9</b>
TEACHER	Carolyn Raiford		
PROJECT TITLE	<b>Gasification</b>		

## ABSTRACT

The purpose of this project was to test which biomass produced the most gas. After many careful steps of assembling the gasifier and careful observations during the burning process. The data suggested that the loose spruce needles and clippings produced the most gas. Out of the four biomasses tested the coal produced the least amount of gas. The hay had the same percentage of mass and gas production as the loose spruce and needles. However, the data that was collected shows that the hard wood chips had the largest and most substantial flame. This suggests that the loose spruce needles and branches contained more condensation and was producing unburnable gas that was passing through and into the atmosphere. The hay did not follow a steady burning pattern. It would hold a steady flame for a period of time, and then it would diminish into almost nothing. Then the flame would burst out again and burn steady for another period of time- but was inconsistent. The hard wood chips held a self-sustaining flame for the longest amount of time, but there was not a large quantity of gas being produced through this biomass. This suggests that the gas being produced was unstable, which made it hard to be burn even though the flame was the highest. The coal biomass was the least to produce a stable amount of burnable gas. The gas production was extremely low and the flame remained small.

The gasifier that was used for this project was made out of a simple paint can. A hole was drilled in the top of the paint can so the elbow pipe fittings could be seal onto it. The pipe fittings came out of the top of the can so the gas would rise to the top of the can could be funneled through the top of the pipe to be ignited. After the gasifier was constructed the biomass was sealed tightly within it, it was placed on a propane burner.

NAME(s)	<b>Rylee Ewald, Anna Huckins</b>	PROJECT NUMBER	<b>GP07</b>
SCHOOL	Green Mountain Union Highschool	GRADE	<b>6</b>
TEACHER	Karen Surma		
PROJECT TITLE	<b>Counting Those Calories!</b>		

## ABSTRACT

### ABSTRACT

In our science project we investigated calories and what they are and how much chemical energy is in certain food items. A calorie scientifically is the quantity of heat required to raise the temperature of 1 gram of water 1 degree Celsius. Our bodies use the calories in food to create energy for our cells to use. We constructed a homemade calorimeter to use in measuring how much energy is available in certain food items. We decided to compare the calories in walnuts (healthy snack) to the calories in marshmallows (unhealthy snack). We discovered in our research that just because a food has more calories than another it does not mean it is unhealthy for you. Walnuts have a much higher calorie count than marshmallows and are better for you. The calories in walnuts release energy that help your body perform better. The calories in marshmallows are burned quickly and contain a high amount of sugar. Our research also taught us that it is important to have a balanced diet and to exercise regularly.

NAME(s)	<b>Marissa Farbman, Kathleen Sheppard</b>	PROJECT NUMBER	<b>GP08</b>
SCHOOL	Woodstock Union High School	GRADE	<b>9</b>
TEACHER	Jen Stainton		
PROJECT TITLE	<b>Mercury Concentrations in Darner Dragonfly Nymphs vs. Soil</b>		

### ABSTRACT

Soil and darner dragonfly nymphs from the Pogue pond in Marsh Billings Rockefeller National Historical Park were collected and tested for mercury. The goal of this project was to see the difference in bioaccumulation along the food chain and to get an idea of how mercury, a potent neurotoxin, interacts with the environment. Since Mercury is harmful to organisms and the environment, it is important to make sure the toxin is not accumulating in amounts that could have potentially harmful impacts. If the findings showed there were large amounts of mercury in the samples collected, then the mercury cycle would need to be compared to the location of the samples in order to see how the mercury was getting into the organisms. From there new ideas that could possibly reduce the amount of mercury in the organisms should be introduced. Looking at and comparing more than one part of the environment makes it possible to see where, and what the mercury is coming from, and how it is getting into the organism. After conducting the experiment, the average mercury concentration in parts per billion for the dragonfly nymphs was 133.42 plus or minus 88.618 and the average mercury concentration in parts per billion for soil was 177.77 plus or minus 172.33. The hypothesis was that the Darner dragonfly nymphs would have higher mercury concentration than that of the soil because of the biomagnification effect. Because the variation was so high, it shows no difference in the mercury concentration between the samples. After examining the samples further, to see if the mercury concentration varied depending on the location they were taken from, there was still no obvious difference. This might be because there were not enough samples.

NAME(s)	<b>Matthew Feiereisen</b>	PROJECT NUMBER	<b>C13</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Deborah Rodolffy		
PROJECT TITLE	<b>Hand Warmers and Their Wonders</b>		

### ABSTRACT

Can a hand warmer save your life? In this experiment a hand, foot, re-usable, and ultra warmer were chosen because they are one of those last resort warming devices that could really help a person or even save someone in a bad situation. It is very important to always keep one or two of these in the car or a safe place because weather is unpredictable and one may need a warmer to keep oneself from catching cold or worse. A self-heating warmer is quite interesting in the way that it creates heat from crystals. Re-usable warmers are simple, but are even more valuable in critical situations. To determine the best warmer one must figure out which has a better efficiency by staying warm for the longest amount of time. After opening up all the packets of the non-reusable warmers they immediately started heating and the temperatures were recorded in fifteen minute intervals for eight hours. Also the re-usable hand warmer temperature was recorded for eight hours and the temperature measured at the same intervals. All of the data was converted to graphs. Each of the hand-warmers had very distinct results. The ultra warmer kept a lower temperature of 118 degrees Fahrenheit. The hand warmer kept a higher temperature of 125 degrees Fahrenheit but didn't last as long as the ultra warmer. The foot warmer was even higher at 134 degrees Fahrenheit. To conclude the reusable hand warmer is much more efficient in all categories.

NAME(s)	<b>Olivia Ferro</b>	PROJECT NUMBER	<b>C14</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Surface Tension</b>		

## ABSTRACT

○The idea behind this project was to determine which abiotic factors alter the surface tension of water and how these alterations affect plant life. The abiotic factors used in this experiment were temperature, salinity, soap concentration, and oil concentration. There were five experimental groups consisting of cold water at 2°C, warm water at 47°C, a solution of water and 2.7% salt, a solution of water and 27% soap, and a solution of water and 27% oil. The control group was room temperature water at 14.5°C.

○ In order to get a relative surface tension, a needle was floated on each test subject 10 times. There were 3 subjects in each group, making a total of 30 needle tests per group. The more times the needle is able to float on top of the liquid, the higher the surface tension. According to this test, cold water had the highest surface tension with a 73% floating rate. The control had the second highest surface tension and a floating rate of 67%. Saltwater came next with a floating rate of 30%, then warm water with 17%, then the oil solution with .3%, and finally the soap solution with 0%.

○To determine the effects of relative surface tension on plant life, duckweed has been placed in each test subject. Duckweed is a plant that requires a certain amount of surface tension as it exists by floating on top of water. It is expected that the control will best be able to support it.

NAME(s)	<b>Brad Fiske</b>	PROJECT NUMBER	<b>B57</b>
SCHOOL	Mill River Union High School	GRADE	<b>11</b>
TEACHER	Carolyn Raiford		
PROJECT TITLE	<b>Making the Cut</b>		

## ABSTRACT

The purpose of this experiment was to determine whether or not the angle or the location of an incision would affect the regeneration time of a planarian. My hypothesis was that the pharynx would regenerate faster than the head, and that 45 degree cuts would regenerate faster than 180 degree cuts.

Planarians are freshwater flatworms that are infamous for their ability to regenerate large segments of their body. If a planarian is cut in half, both halves will grow into a new worm. When planarians are cut, a blastema of stem cells form at the site of the wound. The stem cells then differentiate into the cells of the new segment of tissue. In this experiment, the regeneration of the head and the tail were measured, not the rest of the body. The heads were preserved and grew into new worms.

First, the planarians were put into separate petri dishes, labeled by the angle and location of the cut. Each Petrie dish contained 3 planarians, including the control planarian that was not cut. Each cut was made with a clean surgical blade. Everyday, the planarians were observed and sufficient growth was recorded when it occurred. It was noticed that the head still regenerated tissue after the photoreceptors had formed. Once the white section of tissue, the regeneration blastema, had disappeared the regeneration was complete.

The data collected confirmed my hypothesis. The planarians that were cut below the pharynx regenerated in less time than the planarians that were cut below the head. Also, the planarians that were cut at a 45 degree angle regenerated in less time than the planarians that were cut at a 180 angle. An explanation for the 45 degree angle cuts regenerating in less time than the 180 degree angle cut could be that the 45 degree angle cut had less tissue to regenerate.

○

NAME(s)	<b>Morganne FitzGerald</b>	PROJECT NUMBER	<b>B49</b>
SCHOOL	Rutland High School	GRADE	<b>10</b>
TEACHER	Tim Gilbert		
PROJECT TITLE	<b>Bacteria of the Human Body</b>		

## ABSTRACT

Ever wonder how much bacteria you actually have on your body? To test it, grow some of your own. In my experiment, I tested five different parts of the body; behind the ear, the mouth, the palm, inside the belly button, and between the toes, to see which part contained the most bacteria. I hypothesized that the belly button would contain the most bacteria, but I was proved wrong. To begin, I prepared 25 agar plates. I chose five test subjects, and used new, clean cotton swabs to swab the different parts of the body. After swabbing, I swabbed the bacteria onto the agar plates and placed them into an incubator for a week. During this week, many colonies of bacteria grew in the agar plates, and then I counted the number of colonies in order to come to my conclusion. It was difficult to analyze my data and come to a conclusion, but I did conclude that there would be more bacteria between your toes, than the other four body parts. Some of my data had been skewed due to various factors, but I was able to come to a reasonable conclusion based upon the fact that the number of colonies of bacteria taken from between the test subjects' toes was a consistent and high number, with an average of 105.8 colonies.

NAME(s)	<b>Jenna Flint</b>	PROJECT NUMBER	<b>B50</b>
SCHOOL	St. Francis Xavier School	GRADE	<b>8</b>
TEACHER	Mary Ellen Varhue		
PROJECT TITLE	<b>Microbe Heroes</b>		

## ABSTRACT

Oil spills are very harmful and are an environmental issue. The purpose of my experiment was to see if microbes were an effective and environmentally safe way to clean up oil in both a warm environment and in a cold environment. I also wanted to know what effect the microbes would have on motor oil and vegetable oil. My hypothesis was that the microbes would have a greater effect on both oils in the warmer environment. I also thought that out of the two oils it would have a greater effect on the motor oil. To do the experiment I used ten jars, four for motor oil, four for vegetable oil, and two for control (no oil). For the motor oil I labeled the jars "motor oil not in fridge with microbes", "motor oil in fridge with microbes", "motor oil not in fridge without microbes", "motor oil in fridge without microbes". Everything was repeated with the vegetable oil jars. Control was labeled "control not in fridge" and "control in fridge". I marked a one inch line on the jars to fill with water. According to the jars I then put three milliliters of each oil into their corresponding jars. I put half of a spoonful of microbes into the jars that required microbes. Then each jar was placed in a safe location according to their label. This experiment ran for 16 days; taking notes daily. On the last day I took notes and pictures concluding that the microbes had a greater effect on motor oil in room temperature, vegetable oil in room temperature, then motor oil in fridge, then vegetable oil in fridge. I also concluded that my hypothesis was right, that microbes had a greater effect on both oils in a warmer climate but a greater effect on the motor oil.

NAME(s)	<b>Annie Flower</b>	PROJECT NUMBER	<b>B04</b>
SCHOOL	Woodstock Union High School	GRADE	<b>9</b>
TEACHER	Jen Stainton		
PROJECT TITLE	<b>A Comparison of Mercury Concentration in Human Hair and Dragonfly Nymphs</b>		

### ABSTRACT

Which contains more mercury: human hair or dragonfly nymphs? The hypothesis was if organisms bio-accumulate mercury, then humans will have a higher mercury content than dragonfly nymphs because the mercury bio-magnifies up the food chain. The study was conducted to find out the levels of mercury in the two species, for health and environmental issues. It is important to research this topic because methyl mercury in organisms is not a good thing. It is toxic and can cause fatalities. The process included taking human hair samples from vegetarians and omnivores to get a better picture of the overall mercury content in humans. The group traveled to the Pogue, in Woodstock, and collected the dragonfly nymphs. It was necessary to use the clean hands technique, to avoid contamination of the specimens. The bags were labeled, and we sent them to the Trace Element Analysis Laboratory at Dartmouth College to be tested for mercury content. The results came back with human hair having more mercury than the dragonfly nymphs. This means the hypothesis was supported.

NAME(s)	<b>Samuel Fogg</b>	PROJECT NUMBER	<b>P10</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Dawn Adams		
PROJECT TITLE	<b>Insulation's Cost and Resistance to Convection and Conduction</b>		

### ABSTRACT

Insulation is used in nearly every structure that one sees. Insulation needs to be effective and is favorable when cheap, but it is often hard to know which type will work best. Often times, people, who are looking to reduce their carbon footprint and their energy costs, install ineffective insulation. In order to determine the best insulation, this experiment calculates the cost of each widely used insulation, and compares their effectiveness in preventing heat transfer from convection and conduction.

My hypothesis was if sprayed closed cell polyurethane foam insulation is an air tight sealant and adhesive, then it should outperform both cellulose and fiberglass insulation in terms of conduction and convection. To test conduction, I inserted insulation into PVC pipe. The bottom of the pipe contained the heat source, and the top contained a thermometer to measure the changing temperature. To test convection, I used a similar method. A fan was used at one end of the pipe while a 900 ml bag collected the air being moved. For convection, Foam allowed no air flow, Cellulose allowed 8.4 ml of air to pass per second, and fiberglass allowed 183.7 ml of air to pass per second. For conduction, foam rose zero degrees Celsius in five minutes, cellulose rose one degree, and fiberglass rose two degrees. I found that Foam costs \$1.68 per square foot at one inch thick, and cellulose and fiberglass cost \$0.04. This experiment highlights and determines the importance of choosing a proper insulation for a structure and lets one judge the cost. This experiment provides key information to an area where many owners have little knowledge. Having performed this experiment, I hope building and home owners will become more aware of the qualities and effectiveness of the different types of insulation available.



NAME(s)	<b>Kellie French</b>	PROJECT NUMBER	<b>C15</b>
SCHOOL	Windsor High School	GRADE	<b>11</b>
TEACHER	Jennifer Townsend		
PROJECT TITLE	<b>Which Household Product Best Prevents the Formation of Rust?</b>		

### ABSTRACT

The problem I investigated was to find if there was a household product that could prevent the formation of rust. My hypothesis was that Crisco would prevent rust the best because it is thick and oily and will best repel the water. To conduct the experiment I took sixteen steel nails, and covered four of them with motor oil, four with Crisco, and four with cooking spray and left four plain for controls. I then split each group of four in half and placed the nails in labeled containers. Two nails coated with each material were sprayed every twenty four hours for ten days with plain tap water and the other nails covered in those materials were sprayed every twenty-four hours for ten days with salt water. The nails were judged based on a scale I created to make sure each nail was judged fairly. At the end of the ten days the results showed that the nails covered in cooking spray had the least amount of rust. This disproved my hypothesis. I believe that the cooking spray worked the best because cooking spray is meant to be tough and hold up to things like heat and scraping in pans. I concluded that cooking spray seems to be a viable agent for preventing rust but due to things like its slickness and social acceptance I do not foresee many people running out to their cars to spray the engines or bumpers with cooking spray.

NAME(s)	<b>Maddie Fulkerson, Mariah Gray</b>	PROJECT NUMBER	<b>GP09</b>
SCHOOL	Green Mountain Union High School	GRADE	<b>8</b>
TEACHER	Mr. Allan Garvin		
PROJECT TITLE	<b>Black and White vs. Color</b>		

### ABSTRACT

Our science fair project was an attempt to find out if people prefer black and white or color pictures more. We took pictures of objects and showed them to people in both black and white and color. People told us which one they preferred. We found more people prefer color but it was pretty close to half and half. The pictures that people preferred in color were the ones that had subtle colors. The pictures that had many colors and were very bright were the ones that people preferred more in black and white. It was interesting to find that people preferred color more than black and white. We thought that black and white would be more popular because it is less common. It also hides some imperfections.

NAME(s)	<b>Tara Gallagher</b>	PROJECT NUMBER	<b>P11</b>
SCHOOL	Mater Christi School	GRADE	<b>8</b>
TEACHER	Michele Donlon		
PROJECT TITLE	<b>The Power of Lightbulbs</b>		

## ABSTRACT

The purpose of this experiment was to determine what properties of light bulbs affect its ability to produce power using a solar panel. The hypothesis stated that if incandescent and CFL bulbs were tested with different wattages, distances, and angles of incidence, then CFLs will overall produce more power than incandescent bulbs. Semiconductors, photovoltaic cells, and basic electricity terms were further researched, as well as concepts such as how solar cells work, IV curves, and basic laws of electricity.

○The experiment was performed using 60 and 100 watt incandescent bulbs, and the equivalent of those wattages in CFLs. The solar panel was connected to an ammeter, a variable resistor, and a voltmeter. The bulbs were positioned 1 ft. away from the panel and starting at a resistance of 0Ω; the current and voltage were recorded. Increasing the resistance as gradually as possible, this step was repeated until the measurements stopped changing. As well as the different types of bulbs, the 60 watt incandescent was tested with varying distances (.5 and 2 ft.) and angles of incidence (22.5°, 45°, 67.5°, and 90°). The resistance and power were calculated using the current and voltage measurements.

○The maximum power produced in milliwatts was 39.84 for the 60 watt incandescent, 1.7 for the 60 watt CFL, 35.04 for the 100 watt incandescent, and 2.52 for the 100 watt CFL. The bulbs produced the most when they were close to the panel and positioned at 0°. In conclusion, incandescent bulbs produced more power than CFLs.

NAME(s)	<b>Shelby Gault</b>	PROJECT NUMBER	<b>B05</b>
SCHOOL	Woodstock Union High School	GRADE	<b>9</b>
TEACHER	Jen Stainton		
PROJECT TITLE	<b>Mercury Levels in Dragonfly Nymphs from Maine vs. Vermont</b>		

## ABSTRACT

In order to compare mercury levels in dragonfly nymphs from Maine and Vermont, Samples of dragonfly nymphs were taken from Marsh Billings Rockefeller National Historical Park. The samples were collected using a clean setup and then were sent to the Trace Element Analysis Lab at Dartmouth College to be tested for mercury levels. Data from Maine was found using a website where the information was posted from other data gathering institutions. The hypothesis was that the levels in the dragonflies from Vermont would have more mercury than the dragonflies from Maine. When the results were received, two graphs were made about the data; one with all of the different dragonfly nymphs' mercury levels, and another with just the average. After analyzing the graphs, the conclusion was written based on the comparative results: dragonfly nymphs had a higher concentration of mercury in Vermont than in Maine. Because the Maine data was collected state wide and Vermont's was collected just at Pogue, the results had low reliability.

NAME(s)	<b>Keri Giguere</b>	PROJECT NUMBER	<b>P12</b>
SCHOOL	Northfield Highschool	GRADE	<b>11</b>
TEACHER	Cynthia		
PROJECT TITLE	<b>The Effect of Different Color Filters on the Amount of Energy Produced by a Photovoltaic S</b>		

### ABSTRACT

This lab tests the effect that different color filters have on the amount of energy produced by a photovoltaic solar panel in milliVolts when a full spectrum light bulb is used and when natural sunlight is used as the energy source compared to the energy produced without a color filter. The color filters reflect the color that we see, so it is the complimentary color of the color filter that are absorbed by the solar panel. My hypothesis was that the amount of energy produced by the different color filters would increase as the wavelength of the color filters complimentary colors are absorbed. Meaning the yellow filter would produce the greatest amount of energy, because it absorbs violet wavelengths which have the shortest wavelengths and the highest frequency. In order to perform this lab the solar panel was covered completely with cardboard and the digital voltmeter was turned on when the solar panel was outside in order to ensure that there was not any energy produced, and then the size of the color filter was cut out of the cardboard and the natural sunlight was tested, and then the ROYGB color filters. This same procedure was performed with a full spectrum 26 watt light bulb 14 inches above the solar panel. The data collected shows that the only major difference between the energy produced with natural light and a full spectrum light bulb is that natural light had a greater energy produced with the blue color filter (8.22milliVolts) then the green color filter (8.16milliVolts), while full spectrum bulbs had a greater amount of energy produced with a green color filter (0.95milliVolts) then with a blue color filter (0.83 milliVolts).

NAME(s)	<b>Matthew Gilmartin</b>	PROJECT NUMBER	<b>B06</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Examination of Water Quality in the Winooski River</b>		

### ABSTRACT

The objective of This project is to examine the current state of the water quality in the Winooski River. I specifically set out to determine if the water had been contaminated by human fecal waste. Water samples were collected in several locations on three occasions along the Winooski River, between the Winooski dam and Lake Champlain at the mouth of the river.

The water was assayed for pH, phosphorus and the presence of E. coli. The presence of E. coli was determined by the assaying for E. coli-specific bacteriophage or T4 phage.

This research can be used, along with other research, to promote the recovery of the Winooski River. Second bacteriophage were assayed as a less expensive alternative to the directly testing for E. coli.

NAME(s)	<b>Melissa Gingras</b>	PROJECT NUMBER	<b>B07</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>A Study of Reaction Time and Brain Function in Relation to Sleep</b>		

## ABSTRACT

This project is designed to investigate how or if sleep deprivation has an effect on the speed the brain can perform certain tasks. It compares the performance of subjects who have had enough sleep with subjects who are sleep deprived or may have had excess amounts of sleep. This performance is being tested by a timed Stroop color test, which requires the subject to focus in a different way than is natural to the eye and brain, allowing perhaps for a difference in subjects with different sleeping habits. As of now, the results are showing a trend for the fastest times to be from those subjects who got the least amount of sleep, and those who got the most. They seem to show a slight bell curve, with those who got minimal amounts of sleep being in a hyperactive stage and performing better than those who got moderate amounts of sleep, but more equal to those who got adequate amounts of sleep.

NAME(s)	<b>Jane Goodwin</b>	PROJECT NUMBER	<b>S03</b>
SCHOOL	Woodstock Union High School	GRADE	<b>9</b>
TEACHER	Jen Stainton		
PROJECT TITLE	<b>The Power of Subliminal Messages</b>		

## ABSTRACT

Subliminal messaging is a way of advertising that utilizes the unconscious part of the mind. The technique, which involves using either sound below hearing range or images flashed too quickly for the conscious mind to hear, is controversial because of the fact that without the conscious mind to contradict the advertisement, there is nothing to rationalize whatever the advertisement said. For the experiment, first a video was created with a few stock video clips in theme colors of red and blue. The video was just over 30 seconds in length. Then an audio clip was recorded, saying, "red is good, blue is bad". This audio clip was mixed lower, into an extremely low, almost inaudible frequency, using sound editor software called Audacity. To cover any seams, it was mixed at an almost inaudible volume to a clip of Beethoven's "Moonlight Sonata". The finished music/subliminal message was then played over the video clip. After the clip was finished, the test subjects (groups of volunteers who did not know what they were watching had a subliminal message in it) were offered cupcakes with either red or blue frosting. They were videotaped as they chose, and the number of cupcakes chosen of each color was counted and results were analyzed. It was hypothesized that, because of the audio clip, more test subjects would choose a red cupcake over a blue one. The numbers were statistically analyzed using a chi square test, and the hypothesis was significantly supported.

NAME(s)	<b>William Gregoire</b>	PROJECT NUMBER	<b>G04</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>The Effects of Elevation on pH Content of Precipitation and Waterways in the Champlain Val</b>		

### ABSTRACT

This project is meant to study some of the effects of the sediment problem in rivers and streams on organisms themselves, the minnow in particular. Knowing that sedimentation has been proven to have a negative effect on minnow populations, the project will help discover whether the sediments are harming the minnows directly or not.

The control group is a five-gallon tank containing 5 minnows and clear treated water, with tank bubblers running at all times. Two other five-gallon tanks containing 5 minnows each are experimental groups, each containing a different sediment percentage. Different types of sediments found in rivers will be used for the experimental groups as the experiment progresses, if the initial shows no results. These percentages will be adjusted based on effectiveness. Any dead specimens will be immediately replaced by living ones kept in a nearby ten-gallon tank under the same conditions as the control group.

The behavior and healthiness of the minnows subject to sedimentation will differ from the control. They may lose color and will be sluggish due to the intake of particles during respiration. If unreasonable amounts of casualties result, the sediment content of the water will be reduced to prevent further minnow loss. These effects that the sediments in their habitat have on the minnows' health will help determine how the sediment in waterways is harming the minnows that inhabit them.

NAME(s)	<b>Hunter Griffin-Barnes</b>	PROJECT NUMBER	<b>C16</b>
SCHOOL	Avalon Triumvirate Academy	GRADE	<b>8</b>
TEACHER	Amanda F. Gifford		
PROJECT TITLE	<b>Snow White and The Seven Whiteners</b>		

### ABSTRACT

This experiment was to test which toothpaste whitens best. The reason I chose to do this experiment was because all the toothpaste brands claim their toothpaste is best for whitening teeth. This experiment was fairly simple but provided very good information on how to care for your dentures. I wanted the truth. I decided to add a few normal household ingredients just for fun. I used eggshells soaked in coffee for 24 hours. The coffee stained the eggshells a light brown color. I applied a pea sized amount of toothpaste on each toothbrush. I scrubbed each eggshell for two minutes. I scrubbed in circular motions, as dental hygienists prescribe. I thoroughly washed the toothbrush after each session to keep the results fair. All the toothpastes worked well, and surprisingly the household ingredients worked as well.

My hypothesis was that; Crest- will work best for whitening the egg shells. My hypothesis was correct. The Crest- whitened the eggshell best. I think Crest- worked best because they have so many additives in it made to whiten teeth at all costs. It provided the purest white of all them and dug down through more of the coffee stain.

NAME(s)	<b>Vanessa Griswold, Jordan Stewart</b>	PROJECT NUMBER	<b>GP10</b>
SCHOOL	Green Mountain Union High School	GRADE	<b>8</b>
TEACHER	Mr. Allan Garvin		
PROJECT TITLE	<b>Is It In You?</b>		

## ABSTRACT

We had more than one topic. They were running, water and Gatorade. The question we were trying to answer was “Does Gatorade or water improve your running performance more?” Our hypothesis was that Gatorade would improve running performance more. To test our hypothesis, we had people do a series of laps and up and backs after drinking nothing, water or Gatorade. We had people test Gatorade on separate days so it would not affect the results, because if people tested Gatorade after drinking water, the water could still be in their systems. When we tested people, we had them drink an eight ounce cup of each liquid. Our results showed that people’s running time was always quicker than Gatorade compared to the control. Gatorade was always slower than water compared to the control. This means water was the best liquid to drink to improve running performance. Water being quicker than the control means the running time improved. If it had been slower, like Gatorade was, it means the running time got worse.

NAME(s)	<b>Michael Guo</b>	PROJECT NUMBER	<b>B51</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Testing the Mutagenicity of Household Chemicals</b>		

## ABSTRACT

○This project is about testing the mutagenicity, or a chemical’s capability of causing mutations, of everyday household chemicals. The idea was to see if chemicals that we use in our households can effectively change our DNA in cells.

○The mutagenicity of chemicals is determined by the Ames test. The Ames test consists of growing a specific strain of Salmonella called the Ames strain. These bacteria need histidine, an amino acid essential for survival, but they cannot produce histidine on their own. Thus, they need chemicals that can cause mutations in the bacteria so they can start creating histidine again. By growing these bacteria cultures in Petri dishes with agar, and then putting disks saturated with a specific chemical in specific sections of the Petri dish, we can find if the chemical causes mutations or not. A positive control is needed, a chemical that is certain to cause mutations, as well as a negative control, chemicals which are certain to not cause mutations.

○I have no data at this moment, although I have already carried out my experiment and am waiting for the results. Some household chemicals that I used in my test included vinegar and Lysol, a disinfectant. My positive control was UV light. My negative control was water.

○This project will show how chemicals that we handle in our house may not be as safe they seem, and can in fact change our genetic structure.

NAME(s)	<b>Noah Hall-Potvin</b>	PROJECT NUMBER	<b>B58</b>
SCHOOL	South Burlington High School	GRADE	<b>9</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Effects of Sugar and Caffeine on Heart Rate</b>		

### ABSTRACT

The purpose of this experiment is to discover whether or not caffeine and sugar have an effect on a person's heart rate. I will have the test subjects take their heart rate while they are at rest. This number will be used to compare with the data collected after the liquid of choice is consumed. I will then have the test subject drink one of the following three liquids: water (control), Gatorade (sugar) and coffee (caffeine). I will then re-take their heart rate a minute after they have consumed their liquid. These heart rates will hopefully provide data showing my hypothesized slight increase in heart rate from sugar, and an even greater increase in heart rate from caffeine. I do not expect any change in heart rate from drinking water, however it is a possibility.

NAME(s)	<b>Katie Hango</b>	PROJECT NUMBER	<b>B38</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>The Effects of Oil on Plants</b>		

### ABSTRACT

The purpose of this lab is to determine the full effects of oil on a multitude of plants. Oil will be put in the water used to water the plants to contaminate the soil for the first group of plants, the second group of plants will be covered in oil but given clean water, the third group will be covered in oil and watered with contaminated water, and the fourth group will be cared for normally to serve as the control.. This will be done multiple times with different types of plants. The number of deaths, the heights of the plants, their biomass, and all observations will be recorded to determine their health. I expect that the plants with contaminated water or smothered in oil will not be as healthy as the control but will not die, however the ones that were given contaminated water and smothered in oil will all die.

NAME(s)	<b>Henry Harder</b>	PROJECT NUMBER	<b>S04</b>
SCHOOL	The Renaissance School	GRADE	<b>6</b>
TEACHER	Eve Dubois		
PROJECT TITLE	<b>Subtly Subliminal</b>		

## ABSTRACT

This year I did my science fair project on subliminal messaging. I wanted to know how fast an image or message had to flash on a screen for it to be a subconscious message. Also, I wanted to know if an image flashes in front of you that is just a bit faster than subliminal, will it still affect you in the same way?

My hypothesis is that an image would have to be at least one frame at one hundred frames per second (fps) in order for you to not see it, but have it affect you. I also thought that if people consciously recognized the image, it would not affect them the same way that a truly subliminal message would. I think that all that would happen is the person would wonder what s/he just saw.

In order to make my movies, I first had to design the image that would be flashed. It had to have an extremely clear meaning, because you do not have time to read a word when you are seeing it for only one one hundredth of a second. So, an example of an image I made would be: a picture of an apple in the upper right corner of the image, and a pie in the lower left corner, and an apple pie in the center (Apple Pie). To make the movies, I first made a simple story line, something that has absolutely no relation to the image I am flashing. I had to make three separate movies: one at one hundred fps, one at fifty fps, and one at twenty-four fps. I would have people watch the movies, and fill out a form with the words that come to their minds.

NAME(s)	<b>Abby Hart, Mary Anderson</b>	PROJECT NUMBER	<b>GP11</b>
SCHOOL	Green Mountain Union High School	GRADE	<b>8</b>
TEACHER	Mr. Allan Garvin		
PROJECT TITLE	<b>How's the Weather Up There?</b>		

## ABSTRACT

Our science fair project is about testing wind speed with an anemometer. We were trying to figure out if altitude affected the wind speed. We decided that we would use the data we collect to see where our school should put a windmill to generate electricity for our school's consumption. Our hypothesis was the highest wind speed will be found 20 feet above the school's roof. We tested this hypothesis by going to different locations (school's roof, baseball field, track, and parking lot) and testing the wind speed at three different heights, ground level, 10 feet above ground level, and 20 feet above ground level. Our data shows that the baseball field had a higher wind reading, but that was due to testing on different days. We realized that although the highest reading was in the baseball field, the roof gets higher readings. We know this because the day we tested the roof and got a reading, we also went up to the baseball field, and got nothing. So we concluded that if we had tested the roof on the day we tested the baseball field, and gotten a high reading, the roof would have had an even higher reading.



NAME(s)	<b>Grace Hatch</b>	PROJECT NUMBER	<b>B39</b>
SCHOOL	Northfield Middle High School	GRADE	<b>11</b>
TEACHER	Cynthia Tomczyk		
PROJECT TITLE	<b>The Effects of Music on Plant Growth</b>		

### ABSTRACT

This project tested the effects of different amounts of music on plant growth. Four sets of ten soldier bean plants were used, each one being subjected to 0, 2, 4, or 6 hours of hard rock music. It was hypothesized that the plants that were grown in an environment with no noise stress (music playing) would grow taller because there was nothing to impede the plants growth process. Forty-five seeds were germinated using a plastic sandwich bag, a wet paper towel, a plate placed in front of a window with sunlight shining in. After four days, forty seeds were placed into a seed starter filled with soil. The seeds were covered, watered and placed in four different rooms, ten plants to a room. The plants that were subjected to 2 and 4 hours of music were placed in the same room as the 6 hours plants, and the timer was set for 2 hours. After 2 hours, the 2 hour plants would be taken out and placed back into their original room. The same thing would happen for the 4 hour and the 6 hour plants until their time was up. This procedure would be competed each day and the height of the plants in centimeters would be recorded every other day along with the plants with zero hours of music. After fourteen days, the plants grown without music had an average height of 11 centimeters. Two hours of music had an average height of 10.8 centimeters. Four hours had an average of 11.3 centimeters and six hours had an average height of 10.6 centimeters. The hypothesis was not supported by the data because no matter how much music was played, the growth rate of the plants did not change.

NAME(s)	<b>Thomas Heffernan</b>	PROJECT NUMBER	<b>B40</b>
SCHOOL	Mill River Union	GRADE	<b>10</b>
TEACHER	Carolyn Raiford		
PROJECT TITLE	<b>Hydroponics vs Soil</b>		

### ABSTRACT

The most common method of growing plants is in soil, but many people are not aware of the benefits of hydroponic growth. If plants are grown hydroponically will they develop faster or slower than plants in soil? Hydroponic growth is a much more efficient process. Also the way hydroponics works allows plants to grow taller in a shorter period of time, the result most gardeners are looking for. Therefore hydroponically grown plants develop faster in a shorter time than plants grown in soil. To test this there are a number of methods one can use.

- One particular method someone can use to determine if plants grow better hydroponically or in soil is to setup similar growth systems. A simple hydroponic setup composed of a small container, filled with a growth medium (LECA clay balls i.e.) and filled with hydroponic solution until it is over root level on the plants. The hydroponic solution contains a mixture of nutrients that the plant needs to survive and to thrive. The soil system is constructed of a seedling growth cell, and Miracle Grow soil mixture. Both systems require constant watering and care. One should then measure the plants each day for as long as desired. After this is performed on multiple plants, as to achieve accurate data, one will see that hydroponically grown plants will be taller, in a shorter time period, than the soil plants. This is caused by a number of reasons, each of which affects the growth in different ways.
- The hydroponic plants will grow taller that the plants grown in soil for a number of reasons. Plants grown hydroponically do not require a large root base. This is because when a plant is grown in soil it needs to expand its roots to reach more water, and get the necessary amount of nutrients. When a plant is grown hydroponically nutrient solution is used.

NAME(s)	Emily Herring	PROJECT NUMBER	B41
SCHOOL	Northfield Middle/ HighSchool	GRADE	11
TEACHER	Amy Urling		
PROJECT TITLE	The Effect of Different Amounts of Vinegar on Bean Plant Growth		

## ABSTRACT

For my experiment I took 12 bean seeds and germinated them. Then I planted the seeds in 12 pots of soil. I sprayed the seeds with water each day until they were grown a good amount. Then I sprayed three plants with 1/3 vinegar, three with 2/3 vinegar, three with 100% vinegar, and three with 100% water. I sprayed the plants every day for 3 weeks. I measured the height of the plants once a week for two weeks and then calculated % change.

For results one the three plants that were sprayed with 100% vinegar had a percent change in growth of 136.8%. These plants did not grow well at all and died off shortly. The three plants sprayed with 2\3 vinegar had a percent change in growth of 104.6%; these plants also didn't grow to well and had a short life. The three plants sprayed with 1\3 vinegar had a percent change in growth of 60% so the growth wasn't effected that much but the plants died quickly. The plants sprayed with just water had a percent change in growth of 231.5%; the plants' growth was much better than the ones sprayed with vinegar. This shows that the less vinegar the plants have the more they will grow. For results two I germinated bean seeds with different concentrations of vinegar. The ten seeds that were germinated with 100% vinegar had 0% germination. The ten seeds that were germinated with 2\3 vinegar had 0% germination. The ten seeds that were germinated with 1/3 vinegar had 0% germination, but some of the seeds were beginning to germinate. The ten seeds that were watered with 100% water had 100% seeds that germinated. None of the seeds watered with vinegar germinated at all showing that seeds cannot tolerate vinegar.

NAME(s)	Joseph Hester	PROJECT NUMBER	B08
SCHOOL	St. Francis Xavier School	GRADE	7
TEACHER	Mary Ellen Varhue		
PROJECT TITLE	Investigate		

## ABSTRACT

Police are always fingerprinting. The purpose of doing this experiment is to see if surface temperature affects the quality of the fingerprint. I was curious to learn how to fingerprint and how fingerprints are formed. I was also curious to see if temperature has a big impact or little impact.

○ My hypothesis was that the colder surface would produce a better quality print. I thought that surface temperature would have only a little impact on the quality of the fingerprint. To do this experiment I had different surfaces: glass, plastic, and metal. I also had three different temperature zones: 60 degrees C, 19 degrees C, and -21 degrees C. Once the glass had reached the required temperature I put a fingerprint on it and then dusted cocoa powder over the print. I took clear tape and lifted the print off the surface and mounted it on an index card. I then rated the quality of the print with a rating scale of 1, nothing visible to 5, clear and all ridges visible. I repeated it three times for each surface and temperature.

○ I can conclude that surface temperature does affect the quality of the fingerprint. -21 degrees C and 19 degrees C produced the best quality prints. 60 degrees C produced horrible prints.

NAME(s)	<b>Amanda Hill</b>	PROJECT NUMBER	<b>S05</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Tim Gilbert		
PROJECT TITLE	<b>How Well Can You Multitask?</b>		

## ABSTRACT

Memory is a huge part of life. It is necessary in school, work, and day by day duties. But how much can a person remember. And, how well can they do it while doing another task. Many students say that listening to music is helpful when they study, but it is it really? And you see most teachers grading papers and typing upcoming homework assignments at the same time. Is this helpful for them? Is music helpful? That is what I wanted to find out. My experiment was very rather simple. I just went to random.org and found my sequences. I then went around to all ages and all subjects to test people. When I tested Fred Lower, the art teacher, he did amazingly well on the puzzle part. That is when I thought that the subject had an effect; it was proven to be wrong. Brent Barnett, the music teacher, did not do better on the music portion. The most important thing about this is what I learned. I learned that people is a difficult thing to use for test subjects. Every person varies and so you can't have an exact outcome. The other thing I learned was that I should have kept the song the same or had that be another trial. I could have tested if the type of song had an effect. I liked this experiment a lot. I will probably still study with music one because it seems to be that it can work for some more than others.

NAME(s)	<b>Sally Hoerr</b>	PROJECT NUMBER	<b>S06</b>
SCHOOL	Mater Christi School	GRADE	<b>8</b>
TEACHER	Ms. Donlon		
PROJECT TITLE	<b>Moved By Music</b>		

## ABSTRACT

The purpose of the project was to see if music influenced what people wrote. The hypothesis for the project, "if people are told to write the ending to a story while a certain mood of music is playing, then their writing will relate to the music." While researching, it was recognized that the Limbic system in the brain is responsible for emotions. Also, the Thalamus is what receives signals from the body and sends them to other parts. The research concluded that these systems work together to produce emotions, thoughts, and process data, which may be the cause for the brain to think of words that relate to music.

○

The procedure was performed by having five people sit in a room with a piece of paper in front of them. The paper had four story beginnings. The timer and music started and they were asked to complete the story. There were three different instrumentals. Twenty-eight people were tested. When the testing was complete the data was collected by looking at the stories and determining if the stories reflected the moods of the songs. Then they were all compared to determine the final conclusion.

○

The experiment concluded that most people are affected by music. Specifically, 82% were influenced by scary music, 86% with sad, and 89% with suspense. Only one person was not influenced. This was because they already had a thought in mind before the music started. Overall, the test suggested that music has an impact on people's thoughts.

NAME(s)	<b>Danny Hogenkamp</b>	PROJECT NUMBER	<b>P13</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Dawn Adams		
PROJECT TITLE	<b>Where the Wind Blows</b>		

## ABSTRACT

○The nation in which we live relies heavily on non renewable energy sources to power the 100 quadrillion BTU's of energy that we consume each year (more than any other nation). Only 7.3% of that energy is environmentally friendly and renewable. Wind power is the most up and coming renewable technology yet government has a tough time passing through bills to create large wind farms due to local protest. Smaller Wind stations also have trouble being built from lack of capital investment. Large windmills cost in the low millions. My proposed solution to these problems is residential small scale windmill use. Instead of million dollar windmills that span 100 yards into the air, I propose 4 foot tall windmills on roofs of residential buildings. In my experiment I tested the feasibility of using small windmills on the roof of a residential house, to create a substantial enough amount of power to make them worthwhile. I went about this by purchasing two small windmill kits from PICO wind turbines. These windmills contained a 18 inch blade sweep and stood 3 feet off the ground. When constructed I built stands and wiring on the kit windmills to make it much more durable to the elements (An extremely snowy January). I had wires that lead to voltmeters and for a week I collected voltage data.

○I ended up with the results that my windmills produced a combined 8 volts on average over the span which at first was rather disappointing to me. But, after further research I learned that this number was much more significant than I had anticipated. Although my windmills were only a bit smaller than the smallest windmills on the market for permanent installation, the fact that they were from a kit also made a large difference in the efficiency of their electricity production. If I was to purchase a permanently installable windmill ranging from 100 to 200 dollars I would get around 3 to 5 times the electricity output. With two windmills, that is around 24-40 volts, or 2.4 to 4 watts on average.

NAME(s)	<b>Lingna Horton</b>	PROJECT NUMBER	<b>C17</b>
SCHOOL	Weathersfield School	GRADE	<b>8</b>
TEACHER	David E. Lambert		
PROJECT TITLE	<b>Stain Removal in Various Detergents</b>		

## ABSTRACT

I tested Tide Coldwater, Wisk Deep Clean, and Tide Ultra 2X to see which detergent removed the most of a given stain visibly. I chose this project because I was curious as to which detergent removed the most of a stain compared to what the detergent advertised online.

○All three detergents had similarly high claims of its products, but “Consumer Reports” claimed Tide Ultra 2X worked best for removing stains. My hypothesis was that Wisk Deep Clean would work best because its product claims seemed most realistic and believable.

○I used five socks per wash. I put one spoonful of a mixture of dirt, ketchup, and vegetable oil mixed in a 1:1:1 ratio on each sock. I let the stain sit for five minutes, then put it in a cold wash. I repeated this for each detergent, and after each wash, let the socks dry for 24 hours. After 24 hours, I rated each sock on a scale of 1 to 5, from most to least pure shades of white, one being pure white and five being least white. I averaged the results for each sock and this was the number I used to represent each detergent; in addition, I also tested the results of a wash with no detergent used.

○Wisk Deep Clean averaged 2.2, both Tides received a rating of 1, and No Detergent, my control, averaged 4. My hypothesis was incorrect; both Tide Coldwater and Tide Ultra 2X both removed more stain.

○If I were to continue investigating this question, I would test more brands of detergent and I would test a variety of stains for each detergent.

NAME(s)	Elise Huntley, Lexie Huntley	PROJECT NUMBER	GP12
SCHOOL	Homeschool	GRADE	11
TEACHER	Christine Colella		
PROJECT TITLE	The Comparison between E. coli concentrations to land uses in Vermont through GIS Analysis		

## ABSTRACT

Escherichia coli (E.coli) live in the intestines of living things. Once excreted, E. coli can only survive in nutrient rich conditions, such as waterways or host organisms. High E. coli concentrations in streams pose a risk to human health.

Our research compares E.coli concentrations to land use. We hypothesize that E. coli levels will be highest in streams running through agricultural areas; middle range data will be in the urban sites and the lowest E.coli levels will be in the forested sites. Streams in agricultural land will have the highest levels of E.coli due to high concentrations of manure from animal grazing and land applications. Urban sites will show a slightly lower level of E.coli due to the impervious surfaces that do not allow for percolation of water into the soil. Forested land will have the lowest levels of E. coli because water is easily absorbed into its landscape.

As participants in the Vermont EPSCoR Streams Project, we, along with the other participants, took water samples from streams around Vermont. These water samples were sent to UVM to be tested for the E.coli levels. E.coli data was retrieved from 12 streams in the Streams Project database with a date range of July-August 2010. The date range allowed for a controlled variable in our analysis by eliminating seasonal weather variability. Using datasets from a number of internet resources and ESRI ARC-GIS software, a map was created collating the information of the varying land uses surrounding stream samples. We then compared the E. coli concentrations to the land use to determine if our hypothesis is correct. By averaging datasets, we saw that forested streams had the lowest levels of E.coli, urban streams had slightly higher amounts of E.coli and Agricultural streams had the highest levels of E.coli.

NAME(s)	Abigail Huntsman	PROJECT NUMBER	B09
SCHOOL	Main Street Middle School	GRADE	7
TEACHER	Amy Kimball/Jesse Wolfe		
PROJECT TITLE	Which Burger is Better?		

## ABSTRACT

I have often wondered how much of the urban myths about which burger is better (McDonald's or Burger King) are true. So I conducted an experiment that would show bacterial and fungal growth on a normal hamburger from both places. I predicted that the McDonald's hamburger would have more bacteria than the Burger King burger because of it's high sodium levels, sodium kills bacteria. In my experiment I took swabs of both burgers when I bought them, a hour later, a day later 3 days later, 5 days later, and a week later. I rubbed the swabs on 2 types of agar plates, Maconkey agar and sheep blood. I placed them in an incubator and made notes of how they were doing. At the end of my experiment, I found that the McDonald's burger had more bacteria and fungal growth. I also found that the fungal growth had started by the second day. I found that my hypothesis was incorrect. I can tell from my results that fungus was growing when I bought the burgers because fungal growth takes weeks to develop and I saw it within a day. Through this whole process, I always had more questions and wanted more answers. Some of the questions were: what if I tested more burgers?, what if I tested a home made burger?, would my results change if I hadn't waited an hour before swabbing ? These results could be very important to people who are either health conscious or simply just want to know "which burger is better."

NAME(s)	<b>Eliza Jackson</b>	PROJECT NUMBER	<b>P14</b>
SCHOOL	The Renaissance School	GRADE	<b>5</b>
TEACHER	Eve Dubois		
PROJECT TITLE	<b>Pushing to the Limit</b>		

### ABSTRACT

I was trying to figure out if size matters to make an air pressure rocket go farther. I tested the rockets with three different sizes of nosecones. The sizes of the paper circles that I used to make the nosecones were 3 cm, 4 cm, and 5 cm in diameter. I thought that the smaller 3 cm nosecone would go farther because it is smaller and weighs less. The surface area of nosecone 1 is also smaller, and it is easier to get the nosecone through the air. The nosecones have the same amount of air from the bottle, and the same amount of air outside the bottle, but since the 5 and 4 cm nosecones are bigger in diameter, they weigh more and need more air pressure inside to go farther than the smaller nosecone.

I made my rockets out of plastic soda bottles, then taped straws to the bottles. Then I inserted the nosecones. The nosecones are made of cardstock and a Q-tip. I used a plastic tub as a launch pad. I did my tests one at a time, and I did five tests for each rocket. I tested them by setting the soda bottles on the plastic tub and pushing on them.

My hypothesis was partially proved; nosecone 1's average distance was the farthest. Nosecone 2 is in the middle, and nosecone 3 is the largest. However, in some tests nosecone 3 went farther than nosecone 2. When I looked at the data for the individual flights, nosecone 3 had an outlier, so I dropped the longest distance in each one and I recalculated averages. My hypothesis was proved correct because nosecone 1 went farthest while being tested and in the averages. I found out that since nosecone 1's surface area is smaller, it can go through air easier than nosecone 3 can because nosecone 1 is smaller.

NAME(s)	<b>Jared Jackson</b>	PROJECT NUMBER	<b>P15</b>
SCHOOL	Green Mountain Union High school	GRADE	<b>7</b>
TEACHER	Karen Surma		
PROJECT TITLE	<b>Bombs away</b>		

### ABSTRACT

I was trying to find out what catapult made out of homemade items went the farthest, and which one is most consistent. How far would my catapults go, and how consistent are they. I thought that my third catapult would go the farthest and that my 1st catapult would be most accurate. First I made all three of my catapults, and then I tested my catapults by using meters. I tested each catapult three times for each category. My results showed that my hypothesis was right with the distance my 3rd catapult went the farthest out of three tries but wrong with the consistency. Instead my 2nd catapult was the most consistent. In conclusion my results show that if you are going to make a homemade catapult for distance use my third catapult for the job and if you want to make a homemade for consistency use my second one

NAME(s)	<b>Brent Jacobs</b>	PROJECT NUMBER	<b>P16</b>
SCHOOL	St. Francis Xavier School	GRADE	<b>7</b>
TEACHER	Mary Ellen Varhue		
PROJECT TITLE	<b>Perception</b>		

## ABSTRACT

Purpose: I chose this project on perception based driving because I have always been fascinated by mechanics and using technology to make our daily lives more efficient and easier in the future. My question was: which is the better way to drive a radio-controlled car; watching from a distance (3rd person) or watching from a camera mounted on the car (1st person).

Hypothesis: I believe it will be faster to drive a car through an obstacle course with a 1st person view than a 3rd person view.

Procedure: Using a simple homemade track and a durable remote control car with a camera, I tested 17 people. I kept a consistent maximum time at ten minutes. I kept the same track layout and the same practice time. I also alternated the view that the participants tried first

Results/Conclusions: I found that the completion times on the 3rd person trials were faster than those on the 1st person trials. I conclude that my findings strongly disprove my hypothesis and that the 3rd person view is up to twelve times faster than the 1st person view.

NAME(s)	<b>Rebecca Janney</b>	PROJECT NUMBER	<b>B10</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Cleaning Out the Oil</b>		

## ABSTRACT

This study explores the effectiveness of cleaning oil out of water using common household cleaners. I contaminated water with oil, poured Ajax dish soap and Clorox bleach into it, and then skimmed and mixed the solution in hopes of purifying the water. The purpose is to see how oil spills and their cleaning methods affect a surrounding environment. Oil comes in many forms; gear oil is the closest purchasable product to crude oil. I simulated an oil spill which is unchecked in one tank. The two cleaning methods were used in two other tanks. The control is regular water in another tank. Common plants, such as beans, and soil (in which the plants are planted) are next to the water, therefore simulating a surrounding environment for either the “clean” or contaminated water. I expect the dish soap will help disperse the oil so that the net can catch it easily. I also expect that the bleach will simply decontaminate the water. Because of this, I believe that the bleach will work far more effectively to clean out the oil than the dish soap, because bleach simply destroys the problem while dish soap merely makes it spread out. Although this might provide a different perspective on oil spills, it is not suggested to actually use these methods in real life, seeing as both soap and bleach would have negative effects on a surrounding environment.

NAME(s)	<b>Colomb John</b>	PROJECT NUMBER	<b>C18</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Deborah Rodolfy		
PROJECT TITLE	<b>Dry Ice is Sublime</b>		

### ABSTRACT

Dry ice is the solid form of carbon dioxide and doesn't have a liquid phase so it sublimates when changing form from solid to gas. The problem is that dry ice sublimates to gas at an average temperature. So how adversely is sublimation affected by the temperature? To test this, the dry ice was placed in water at different temperatures. Then the mass measured every twenty seconds until five minutes were done or the dry ice sample was completely sublimated. With around ten degrees in Celsius difference the sublimation changed completely. It created an ice shell around itself in the coldest test this is due to how it changes the water's temperature. The dry ice disappeared in less than five minutes during the warmest test. Minimal changes in temperature can cause dry ice to change at elevated rates proven by it sublimating slower as it cooled the water.

NAME(s)	<b>Ashley Johnson</b>	PROJECT NUMBER	<b>B11</b>
SCHOOL	Mill River Union High School	GRADE	<b>10</b>
TEACHER	Carolyn Raiford		
PROJECT TITLE	<b>Beans Get a Boost</b>		

### ABSTRACT

Over the course of a few weeks an experiment was conducted that tested the effect of compost on bean plant growth. The composts in this experiment consisted of composted cow manure, garden compost, leaves and bark mulch. Then there was a pot of plain soil for comparison. Each pot had a mixture of fifty percent soil and fifty percent compost. Each week the height of the bean plants were measured. There were three bean plants in each pot so the average was taken of the three. Also, there were two soil tests conducted, one at the beginning of this experiment and one at the end of this experiment. The soil test tested the amounts of phosphorous, nitrogen, potash, and pH. Things that were learned from this experiment were that if it was ever to be repeated fresh composts should be used. Fresh composts were not used in this experiment because they were collected in the fall and then were in the basement for a couple of months before they were used. Fresh composts should have been used because if they were fresh the nutrients in them would have also been fresh and may have produced better and more concise results. Also when testing the pH of the soil, distilled water should have been used because the pH of the tap water could have affected the results for the pH of the soil. This experiment did not go as well as planned because all of the bean plants grew about the same height. However, the bean plants that were planted in the composted cow manure had thicker stems. Another thing that was learned was that if this experiment were to be conducted again it should be conducted in the summer when the composts would be fresh and the bean plants could be put outside so they could get more sunlight. In this experiment the bean plants had a lack of sunlight so they grew really tall and they had thin, weak stems. This experiment was fun to conduct and it may be conducted again in the future with the changes that should be made.



NAME(s)	Elizabeth Kamb	PROJECT NUMBER	B12
SCHOOL	Woodstock Union High School	GRADE	9
TEACHER	Jen Stainton		
PROJECT TITLE	Are Mercury Levels Higher in the Hair of Omnivores or Vegetarians?		

### ABSTRACT

Mercury is a neurotoxin that is found in the environment and food chains. Concentration of mercury increases up the food chain as one organism consumes another, and can dramatically alter an organism's behavior if too much is consumed. This is why it is such an important thing to monitor in the environment. This project investigated the mercury concentrations in omnivores compared to the concentrations in vegetarians because of their different placement on the food chain. By finding an answer to this question it was possible to determine whether an omnivore or a vegetarian had a lower mercury body burden. Two samples of omnivore hair and one sample of vegetarian hair were collected using clean hands techniques so samples wouldn't become contaminated. Sources of the samples included students and community members. The samples were sent to the Trace Element Analysis Lab at Dartmouth College, where the concentrations of mercury were determined using a mass spectrometer. The average mercury content for human omnivores was 2.3 times the content of vegetarians. However, there was a standard deviation of almost 200 so it was concluded that there was low confidence with the results because the samples varied so much. If this experiment were conducted again, more samples of hair would need to be collected to obtain a more dependable average and the age of the hair samples would need to be regulated.

NAME(s)	Lejla Kelestura	PROJECT NUMBER	B64
SCHOOL	South Burlington High School	GRADE	10
TEACHER	Curtis Belton		
PROJECT TITLE	The Effect of Music on Memory		

### ABSTRACT

This experiment was conducted to test whether or not music aids in memory. Another important aspect of this experiment was to test whether those with a musical background have better memories than those without a musical background. In my procedure, I gathered participants and asked them to look at a list of 15 words for thirty seconds and recall the list back to me as best as they could. Then, after 5 minutes the participants were asked to do the same thing while listening to music and looking at a similar list of 15 words. Participants filled out a survey asking them about their musical backgrounds and whether they listened to music while studying. The results were very varied. Some participants had improved scores in the second round while others had lower scores in the second round of testing. Still, the scores of some remained the same. Although I hypothesized that participants who had a musical background would do better than those with no musical experience, this proved true only for some and inconclusive. I also hypothesized that those who listened to music while studying would do better than those who studied in silence. However, this too was not true in all cases. However a few patterns did emerge distinguishing musicians from non-musicians. Whereas non-musicians would randomly recall the words given to them, some musicians developed different strategies of memorization.

NAME(s)	<b>Gregory Kennett</b>	PROJECT NUMBER	<b>P17</b>
SCHOOL	Windsor High School	GRADE	<b>12</b>
TEACHER	Jennifer Townsend		
PROJECT TITLE	<b>Exploring the Nature of Concrete</b>		

## ABSTRACT

For my experiment I wished to test, through brute force, which curing environment would yield the strongest sample of concrete. I hypothesized that the concrete sample that was allowed to set up in the hot and humid environment would be the most durable. In order to test the characteristics of the concrete, this is what I did; I first began by pouring three separate samples of concrete four inches high in the bottom of a gallon milk jug. The first sample would dry in my boiler room in my basement (having a humidity level of approximately 70 percent), being the hot/humid sample. The next sample I let dry in my mudroom and this would be my hot/dry sample and the last sample dried in my garage and this is approximately the temperature of outside so this would be my cold/dry sample. To test the strength of each sample I would drop a 25 lb. barbell (round and flat plate) from an exact height of six meters on the sample (sitting on a flat surface). I would record the number of drops until the sample was approximately a baseball-to-grapefruit size (for picture taking purposes). After examining the results, my hypothesis was correct leaving the competition in the dust, almost doubling the next best sample in strength. I concluded that the longer you can keep concrete moist and the longer you can make it take to dry (in a hot environment), the more durable it will be. I also derived from this experiment, that the last thing you would possibly want to do is pour concrete in near freezing or below freezing temperatures because this weather results in brittle, crumbly, and surprisingly weak concrete.

NAME(s)	<b>Kylie Keune</b>	PROJECT NUMBER	<b>C19</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Dawn Adams		
PROJECT TITLE	<b>Natural Remedies for Dry and Damaged Hair</b>		

## ABSTRACT

○Many people have bleached, dyed, blow-dried, straightened or curled their hair, and it is often left dry and damaged. The purpose of this experiment was to determine the best natural remedy for dry and brittle hair that has been affected by bleach and heat damage. This problem was tested by treating hair that had been bleached and damaged by a hot iron with five different natural remedies, including coconut oil, olive oil, avocado, egg, and honey. These five sections of hair, as well as a sixth section treated with simply water and a seventh section of hair prior to damage as controls, were tested for their softness, luster and strength. The strength test included stretching strands from each section of hair along a ruler to see how far they would stretch before breakage. The hypothesis was that if hair damaged by bleach regains its softness, luster and strength through natural oils, then coconut oil would be the best remedy. However, the result was that honey was the best natural remedy for hair because it is a humectant, meaning it is a natural moisturizer. Honey was not only the softest and shiniest of all of the sections besides the hair prior to damage, but on the strength test, honey was able to be stretched an average of 4.08cm before breaking, the highest of all seven sections. Brittle hair breaks faster than healthier hair, so the water could only stretch to 2.6cm. These results conclude that if a person would like to have healthy hair, honey is the answer!

NAME(s)	<b>Lindsay Kimball</b>	PROJECT NUMBER	<b>B59</b>
SCHOOL	Lindsay Kimball	GRADE	<b>7</b>
TEACHER	Maria duryea		
PROJECT TITLE	<b>Lenghy Lungs- The comparison of the capacities of lungs to age</b>		

### ABSTRACT

While researching I discovered that at age 20-30 lung capacity should be at its peak. Also that people who are more fit and exercise regularly. Tall people are also said to have larger capacities then short people. This experiment was designed to compare lung capacities with variables like age, height, and weight. My question is “How do the capacities of lungs vary with age?”

I used a table labeled with the different variables as well as diameter trial 1-3, diameter average, and capacity cubic centimeters. My subjects blew up a stretched out balloon three times and recorded the diameter trials, then finding the average. I used the formula for finding the volume of a sphere with the averaged capacities. At the end I had different data for different ages, weights, and heights.

My data proved that age 20-50 had the largest capacity of 5575.28, and the smallest capacity was at age 8 with a capacity of 1288.25 cubic centimeters. The tallest person was 6'3" and weighed 185 lbs. he had a capacity of 5575.25 which was one of the people with the largest capacities. I noticed that males had a larger capacity then females, and that taller people also had larger capacities then short people.

NAME(s)	<b>Abbe Kind</b>	PROJECT NUMBER	<b>P18</b>
SCHOOL	Mater Christi School	GRADE	<b>8</b>
TEACHER	Ms. Donlon		
PROJECT TITLE	<b>Little Green Houses optimization of insulation</b>		

### ABSTRACT

The purpose of this project is to learn what type of insulation retains the most heat outside a house. If one tests regular insulation, insulation with an air gap, and insulation with a plastic liner, then insulation with an air gap will be the most efficient in retaining heat. The background research showed information about heat transfer and the three laws of thermodynamics. The background research also showed information about Heat Flux, Natural Convection and R Value. The first part of the procedure was setting up the equipment: platform, heat lamp, Wall Insulation Test Samples (WITS). Then, the different kinds of WITS were tested and the temperature was read with a temperature gage in ten second intervals. The data was averaged and it showed that medium insulation with a thin air gap, the temperature will rise from 69.3oF to 72.8oF in 180 seconds, medium insulation and a medium air gap, the temperature will go from 69.5oF to 71.5F in 180 seconds and medium insulation with an air gap will go from 69oF to 73oF in 180 seconds. In conclusion, medium insulation with a thin air gap demonstrated to be most efficient on retaining heat outside the house.

NAME(s)	<b>Kathryn Kurchena</b>	PROJECT NUMBER	<b>P19</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Tim Gilbert		
PROJECT TITLE	<b>Advantages of Hydrodynamic Swim Suits</b>		

## ABSTRACT

For my science fair project I wanted to explore why Olympic swimmers were so excited about the new speed suits. A few versions were actually banned from the games due to apparent unfairness. But my question was what is it that makes these suits so great that these world class athletes swore by them. In order to investigate this I did an experiment. I wanted to see what the difference was between regular attire and the swim suit. I wore different articles of clothing (sweatshirt, T- shirt, swim suit, and speed suit) and tested how long it took me to sink to the bottom of a pool for each different article of clothing. The name for what I was testing was hydrodynamics, or how well something is able to move through water. The big factor was drag. The sweatshirt and T-shirt had more drag as I was going through the water, making my decent slower. There was more surface area for the water to have friction with more clothing. The difference between the swim suit and the speed suit was the amount of friction the water had with the fabric. Ultimately the speed suit is the perfect hydrodynamic creation, this is the reason for its advantageousness.

NAME(s)	<b>Andrew Laird</b>	PROJECT NUMBER	<b>C20</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Tim Gilbert		
PROJECT TITLE	<b>Check the Temp</b>		

## ABSTRACT

○In my project I tested how two different waxes performed in two different temperatures. My goal was to see which wax would work the best, and then figure out the chemistry behind the creation of the waxes to tell me why one worked better in one temperature than it did the other. I gathered three different waxes, all from the same company, and chopped up a nordic ski into six pieces. Using proper ski waxing techniques I applied each wax onto two segments of ski using an iron. Three of the six waxed segments I stuck in the freezer for 24-hours, and the other three I tested at room temperature. To assess the waxes I placed an ice cube on the end of the piece of ski and I lifted the end up at an angle until the cube completely slid off the ski. At this point I had a ruler ready to go and measured the height that the ski was lifted and recorded it. If I did not have to lift the ski as high for the cube to slide that simply meant that the wax worked better in that temperature. After I did this with all the waxes and all the skis I researched the chemistry behind ski waxing. The information I found helped me explain my results. Now I not only know which wax works best in certain temperatures, but I also know why the waxes perform at different levels depending on the temperature. Also, I learned how the waxes do their job.

NAME(s)	<b>Brentt Lamb</b>	PROJECT NUMBER	<b>P20</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Susan Ponto		
PROJECT TITLE	<b>Magnetic Effects on a Rail Gun</b>		

## ABSTRACT

The subject I chose to use in as my project was magnetically accelerated objects using a rail gun. A rail gun is basically to parallel steel or aluminum rails with a metal object placed in between the two rails. When electricity is run through the rails it creates a magnetic field that accelerates the object down and out of the rails. The hypothesis was an increase in the size of the power source would create an equal increase the distance the projectile travels. I kept the amount of capacitors the same and the amount of time I charged them from the power source. While it did show an increase the distance did not show an equal increase with the power source. When the power source was doubled the distance would only show a small increase. The uses for a device that can magnetically propel objects is limitless, aircraft carriers can decrease their size or increase the amount of planes they can carry, space craft can save fuel during launch the possibilities are endless and as we get further in our current oil crises I believe that there will be a large public interest in ways to save fuel and the impact on the environment.

NAME(s)	<b>Raina Langevin</b>	PROJECT NUMBER	<b>S07</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>The Effect of Stress on Memory</b>		

## ABSTRACT

Memories are created when synapses, border regions between neurons, in the brain change and strengthen to create a lasting network. In stressful situations, the adrenal glands secrete cortisol. It can give a burst of energy and heighten memory functions. But at high levels it can negatively impact the glucose energy supply to the brain and the communication between neurons. The purpose of this project is to discover if exposure to a small amount of stress, when taking in new information, will or will not improve long term memory. To test how memory is affected by stress, subjects are either exposed to luke warm water, in the control group, or to ice water, which is intended to raise their heart rate. By using a heart rate monitor, Their heart rate will be taken before and after placing their hands in the water for 30 seconds. Then, they will view four images and four sentences for 15 seconds each. After viewing each item they will answer three questions about what they saw or read. A week later the subjects will be given a sheet with the same questions they had answered before and they will be asked to recall. It is predicted that stress will improve visual memory, but not memory of the sentences. It is also predicted that memory of later questions will decrease because the stress and heart rate will also decrease over time.

NAME(s)	<b>Ethan Lawrence</b>	PROJECT NUMBER	<b>B42</b>
SCHOOL	Green Mountain Union High School	GRADE	<b>8</b>
TEACHER	Mr. Allan Garvin		
PROJECT TITLE	<b>Orchid Growth</b>		

### ABSTRACT

For my project, I studied the propagation rate of Lady's Slipper Orchids; not an entirely entertaining task, but an engaging one. John Rice, the head of the science department at Green Mountain knew a man who practiced botany as a hobby. This man is Peter van Shaik, who noticed that something at a particular site of these Lady's Slipper plants (a semi-rare and valuable breed) caused the rate of blooming to be astonishingly high, compared to the species' average. John Rice informed me of the project, and that's how it started.

○Throughout my project, you will see all of the sites (also known as fens) compared/contrasted to the "Newell" site, which is the frequent-blooming site.

NAME(s)	<b>Theophila Lee</b>	PROJECT NUMBER	<b>B13</b>
SCHOOL	South Burlington High School	GRADE	<b>11</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>The Effect of Constricting Prostanoids in PCOS-induced endothelial dysfunction of adult f</b>		

### ABSTRACT

The purpose of this experiment was to find the effect constricting prostanoids had on the endothelial dysfunction of adult female rats induced with PCOS (Polycystic Ovarian Syndrome). We selected 2 rats from the same litter and exposed them to the same conditions. The first rat, we used as a control. The second rat we implanted a DHT (dihydrotestosterone) pellet into a female rat, age 4 for 4-14 weeks to simulate the effects of PCOS. The vessels in the mesentery were then dissected, cannulated, suspended in glass tubes, and pressurized to 50 mmHg. We tested the response of the control rat's vessel by constricting the vessel with phenolypherine, and then dilating it with acetylcholine to generate a sensitivity curve. We then tested the endothelial dysfunction of the rat implanted with the DHT pellet (using the same method), but found that the vessel only dilated about 50% of the control. This proved the existence of endothelial dysfunction within the rat implanted with a DHT pellet. Therefore, the reason the PCOS vessel dilated less to acetylcholine was that there must have been a vasoconstrictor released that opposed vasodilation. The constrictor being released was a prostaglandin, therefore, we used indomethacin (which is a prostaglandin inhibitor) in hopes that it would restore normal dilation. The same setup was used: The vessel was constricted using phenolypherine and then dilated using acetylcholine. We then measured how much it dilated through a video electronic computer- based system. Eventually, it was found that when dilation was restored.

NAME(s)	<b>Sophia Leiter</b>	PROJECT NUMBER	<b>C21</b>
SCHOOL	Woodstock Union High School	GRADE	<b>10</b>
TEACHER	Jennifer Stainton		
PROJECT TITLE	<b>The Ethanol Experiment: Is Paper a Feasible Alternative to Corn in the Production of Ethan</b>		

## ABSTRACT

The purpose of this experiment was two-fold. First, the effect of the enzymes amylase and cellulase on the process of ethanol production using corn and waste paper was experimentally determined. Second, from the results of this experiment, the feasibility of using recycled paper as a substitute for corn in ethanol production was calculated. It was hypothesized that if cellulose were used rather than amylase in the production of ethanol in recycled paper, then more ethanol would be produced, and recycled paper could be used as a feasible alternative to corn in ethanol production. To test the hypothesis, recycled paper and corn were fermented for two weeks, and then sent to a laboratory for testing. The testing method used for analysis was High Performance Liquid Chromotography. The results of the experiment indicate that (1) the corn produced more ethanol (almost 10 times more) than paper regardless of the enzyme used, and (2) cellulase worked better (by about 30% on average) than amylase for both corn and paper. These results support the portion of the hypothesis that cellulase is more effective than amylase in ethanol production. However, the corn made an average of almost 10 times more ethanol than the recycled paper, which refutes the hypothesis that paper can replace corn in ethanol production. The amount of paper that is recycled per year at Woodstock Union High School was determined, and from this, the amount of potential ethanol production was calculated. It was determined that \$210 worth of ethanol from over 5500 lbs of paper would be produced compared to what dollar amount of ethanol for corn weighing the same amount, thus making ethanol production from recycled paper using the enzyme cellulase neither cost nor time effective.

NAME(s)	<b>Caitlin Long</b>	PROJECT NUMBER	<b>B14</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Soggy Cheese</b>		

## ABSTRACT

○Cheese is a commonly eaten food, and as such, I wondered what effects “aging” or “ripening” have on cheese. I hypothesized that the more a cheese ages, or is left to sit in a salt coating, and a layer of wax, the drier it gets. This means that it loses moisture. By testing three types of cheddar cheese, each aged a different amount of time; I hope to determine whether or not this is true. I will take mild cheddar, sharp cheddar, and cheddar aged longer than the sharp cheddar. Each of these is aged longer than the one before, providing me with a moderate range, without too many variations between the samples. As no two batches of cheese can ever be exactly the same, there may be a few discrepancies in the data, but as they are the same type of cheese, and I will be testing three cheeses from the same manufacturer, they will most likely be minute. With the mild cheese as a control, and the sharp, and sharper cheeses as variables, there should be significant data to help me understand the answer to the question: how does ripening affect cheese?

NAME(s)	<b>Liam Lustberg</b>	PROJECT NUMBER	<b>S08</b>
SCHOOL	The Renaissance School	GRADE	<b>5</b>
TEACHER	Eve Dubois		
PROJECT TITLE	<b>How Music Affects Human Emotions</b>		

## ABSTRACT

My project is on How Music Affects Human Emotions, and I wanted to find out how age and type of music influence the emotions being expressed by humans. My hypothesis is that the older people got, the more they would feel as if a positive attitude was emanating from the more calming types of music, such as classical and reggae. I also thought that the younger age groups would like the feeling coming from the more energetic types of music, such as jazz, pop, and rock. I used five different types of music: rock, jazz, pop, classical, and reggae. Next, I tested people in each age group: 0 û 12, 13 û 35, 36 û 65, and 65 and up, by playing a short part of one song from each genre of music and questioning the subjects about how they felt after each type of music had been played. Finally, I compared the results from each test and looked at their similarities and differences. I found that pop music is very upbeat and happy, no matter what the person's age is. I also found that almost all children find reggae to be calm and soothing, and most adults and older people find it to be irritating or happy. Middle-aged humans find classical music to be calm and peaceful, while younger and older humans find it to be exciting and energetic. Older people find jazz music to be annoying and irritating, while younger people find it to be either annoying or happy. The younger-middle-aged group found rock music to be boring, while the youngest people found it to be exciting, but not very. The older-middle-aged people thought that rock was extremely exciting and hyper, and the oldest people thought it was confusing. My hypothesis was disproved because many of the older people found classical to be exciting and energetic, and many of the younger people found it to be calm and peaceful. My hypothesis was also proven because younger people think jazz music is more happy, while older people think that it is annoying.

NAME(s)	<b>Alex Lynn</b>	PROJECT NUMBER	<b>P21</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Susan Ponto		
PROJECT TITLE	<b>Measuring Knee Tension</b>		

## ABSTRACT

Knee tension has become a problem amongst many people in their daily lives. Knee tension is caused by the recent gravitational forces and physics, usually by bending the knee that push against the patellar tendon, which is located in the knee and the quadriceps, which are located above the knee. For the objective of the experiment is to test the hypothesis whether that when a person does a complete knee bend, then there will be more tension on the patellar tendon if a person does a partial knee bend. To test this, a model knee was built that contained a spring to measure tension. To collect data, the knee was held in a desire position, which was determined by measuring the inside angle of the knee. Then the tendon was tightened using a guitar tuner. The tension adjusted until the knee stayed in position. Once in position, the extended spring was measured and the data was converted to tension based on Hooke's law equation ( $F = kx$ ). The data was graphed and showed that the tension on the patellar tendon goes up at a faster than linear rate as the bend gets deeper. Results show that there was 100% more tension on the patellar tendon in a complete knee bend than a partial knee bend. In contrary, the reason that the theoretical force did not agree with the model is because of the complications of the model were hard to measure. Overall, all objectives were met at their standards.



NAME(s)	<b>Ian Martel</b>	PROJECT NUMBER	<b>P22</b>
SCHOOL	Green Mountain Union High School	GRADE	<b>8</b>
TEACHER	Mr. Allan Garvin		
PROJECT TITLE	<b>The Forces of Flight</b>		

## ABSTRACT

What I did for my science fair project was test different types of airfoils to see which airfoil created the most lift. I used the Wright Brother airfoil and the flat Bottom airfoil for my test airfoils. I built a wind tunnel using a heating duck and two fans. I taped fishing line to the corners of the airfoil I was testing. I then taped the other end of the fishing line on the inside of the wind tunnel then I would make sure that the airfoil was flat. To help me measure I taped a scale marked off in centimeter increments to the wall of the wind tunnel. I would turn on the fan and take 16 pictures of the airfoils while the fans were running then switched the airfoils and took 16 more pictures. After I took all the pictures and got them all in a graph I made an average of lift height for both of the wings and put the data onto the graph. Once I put both airfoils on a bar graph you could easily see which had more lift. The Wright Brothers airfoil had an average of 2.2 cm of lift and the flat bottom airfoil had much better lift than the Wright Brother airfoil.

NAME(s)	<b>Sarah Martel, Hannah Sheere</b>	PROJECT NUMBER	<b>GP13</b>
SCHOOL	Green Mountain Union High School	GRADE	<b>7</b>
TEACHER	Karen Surma		
PROJECT TITLE	<b>Acid Rain's Affects on Plants</b>		

## ABSTRACT

Abstract

Our topic was Acid rains affects on plants, we added vinegar and water to chia seeds each day. We wanted to see if plants could live in acidic liquid, such as vinegar. We wanted to do this because rainwater has acid in it and we wanted to see if the plants would grow better in the rainwater, or regular water. Our hypothesis was that the plants would grow better in water then vinegar, or the vinegar combined with water. We thought that because we thought the vinegar would be to over powering for the plant. Our procedure for this project was Put 5 holes in the bottom of a cup, put 1\2 cup soil in the cup, label the cups with a marker to mark the different water measurements we had, they were, 5ml water 15ml vinegar, 15ml water 5ml vinegar  $\frac{1}{4}$  and  $\frac{1}{2}$ , 20 ml water, and 20ml vinegar, make 5 of each plant. Then you put 30 chia seeds in, then make observations every day and take pictures of your work. Our results were that plants grow better in plain water then in acidic liquids. 2 of our 5 water plants sprouted and grew tall all the other ones never sprouted. The conclusion is that chia grows better in water then in acid, this is because the vinegar was over powering the plants.

NAME(s)	<b>Michael McCarroll</b>	PROJECT NUMBER	<b>C22</b>
SCHOOL	Rutland High School	GRADE	<b>10</b>
TEACHER	Dawn Adams		
PROJECT TITLE	<b>The Race For Relief</b>		

### ABSTRACT

There is no need to spend extra money on the brand name or “fast relief” over the counter medicines. This experiment focused on the dissolving rate of pain relief medicines. Which should have dissolved as they were advertised, because false advertisement is illegal. The name brands of the drugs, ibuprofen, acetaminophen, Naproxen Sodium, and Aspirin were tested. A simulated esophagus and stomach were used for my experiment. First the pill was dropped into 15ml of water for nine seconds, and then moved into 15ml of lemon juice for four to six hours. That simulated the nine seconds it takes, on average, for anything to reach the stomach. The lemon juice had the same ph level as stomach acid. Results were varied. For ibuprofen the Advil was three times faster than the store brand Equate. But for Tylenol the Name brand was fairly equal with the Store brand. For Aleve the Equate Naproxen Sodium was faster, and the Bayer Aspirin never dissolved as where its store brand counterpart dissolved in nine to ten seconds. On top of the store brand vs. name brand test, I also tested sleeping pills, and liquid gels. The results from this were shocking. The liquid gels took longer than the normal pills and the Advil one took four hours to dissolve. The Advil PM pill was gone in less than an half hour, but the Tylenol PM pill did last almost five hours. This experiment showed that for all the medicines, other than Advil’s normal pill, the cheaper priced store brands are not only equal to, but better than the expensive store brands.

NAME(s)	<b>Ben McCormick</b>	PROJECT NUMBER	<b>B15</b>
SCHOOL	St. Francis Xavier School	GRADE	<b>7</b>
TEACHER	Mary Ellen Varhue		
PROJECT TITLE	<b>Blow 2 The Beat</b>		

### ABSTRACT

The heart and lungs are large organs in your body and have a lot to do with your health. What is the relationship between lung capacity and heart rate? My hypothesis was that if the lung capacity is larger, then the heart rate will be lower following exercise. Using a group of 33 students, I made record forms and brought them to the gymnasium. I taught participants how to take their heart rates. I measured the heart rates of the participants while they were at rest and then immediately after two minutes of exercise. I took their heart rate once again three minutes later, and once more two minutes following the previous test. I then tested the lung capacity of the participants using lung capacity bags and analyzed the data. I learned if the lungs were large (ie 5.4 liters) you had a lower average heart rate, around 54 beats per minute. My hypothesis was correct although I did learn that testing with people can introduce error into an experiment. The data shows that if the lung capacity was larger, the heart rate was lower.

NAME(s)	<b>Finn McFarland, Erin Wood, Anna Ramsey</b>	PROJECT NUMBER	<b>GP14</b>
SCHOOL	Woodstock Union High School	GRADE	<b>9</b>
TEACHER	Jen Stainton		
PROJECT TITLE	<b>A Comparision of Mercury Concentration in Human Omnivore and Vegetarian Hair</b>		

## ABSTRACT

What toxins exist in the human body? This study compared mercury concentration in the hair of vegetarian vs. omnivore humans. According to a study conducted by the Center for Disease Control and Prevention in 2004, people were measured with a mercury concentration of less than 33  $\mu$ g/L. Human hair is the preferred way to determine the amount of toxin in the human body because it is easy to gather and hair follicles are bathed with blood which carries the mercury. Our hypothesis stated that omnivore hair would have a higher concentration of mercury than vegetarian hair because omnivores eat fish and other meats which have higher amounts of mercury than non-meat products. This is due to biomagnification, the magnification or increase in concentration of a toxin in the food chain. Hair samples were collected from both omnivores and vegetarians. They were then sent to a lab at Dartmouth College where they were freeze dried in a clean room, dissolved with acid, atomized and then analyzed at the Dartmouth Trace Element Analysis Lab for mercury concentrations. The data showed that on average omnivores had 197.6 more ppb in their hair than vegetarians. The vegetarian sample was a pool of four hair samples and the omnivore samples were averaged. Considering the fact we were limited to the number of samples we could test these data are not necessarily accurate. Preferably we would have had more samples with more accurate results. The data we received did however support the hypothesis.

NAME(s)	<b>Sherrie McHugh</b>	PROJECT NUMBER	<b>C23</b>
SCHOOL	Windsor High School	GRADE	<b>12</b>
TEACHER	Jennifer Townsend		
PROJECT TITLE	<b>Octane Accuracy</b>		

## ABSTRACT

Gas stations are often checked to see if their fuel meets the standards set by the EPA. However, there have been complaints in this area about watered down gas in the fuel tanks. The purpose of this experiment is to test the specific gravities of different fuel grades at gas stations in the area. My hypothesis was that all five gas stations would have a pattern. The pattern is that as the octane rating increases, the specific gravity decreases. A sample of each gas grade was taken from five different gas stations and tested by using a light liquid hydrometer. The hydrometer was dropped into a fuel sample it which should have read somewhere between .73 and .76. This means that the density of the fuel is 73 percent to 76 percent of water's density. After completing this experiment, I found that three of the five gas stations tested didn't follow the trend I expected. Two of the three had one fuel grade with a greater specific gravity than expected and one gas station had the specific gravity values increasing with octane grade on all three of the fuel samples. These are possibilities because when water is added to a gas sample it will make the specific gravity increase and older fuel has allowed some of the chemicals to evaporate from the tank supply which could also make specific gravity increase. This meant that three of the five stations could have something contaminating their fuel tanks, like water, or it is just older fuel.

NAME(s)	<b>Kelsey McKay</b>	PROJECT NUMBER	<b>C24</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Tim Gilbert		
PROJECT TITLE	<b>Krazy Ketchup</b>		

## ABSTRACT

Ketchup is a sneaky condiment. It drips off your hot dog or hamburger and onto your favorite new shirt. Or worse, it splatters all over while you're trying to squeeze the last bit onto your food. And what about organic ketchup? Is there even a difference between it and non-organic ketchup? For this experiment, the effectiveness of stain removal techniques on organic and non-organic ketchup stains was tested. A nice, new, white t-shirt was cut into a bunch of short, fat strips. A little stain of organic and non-organic ketchup was put on each strip. The strips were soaked in all different laundry detergents for three minutes. Then each stain scrubbed 25 times with sponge. Some stain removal techniques were done differently. A Tide-to-go pen was used following the directions on the pen. Some strips were just soaked in different temperature water. And others were treated with hydrogen peroxide or lemon juice. Bleach was also tested using the same method as described above. How well do you think your laundry detergent stands up to ketchup stains?

NAME(s)	<b>Jodie McMahon</b>	PROJECT NUMBER	<b>B16</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Environmental Toxins Impact on Thyroid Cancer Cell Characteristics</b>		

## ABSTRACT

My project is focusing on thyroid cancer and it's currently in its final stages of experimentation. The purpose of the experiment is to find out how large of a part, if any, environmental toxins play in the growth of cancer; thyroid cancer to be specific. Through my experimenting and gathering data I'll be able to see whether or not toxins from the environment causes thyroid cancer to grow, migrate, and reproduce quicker. It is broken down into multiple stages: the first is moving cells into growth dishes and recording their migration after twenty-four hours. I used four different sets of thyroid and each set came up with different sets of results. The second stage is adding the toxin to the groups of cells that will, if my hypothesis proves correct, have an effect on the cancer cells. For each set of cells I take photographs before they are left to sit for twenty-four hours and I take photographs after the twenty-four hours. This way it is easy and clear to see where changes occurred and when. There are many useful resources in the lab that I am fortunate enough to be able to work in and one of which is a high-resolution microscope that can take the informative pictures. Using this and a program on the computer I can organize my data into an understandable collection. Through my presentation I hope to show a greater understanding for how serious environmental toxins are as well as how they can affect the body as a whole.

<b>NAME(s)</b>	<b>Emily McNamara, Samantha Wood</b>	<b>PROJECT NUMBER</b>	<b>GP15</b>
<b>SCHOOL</b>	<b>Green Mountain Union High School</b>	<b>GRADE</b>	<b>8</b>
<b>TEACHER</b>	<b>Mr. Allan Garvin</b>		
<b>PROJECT TITLE</b>	<b>Did You Remember That?</b>		

## ABSTRACT

People listen to music all the time even when they are working. This brings me to a question: Does music affect your memory? Our Hypotheses was that Classical music will have the least affect on your memory and that Rap would affect it the most. We tested this by having people study a paper with twelve random pictures on it for a minute. When the minute was up they would sit for another minute and have to remember what they saw. Then after a total of two minutes they have to tell us what they remembered. Over all we figured out that music does affect your memory. Most people did the best without music but the type of music that they remembered the most while listening to was Country. The type of music that had the most affect on the memory was a tie between Classical and Pop. Our conclusion is that music does affect your memory in a bad way.

<b>NAME(s)</b>	<b>Keagan McNamara</b>	<b>PROJECT NUMBER</b>	<b>B65</b>
<b>SCHOOL</b>	<b>Avalon Triumvirate Academy</b>	<b>GRADE</b>	<b>5</b>
<b>TEACHER</b>	<b>Amanda F. Gifford</b>		
<b>PROJECT TITLE</b>	<b>Sleep On It</b>		

## ABSTRACT

The purpose of my project is to show that being well rested is very important. When you are well rested your body functions better than when you are sleep deprived.

The materials I used are paper, timer, pencil, test subject, and three puzzles. I had each subject do three puzzles and they were timed on how long it took them to do the puzzle when they were deprived of sleep and when they had 8 or more hours of sleep.

My hypothesis is that when you are well rested you will finish the puzzles faster and that when you are sleep deprived it will take you longer to finish the puzzle.

My observations are that most of the people that were deprived of sleep took longer to finish the puzzle and that the people that had eight or more hours of sleep were a lot faster than the people that were sleep deprived.

My conclusion is that people who are sleep deprived take longer to finish the puzzles than the people that had eight or more hours of sleep. This proves that is very good to be well rested.

NAME(s)	<b>Kurt McNamara</b>	PROJECT NUMBER	<b>P23</b>
SCHOOL	Avalon Triumvirate Academy	GRADE	<b>8</b>
TEACHER	Amanda F. Gifford		
PROJECT TITLE	<b>Get Through It!</b>		

### ABSTRACT

The purpose of my project is to test what type of track or wheel works better on an ATV for going through water. I used a model Lego ATV, sand, water, rocks and three different types of moving devices: regular tires, bubble tires, and tracks. My hypothesis is that tracks will enable the ATV to cross a river without getting stuck. The bubble tires worked the, the tracks got stuck more often, and the regular tread tires got stuck the most often. I believe that the bubble tires work better because they floated more on the surface of the water instead of touching the bottom.

NAME(s)	<b>Jaffer Merali</b>	PROJECT NUMBER	<b>S09</b>
SCHOOL	South Burlington High School	GRADE	<b>9</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Do you Remember...</b>		

### ABSTRACT

The purpose of this experiment was to figure out if throughout the course of high school your skills of the three stages of memory (store, retain, and recall) were finely tuned. The way I am going to do this is through a simple memory test where I read a story to the subject. They will also have the story in front of them to follow along. I will then take the paper away and have them listen to a song so that a true memory test can occur. Naturally you start repeating the facts in your head so you don't forget them. The music helps avoid that to make it a true memory test. I would then take the headphones away and ask them five questions. After testing the seniors and freshmen I came to a conclusion that there really isn't a difference between the two and how they are able to process the stages of memory.

NAME(s)	<b>Katie Merrick</b>	PROJECT NUMBER	<b>S10</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Cat Psychology--Clicker Training vs. Compulsion Training</b>		

### ABSTRACT

The purpose of this experiment was to determine the effectiveness of clicker training on shelter cats as opposed to the traditional method of compulsion training. Clicker training is based on the psychological principle of operant conditioning. Compulsion training is centered on luring an animal to complete the task.

The effectiveness of the two methods was determined by the amount of tries it took for each cat to learn a new skill, four were taught, and how well each cat retained the skills, found by a test on the hardest skill 30 minutes post-teaching. The compulsion-trained control group was taught each skill by being lured by a treat. When they completed the desired task, they were rewarded with the treat. The experimental group saw the treat prior to completing the task, which led them to complete the task. Once they had accomplished this, the clicker clicked and then they were given a treat. They learned to associate the task with the clicker, and the clicker with a treat.

I expect that results will conclude that the clicker training method is more effective. It would be shown to be more effective because the cats would have taken less tries to learn each task and less tries to complete the “test”. The prior shows which way the cats can learn more quickly and the latter shows with which method the cats retain the skills. I expect that clicker training will be overall more effective since it is based on operant conditioning.

NAME(s)	<b>Abby Millard</b>	PROJECT NUMBER	<b>C25</b>
SCHOOL	Weathersfield School	GRADE	<b>8</b>
TEACHER	David E. Lambert		
PROJECT TITLE	<b>Do fluoride toothpastes, treatments, and rinses protect your tooth enamel?</b>		

### ABSTRACT

I chose to study whether or not fluoride toothpastes, treatments, and rinses protect your tooth enamel. I chose this problem because I had previously done an experiment on this topic. It was vague and just for fun but the results interested me and I wanted to further investigate it.

Before forming a hypothesis I researched different opinions on the subject of fluoride protection. I found that the ADA, the Center for Disease Control and Prevention, the USDA, the United States Surgeon General, and Consumer Reports all support fluoride use and believe it protects your tooth enamel. I found the Global Healing Center believes fluoride is ineffective and harmful. I also researched the main ingredients in fluoride toothpastes, rinses, and treatments. I found that the main type if fluoride used is stannous fluoride. I also found out that the compounds, sodium fluoride and sodium monofluorophosphate are used in toothpaste. I also learned about the process of demineralization, in which bacteria deteriorates your tooth enamel. In addition, I learned that egg shell and tooth enamel are both composed of calcium carbonate. My hypothesis was that fluoride toothpaste, rinse, and treatment would protect an egg's shell when soaked in vinegar. I also predicted that fluoride treatment would protect the egg shell more effectively than the toothpaste and the rinse.

In my experiment, I massed eggs and recorded the masses. Then I coated one egg in Acclean Acidulated Phosphate Fluoride Treatment, one in Crest Pro-Health Fluoride Anti-Cavity Toothpaste, and one in Act Alcohol Free Anticavity Fluoride Rinse. I did not coat the control. I let the eggs sit in their coating for one hour. Then I soaked them in jars of vinegar for twelve hours. When they finished soaking, I recorded their masses again. Then I found the differences between the original masses and the masses after the eggs were soaked. I completed five trials for each type of fluoride.

NAME(s)	Keegan Moynihan	PROJECT NUMBER	B60
SCHOOL	Northfield Middle High School	GRADE	11
TEACHER	Cynthia Tomczyk		
PROJECT TITLE	The Effect of Temperature on Mealworm Metamorphosis		

## ABSTRACT

Heat is easily transferred energy, and the physiology of a living thing is greatly affected by temperature. As heat is increased, a body's metabolism is increased and requires more nourishment. The mealworms that were used in this experiment were to illustrate this property. Mealworms are larva of the species *Tenebrio molitor* and have multiple stages of life. Beginning the life cycle, after the egg, is the larval stage, commonly called a mealworm. Through metamorphosis the mealworms go through a pupal stage and become beetles. During the larval stage of life, the mealworms go through several stages of growth, called instars, for which they shed skin marking the end of one instar and the beginning of the next. Twenty larvae were put under each temperatures (104°F, 90°F, 80°F, 70°F, and 41°F). The hypothesis tested was: If mealworms are put under different temperatures, then the colder temperatures will cause the larvae to take longer to cycle through life stages, and warmer temperatures will cause the larvae to cycle through life stages more rapidly as compared to room temperature. By the end of ten weeks, the tests at 104°F, 90°F, and 41°F all had no living inhabitants. The 90°F treatment yielded one pupa but it was deceased by week ten. The 80°F treatment was the only treatment to produce a mealworm that finished the life cycle. This mealworm made it through the pupal stage and into the beetle. Other than this beetle, the 80°F treatment had six living larvae at week ten. The 70°F treatment held nine mealworms at week ten, yielding the greatest number of living inhabitants. The 70°F treatment is shown to be the most conducive to larvae longevity, but the 80°F treatment was shown to be the most conducive to the growth of mealworms.

NAME(s)	Sam Myers	PROJECT NUMBER	P24
SCHOOL	St. Francis Xavier School	GRADE	7
TEACHER	Mary Ellen Varhue		
PROJECT TITLE	On The Line		

## ABSTRACT

The purpose of my experiment was to find out which type of fishing line is the strongest. My hypothesis was that the fluorocarbon line would do the best, the extra strength monofilament the second and the standard monofilament the worst. I used a weighing scale, a Weight scale, 8 pound test fluorocarbon fishing line, 8 pound test extra strength monofilament fishing line, 8 pound test standard monofilament fishing line, a nail, a hammer and a tape measure in my experiment. I hooked the scale onto the nail, which was in the wall, measured out a 2 foot piece of line, tied the line to the scale and pulled down on the line. When the line broke, the scale would hold the current weight and I recorded it. I did multiple trials for each type of line. One problem was that the line would come undone at the knot instead of breaking so I had to take a new piece of line and redo the trial. My hypothesis was correct and I concluded that the fluorocarbon line could with stand the most weight.



NAME(s)	<b>Tristan Nagiba</b>	PROJECT NUMBER	<b>P25</b>
SCHOOL	The Renaissance School	GRADE	<b>6</b>
TEACHER	Eve Dubois		
PROJECT TITLE	<b>Sailing Over Science</b>		

## ABSTRACT

For my science fair project, I did “What sail shape makes for the fastest land yacht?” I believe that the trapezoid-shaped sail will be the fastest because the height of the trapezoid-shaped sail is much taller than the other two sails. I believe that the trapezoid sail will be able to catch more wind. That will affect the speed of the trapezoid-shaped sail because, even though all three sails are 400 square inches, the height of the trapezoid sail is taller and can capture more wind, which makes it go faster.

For my procedure, I first made the land yacht and an eighty-inch-long test course. I tested the land yacht on a smooth floor. Then I used a box fan to create a constant wind source. I ran the land yacht four times with each sail shape attached securely with the same amount of white duct tape, and then timed each run. The materials I used for my science project were a skateboard, a wooden dowel, three PVC pipes, 1200 square feet worth of nylon for the sails, and a box fan as a constant wind source. Each sail is 400 square inches.

The winning sail shape was the trapezoid sail. That was the fastest sail of all three sail shapes. I had stated in my hypothesis that the trapezoid sail shape would be the fastest sail because it was the tallest sail of the three and would catch more wind. I also stated that the trapezoid sail would be the fastest because the world’s largest sailboat, which belongs to Tom Perkins, has trapezoid sails, and it is as long as a football field. If I were to further investigate this topic, I would get a more powerful fan, have a larger test track, remake all of my old sails, make more sails of different shapes, and do more tests per sail.

NAME(s)	<b>Avni Nahar</b>	PROJECT NUMBER	<b>B17</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>The Allelopathic Effects of Marigolds on Beneficial Bacteria</b>		

## ABSTRACT

French marigolds are known as valuable companion plants in the garden. This is because they are allelopathic; they release sulfurous compounds from their roots that kill or weaken bacteria and other plant pathogens in soil. However does this “advantage” also have a downside?do marigolds kill beneficial bacteria in soil as well? Rhizobium leguminosarum (R. leg) and Bacillus subtilis (B. sub) are two naturally occurring bacteria that are helpful to plants, increasing plant growth. The main purpose of this project was to determine whether or not French marigolds planted with wheat plants inoculated with either of the two beneficial bacteria would impact the growth of the wheat. The original hypothesis was that the marigolds would indeed limit the growth of wheat.

The experiment was conducted by planting wheat and marigolds in a number of arrangements: one group of wheat without any inoculation (which served as the control), one group of wheat with solely R. leg, one group of wheat with solely B. sub, one group of wheat and marigolds with R. leg, one group of wheat and marigolds with B. sub, and one group of solely wheat and marigolds. All groups were given the same amount of light, heat, and water. All wheat plants began at the same height, and height measurements were taken each day of the experiment, in addition to color and health observations. At the end of the data collection period, a number of wheat plants in each group will be harvested, and the masses of each group will be taken. Heights and masses of wheat plants in the experimental groups will be compared to the heights and masses of plants in the control group to determine whether or not marigolds and/or the bacteria impacted the wheat growth in any manner. It is expected that the wheat with R. leg will have the greatest growth, while the wheat, marigold, and B. sub group will have the least.

NAME(s)	<b>Evelyn Needham</b>	PROJECT NUMBER	<b>P26</b>
SCHOOL	Hinesburg Community School	GRADE	<b>8</b>
TEACHER	Stephanie Konowitz		
PROJECT TITLE	<b>Sunny Systems: the Effect of Solar Energy on Hot Water Systems</b>		

### ABSTRACT

Solar hot water systems are one of several systems developed to transfer the sun's solar rays into energy. These eco-friendly systems are becoming more and more popular as the impulse to "be green" has begun to increase throughout the country and others as well. This experiment was designed to determine the outcome of black, red, copper, green, and white systems when exposed to equal amounts of sun rays. The outcome might persuade citizens to "go green" and support solar hot water system suppliers in an effort to reduce pollution.

Each different colored system was filled with 20 mL of room temperature water. I placed each of the systems in a position outdoors facing towards the sun and left them for an hour. This allowed the systems to absorb as much sunshine as possible within the one hour period. I then recorded the temperature changes and the weather conditions after the systems were exposed to the weather conditions for one hour. Ambient temperatures, starting temperatures, starting times, and stopping times were recorded as well.

The temperature changes of the different colored systems when exposed to each weather condition were similar. During the trials in which all the systems were exposed to full sun, the black system, on average, rose 17.86°C in temperature. When the systems were exposed to light cloud cover, the copper (or control) system rose, on average, 2.38°C which was proven to be the highest increase. The temperature at which the copper (control) and red systems rose 0.36°C was when the systems were exposed to moderate cloud cover. The copper (control) and red system rose the highest in comparison to the other colored systems. In fact, the green and black systems dropping in temperature during the exposure to moderate cloud cover. Lastly, the green system dropped 8.23°C in temperature during the trials exposed to heavy cloud cover, this system proved to decrease the least in temperature.

NAME(s)	<b>Jennifer Needle</b>	PROJECT NUMBER	<b>B52</b>
SCHOOL	Northfield Middle High School	GRADE	<b>11</b>
TEACHER	Cynthia Tomczyk		
PROJECT TITLE	<b>The Effect of UV Light on Bacteria Growth</b>		

### ABSTRACT

To collect data for this lab the first step was to grow the bacteria samples. This required the making of agar plates which were then swabbed with samples of bacteria. These grew for a few days, and then the number of bacteria colonies was counted. After that the plates were tested under UV light for different amounts of time, and the number of remaining colonies after testing for three days was counted. Then the percent change in colony number was calculated, and an average was obtained for each group of plates receiving the same exposure time to the UV light. In this lab, it is displayed that that as more UV light is added, the amount of bacteria colonies goes down. The average percent change for the plates receiving 15 minutes of exposure time was -24.09%. For samples receiving 30 minutes of exposure, the average percent change in colony number was -37.87%. The average percent change for samples receiving 45 minutes of exposure was -51.32 %. The samples receiving 60 minutes of UV exposure showed an average percent change of- 66.76%. Lastly, the average percent change in colony number for 0 minutes of exposure, the control, was 8.02%. The data followed this downward trend because UV light has negative effects on bacteria. UV light enters bacteria and alters the DNA. It forces amino acids to clump together. In the replication process, these clumps create a block, and DNA is incorrectly copied, thus destroying the cell. Because UV light destroys cells, plates of bacteria receiving more UV light had the greatest decrease in percent change of colony number in this lab.

NAME(s)	<b>Haley Newman</b>	PROJECT NUMBER	<b>S11</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>How Color Affects Your Memory</b>		

## ABSTRACT

My project was to determine whether a use of color will make it easier for somebody to memorize a set of words. If we found out that color did help make it easier to memorize than many people could adapt how they teach or study to incorporate color. You would think that color helps memory because it will stand out on a page better than black words will making it easier to remember. To test this I created three different sets of 12 words each. The words will two to three syllables each and were common, every day words. The first test, the control, was in black and white and the other two were in blue and white and yellow and black. I gave each person 30 seconds to memorize the 12 words and then we waited 15 seconds and they repeated back to me the words that they remembered. We repeated this for all three tests. So far I have found that most people remember more words on one of the color tests than they did with the black and white test. I believe that as I continue my experiment my results will continue to support my hypothesis that color does help with memory.

NAME(s)	<b>Thomas O'Neill</b>	PROJECT NUMBER	<b>P27</b>
SCHOOL	Windsor High School	GRADE	<b>11</b>
TEACHER	Jennifer Townsend		
PROJECT TITLE	<b>Weight Distribution and Speed</b>		

## ABSTRACT

The focus question for my experiment was: How does weight distribution affect the speed of a sled? I hypothesized that a sled with greater weight positioned in the back would travel faster. This is a common belief when sledding and at water parks lifeguards instruct the larger riders to sit in the back of double tubes when going down water slides. To test this, I made a sled out of a block of wood and drilled two holes in it where I could place weights. I placed 10g, 50g, 100g, and 200g weights in different positions in the sled and in different combinations with each other. I the timed the sled when traveling down a 6 ft. rain gutter propped up at a 22.5 degree angle. Then using the formula speed equals distance divided by time I found the speed of each sled's run. I found that in every weight pairing, the sled with the greater weight positioned in the back traveled at a greater speed than the sled with the greater weight in the front. This data supported my hypothesis and could easily be applied to real life when sledding for fun or competitively.

NAME(s)	<b>Miranda Orcutt</b>	PROJECT NUMBER	<b>C26</b>
SCHOOL	Mater Christi School	GRADE	<b>8</b>
TEACHER	Michelle Donlon		
PROJECT TITLE	<b>Stomach Ache? Take a... Tums?</b>		

### ABSTRACT

This experiment was performed to determine which stomach acid remedy would lower the acidity of lemon juice (simulating hydrochloric acid) the best. The choices were: one Tums and a cup of water, five Ritz crackers and a cup of water, one and a half tablespoons of tofu and a cup of water, or one cup of milk. The hypothesis was: if a Tums and water, Ritz crackers and water, tofu and water, or milk, are each put into separate containers containing lemon juice, then the lemon juice combined with the Tums and water will be the least acidic. Research was conducted regarding acid-base reactions. It was discovered that neutralization was the process where positive hydrogen ions from an acid combine with negative hydroxide ions from a base and produce water and a salt. The salt is formed by the remaining ions of the acid and base.

For the four trials, the food was chewed up and the liquid was swished around in one's mouth. Four containers held a half cup of lemon juice blended with one Tums and water, Ritz crackers and water, tofu and water, or milk. Once these mixtures sat for an hour, their pH's were recorded. The final results of each trial were averaged, coming to 3.19 for the Tums mixture, 2.91 for the Ritz blend, 2.90 for the tofu substance, and 3.38 for the milk combination. Surprisingly, the milk lowered the acidity of the lemon juice more than the Tums and water did.

NAME(s)	<b>Jacob Page</b>	PROJECT NUMBER	<b>P28</b>
SCHOOL	Windsor High School	GRADE	<b>12</b>
TEACHER	Jennifer Townsend		
PROJECT TITLE	<b>Planes, Grains, and Alternatives</b>		

### ABSTRACT

The purpose of this experiment was to explore a low cost and safe alternative to Sitka Spruce for rib cap strips on a wooden aircraft wing. If Douglas Fir, Northern white pine, and Sitka spruce are tested for their ultimate tensile strength (UTS), mass, and strength to weight ratio, then carefully selected Northern white pine will be lighter and stronger than Sitka spruce. To test the specimens, I constructed a test fixture that utilized sand to measure the UTS. My results showed that the Douglas Fir specimens were the strongest, but were also twice the weight of the other two specimens. The Northern white pine broke with the smallest amount of weight and Sitka Spruce averaged as the middle strength. Douglas Fir is a great type of wood for Aircraft material, but for my blueprints, it would put a damper on the payload; it also is well known for its splintering characteristic when working with the material. Northern white pine was not as strong as Sitka spruce, making my hypothesis false. In order for the Northern white pine to work with the blueprints, I would have to scale the design for a bigger wing. Sitka spruce, for completion of the cap strips in my aircraft's wings is 150 dollars. Douglas Fir and Northern White Pine ranges around 40 to 50 dollars. I conclude that buying Sitka spruce is the easiest and most practical specimen to use for the material in my aircraft.

NAME(s)	<b>Molly Palmer</b>	PROJECT NUMBER	<b>C27</b>
SCHOOL	Mater Christi	GRADE	<b>8</b>
TEACHER	Ms. Michelle Donlon		
PROJECT TITLE	<b>Equation for Water</b>		

## ABSTRACT

This experiment tested a new mathematical formula ( $a = 10^{-7/10-x} + b/1000^{1/10-x} + 10^{-y/10-x} + 1000/10-x$ , where  $a$ =volume of acid,  $x$ =pH of Acid,  $b$ =volume of base, and  $y$ =pH of base) which was designed to determine the quantity of an acid needed to neutralize (bring to a pH of seven) a set quantity of a caustic mixture. The hypothesis was: if this equation is used when combining an acid and a base, then the resulting pH would be seven. Through research it was found that a pH number is the negative base ten logarithm of how many hydrogen molecules are present per liter of any substance containing water. A material needs water to be acidic or basic because of a key feature in H<sub>2</sub>O molecules which allows them to form bonds with certain other molecules or atoms.

○First, a caustic baking soda/water mixture was created, measured, and its pH reading was taken by a pH meter. Then the pH's of acids (lemon juice, grape juice, and vinegar) were tested. Finally, each set of data was plotted into the equation and the results were tested by combining each acid with baking soda in proportions according to the formula. Two trials were conducted and averaged.

○Between the trials, the mixture with vinegar and baking soda yielded a pH of 7.47, the mixture with lemon juice and baking soda yielded a pH of 7.74, and the mixture with grape juice and baking soda yielded a pH of 7.62. In conclusion, the equation did not work, but certain approximations may have impacted results.

NAME(s)	<b>Kristie Palowski, Tessa Bushey</b>	PROJECT NUMBER	<b>GP16</b>
SCHOOL	Green Mountain Union High School	GRADE	<b>8</b>
TEACHER	Mr. Allan Garvin		
PROJECT TITLE	<b>Optical Illusions</b>		

## ABSTRACT

○Optical Illusions trick the mind into seeing something completely different than what is really there. For instance if you look at the illusion of the two faces. Up close you'll see the famous inventor/scientist Albert Einstein. But if you back up about 10 feet it looks like the classic Hollywood actress Marilyn Monroe. We wanted to see whether you wear glasses or not, and whether your old or young would affect how you see the illusions, and how fast. We tested 8 people, 2 young without glasses and 2 young with glasses. Then 2 old people with glasses and 2 old without glasses. We found that older people without glasses saw the illusions slower than older people with glasses. We also found that younger people with glasses saw our optical illusions slower than younger people without glasses.

NAME(s)	<b>Devin Paradis</b>	PROJECT NUMBER	<b>PN00</b>
SCHOOL	Fair Haven Union HS	GRADE	<b>9</b>
TEACHER	Ben Worthing		
PROJECT TITLE	<b>How Skatboard Bearings Affect Speed</b>		

### ABSTRACT

○The science fair project of How Skateboard Bearings Affect Speed has a problem statement of “Do lower or higher grade skateboard bearings make you go faster.” The hypothesis was “if I use higher grade skateboard bearings in my skateboard then I would go faster because higher means better which means faster.” The conclusion was “my conclusion is that the higher grade bearings were the fastest and lower grade bearings were the slowest.” I tested this by getting all the bearings that were made by the company Lucky Bearings and I tested each bearing 10 times and averaged the times to find which one was better.

NAME(s)	<b>Nikko Pasanen</b>	PROJECT NUMBER	<b>PN00</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>The Effects of Fertilizer in Turf Management</b>		

### ABSTRACT

The purpose of this project is to determine the effects of different types of fertilizers in turf management. The experiment consists of three trays of primarily ryegrass seed: tray one is the control which contains only the original germinating mix; tray two contains the germinating mix as well as 3 grams of Scotts Starter Brand Fertilizer; and tray three contains the germinating mix as well as 25 grams of Gardener’s Supply Company Organic Fertilizer. The fertilizer was added based on the recommended totals on the packaging. Regarding the Scotts Fertilizer, it had a ratio of 24-24-4 for nitrogen, phosphorus, and potassium. The organic brand had a ratio of 5-5-5.

Currently, the grass has been growing for five weeks. Water runoff has not been tested yet, but soil tests were conducted to see what the nutrient levels were at four weeks. The control and organic trays actually received the same results for all three tested nutrients, but Scotts had slightly higher numbers for nitrogen and potassium. Later, each tray will be tested again to see what has happened to the nutrient levels over time. Water runoff will be tested by taking samples from the collection bins underneath each tray. I predict that Scotts will have the highest nutrient readings in the runoff, followed by the organic fertilizer and then the control. This project will help identify the harmful effects of fertilizer and which type is the most efficient, or if it is not worth using fertilizer at all.

NAME(s)	<b>Riya Patel</b>	PROJECT NUMBER	<b>B18</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>The Optimization of Bioremediation</b>		

## ABSTRACT

The purpose of this project was to determine whether adding a variety of essential elements to an oil-polluted area would increase bioremediation, resulting in a biostimulation formula that increases microbe population and optimizes efficiency. Bacteria's elemental nutritional requirements were added through iron sulfate, magnesium acetate, calcium chloride, and NPK fertilizer. Simulating a real-world oil spill, each sample contained seawater, crude oil, and an additional compound mentioned above; except the control containing just seawater and crude oil. By freezing the experiments three weeks later, the remaining oil sitting on top of the frozen seawater was drawn by a pipette and measured for volume. Each test's average percentage of oil remediated was calculated.

As hypothesized, introducing additional elements to the oil-polluted site increased oil degradation, with the NPK test remediating 34.4% of the oil versus 15.2% in the control. In stage two, each compound's concentration was increased to 0.35mL to analyze the effects of various element quantities on bioremediation. The tests yielded a greater average percentage of oil remediated, except for the control, which remained fairly consistent.

Experiment three tests every combination of two compounds in each sample, which will be followed by an experiment adding different amounts of the third most effective element to the optimum mixture of the preceding tests, and so on, until all four compounds are added into a "recipe" for remediation. Conclusions leading to the final and optimized biostimulation formula are yet to be made based on the pending results.

NAME(s)	<b>Ben Peacock</b>	PROJECT NUMBER	<b>P30</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Dawn Adams		
PROJECT TITLE	<b>Fluid Mechanics of Weirs</b>		

## ABSTRACT

○This experiment tested the flow rate of water over a dam. There is no accurate way to calculate the exact flow rate over a dam or weir without experimentation. By running many tests a constant or coefficient is developed for that particular dam that can be used to accurately calculate the flow rate.

○This experiment tested the relationship between the height of the water flowing over the dam and the flow rate of the water. The flow rate was expected to increase by 1.62 multiplied by the height raised to the power of 1.5.

○The experiment was conducted on a scale model broad-crested weir. The model was designed as close to a ideal situation as possible, isolating as many variables as possible. The height of the water was increased by adding more water to the model and the resulting flow rate was recorded.

○The flow rate values are best calculated in the data by 2.24 multiplied by the height raised to the power of 1.5. The constants ranged from 2.35 at the smallest height to 2.03 at the largest height. The average constant has a 38 percent error from the theoretical value.

○The error in the results is caused by surface tension and friction, aspects of the experiment that could not be calculated for or removed from the experiment. The results prove the hypothesis. Experiments like this one, along with many repetitions of other dam sizes, can improve the accuracy of flow rate calculations in real world situations.

NAME(s)	<b>Brandon Philbrick</b>	PROJECT NUMBER	<b>C28</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Commercial Water Filter's Effect on Tap Water</b>		

## ABSTRACT

Filter companies claim that their filtered water is cleaner, better tasting, and healthier. This project will put this claim to the test by evaluating what changes in total chlorine, fluoride, zinc, pH, and bacteria count occur when tap water from the Champlain Valley Water District is put through a filter. This was tested by collecting samples from various types of filters and comparing them to the water that is put out by our local water district. The samples were grown for 48 hours on an agar to obtain a bacteria count. Also, the same type of filter will be tested, one being newly installed and the other is 10 months old. In addition, the samples were tested using professional grade instruments at the water district for changes in the minerals stated above along with pH. It was discovered that across the board, the total chlorine was almost completely removed from the tap, or high service treated water. Whereas in the other elements that were tested, the numbers were not as consistent. With the absence of chlorine to disinfect any bacteria or microorganisms, the filtered water had much higher bacterial numbers than the high service water, which had only one colony grow on the agar plate. These results conclude that chlorine is the lone element that is being removed from water, which then allows for growth of bacteria. This proves that water companies are false when saying that they have cleaner water when it promotes bacterial growth.

NAME(s)	<b>Jackson Pine</b>	PROJECT NUMBER	<b>B19</b>
SCHOOL	South Burlington High School	GRADE	<b>9</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>The Relationship between Exercise and Lung Capacity</b>		

## ABSTRACT

Presently, my experiment is a comparison between the level of fitness of an individual and that same individual's lung capacity. The purpose is to determine what relationship the two qualities have, and which characteristics have a reaction on the qualities. Although the initial idea for this involved testing for the effects of exercise on lung capacity, this, in its present form, seems much more plausible.

In this particular project, two things are required in order to develop the relationship between exercise and lung capacity. The first objective would be to complete an exercise survey, on which you would simply rate how much strenuous, moderate, and mild exercise you do, on average, a month. The second objective is to test your specific lung capacity. In order to do this, you would breathe into a simple device called a spirometer in a particular fashion. First you would breathe normally, in and out, for four cycles, after which you will fill your lungs as deeply as you can and then exhale as fully as you can.

The data from the lung capacity test, which has resulted from the frequent testing of a diverse number of subjects, is developed into a graph where a variety of statistics are shown, such as; the peaks and valleys in the Tidal Volume, the Vital Capacity, and the Residual Volume. From that point, Total Lung Capacity, the statistic which is strived for, may be calculated by the sum of Vital Capacity and Residual Volume. Analysis follows, as a relationship between the resulting scores from the survey and the Total Lung Capacity is now relatable.



NAME(s)	<b>Elise Prehode</b>	PROJECT NUMBER	<b>C29</b>
SCHOOL	St. Francis Xavier School	GRADE	<b>8</b>
TEACHER	Mary Ellen Varhue		
PROJECT TITLE	<b>Revive the Roadside</b>		

## ABSTRACT

For my science fair project I studied the corrosiveness and effectiveness of rock salt versus Calcium Magnesium Acetate (CMA). My first experiment tested the corrosive effects of rock salt and CMA on green plants. The second experiment tested the corrosive effects of rock salt and CMA on metal. The third experiment tested the effectiveness of rock salt and CMA melting ice. For the first experiment I used three plants and twice a week for two weeks I sprinkled a solution of rock salt on one plant, a solution of CMA on a second plant, and tap water on a third plant. After one and two weeks, I measured how many plant stems died. For the second experiment I prepared a solution of rock salt and a solution of CMA in 1000ml beakers. I also maintained a 1000ml beaker of tap water as a control unit. I recorded the weights of three nails prior to placing them in solution. After placing one nail in the solution of rock salt; one nail in the solution of CMA; and one nail in the unfiltered tap water I left the nails undisturbed in the beakers for two weeks. After two weeks, I recorded the weight of the nails. For the third experiment, I filled three small pie tins with a  $\frac{1}{2}$  cup of unfiltered tap water in each and placed the tins in the freezer until the water was frozen. I removed the tins from the freezer and sprinkled one teaspoon of rock salt and CMA on two separate tins, and left one tin undisturbed. I placed the tins back in the freezer. After fifteen minutes I removed the tins from the freezer and poured whatever excess water there was into separate cups. Then, I measured how much water was found in each cup. In my first experiment all of the stems of the plants exposed to rock salt died. During the first trial of the first experiment, only one stem of the plant exposed to CMA died; in the second trial four died.

NAME(s)	<b>Vishnukumaar PremSankar</b>	PROJECT NUMBER	<b>B20</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>The Effect of Synergy</b>		

## ABSTRACT

The purpose of this experiment was to find synergy between different antibiotics. To come to a conclusion there had to be three experiments conducted. The first experiment was to test and see whether it was possible or not to measure the growth of Escherichia coli bacteria. The second experiment was to set the range of doses for each antibiotic. The third experiment was to culture the bacteria and test for synergy between the different antibiotics.

To execute this three part experiment, the following steps were followed. For the first experiment, 100 milliliters of cultured E.coli bacteria was put into 2 milliliters of broth. The tube was placed in a shaking incubator. This incubator was monitored and checked using a spectrophotometer for possible growth every 30 minutes. Doubling time turned out to be 2 hours of incubation. For the second experiment, the Minimum Inhibitory Concentration of the antibiotics were researched and tested on the E.coli bacteria. This gave an S curve of bacteria inhibition which was possible to analyze when looking for the right dose that was needed to be used for the synergy test. In the third part of the experiment, the different doses of the antibiotics were put together into culture tubes of 100 milliliters of E.coli cultured bacteria and 2 milliliters of Luria broth. This test produced the information needed to determine any sign of synergy between the different antibiotics.

After conducting the experiment, a synergetic effect was found between two of the antibiotics, ampicillin and neomycin.

NAME(s)	<b>Logan Prior</b>	PROJECT NUMBER	<b>B43</b>
SCHOOL	Northfield Middle High School	GRADE	<b>11</b>
TEACHER	Cynthia Tomczyk		
PROJECT TITLE	<b>Effect of Different Concentrations of Salt Solution on Plant Growth</b>		

## ABSTRACT

During this experiment data was collected to see if different percentages of salt solution would Effect the growth of Sugar Daddy peas. I added the peas into the soil and started to add the salt water that day as an average start of 0 cm. My hypothesis for this experiment was that when the percentage of salt in water was increased the plants wouldn't grow as tall as the plants with less percentages of salt in water. This experiment was through a span of 21 days. There were five plants that were watered with 0% salt solution. The next five plants were watered with 1% salt solution. The next set of five plants was watered with 3% salt solution. The last five plants were watered with 5% salt solution. I measured these plants every 3 days and recorded the height in centimeters. For 0% salt solution on day 21 I had an average height of 18 cm, for 1% salt solution I got an average height of 10.8 cm, for 3% salt solution I got an average height of 7.7 cm, for 5% salt solution I got an average height of 4.6 cm. From this data it was shown that when the percentage of salt solution increased the average height of the plants decreased. The data in my experiment supports my hypothesis. The salt in the water when it is added to the plant makes it hard for the plants to get all of its nutrients to grow to its full potential. The salt dries the plants roots and decreases the amount of water that can enter the plant.

NAME(s)	<b>Liam Quinlan</b>	PROJECT NUMBER	<b>B61</b>
SCHOOL	Mater Christi	GRADE	<b>6</b>
TEACHER	Michele Donlan		
PROJECT TITLE	<b>The Eggsperiment for Eggcellent Egg Laying</b>		

## ABSTRACT

The purpose of this experiment was to determine which chicken diet produces the most eggs per day, the heaviest yolk and white, and the heaviest shell. This project was decided following frustration at our family's smalll flock of chickens decreased laying. It was hypothesized that if fed calcium and protein enhanced diets, the chickens' eggs would increase in shell weight, white and yolk weight, and number of eggs per day. It has been proven that yogurt gives chickens essential calcium, and lentils gives chickens essential protein. Four hens were fed three diets: Seventeen percent protein mash, seventeen percent protein mash with low fat, plain yogurt, and seventeen percent protein mash with cooked, red lentils. During this time, the chickens were exposed to constant light throughout the procedure. The eggs were collected every day for seven days during the first experiment, and ten days in the other two. The eggs were then weighed. It was then determined that cooked red lentils produced the most eggs per day with 3.22, whereas yogurt and mash produced 2.22, and layer mash alone produced 2. Yogurt and mash, and lentils and mash both produced .33 ounces in shell weight, and layer mash alone produced .31 ounces. Finally, yogurt and mash produced 2.29 ounces for the weight of the white and yolk, lentils and mash produced 2.28, and layer mash alone produced 2.2 ounces. It was concluded that lentils and mash produced the most eggs per day, yogurt and mash and lentils and mash both had the highest shell weight, and yogurt and mash produced the largest weight of the yolk and white. With this information, farmers and families will be able to increase their flock's egg production and the quality of the eggs.

NAME(s)	<b>Erin-Kiernan Reilly</b>	PROJECT NUMBER	<b>P31</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Dawn Adams		
PROJECT TITLE	<b>Liar, Liar, Fabric on Fire!</b>		

### ABSTRACT

For my Science Fair project I chose to test the fire retardancy of fire retardant fabric after washing it several times. I chose this topic because I was interested in learning more about fire retardancy. My family also has a wood stove as a primary heat source in my house, so knowing how long fire retardant fabrics last in my home is important. My research also shows that fire retardant fabric does not stay fire retardant after washing it, so it is an important safety precaution to take and be aware of. My Hypothesis was that if you wash fire retardant material then it will become less retardant to fire. To test my hypothesis I washed, then burned two types of fire retardant material. One had an Aluminum coating and the other had a Polyurethane coating. My control was burning the fabric unwashed, then timing and observing the fabric burn. I burned all of the fabric in aluminum pans, and used a safety lighter to set them on fire. My results accepted my hypothesis but when I burned them without washing them, they barely burned, so their times were much shorter than I expected. I expected them to be about 2 minutes, and they were only on average 10 seconds. But then, I noticed after washing them once the fabric was clearly not as strong as before, and my times showed that, because after each wash the fabric burned about 10 seconds faster with the polyurethane and about 5 seconds faster with the aluminum. I believe that this project will help people be more knowledgeable about fire retardant fabric and how to care for it. It also shows that not all fire retardant fabrics stay fire retardant, after washing them.

NAME(s)	<b>Sean Remillard</b>	PROJECT NUMBER	<b>P32</b>
SCHOOL	St. Francis Xavier School	GRADE	<b>8</b>
TEACHER	Mary Ellen Varhue		
PROJECT TITLE	<b>Snap Shot</b>		

### ABSTRACT

Purpose: Trail cameras are useful devices for tracking the movement of animals. My experiment was to determine which trail camera had the best trigger speed and best picture quality.

Hypothesis: I think that the Cuddeback trail camera will have the fastest trigger speed and the best picture quality because my research showed that the manufacturer claims that the Cuddeback trail camera has under a second reaction time.

Procedure: To perform my experiment I used a Cuddeback trail camera, and a Moultrie game spy I50 trail camera. I also used an object about the size of a stuffed animal puppy, (which I used). Then you have to put the puppy in a dryer because you need to have body heat for the camera to take a picture(this is why it takes pictures of animals, not branches). Then you tie your string to the puppy and let the puppy go from a set starting point. The camera will take a picture and by comparing the puppy position in the picture you can figure out what the camera trigger speed is. Do this 5 times in the dark and light for both cameras.

Results/Conclusion: My results showed that the Moultrie camera had a .15 trigger speed. My hypothesis was half right and half wrong. The Cuddeback trail camera had better picture quality because it has a flash like a regular camera and gives color pictures. The Moultrie camera uses an infrared light and only takes pictures in black and white. The half that I was wrong on is the trigger speed. The Moultrie game spy i50 had the fastest trigger speed by a wide margin.

NAME(s)	<b>Katie Reuther</b>	PROJECT NUMBER	<b>P33</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Dawn Adams		
PROJECT TITLE	<b>Structure and Function: How a Horse's Conformation Affects its Performance</b>		

## ABSTRACT

○In the competition world, performance is everything. This applies to humans and animals. In this case, a horse's performance is directly connected to its conformation, or build. This experiment was designed to see how a horse's shoulder angle affects its stride length. A larger stride length is usually desired by many equestrian competitors. A larger shoulder angle generally inhibits the horse's freedom of movement and shortens its stride length. This means that a smaller shoulder angle is best for maximum stride length and performance.

○To test this hypothesis, sample horses with similar leg lengths were walked on a snowy surface. The distance between their front hoof prints was measured, and their shoulder angle was measured. The two measurements were then compared to observe their relationship. Five out of the seven horses proved that a smaller shoulder angle leads to a larger stride. As each horse's shoulder angle increased by one degree from the previous horse's shoulder angle, their stride length decreased by .1-.2 inches. Though the change is small, it makes an enormous difference. The other two horses were out liars, which was expected because of other conformational differences. Two of the most important variables in this experiment are a horse's leg length and the way of measuring the shoulder angle. These factors are crucial to correct results. A horse's leg length can cause its stride length to be long or short.

○This experiment proved that structure is critical to function. Performance horses who must jump and extend their legs need as much freedom of movement as possible. This means that, in general, a smaller shoulder angle is the most desirable. It is important for competitors to choose their horses wisely.

○

NAME(s)	<b>Marcus Roberge</b>	PROJECT NUMBER	<b>P34</b>
SCHOOL	Mater Christi School	GRADE	<b>6</b>
TEACHER	Michelle Donlon		
PROJECT TITLE	<b>Floating Magnets</b>		

## ABSTRACT

My project is based on the same technology that the magnetic bullet trains in Japan use. My project is about the weight differences between two different floating platform designs.

What floating platform design holds the most weight?

Design 1 is a floating bed with strings stabilizing the platform from below. Design 2 is a floating bed stabilized by strings from above and with a Plexiglas box.

My hypothesis is that design 2 will hold more weight than design 1 because design 2 is more stable as a result of the Plexiglas frame.

My hypothesis was correct because design 1 failed.

NAME(s)	<b>Tomas Rogel</b>	PROJECT NUMBER	<b>B62</b>
SCHOOL	Main Street Middle School	GRADE	<b>8</b>
TEACHER	Amy Kimball / Jesse Wolfe		
PROJECT TITLE	<b>What is the Difference in Eye Dilation Reaction Time Between Genders?</b>		

### ABSTRACT

Light is a common stimulus that causes pupil dilatation. The less light there is the bigger the pupil becomes and the opposite happens when there is intense light. The purpose of the experiment was to find out if there was a gender difference when it comes to pupil dilatation reaction time. The prediction was that if there is a relationship between eye dilation and gender then one gender will react faster to a change in light compared to the other. In the experiment, the subject was placed in a dark room for 5 minutes and would then be asked to come out into the light and their pupil reaction time was recorded. The results showed that there was a significant difference between boys and girls, with girls being, on average, .4 seconds faster. This may indicate girls are more sensitive to light and suffer from photophobia.

NAME(s)	<b>Alecia Rokes, Taylor Hendee</b>	PROJECT NUMBER	<b>GP17</b>
SCHOOL	Green Mountain Union High School	GRADE	<b>8</b>
TEACHER	Mr. Allan Garvin		
PROJECT TITLE	<b>Global Warming vs. Algae</b>		

### ABSTRACT

Algae grows in the ocean, and takes carbon monoxide from the air through photosynthesis. This brings up the question: What temperature water does algae grow best in? Our hypothesis is that algae grows best in water that is 20 degrees Celsius. This we tested by putting algae in test tubes, and then putting them in different temperatures of water. The algae in the hot water grew more rapidly than the warm, and cold water. The algae kept its color (green), or got greener than before in the hot water. The algae in the warm water stayed a light green, and the cold turned almost completely white. These results show that algae grows rapidly when the ocean is warmer, grows slowly when the ocean is warm, and dies when the ocean is cold. This means that as global warming increases temperatures, the oceans may become over run with algae.

NAME(s)	<b>Dominic Romano</b>	PROJECT NUMBER	<b>M01</b>
SCHOOL	Christ The King School	GRADE	<b>6</b>
TEACHER	Amy E. Wright		
PROJECT TITLE	<b>JavaScript Changes And Effects</b>		

### ABSTRACT

My experiment is about JavaScript. I chose this experiment because I really like computers. I usually just play around with computers to see what settings/preferences they have. Once I see what they do, I change them to see what can make the computer better. If it doesn't do much, I change it back and try something else. Sometimes, it messes up the computer. But I usually find a way to change it back. Some things I usually change on the computer are the colors. First, I wrote any program. Then, I looked for a place where changing just a couple of characters will have a big effect on the program. Lastly, I compared the changes. The data I collected was basically just different levels had a different effect on different sections of the program that I wrote. The levels of effects weren't that different but they still had an effect. I concluded that, like I said, because it is a program language, the changes were predictable. If I tried it in different places, I might have different results. Some important highlights was the .txt and .html mix up. That only had the text show up.

NAME(s)	<b>Sara Romano</b>	PROJECT NUMBER	<b>B21</b>
SCHOOL	Christ the King	GRADE	<b>8</b>
TEACHER	Amy Wright		
PROJECT TITLE	<b>The Nose Knows Smell but how about Taste?</b>		

### ABSTRACT

My project was about studying the connections between your nose and your mouth. I found that when you plug your nose and eat something, it's not tasteful and as strong as if you were to leave your nose unplugged. Your nose and mouth are attached from the back of the throat, and if you take one of those connections away, then it decreases its power of taste and smell. My procedure was simple. First I set up my 11 foods in small samples. I blended and cooked some foods so they couldn't guess by the texture. My first person had to use a blindfold and plug her nose and I had her describe what she tasted by using descriptive words. After that, she would have to guess what the food item was. Then after that, I'd have her do it without her nose plugged, this procedure took about 2 hours with 3 people to test. The outcome was actually surprising. Looking at my charts, I found that the nose is a big part of eating. The one observation that really interested me was that people thought salt water was lemonade! Even though I did use some awkward foods in my experiment. All and all, it really does matter if your nose is disabled to eat foods because you cannot identify them as clearly.

NAME(s)	<b>Rajit Sachdeva</b>	PROJECT NUMBER	<b>PN00</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>soap vs hand sanitizer</b>		

### ABSTRACT

The Effects of soap and Hand Sanitizer on Bacteria  
 Rajit Sachdeva  
 South Burlington High School, South Burlington, VT, United States

This project in its present form is the result of bioassay experimentation on the effects of Hand Sanitizer and Hand Soap on bacteria. The initial idea was to acquire four dishes of B. Subtilis, requiring broth and agar to be made. The dishes would represent human hands. Quadrants were then made in each Petri dish to make efficient use of space. Next, circles of cloth that had been punched out via hole-puncher were placed in respective substances for 30 seconds and then placed in each quadrant. The Petri dishes were then put to rest in an incubator for 24 hours. After taking out the four Petri dishes, I recorded all observations. I measured the sphere of influence on each quadrant of each Petri dish. After averaging the measurements of the spheres of influence, there will be data for analysis. After carefully analyzing the data that has been collected, I will draw a conclusion. This conclusion will be based on whether the average measurements of the spheres of influence are greater for the hand sanitizer or the hand soap.

NAME(s)	<b>Lena Sadler</b>	PROJECT NUMBER	<b>C30</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtic Belton		
PROJECT TITLE	<b>Break It Down - Breaking Down the BP Oil Spill</b>		

### ABSTRACT

The purpose of this project is to compare how well different types of dish soaps “break down” grease on tar-balls I have collected from the Gulf of Mexico oil spill. The idea is to see which soaps are really the best at breaking apart grease while putting a spin on the commercial lab soap test and testing the soaps on tar-balls from the recent oil spill in the Gulf of Mexico.

I’ll be testing their effectiveness in two ways: by leaving a sample of the soap overnight on a streak of tar rubbed across a sample of white cloth to test the gradual breaking down of the petroleum and by consistently scrubbing the same amount of soap over a streak of tar rubbed across a sample of white cloth.

I will compare them side-by-side with visual observations and my measuring the samples against each other.

The experimentation has not started yet but results are expected to show that the dish soaps can break apart the grease and petroleum of the tar-balls and that some differences will be noticed between different products.

NAME(s)	<b>Matthew Sadler</b>	PROJECT NUMBER	<b>S12</b>
SCHOOL	Mater Christi School	GRADE	<b>7</b>
TEACHER	Ms. Donlon		
PROJECT TITLE	<b>Psych My Tempo</b>		

## ABSTRACT

The purpose of this experiment was to see if one's heart rate increases with fast tempo music, and decreases with slow tempo music. The hypothesis of this project was if fast tempo music and slow tempo music are listened to at different times, then fast tempo music will increase the heart rate, and slow tempo music will decrease the heart rate. In the research it was found that when a music listener's brain registers the tempo of a song, the brain will then send signals to the body that cause breathing and the heart rate to either accelerate or decelerate, matching the tempo of that song.

The procedure for this project was to test the resting heart rate of eight people and to then take an iPod with a fast tempo song and an iPod with a slow tempo song and have people listen to each song at a different time. While the testers were listening to each song separately their heart rate was taken and recorded.

Once the procedure was followed through the averages were found for the resting heart rate which was 81 beats per minute, the fast tempo music which was 89 beats per minute, and for the slow tempo music which was 73 beats per minute.

In conclusion it was found that the when people were listening to music with fast and slow tempo music the heart rate would increase or decrease to mirror the tempo of the song.

NAME(s)	<b>Forrest Scharmer</b>	PROJECT NUMBER	<b>B23</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Efficiency and Effectiveness of Low-Tech Water Purification Methods</b>		

## ABSTRACT

This project consists of testing suitable ways to make water drinkable in rural environments with limited resources. The idea of testing high-tech systems used in urban and suburb areas changed because the importance of drinking water is more revolved around areas that don't have these high-tech systems. Most or all of the materials used in each method can be gathered from the Earth.

The methods that will be tested are boiling, solar stills, ultraviolet light, and sand filters. Boiling will be tested using a pot and stove top to simulate a pot on top of a fire. A solar still will require a hole in the ground, a cup, stones, and plastic.

Ultraviolet light will be tested with ultraviolet lamps to simulate the sun. A sand filter will have the process of pouring water through dirt or sand into a container. The water that will undergo these processes will have a bacteria broth mixed into it.

The expectation is that levels of bacteria in each water sample after each purification method will be different from each other concluding that each method probably takes out different substances in water. The results will show efficiency by showing how long the process takes and how much water is lost in the process. Effectiveness will be shown by the calculated levels of bacteria remaining after each process.



NAME(s)	<b>Sharon Schuppe</b>	PROJECT NUMBER	<b>S13</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Subliminal Stimuli</b>		

## ABSTRACT

The purpose of this project is to test for effective ways to give a visual subliminal message and if one way is more effective. Also, if any group of people is more effected than another. Short 30 second videos containing subliminal messages were made. These videos appeared to be a black screen for 30 seconds; however words and pictures were put in. These messages flashed for only a short time in a small dark font at random intervals. This lessened the chance that anyone actually consciously saw the message. Each subject watched one of the videos and answered questions regarding their age, gender, occupation, and what they thought the message was. Through the analysis and comparison of the data that has been collected to date, subliminal messages do not seem to have any affect on a person's decisions. None of the 30 people tested so far picked the correct word. This may be because no message was successfully given. All 30 people may simply feel disinclined to pick the one correct word. Another explanation could be that the message did not make them pick the word but made them avoid the word; this is unlikely. As I continue testing and analyzing my data, the meaning of my results will be more clear. I expect, with future tests involving a different word as the message, that the percentage of people who choose the correct word will be close to 10%. I do not believe, based on my current data, that the messages used in this study will successfully affect a person's subconscious.

NAME(s)	<b>Marie Schwalbe</b>	PROJECT NUMBER	<b>B24</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Dawn Adams		
PROJECT TITLE	<b>Phytoremediation</b>		

## ABSTRACT

Groundwater contamination is a potentially dangerous type of pollution which can disrupt ecosystems and pollute drinking water. There are various techniques to remedy this problem, but this experiment focuses on phytoremediation, the use of plants to clean up contaminated soils and prevent groundwater contamination. Phytoremediation is a safe, attractive, and inexpensive method of decontamination. This experiment tests the hypothesis that Peace Lilies are more effective at removing copper from low concentrations of copper solution than from higher concentrations. The plants were placed in 0.005 M, 0.01 M, and 0.1 M copper sulfate solutions, with three samples for each concentration, and three control plants in distilled water. The plants were allowed to grow for one week. At the end of the week the copper concentrations in the solutions were analyzed and compared to the starting concentrations. By calculating the average mass of copper which was removed from each solution, it was found that plants removed 17 percent of the copper from the 0.005 M solutions, 10.8 percent from the 0.01 M solutions, and 5.36 percent of the 0.1 M solutions. Although these results indicate that Peace Lilies were effective at reducing the copper content in the solutions, all of them, except the controls, died after seven days or fewer. This experiment shows that at lower concentrations, the Peace Lilies were more effective phytoremediators. Also, because all of the concentrations tested were high compared to common contamination levels, it is very likely these plants could be used for phytoremediation in the environment.

NAME(s)	<b>Marlynn Serwili</b>	PROJECT NUMBER	<b>C31</b>
SCHOOL	St. Francis Xavier School	GRADE	<b>7</b>
TEACHER	Mary Ellen Varhue		
PROJECT TITLE	<b>Rotten...?</b>		

## ABSTRACT

Expiration dates tell us when something is rotten so we don't get sick from consuming the expired item. Some people say expiration dates won't help if you put liquids that are supposed to be in the refrigerator in warmer temperatures because of the different environment.

In my experiment I was trying to figure out if storage area temperature affected the pH of several liquids (The more rotten something gets the more acidic it gets.)

Hypothesis: If the age of the liquid and the temperature of the storage area increases then the pH of the liquid decreases more quickly.

I put five different liquids: grape juice, apple cider, orange juice, milk and water, in three different storage areas: in the refrigerator, at room temperature and near the heater. I kept them there for three days and I measured the pH each day. Every two days after this I measured the pH and recorded it on paper. After nine days I finished my experiment and compared my data.

○I found that the higher the temperature and the longer the liquids stayed in their storage area, the lower the pH was (the more rotten). I found that the apple cider started to go bad first, but the Milk spoiled faster, once it started to go bad. In my experiment I also observed that of all my liquids, only the grape juice started growing mold. My hypothesis was correct. I think my hypothesis was correct because the cold slowed down the growth of bacteria in my liquids.

NAME(s)	<b>Wyatt Shippee</b>	PROJECT NUMBER	<b>S14</b>
SCHOOL	Twin Valley Middle School	GRADE	<b>8</b>
TEACHER	Jessica Hammond		
PROJECT TITLE	<b>Paid for Schoolwork?</b>		

## ABSTRACT

The project chosen for this science fair experiment evaluates whether paying a student will make them do better in school. This topic was chosen because my hypothesis is that if someone was paid to do something they would do better, when in fact science says that if someone is paid for even rudimentary cognitive thinking, that person will not do as well as if they had not been paid.

The hypothesis that I am trying to prove is if someone is offered an incentive to do well in school, will they actually do better than if the offer is not made.

To test this hypothesis, four groups of ten students were created, and each subject performed a standardized math test. Group one was the control group; they received no reward. Group two was offered a candy bar reward for a score of twenty-five or more correct answers. Group three was offered a five dollar reward for a score of twenty-five or more correct answers. In Group four, all students who scored twenty-five or more correct answers had their names placed in a pool; one of those students would receive ten dollars, by random chance.

Group three's performance was better than any of the other groups, which supports my hypothesis that rewards have a positive effect on school performance. The five dollar reward was more valuable than the reward of a candy bar, and that was demonstrated by Group three performing better than Group two.

NAME(s)	<b>Ava Simonds</b>	PROJECT NUMBER	<b>P35</b>
SCHOOL	St. Francis Xavier School	GRADE	<b>7</b>
TEACHER	Mary Ellen Varhue		
PROJECT TITLE	<b>Got Domes?</b>		

### ABSTRACT

Geodesic domes accomplish more with less. The purpose of my experiment was to determine which material, built into a geodesic dome, would be the lightest and the strongest. The materials I tested were plastic straws, bamboo, newspaper struts, and hollow newspaper rods. My hypothesis was that the bamboo geodesic dome would be the strongest and lightest because the other materials in the experiment were slightly bendy. I constructed the four geodesic domes using 16.7cm and 18cm struts. I used a hot glue gun to join the intersections on all of the domes. To test the strength of the geodesic domes I put a circular container on the pointed top of the dome to make a flat platform to hold water bottles. I filled the water bottles until the dome collapsed and weighed the water bottles. I recorded the weight of the water bottles and the circular container and divided the strength of the dome by its weight. I found that the bamboo was strongest and held 53.9 times its own weight. The newspaper struts held 34.6 times its own weight and the plastic straws, even though it was weakest and lightest, held 17 times its own weight. Lastly, the hollow newspaper rods held 12.5 times its own weight. Even though the results supported my hypothesis, it would not be entirely fair to draw a complete conclusion. The three materials besides bamboo were bendy, and even though after they collapsed they recovered once the weight was lifted off, they were not as strong. Also, two of the materials were hollow and also were not as strong.

NAME(s)	<b>Kate Skinas</b>	PROJECT NUMBER	<b>B44</b>
SCHOOL	Northfield Middle High School	GRADE	<b>11</b>
TEACHER	Cynthia Tomczyk		
PROJECT TITLE	<b>The Effect of Acid Rain on Natural Plants</b>		

### ABSTRACT

For many years, scientists around the world have been noticing the effects of acid rain on delicate ecosystems in our environment. Acid rain is produced due to an excess amount of pollution in the air, and when this rain reaches the roots and leaves of any plant, it destroys the nutrients it needs to successfully grow, therefore the plant dies. My science fair project was designed to demonstrate that acidity in water does affect the health and growth of a plant. Romano Pole Beans were watered every four days with different amounts (1, 2, 3, and 4 drops) of distilled vinegar mixed with  $\frac{1}{4}$  cup water. I had five different tests, with eight plants in each of those tests, and after eight weeks of collecting data, a common trend had formed. The control plants, which had no vinegar in their water, grew the tallest, the healthiest, and the quickest, with an average increase in height per week of 13.67 centimeters. The other four tests had a significant decrease in height and health due to the increase in acid (the vinegar). The second test, which had 1 drop of vinegar, had an average increase in height per week of 8.84 centimeters, while the third test had an average height per week of 7.36 centimeters. The fourth test had an average increase of 6.51 centimeters, and the final test, which had the greatest amount of vinegar, had an average increase in height per week of 5.24 centimeters. These averages show a clear pattern that with an increase in vinegar (acidity) in a plant, the more the growth of it decreases. This shows scientists around the world that acid rain is a problem and a solution needs to be found before the acid really affects the future of our ecosystems.

NAME(s)	Jessica Slocum	PROJECT NUMBER	B45
SCHOOL	Northfield Middle High School	GRADE	11
TEACHER	Cynthia Tomczyk		
PROJECT TITLE	The Effect of Different Colored Light Sources on Plant Growth		

## ABSTRACT

○In this experiment, different colored light sources were used to determine if there is a relationship between colored light and the growth of plants. Five radish plants were placed in sunlight for twenty-five days and their height was measured every five days. Five radish plants were placed in red light, five were placed in blue light, and five were placed in green light. These plants were also under the light sources for twenty-five days and their heights were recorded every five days. It was assumed that the plants in the sunlight would have a greater overall growth than the plants in blue, red, and green light because sunlight offers the whole spectra of colors. The data supported this because the average overall growth of the plants in sunlight was 18.5cm, while the average overall growth of the plants under red, green, and blue lights were 9.4cm, 3.0cm, and 9.4cm. The plants that grew under a green light had the least overall growth because plants absorb every color light except green light and that is why they appear green. The wavelength of the red light was 650 nm, the wavelength of the blue light was 580 nm, and the wavelength of the green light was 510 nm. The wavelength of sunlight is 290-3000 nm (Rice, 2009). In conclusion, this experiment demonstrated that different colored light sources have an effect on the growth of plants.

NAME(s)	Cassie Smith	PROJECT NUMBER	B25
SCHOOL	Rutland High School	GRADE	11
TEACHER	Susan Ponto		
PROJECT TITLE	Non-Antibiotic Defenses		

## ABSTRACT

The purpose of this experiment was to examine five different foods that are claimed to have preventative qualities to see which one would be the best at preventing the colonization of E. coli. These foods were Wasabi, Cilantro, Cranberries, Green Tea, and Garlic. This is important because throughout history anti-biotics have indeed been used in excess which has caused many types of bacterium to become resistant to the anti-biotics. This makes treatment more difficult due to the constant mutating bacteria. By using a natural food instead of an anti-biotic, the anti-biotics can be used when they are needed without the problem of resistance. To discover which food would work the best, each food had three Petri dishes with the E. coli bacteria and that food swabbed or placed onto the agar in the dish then incubated at thirty-seven degrees Celsius for eight days. By measuring the colonies and spots to the nearest centimeter was how the growth was monitored. On the eighth day, each dish of Wasabi showed from 5% to 10% growth with just spots of bacteria, while all other dishes for each food had 40% to 100% growth of colonies. The food with the least bacterial colonization was Wasabi which concludes that Wasabi was the best preventative food against the colonization of E. coli. This is beneficial to the area of Biology because it has the potential to be used for medical purposes pertaining to the human body and preventative medicine.

NAME(s)	<b>Sarah Socia</b>	PROJECT NUMBER	<b>S15</b>
SCHOOL	Mill River Union High School	GRADE	<b>10</b>
TEACHER	Carolyn Raiford		
PROJECT TITLE	<b>The Science of Art</b>		

## ABSTRACT

Coming into tenth grade everyone knew they were required to do a science fair project. When the time came around to begin the projects the students were told that they should base their projects on something that interested them most. Drawing was the first thing that came to mind. After some doing some research and consulting people, whose abilities in art and/or science surpass the average person, the decision was made to focus the project on why some art appears more realistic than others. But knowing that the realism of a drawing comes from the accuracy of the drawing (accuracy is a factor that helps determine what makes a person believe that certain artwork is more aesthetically appealing over others), the project was refocused on which method of drawing was most accurate.

○There were many components of drawing to choose from, but one that could be controlled fairly easily was the contour lines; this was done by controlling the methods of drawing. Contour lines are the foundation of drawing; they are essentially the basics component of an accurate drawing. The variables that were controlled were medium (charcoal and pencil), type of paper, artist, and time. The independent variables were the methods of drawing which included: graphing, projecting, and freehand. Each method of drawing was used once per set of drawings (there were two sets). The focus of all of the drawings in a set was a photograph. First, the photograph was drawn using freehand, then by graphing, and the third with a projector (the drawings were done on separate days so that the memory of having already drawn the picture did not affect the outcome). All three of the drawings in a set were drawn using the same photograph and were all the same size. The second set of drawings was videotaped as they were being drawn.

NAME(s)	<b>Noah Spoth</b>	PROJECT NUMBER	<b>C32</b>
SCHOOL	Avalon Triumvirate Academy	GRADE	<b>5</b>
TEACHER	Amanda F. Gifford		
PROJECT TITLE	<b>Pepsi V.S. Coke</b>		

## ABSTRACT

My experiment was, would Pepsi or Coke take more rust off a metal nut. As I had heard, Pepsi had traces of alcohol in it so I had thought Pepsi would take off more rust. However, my observations prove otherwise. After two days, none of the rust on the Pepsi nut is gone, but all of the rust on the coke nut is gone. After 18 days, more the results are the same, with one exception the soda is honey like. My materials were applesauce containers, Coke, Pepsi, and two nuts.

NAME(s)	<b>Miriam Stats</b>	PROJECT NUMBER	<b>S16</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	C. Belton		
PROJECT TITLE	<b>Perception of Beauty: Facial Symmetry</b>		

## ABSTRACT

This project in its present is in the data collection stage. The initial idea was to test high school students on how attractive they perceive a face to be and how symmetry affects the results. I used three of the same facial image and edited the face in photo shop to make each vary in amount of symmetry. The faces range from completely asymmetrical to exactly symmetrical.

Results were determined by asking peers to rate the photos on a survey. So far, the majority of my data has agreed with my hypothesis. 80% of the students that have taken my survey so far have rated the asymmetrical face as the most unattractive and the most symmetrical face as the most attractive. The other 20% surprisingly said that the most symmetrical face was the most unattractive.

This data makes me believe the ending conclusion will be that people with symmetrical faces are perceived to be overall more attractive. However, more students are going to be tested to reach a level of 25-50 total students tested for the purpose of getting the most accurate statistics possible.

NAME(s)	<b>Jason Stockett</b>	PROJECT NUMBER	<b>P36</b>
SCHOOL	Homeschooled	GRADE	<b>10</b>
TEACHER	Robert Stockett		
PROJECT TITLE	<b>Go Green with Magnetic Braking!</b>		

## ABSTRACT

○The purpose of this project is to evaluate, and to improve, my last years braking system for vehicles. This years project was mainly focused on how differences in the rotating disk effects the braking force used to stop the rotating disk for which would stop your vehicle. Unlike the brakes that we use today, Magnetic Braking has no physical contact at all, resulting in less frequent restoring of our brakes, and a lot less material thrown away each year.

○For this years project I used a program named Open Data Studio to provide me with the ability to plot angular velocity vs. time from a rotary motion sensor. The different disks that I used for this years project consisted of 5 different Aluminum, and 2 different Copper disks. For comparing how different materials have an effect on the braking force. Then I chose one of my disks and recorded it's composition, radius, thickness, and mass. After this I attached one of the disks to the rotary motion sensor axle. Then I suspended a mass from one of the string, and wrapped the other end around the pulley on the rotary motion sensor. After I wrapped the string around the pulley raising the mass above the ground, to a height about 2m. Then when I was all ready to take data, I would hit the start button on the Data Studio, hit the timer on the stopwatch, and release the hanging mass simultaneously. When the mass hit the floor, I hit stop on the stopwatch and the Data Studio, and record the information I got from both. I repeated this several times to assure that I had accurate data. Later I added a magnetic field to the rotating disk, and recording the changes in data from the two different sets of runs. This was done the same for all the Aluminum disks, and Copper alike.

NAME(s)	<b>Jacob Swane</b>	PROJECT NUMBER	<b>B26</b>
SCHOOL	Rutland High School	GRADE	<b>12</b>
TEACHER	Susan Ponto		
PROJECT TITLE	<b>Effect of Salt on the Growth of Bacteria</b>		

## ABSTRACT

There are many compounds on earth. The compound that separates earth from lifeless planets is water. If water is the key to life and life on earth originated with the sea, then what type of effects does the salty water have on the simplest of life forms, bacteria? By exposing a common species of bacteria (Bacillus Megaterium) to various levels of salt one can see the effects that diminish or improve the growth of the bacteria. Bacteria require a median or food source, like all life, to grow and to live. By changing the percent of salt in the food source by adding a small amount as a variable and leaving all other extraneous factors constant one can see the direct effect the salt has. Salt has a direct negative effect on the common soil base bacteria when exposed to various levels of salt. With 10% of the food source salt there was no bacteria present at all. At 5% only about a 10th of what was present with no salt was present in the presence of salt. Thus proving that salt is very affective in preventing the growth of bacteria. This information can be used to help future microbiologists understand what kind of effects salt will have on this strand of bacteria.

NAME(s)	<b>Stephen Terry</b>	PROJECT NUMBER	<b>G06</b>
SCHOOL	Avalon Triumvirate Academy	GRADE	<b>11</b>
TEACHER	Amanda F. Gifford		
PROJECT TITLE	<b>Electric Crystals</b>		

## ABSTRACT

Crystals are useful to the world because geologists study them for their resources. Electricity is a world resource. Without it we would have no light bulbs or machines.

My hypothesis is that a quartz crystal will have more electricity passing through any other crystal. I expect this because of how clear a quartz crystal is. I think that electricity will pass through crystals that are clear in color. I expect that a crystal such as Tourmaline which is green or red will not allow electricity to pass through it. I tested ten crystals and I found out that the crystal Pyrite had more electricity passing through it than any other crystal. Pyrite is not clear, it is gold with cube crystals. I found that four of the other crystals also had electricity passing through them, none of them were clear. The rest of the crystals did not have any electricity passing through them.

I used wires to connect a battery to the crystal, from the crystal to the volt meter to read how much volts could pass through.

NAME(s)	<b>Viann Tran</b>	PROJECT NUMBER	<b>B27</b>
SCHOOL	St. Francis Xavier School	GRADE	<b>7</b>
TEACHER	Mary Ellen Varhue		
PROJECT TITLE	<b>Hear It?</b>		

## ABSTRACT

○Purpose: My project is involved with hearing and the pitch of sound. It can help musicians understand how people hear different pitches.

○Hypothesis: If the pitch of a sound increases, the number of people that will be able to hear it will decrease. The reason I think this is because there are limits to what the human ear can hear.

○Procedure: To conduct this experiment, I had a keyboard on one side of a large quiet room. I had to play 3 different octaves of C. As the note was played I had the participant back away from the sound until they couldn't hear the sound anymore. I measured how far they backed up to show how well they could hear the sound. I conducted this experiment on more than 35 students.

○Results/Conclusion: I saw that the lowest pitch was harder to hear than the others. I tested it myself; I conclude that my hypothesis was proven wrong. I thought it would be the higher pitches that were hard to hear because I learned this through my choir experience. I actually don't know why this happened, but I'd like to research more about this.

NAME(s)	<b>Alex Trudeau</b>	PROJECT NUMBER	<b>P37</b>
SCHOOL	St. Francis Xavier School	GRADE	<b>7</b>
TEACHER	Mary Ellen Varhue		
PROJECT TITLE	<b>Clamation Station</b>		

## ABSTRACT

Studying aerodynamics of shapes for cars can help to create a more fuel-efficient car design. Designers are always looking for a perfect shape, but since all cars have a different purpose, it is hard to be certain what a good car shape is. My project tested which of the five shapes I chose moved the fastest/had the best aerodynamics. I believed that the wing shape would be the fastest and have the best aerodynamics. because on a plane, that design is used to lessen drag, I investigated my project by testing each shape 15 times timing each run and measuring how far the car went to measure its speed. I then took the average of the 15 runs to find each car's speed. My independent variable was the shape of the car, the dependent variable was the speed resulting, and the constant variables were the amount of clay used, the wheels/bottom of the car used to hold the modeling clay, and the ramp used. The bus/rectangle shape went the fastest with 105.19 cm/s, and then the rest fell in this order: 2) wing shape (98.58cm/s), 3) Flintstones (98.54cm/s), 4) truck (93.36cm/s), and 5) wedge (92.52cm/s). My results disproved my hypothesis, and I decided that the reason the bus went the fastest must have been because all of its weight was bunched together, which must have caused faster acceleration on the ramp, because the bus moved slower when it hit the actual ground.



NAME(s)	<b>Amanda Tucker</b>	PROJECT NUMBER	<b>P38</b>
SCHOOL	Fair Haven Union High School	GRADE	<b>10</b>
TEACHER	Shawn Ketcham		
PROJECT TITLE	<b>A Better Way For Vermont's Wind Energy</b>		

## ABSTRACT

The experiment was to figure out what windmill would be the best model to produce wind energy. The experimental models were built with a horizontal and vertical design. The hypothesis is the vertical windmill would produce the most energy rather than the horizontal windmill.

○The idea for this experiment came from hearing about how Vermont is going to be having windmills to help produce energy. This may hurt Vermont's tourism and population growth because land value will go way down. The project was also started because I read in the Rutland Herald an article about the wind energy that could come to Vermont and potentially ruin Vermont's beauty.

○The experiment was to test which windmill, horizontal or vertical, would be the best way to produce the most energy (looking for a better way for Vermont to get a pleasanter looking energy maker). The experiment started out with the horizontal windmill model being tested by taking the reading with the amp meter, and did the same with the vertical windmill model. The hypothesis was refuted with the first vertical windmill model made, so a second vertical windmill model was made in hopes of seeing if that model would make more energy than the horizontal windmill model. It was tested and the hypothesis was still refuted. The readings were taken (which everything was measured on an amp meter of mA and had a three voltage) and was made so people could compare the models to realistic size windmills. It showed the realistic figures by changing the mA by putting them into watts (volts x amps = watts). The hypothesis was refuted because the horizontal windmill model produces the most energy.

○This experiment still shows how Vermont needs to think very long about if they really should bring windmills into Vermont. The reason why vertical windmills would be better than horizontal windmills, because vertical windmills are to be said that they are more pleasing to the eye and can take up less space (even though most think we should not have any at all).

NAME(s)	<b>Neira Valentic</b>	PROJECT NUMBER	<b>B28</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Effects Sunlight/Drier has on Bacteria Found on Clothing</b>		

## ABSTRACT

This project investigates how well the drier versus natural sunlight is when it comes to destroying bacteria that we typically desire to get rid of on pieces of clothing. If the settings of a drier have a heat setting up to a certain degree then the conditions become to hot for the bacteria to prosper. Natural sunlight gives off ultraviolet radiation which has a wavelength in the range 10 nm to 400 nm that will either degrade DNA and kill bacteria or inhibit bacterial growth. The procedure starts with placing an article of clothing in the drier and taking a sample in a Petri dish. Then after keeping the Petri dish in an incubator for 24 hours you will see the bacterial results. Now by doing the same procedure using a piece of clothing that was out in natural sunlight the bacterial results are comparable for each condition. Depending on the bacterial results we can conclude which method of drying your cloths might be most effective in destroying bacteria. I believe the drier due to the temperature ranges will be most effective in destroying bacteria.

NAME(s)	<b>Tyler VanDyk</b>	PROJECT NUMBER	<b>P39</b>
SCHOOL	Hinesburg Community School	GRADE	<b>8</b>
TEACHER	Ms. Stephanie Konowitz		
PROJECT TITLE	<b>Magnet Mayhem: The effect of Temperature on a magnets reach of potent strength.</b>		

## ABSTRACT

Maglev or magnetic levitation is the levitating transportation breakthrough that allows trains to “float” about 10mm of the tracks as well as being magnetically pushed from point A to point B. They work with two like poles of electro magnets, one attached to the train one attached to the tracks, repelling each other to push the train forward as well as letting it hover to reduce friction so they require less power and get more speed. This experiment was designed with thoughts of maglev being the main motivator. My main thought was: What would happen if the magnets got really cold or hot due to the weather? Would it affect how high the train was above the tracks? I did some background and found that at a certain temperature all magnets lost power but I didn’t find anything about how much it might decrease overtime just a drop off. So I decided to test in-between temperatures. I tested this by trying different temperature magnets ability to hold another magnet in the air. I took four magnets, two cylindrical and two square, and built a stand where the cylindrical magnets could slide up and down a tube with a slot to read it. I then heated or cooled the two square magnets to a certain temperature and tested all four combinations of the cylindrical and square magnets for variation. I slide the square heated or cooled magnet under the stand north face up and dropped the cylindrical magnet into the tube north face down then measured the distance between the two as the cylindrical one “hovered” in the stand, or the magnetic field. For results I learned that the more heated up the magnets were the smaller the magnetic fields reach of potent strength was. So if the tracks on a Maglev got heated up on a warm, sunny day you would have to counter by pumping more electricity into the tracks.

NAME(s)	<b>Garth Vest</b>	PROJECT NUMBER	<b>G07</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Deborah Rodolfy		
PROJECT TITLE	<b>Light Pollution in Rutland County</b>		

## ABSTRACT

Light Pollution in Rutland County

By Garth Vest

Light pollution is a growing problem in cities across America. This problem affects plant and animal life, including humans. It also limits the amount of stars we can see in the night sky. The Purpose of this experiment is to determine the amount of light pollution in Rutland County, and where in Rutland County the highest amount of pollution occurs. A digital camera is used to measure light pollution. After taking photos in various locations of the night sky, the photos are then put into ImageJ and a histogram showing grayscale levels is used to find the amount of light pollution in that photo of the sky. A bar graph is used to show the relationship of the grayscale levels in each photo. Results should show that the highest amount of pollution occurs in the downtown area of the city, and that the lowest amounts of pollution occur in the rural places outside of the city. This is due to the amount of light produced in these areas. Light pollution is a growing problem, and these results show where it is most prominent.

NAME(s)	<b>Breanna Vittum, Courtney Sheldon</b>	PROJECT NUMBER	<b>GP18</b>
SCHOOL	Green Mountain Union High School	GRADE	<b>8</b>
TEACHER	Mr. Allan Garvin		
PROJECT TITLE	<b>Sleep Deprivation</b>		

### ABSTRACT

For our science project we decided to learn about sleep depravation. We found that this out by testing the amount of sleep had an affect on how you perform academically. We thought that this would be fin to find out what the results would be. We did this by staying up all night and testing every two hours the end result was that around 2:00 am it was harder to concentrate be4cause they were sleep deprived. We found out that after 2:00am it got harder to concentrate but at the same time answer.

NAME(s)	<b>Lena von Buren</b>	PROJECT NUMBER	<b>P43</b>
SCHOOL	Mater Christi School	GRADE	<b>6</b>
TEACHER	Michele Donlon		
PROJECT TITLE	<b>Shake 2 Break</b>		

### ABSTRACT

The purpose of this experiment was to determine which structural adjustment improves the stability of a building during an earthquake. It was hypothesized that if a structure is built upon base isolation and cross bracing, it will prove more stable in an earthquake than a structure with buttresses and cross bracing. The background research investigated the types of ways to create a safer building in a seismic area. Three concepts were found and used to experiment: buttresses, base isolation, and cross bracing.

○The experiment was conducted on top of an earthquake board, constructed to simulate an earthquake. Six building designs were constructed out of wooden Jenga« blocks, one basic structure, and five with different types of adjustments. The base isolation, which lies underneath the structure, was expected to absorb the shock of the earthquake. The buttresses were assumed to hold the structure together by leaning against it. The cross bracing in the structures was expected to stabilize the building. Three trials per design were completed.

Based on the collection of data, the building with base isolation proved more stable and collapsed later than the building with buttresses. The building with buttresses and cross bracing took the longest to fall apart. However, it showed signs of breakage much earlier than the structure with base isolation and cross bracing. Hence, a structure, built in a seismic area, which is constructed with base isolation and cross bracing, would greatly improve safety for the people inside during an earthquake.

NAME(s)	<b>Margaux von Buren</b>	PROJECT NUMBER	<b>P44</b>
SCHOOL	Mater Christi School	GRADE	<b>8</b>
TEACHER	Michele Donlon		
PROJECT TITLE	<b>Saving the Grid</b>		

## ABSTRACT

○The inquiry behind this project was: which insulation and phase change materials will produce the most efficient thermal energy storage? The hypotheses for this experiment are: if Fiberfrax« Ceramic Fiber, Firemaster« Board, and Superwool« Plus insulations are all tested using water as the heat source, then the Firemaster« Board will have the least amount of heat loss, and, if PCM58P, PCM00P, and PCM07N, are all tested at their operating temperature over a period of time, then PCM58P will be able to retain the energy for the longest amount of time. The background research was conducted mainly on the different properties of energy storage.

○In Procedure 1, three insulation boxes were constructed and tested using water as the heat source. The temperature data was collected over time and the final difference was calculated by subtracting the end temperature from the starting temperature of 175 °F. Procedure 2 tested three phase change materials (PCMs). For the results, the difference between the starting and ending temperature was calculated.○

○In summary, the insulation materials Superwool« Plus and Fiberfrax« Ceramic Fiber's performed equally over time, therefore being the most efficient materials for insulations. PCM00P was the best performing phase change material, with a 1.4 °F difference over 1 hour and 30 minutes. Consequently, Superwool« Plus or Fiberfrax« Ceramic Fiber and PCM00P would be the best choice of materials for an efficient energy storage system.

NAME(s)	<b>Jenna Wang</b>	PROJECT NUMBER	<b>S17</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Dawn Adams		
PROJECT TITLE	<b>Swim Science</b>		

## ABSTRACT

Why does psychology affect swimming significantly more than other sports, such as soccer, basketball, or hockey? It is surprising to find that a swimmer's performance is so greatly dominated by psychological factors. My research reflected a tendency in swimmers, from first-year competitors to Olympic, to be affected greatly by psychological factors. This caused me to question which aspect of psychological motivation could be used to the greatest advantage of a swimmer. Because motivation before or during a swim event beneficially affects the general performance of an individual, I predicted that competition would cause an individual to exemplify his or her best performance. To test this theory, I selected a variety of swimmers to take part in an experiment including three different methods of motivation. The first, control trial required each swimmer to sprint twenty-five yards alone in a pool lane. Three other trials were conducted to test different sources of motivation. The second trial required the swimmer to repeat the control trial with one swimmer swimming beside them. The third trial required the swimmer to repeat the control trial with a reward awaiting him or her. The fourth and final trial required the swimmer to repeat the control trial and try to beat his or her best time. The results display that, of the three, competition is the most effective source of psychological motivation in swimming. The variety in age and gender of the swimmers proves that each psychological aspect of swimming affect nearly everyone in the same manner. The major effect that psychology proves to have on swimming can be used to the advantage of competition swimmers, who can study and change their own behavior to improve their performance.

NAME(s)	<b>Christa Weaver</b>	PROJECT NUMBER	<b>S18</b>
SCHOOL	South Burlington High School	GRADE	
TEACHER	Curtis Belton		
PROJECT TITLE	<b>The Effects of Advertising through Technology on Vermont Students</b>		

### ABSTRACT

With the growing use of technology in our society, marketing has turned to the internet to capture its largest market: children and teenagers. The purpose of my study is to observe how the knowledge of major corporation logos increases as the age and exposure to advertisements increases in Vermont students. My hypotheses are that as student age increases, so will their recognition of major corporation logos, and as the amount of student technology use and exposure increases, so will their knowledge and recognition of major corporation logos. I surveyed students in grades 1-12 who are Vermont residents. Each student was shown a series of 40 flashcards with images of corporation logos (such as Apple, Nike, and Facebook), and were scored according to the number of corporation logos they were able to identify. The students (grades 5-11) or their parents (grades 1-3) were asked to fill out an additional multiple-choice survey about their internet, television, and cell phone use. The results of my survey confirmed my hypotheses. General exposure to logos were associated with corporate product category recognition. Specific corporation name recognition was associated with age. Recognition of specific technology company logos indicates advertising is effectively establishing company recognition in young children.

NAME(s)	<b>Billy Whaley</b>	PROJECT NUMBER	<b>B46</b>
SCHOOL	Northfield Middle High School	GRADE	<b>11</b>
TEACHER	Cynthia Tomczyk		
PROJECT TITLE	<b>The Effect of Different Percentages of PowerAde in a Solution on the Height of Mung Bean P</b>		

### ABSTRACT

In this lab, PowerAde was used as the source of nutrients for mung bean plants to see if different percentages of PowerAde in a solution had an affect on the height of the mung beans compared to water. My hypothesis for this lab was that as more PowerAde was added to the solution, the average height of the mung beans would increase. The percentages of PowerAde were 0%, 33%, 66%, and 100%. The data for this lab was obtained by using small planting pots filled with soil and planting 5 mung bean sprouts into each pot. I allowed the beans to germinate for 5 days before starting to water the plants using PowerAde. The height of each sprout was measured every 3 days and recorded in centimeters, and then the average height was calculated for each of the different percentages of PowerAde. The average height for the sprouts with 0% was 7.3cm, for 33% it was 5.6cm, for 66% it was 3.9cm, and for 100% it was 2.8cm. From the data found it was determined that as more PowerAde was added to the solution, the less the plants grew. In conclusion to the lab, I found that the data showed that PowerAde did not increase the height of mung beans, but instead the height declined as more PowerAde was added to the solution.

NAME(s)	<b>Nikki White</b>	PROJECT NUMBER	<b>P40</b>
SCHOOL	Windsor High School	GRADE	<b>12</b>
TEACHER	Jennifer Townsend		
PROJECT TITLE	<b>Temperature and Surface Tension</b>		

## ABSTRACT

The problem studied in this project was the effects of different temperatures on the surface tension of water. Before the actual experiment, it was hypothesized that as temperature increases, surface tension will decrease. This hypothesis was formed due to the fact that temperature directly affects the particles in a liquid. Particles at higher temperatures move at greater speeds and can escape the water's surface more easily. To complete the experiment, the first step was to create a balance. A needle was hung at one end of the balance and a square pan made from tinfoil was hung at the other. The needle was submerged into a cup filled with water. Using an eyedropper, drops of water were added to the tinfoil pan. The number of drops were counted until the needle was pulled up and out from the water. After completing five trials for four different water temperatures and gathering all the data, mathematical calculations were used to solve for surface tension in Newtons per meter and a graph was created. The graph showed that as temperature increased, surface tension decreased. From these results, it can be concluded that temperature does have an effect on surface tension.

NAME(s)	<b>Emma Wilkinson</b>	PROJECT NUMBER	<b>B29</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Effective Acne Medications</b>		

## ABSTRACT

The purpose of this experiment is to determine which acne medications work best at killing bacteria. Four medications were used; one with 10% benzoyl peroxide, one with 2.5% benzoyl peroxide, one with 2% salicylic acid and the last a solution of 2% tea tree oil and water. With this information, people will know which is the best skin treatment to use.

○Several methods were used to collect data. Skin swabs were taken from the cheek and grown on agar plates. These plates were then grown overnight. The two most frequent colonies from that were grown in liquid broths and then evenly distributed on two plates. Disks impregnated with the face washes were placed on and these plates were grown overnight. The diffusion circles left from the washes and the bacteria they killed were then measured across the diameter to compare effectiveness.

○Five different colonies were discovered in the first part of the experiment. There were myriad tiny colonies, white shiny colonies, a red colony, a yellow colony, and a fuzzy colony. The average number of colonies per plate was ten, however, there was an anomaly of a plate with 82 colonies while most had numbers below ten. The most effective medication was Oxy, with 10% benzoyl peroxide. It made circles with diameters of 1.8 cm and 1.7 cm on the two dishes. Second most effective was 2% salicylic acid and third was 2.5% benzoyl peroxide. The least effective was tea tree oil, which didn't kill any bacteria.

NAME(s)	<b>Flynn Williams</b>	PROJECT NUMBER	<b>C33</b>
SCHOOL	Weathersfield School	GRADE	<b>8</b>
TEACHER	David E. Lambert		
PROJECT TITLE	<b>Absorbing Motor Oil</b>		

## ABSTRACT

The problem I studied is what absorbs motor oil out of salt water the best. I chose this issue because I was hoping to find a better and more environmental way to absorb motor oil out of salt water. I chose salt water because that was the type of water most common to have oil spills and I chose motor oil because it is a type of crude oil which is the most common oil to leak or spill in salt water, these choices are also relevant to the BP Oil Spill. ○My research before my experiment included which household items are the best absorbents and what natural items are the most absorbent. I found paper towel and sponges to be the most absorbent household items and hair and hay to be the most absorbent natural items. I also decided to use dirt as an absorbent because I hadn't seen it used as an absorbent in oil spills but I knew it did absorb liquids, such as water when it rains, quickly.

○My hypothesis was that hair would absorb the most motor oil, then paper towel, then hay, then sponge, and then dirt. I hypothesized this because hair was most commonly used to absorb motor oil. Everything else was based on my research which stated that paper towel was the best household absorbent, hay was found to absorb when wet, sponge was the second best household absorbent, and dirt absorbed water quickly.

○My procedure was first put 20 tablespoons of salt water in each container of equal size, and then put 3 tablespoons of motor oil in each container. Third take paper towel/dirt/sponge/hay/hair with a plastic sandwich bag and equal mass to two grams on a balance. Next put paper towel/dirt/sponge/hay/hair on top of water for one hour. After one hour I removed the object with tweezers and put it in a plastic bag. Then I measured the mass in grams in a plastic bag on balance.

NAME(s)	<b>Jessica Willman</b>	PROJECT NUMBER	<b>C34</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Dawn Adams		
PROJECT TITLE	<b>Paint Binders</b>		

## ABSTRACT

Basic paint is made up from two ingredients, a pigment and a binder. The binder's job is to hold the pigment together and to the surface it is being applied to. This experiment tests which binder in the three most common paints works the best based on separation times and overall quality after being applied to a surface. The hypothesis stated that a paint using an egg white binder would take the longest to separate and have the best results. To make the paint, two teaspoons of powdered mustard (pigment) was added to each an egg yolk, egg white, whole egg, flour and water, olive oil, sunflower oil, safflower oil, grapeseed oil, and vegetable oil. A brushstroke of each paint was put on a swatch and timed how long each took to dry. After the individual appearances were recorded. Each paint was also transferred to jars where they were left to separate into two layers of pigment and binder.

The results showed that the egg yolk worked as the best binder rejecting the hypothesis. It has the longest separation time, 1826 minutes, and the best physical appearance on the swatch. The shortest time of 10 minutes was by the olive oil binder and its physical appearance was also poor, the pigment could be scratched right off the swatch. This information is useful for artists and people cutting back budgets and are making their own paint for their homes or art. The economy is tough and paint is expensive, there are items all around the house that can be used to make a pigment of any color one desires for a fraction of the price.

NAME(s)	<b>Cooper Willsey</b>	PROJECT NUMBER	<b>P41</b>
SCHOOL	Hinesburg Community School	GRADE	<b>8</b>
TEACHER	Stephanie Konowitz		
PROJECT TITLE	<b>Cyclocross Presssures</b>		

## ABSTRACT

○In cycling racers use different tire pressures for different terrain but in Cyclocross racers race on every type of terrain. I wondered if the pressure I was running for my races was the fastest pressure. I took out my bike in the middle of December and tried different pressures on different surfaces. The pressures consisted of 10psi, 15psi, 20psi, 25psi, 30psi, and 60psi. The surfaces were grass, pavement, and gravel. I tried each pressure 5x on each surface. I timed and recorded each run. Although the times were very similar there was a difference that followed a pattern of 20psi being the fastest on gravel and grass, and 60psi was the fastest on the pavement. From this I concluded that running around 20psi to 25psi would be the fastest in cyclocross because your riding on every type of terrain.

NAME(s)	<b>Owen Wood</b>	PROJECT NUMBER	<b>P42</b>
SCHOOL	St. Francis Xavier School	GRADE	<b>7</b>
TEACHER	Mary Ellen Varhue		
PROJECT TITLE	<b>Trusses</b>		

## ABSTRACT

Purpose:  
The purpose was to test the strength of different kinds of trusses. I tested the Pratt, Howe, and Warren trusses to see which would hold the most weight

Hypothesis:  
I believe the Warren truss will hold the most weight when compared to the Pratt and Howe trusses for the following reason. The Pratt truss has diagonal members pointed inward so I think it will not spread the weight out equally. The Howe truss has diagonal members pointed outward so I think it will not spread the weight out equally. The Warren truss has the diagonal members pointed inward and outward so I think it will spread the weight out more equally.

Procedure:  
My procedure is: Make the Warren, Pratt and Howe trusses by gluing them. Make sure they are all about two feet. It does not need to be exact because all the trusses span differently. Cross the top and bottom trusses. Tie a rope around the handle of the bucket and the bridge truss and determine how much weight each can hold.

Results:  
The Pratt held 85 pounds. The Warren held 45 pounds and the Howe held 77 pounds.

Conclusion:  
I found that my hypothesis proved wrong. The Pratt truss held more weight. Two of my bridges buckled and the other one was a shear failure. I learned that if you brace the trusses they will hold more weight because they will not buckle as easily.



NAME(s)	<b>Alden Woodard</b>	PROJECT NUMBER	<b>B30</b>
SCHOOL	Avalon Triumvirate Academy	GRADE	<b>8</b>
TEACHER	Amanda F. Gifford		
PROJECT TITLE	<b>Trophy Deer Antlers - Where Do They Grow?</b>		

## ABSTRACT

I chose this experiment because I wanted to know which environment would support larger deer antlers. I think that less mountainous areas would support largest deer antlers.

I researched what deer need to eat to grow larger antlers and what environment might support them better.

I got deer records from Vermont Trophy Hunter.com and put together a map of deer that were shot in those records, how big their antlers were and the location where they were shot .

I observed that nearly all of the trophy deer were harvested not in mountains but on flatter ground.

I believe this is because there are more cornfields, berries, prickly bushes, grass, and generally better food in fields or flatter ground.

NAME(s)	<b>Grace Wright</b>	PROJECT NUMBER	<b>C35</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Dawn Adams		
PROJECT TITLE	<b>Going for the Gold? Electrolytes Will Get You There</b>		

## ABSTRACT

I investigated the hypothesis that Gatorade has the highest electrolyte content when tested with gold colloid. I was interested in finding which brand of sports drink (Gatorade, Powerade, Vitamin Water, Propel, and Water (control)) would replenish electrolytes the best, for during workouts we lose fluids and electrolytes and need to replenish them.

For my experiment I added each of the sports drinks to 10 drops of gold colloid and observed the color changes that occurred. I kept the number of drops of each sports drink added constant for each trial (1 drop, 5 drops, 10 drops, and then 20 drops) and the flavor (lemon-lime) constant, although they were not all the same color.

I obtained the result that Vitamin Water contained the highest amount of electrolytes because it changed the gold colloid to the darkest shade of purple, and this color stayed the most constant throughout all the trials. This result rejected my hypothesis that Gatorade would have the highest electrolyte content.

The highest electrolyte content changed the gold colloid to the darkish color purple because of how the electrolytes affected the nanoparticles in the colloidal gold. The electrolytes caused the nanoparticles to clump together, so they were able to absorb longer wavelengths of light and reflect shorter wavelengths. According to a color spectrum, the shorter wavelengths are violets and indigos, so these are the colors I would see reflected by the highest electrolyte content. From the results I found that marketing for the sports drinks can be deceiving. Powerade had a very flashy and promoting container, yet contained the least amount of electrolytes. However, the disparities in colors of each sports drink could have contributed to the lighter color changes, Powerade especially, so it was a source of error. For future experimentation colorless sports drinks would be ideal.

NAME(s)	<b>Mallory Wright</b>	PROJECT NUMBER	<b>B47</b>
SCHOOL	Northfield Middle High School	GRADE	<b>11</b>
TEACHER	Cynthis Tomczyk		
PROJECT TITLE	<b>The Effect of Various Amounts of Coffee on the Hight of Bean Plants</b>		

### ABSTRACT

Do various amounts of coffee affect the growth of pinto bean plants? That was the question that was going to be answered during the three trials for the 30 days each. The hypothesis for the experiment is, If the amount of coffee in a water and coffee mixture is increase from 25% coffee, 50% coffee, 75% coffee, and 100%, with a control of 0% coffee, then the plants with the less coffee will end up growing more after the 30 day test period, because the coffee will start to slow down the process that the chloroplasts have in producing food, the plants will start to shut down due to not having the proper food consumption which will result in death. To first start the plants on a healthy route they needed to be germinated for about a week. Then planted in individual small pots. Five plants were being tested for each different mixture of coffee and water. Once planted the various mixtures of coffee and water were added to the soil, the mixtures were added every two-three days to their designated plants as they needed it due to the dryness of the soil. The height of the plants was recorded every three days for 30 days. The major conclusions of the experiment was that the control of no coffee grew the most during the thirty days while the more coffee that was added the less the plants grew, and the earlier the plants died. The average height change during the thirty days for 0% coffee was 60.5cm, 25% coffee 38.2cm, 50% coffee 13.3cm, 75% coffee 9.9cm, and 100% coffee 1.9cm, all of the plants started at 0cm tall for day zero.

NAME(s)	<b>Samantha Wulfson</b>	PROJECT NUMBER	<b>B31</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>The Effects of Nicotine and Galantamine on the Developing Nervous System of Chicken Embryo</b>		

### ABSTRACT

This project aimed to test the effects of nicotine and galanthamine on the developing nervous system of chick embryos. Eggs were given either nicotine, galantamine, or the control, saline. Eggs were windowed on day 5 of incubation, drugs were added on days 7-12, and kicks per minute were counted on day 13. The eggs given nicotine yielded the highest results for kicks per minute with galantamine second and saline with the lowest results. The higher results for the embryos given nicotine was hypothesized to be a result of the continuous stimulation of the muscles caused by a buildup of acetylcholine in the synaptic cleft due to the inhibition of acetylcholinesterase.

NAME(s)	<b>Cody Yu</b>	PROJECT NUMBER	<b>B32</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Effects of Barley Straw on Algae Populations</b>		

### ABSTRACT

This study's inspiration came from revisiting an old fishing lake where I was shocked to discover that the once bountiful lake was now covered in a layer of pale green algae. This lake and the fish that lived in it were suffering from eutrophication which leads to decreased oxygen levels in the water due to a massive increase of algae production. The goal was to find something that might reduce the algae population while remaining eco-friendly and biodegradable. To test the effectiveness of the barley straw on algae populations, algae were cultured in three separate containers. One container was given barley straw in the quantity of 10 grams of straw per squared meter of water surface. In another container, an algaecide containing copper sulfate was used. This treatment is potentially deadly to fish and other organisms if it is used in high concentrations. The final container was used as the control, which wasn't given any other variable besides the nutrients that algae need to survive. Throughout the experiment, the dissolved oxygen levels and the amount of algae were recorded for each container. After a week of carrying out this experiment, the results revealed that the control had more algae, based on a light passage colorimeter analysis, in the container than when the experiment first started. The container with barley straw had fewer algae than on day one and the container with the algaecide had only the remains of rotting dead algae. These results were very positive and definitively showed that the barley straw inhibited algae growth. This means that there are definitely environment friendly ways to reduce the effects of eutrophication in bodies of water around the world.

NAME(s)	<b>Aleksandra Zakrzewska</b>	PROJECT NUMBER	<b>B33</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>The Effect of Glucose Taste on Athletic Performance</b>		

### ABSTRACT

Glucose is a simple carbohydrate useful for providing quick energy. Athletes must often replenish energy quickly during exercise and glucose is perfect for that role. Previous studies have suggested that the brain may react to the taste of glucose more than to the presence of new energy in the bloodstream itself. This study was designed to test whether taste receptors in the mouth would react to glucose and provide an energy boost even before the glucose was swallowed. Subjects performed four time trials, of approximately one mile, on a set course on four separate occasions. Sports included skiing and running. Each time while running a designated warm-up, they would either swish and spit or drink either a glucose water solution or a placebo. The placebo solution was used to provide for the possibility that any effects of the glucose may have been psychological. The brain may have been reacting to the false sweet taste, rather than the caloric energy benefits of glucose. At the completion of the study, the times of each trial were compared to find any correlation between substances and times. Preliminary data suggests that there is no difference between glucose and placebo solutions, for both drink and swishing, although drinking generally provided faster times over rinsing.

NAME(s)	<b>Kristina Zaloudek</b>	PROJECT NUMBER	<b>B34</b>
SCHOOL	Rutland High School	GRADE	<b>11</b>
TEACHER	Deborah Rodolfy		
PROJECT TITLE	<b>Bacteria of the Mouth</b>		

## ABSTRACT

### Bacteria of the Mouth

When brushing a person's teeth, it is important to know what is in the toothpaste, and how it affects a person's oral bacteria. This experiment is designed to test three brands of toothpastes, and determine which toothpaste is the most affective towards fighting oral bacteria and preventing more from growing.

Throughout this experiment, three types of toothpaste, Colgate, Crest, and Aqua-fresh, were tested using the same person, a new toothbrush to ensure sterilization, and will brush for two minutes because that's the amount of time dentists suggest for brushing their teeth. Using a cotton swab, saliva was taken from inside the mouth of the person that brushed their teeth, and swabbed into a petri dish filled with agar. Three petri dishes per toothpaste were swabbed with the saliva so an average amount of colonies of bacteria could be determined. The petri dishes were then put into an incubator for five days at 37 degrees Celsius because that's the temperature that bacteria grow at. After the bacteria were grown, each petri dish was counted and then averaged out with the two other petri dishes of that type of toothpaste.

At the end of the experiment, the averages that were calculated showed that Crest toothpaste was the best to use because it generated only 31 colonies of bacteria compared to the 50 that Aqua-fresh grew, and 37 that Colgate grew. This experiment allowed and accurate decision to be made about which toothpaste best aids in oral protection from bacterial growth.

NAME(s)	<b>Yaxin Zhang</b>	PROJECT NUMBER	<b>B35</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Fluffy Green Bread</b>		

## ABSTRACT

In order to dissuade the growth of mold, soap and other materials were used. A better understanding of mold's habitat can be observed using different conditions, such as darkness versus light and air contact versus without. Soap has a pH over 7, an acidic level which mold cannot tolerate. Other types of materials, such as dish-washing soap contain ammonia, which kills mold. By applying these materials to bread, determining whether or not this could work is only a question of time. The bread is separated into four categories: those who are in Ziploc bags stuffed in darkness or light, or those who are wrapped in aluminum foil put in our daily environments. The control is plain bread put in all of the four different environments. By the second week, mold started to grow exponentially on bread that was applied with bar soap. A month later, slowly, mold started to grow on all of the experimental factors. The control remained intact and after leaving it out for months, dried to a crisp. Almost all the bread put in dark conditions remained mold-free. One factor that may have contaminated the results of this lab was that the control was the only part that did not touch water prior to the experimentation. Because they remained dry, mold could not grow, unlike the experimental factors that were applied with liquids. But, remaining three months mold-free raised lots of suspicion. Why the mold didn't grow on bread in dark environments is still being analyzed.

NAME(s)	<b>Sam Zonay, Annie Arthur</b>	PROJECT NUMBER	<b>GP19</b>
SCHOOL	Woodstock Union High School	GRADE	<b>9</b>
TEACHER	Jen Stainton		
PROJECT TITLE	<b>Mercury in Leaf Litter</b>		

## ABSTRACT

Leaf litter is the blanket of tree debris on the floor of a forest. Mercury is a heavy metal substance with the symbol Hg. Even small amounts of mercury in an organism can be harmful. In Marsh Billings National Historical Park there is a pond surrounded by hills named the Pogue. Surface water runoff contains mercury because mercury is present in all New England ecosystems. After studying mercury and the ecosystem at the Pogue the following scientific question was devised: is there a difference in mercury levels in leaf litter at different spots around the Pogue? In order to conduct the experiment, three samples of leaf litter from three different spots surrounding the Pogue were collected. After studying a topographical map it was hypothesized that the collection area near the most runoff would contain the highest mercury levels. The leaf litter samples were sent to the Dartmouth Trace Element Analysis lab for analysis of mercury levels. Analysis of data from the lab showed the hypothesis was not supported. After interviewing a Marsh Billings Rockefeller National Historical Park scientist, we discovered that there was no concrete answer that explained our results, however there were many factors that could potentially influence the results. A river near the Pogue could be to blame, for it intersected the runoff and could potentially sweep away the mercury. In addition, the deciduous trees near the area that tested low in mercury levels were not known for containing lots of mercury, while the evergreen trees in the other two collection areas that weren't exposed to as much runoff were.