Welcome

to the

2015 WCCUSD Science Fair

7th Grade

Behavioral Science

FOURTH PLACE

The McCollough effect

BOYS vs GIRLS

INTRODUCTION

I like to think that curiosity leads to many opportunities and a variety of outcomes. Science is very much like curiosity to me, which is why I'm very interested in it! Since I was younger, the human brain and body itself intrigued me. One of the things that has affect the human brain is optical illusions. Optical illusions are images that are created by other images or images made to let a person see something that isn't there or not how they will see it. Optical illusions are light, color, and patterns to trick us. However, "An illusion is proof that you don't always see what you think you do — because of the way your brain and other entities visual system perceive and interpret an image." Anything you see goes through your brain, and may get processed wrong which makes you visualize something you shouldn't. The McCollough effect is one out of the many optical illusions out there. The McCollough effect is a series of black and white horizontal lines they may appear that they are moving once you stare at the image. Some effects may include that the lines may appear pinkish, or that if you look away your vision appears wavy. The effect can last from seconds to even hours! According to The UCLA undergraduate Science Journal, the results in a survey taken place in spring of 2011, showed that females have an increased tendency to see color, motion, and appearance in optical illusions than males. Age made almost no difference to the effects of optical illusions as well as physical differences in female and male eyes. However, behavior, attention span and focus may have a big impact on the optical illusion.

QUESTION

Which gender will experience the McCollough effect for the longest amount of time?

HYPOTHESIS

I hypothesize that females will experience the McCollough effect longer than males. I concluded that the effect will last longer on [illegible] than males since researchers found [illegible] have an increased tendency to be [illegible]olor, motion, and [illegible]ions, such as the

MATERIALS + PROCEDURE

- Test Subjects (5 female, 5 male)
- Online video of the McCollough effect (4 minutes long)
- Stopwatch
- Notebook to record results

1. Prepare a online video of the McCollough effect.
2. Before having the tester watch the video, tell them beforehand what they should see afterwards (their vision should appear wavy).
3. Have tester watch video.
4. Once the video is finished, have the tester look away and **start the timer**. As stated in step 2, the tester should know that their vision should appear wavy.
5. Once the tester reports that their vision has stopped appearing wavy, **stop the timer** and record the results.
6. **Repeat** steps 1-5 for the group of 5 females and 5 males individually.

DATA

RESULTS

The data I collected during my experiment shows the following; the average duration of the McCollough effect on females lasted for 7.114 seconds. The seconds for them individually were; 7.37, 7.50, 9.57, 5.48, and 5.65. The average duration of McCollough effect on males lasted for 12.628 seconds. The seconds for them individually were; 3.75, 26.16, 6.26, 16.76, and 14.21.

CONCLUSION

In my hypothesis I predicted that females will experience the McCollough effect longer than males. I tested my hypothesis on the idea that researchers found that females have an increased tendency to be able to see more color, motion, and appearance in optical illusions, such as the McCollough effect, than males. The results indicate that this hypothesis should be considered incorrect, in the experiment I found that the average amount of time the McCollough effect took on females was 7.114 seconds, while the average amount of time for males was 12.628 seconds. Because of the results of this experiment, I wonder if it also applies to the other kinds of optical illusions. If I [illegible] this experiment again, I would try it with [illegible] and white horizontal lines to see if the effect [illegible]

NATURAL VS. ARTIFICIAL SCENTS

MATERIALS

- 6 Participants
- 1 Pack of Trident Cinnamon Flavored Gum
- 1 Cinnamon Stick
- 1 Vanilla Cupcake (no frosting)
- 1 Pack of Vanilla Cupcake Scented Wax Melts
- 1 cup of Chai Tea
- 1 pack of Chai Tea Scented Wax Melts
- 1 Tangerine
- 1 Pack of Tangerine Scented Wax Melts
- 1 Peppermint Candycane
- 1 Bottle of Peppermint Candy Scented Soap
- 1 Peach
- 1 Peach Scented Gel Freshener
- 1 Blindfold
- 1 Glass Container
- Notebook
- Pen

PURPOSE

The purpose of this experiment is to see whether a person can smell which items are artificially scented or flavored compared to their original derivation.

HYPOTHESIS

DATA

Amount of Correct Guesses For Natural Scents

ITEM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cupcake	YES	YES	YES	NO	YES	YES
Chai Tea	YES	NO	YES	NO	NO	YES
Tangerine	YES	YES	YES	YES	YES	NO
Peppermint Candycane	YES	NO	YES	YES	YES	NO
Peach	YES	NO	YES	YES	YES	YES
Cinnamon	YES	NO	YES	NO	YES	YES

GRAPH

PROCEDURE

1. I put together all of my materials (excluding the participants) and prepared them differently.
2. I squeezed the juice out of the peach, and the tangerine so I could get a stronger smell from them. For the Peppermint Candycane scented hand soap, I unscrewed the barrel pump at the top and let the participants smell the soap from the straw pump. For rest of the scents, I just placed it next to the natural scent or artificial scents for the item does not require much unpackaging.
3. I gathered six participants for my experiment.
4. Then, I sat each one down on a chair and blindfolded them.
5. For participant #1 I first gave her the two peached smelled items, both of the real peach and the gel freshener.
6. She then had a choice of #1 (real peach) or #2 (scented freshener) to choose from after smelling both. When she chose which one she thought had been the real scent, I marked it down as yes or no if she chose the natural item.
7. I repeated these steps to the other 5 participants and continued with the other scents too using the same steps.

VARIABLES

CONCLUSION

FOURTH PLACE

The Effect of Color On Memory

Introduction

Have you ever wondered if color can help you remember? The question I hope to answer is whether color has an effect on memory. I think that it is an interesting idea and I was intrigued to see if emotion has anything to do with memory. Doing research, I learned that certain colors can produce or trigger certain emotions. I researched more and found out that color coding words will make the things stick more in people's memories. Let me tell you more.

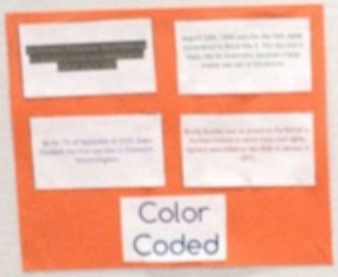
For instance red is normally associated with anger or bad things. Blue is actually used by banks to create a reassuring feeling, and yellow means happiness. I used many of these colors in the experiment. For example, the fact cards in the experiment, on a date where there was a battle, I wrote it in red because it was bad. Another example is that a date with a happy occasion was written in yellow.

Question and Hypothesis

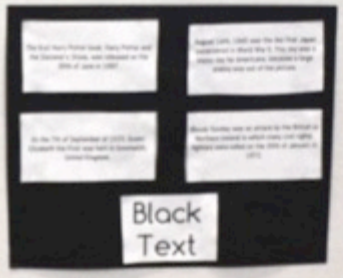
Does the color of text effect memorization?

I hypothesize that the cards with colors that correspond to the things that happened on certain dates will cause people to remember the facts more easily. The reason for my hypothesis is because the dates and colors are connected to certain emotions, so a person could remember what emotion the colors represented in order to remember the date.

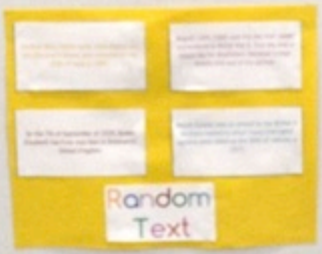
Color Coded



Black Text



Random Text



Materials

- 12 Index Cards
- 2 Different Colored Pens (Including Black)
- 2 different quizzes of 8 related to facts cards
- 4 People

Procedure

1. Recruit 4 participants

2. Find 4 obscure dates that are not commonly known that could be connected to emotions

3. Write one of the dates on one side of an index card. For the first 2 cards, write one date on each. In black. Then on the next 2 of these cards, write one date on each. In the same way as the dates were written on the first 2 cards. On the same line as the date, write down one thing that happened on that date. For example, for dates that were connected with a happy emotion, write down something that made people happy. For dates connected with sadness, write down something that made people sad. For dates connected with anger, write down something that made people angry. For dates connected with fear, write down something that made people afraid. Write down one thing for each date that corresponds with your emotion. Write the date and the one thing for the other 2 cards in black. Now you have four cards, two are black, and two are color coded.

4. Divide your 4 participants into 2 groups of 2. Give one group the black cards, and give the corresponding cards with the color coded.

5. Let each person study for as long as they want, but they can't take the cards home.

6. After they believe they have studied enough, give them either the color coded or black quiz. Depending on what they studied. Then give them the other quiz. Make sure that the participants who studied the same cards don't get the same quiz.

7. The next day, give them again, with different questions, but about the same topics. Then see how well each person in the group remembered.

RESULTS

Black Text	Participant 1	Participant 2	Average	Average of both cards
Test 1	63%	62%	63%	58%
Test 2	62%	62%	62%	
Color-coded Text	**Participant 3**	**Participant 4**	**Average**	**Average of both cards**
Test 1	58%	100%	79%	77%
Test 2	69%	100%	85%	
Random Text	**Participant 5**	**Participant 6**	**Average**	**Average of both cards**
Test 1	50%	50%	50%	53%
Test 2	62%	50%	56%	

Conclusion

The results show that my hypothesis was correct. When I added up the correct answers on the 2 quizzes the participants took the combined results of each group showed that the 2 people in the color coded test group were able to correctly answer more questions about the facts on the index cards. They scored 77% correct. The other two groups on average scored 58% and 53% correct. The results of each participant and the average for each group are shown in my RESULTS section.

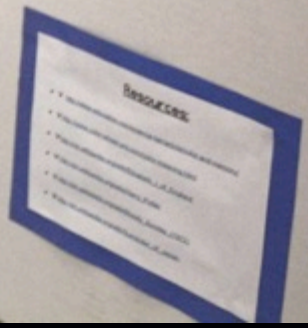
However when looking at my data, I did notice that in some pairs one member did much better than the other person and that did affect the average score. If I repeated this experiment, I would need to be more selective of participants. I feel that if all of my participants had a similar memorization skills, the results would have been more conclusive. I do think that my question is interesting and more research should be done on this topic.

Application

There are a few ways that the conclusions of my project could apply to the real world. One way is that teachers could use color coding according to emotions to write important things. Also, they could use that to highlight things in a lesson. Students could also use this method to write notes for tests or to study things. If they color coded it, they could remember what emotion that color made them feel to remember what it was.

People who had to do presentations could use color coding as well. This way, the presentation could attract attention as well as make it stick in other's minds. There may be other ways to apply this to everyday life as well. I feel that this experiment can help people in many instances, for both memorization and for making things pop! This was fun to do and I am glad that my results can help people with everyday things.

Resources:



Which Kind of Music Affects People's Emotions More; Music With Words or Music Without Words?

FOURTH PLACE

WEST CONTRA COSTA SCIENCE FAIR

Question

Does music with words affect people's emotions differently than music without words?

Hypothesis

I hypothesize that the music with words will affect people's emotions more than music without words because language invokes more emotions.

Control and Variables

Independent: Different type of music.
Dependent: The emotions of the people.
Control: The same amount of people.

Procedure

I picked six people to listen to music with and without words and take surveys. Each person listened to one happy song with words and then a happy classical piece without words. They repeated the same for the sad emotion. I used headphones to allow people to listen to the music from an Ipad. All participants listened to the music in the same room. Participants took surveys after each song.

Emotions	Music w/ Words: Before	Music w/ Words: After	Music without Words: Before	Music without Words: After
Happy	12	3	5	3
Sad	0	3	4	3
Angry	0	1	1	0
Fear	0	0	0	0
Suprise	0	0	0	1
Disgust	0	1	0	0
Other	0	3	2	3

By: [redacted] GRADE 7

SAMPLE SURVEY

Music Survey

1) What was your emotions before you listened to the song?
(A) Happy B. Sad C. Angry D. Fear E. Surprised F. Disgust G. Other (self-disclosed)

2) What is your emotions after you listened to the song?
(A) Happy B. Sad C. Angry D. Fear E. Surprised F. Disgust G. Other (self-disclosed)

3) Did music with words affect your emotions more or less?
Yes / No

4) Did music without words affect your emotions more or less?
Yes / No

SAMPLE SURVEY

Music Survey

1) What was your emotions before you listened to the song?
(A) Happy B. Sad C. Angry D. Fear E. Surprised F. Disgust G. Other (self-disclosed)

2) What is your emotions after you listened to the song?
(A) Happy B. Sad C. Angry D. Fear E. Surprised F. Disgust G. Other (self-disclosed)

3) Did music with words affect your emotions more or less?
Yes / No

4) Did music without words affect your emotions more or less?
Yes / No

Materials

1) Headphones
2) Ipad for music
3) Survey

Conclusion

My hypothesis was correct because when people listened to the music with words their emotions changed more than the music without words. When I had the people listen to the music with words everyone was happy before they listened. When I had the people listen to music without words everyone was happy/sad/angry/disgust or other. When everyone listened to the music with words, they changed emotions from happy to happy/sad/angry/disgust or other. When everyone listened to the music without words their emotions changed from happy, sad, angry, or other to happy/sad/angry/disgust or other. Like I said in my hypothesis, words invoked more emotions so I was right. To change music with words changed people's emotions more.

Does Color Affect Memory?

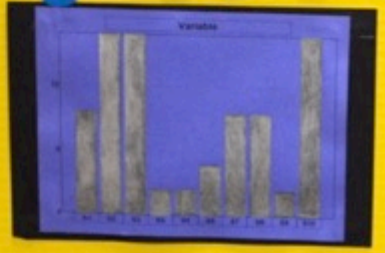
Problem

Does the color of text affect memory?

Hypothesis

Materials

Variable



Control

FLOAT

FLOAT

Conclusion

Procedure

Results

The lowest score of the Variable group was 2, as the lowest for the Control room was no points at all. Three people within the variable group received the total 14 points (meaning they had recited all 7 words in the correct order), while the highest score achieved for the control group was 12 points.

Total Points Earned for Variable Group: 76
Total Points Earned for Control Group: 40

FACTORS OF INSTAGRAM LIKES

SECOND PLACE
WEST CONTRA COSTA SCIENCE FAIR

Purpose:

These days, Instagram likes are used as a social status amongst our newer generations. Likes are affected by how many active followers you have, but does anything else contribute to it? Posts are shown in order of last posted in an account's feed, so does what time and day you post a picture affect how many likes it gets? Do people find certain posts more appealing and "likable" than others? Let's find out!

Hypothesis:

In this experiment, I predict that the time with the most likes would be during the weekends at the night hours, around 9 p.m. to 12 a.m. I notice that people are often on their phones at night and when they don't have school. The least amount of likes will be near the middle of the week, at the really late times, around 12 a.m. to 3 a.m. I also notice that many people, even at school, are on their phones, and many people sleep late, so I'm guessing that none of the posts will have zero likes.

I think that posts of animals and humans will have most amount of likes and the posts of inanimate objects will have the least amount of likes. Posts are shown in the order of last shared so if we post at a time where a lot of other people are doing so as well, it will be buried behind other posts. I'm guessing this time is around 3 p.m. to 6 p.m. because it is after school but not nighttime yet. For weekends, this data may vary.

Research:

"Statistics from the year 2014 show a lot of information which could affect our data. 47 percent of Instagram users in the United States access it on their smartphones, while the other 53% access it on their tablets. It is something to consider when since most people only carry around their phone throughout the day, as opposed to tablets, which are usually left at home. Instagram is a photo application, so most people access it on their smartphones, which is why the majority of users are between the ages of 18 and 29 years old. Instagram is also a free application, so most people have access to it. Instagram is available for multiple

Materials:

The materials you will need to conduct this experiment are:

- Any device that has access to Instagram (the website or application), with an optional screenshot ability
- A timer set on hour sessions
- An Instagram account free to post many pictures with some amount of followers
- A picture file each for the themes: animals, humans, nature, food, & inanimate objects

Procedures:

Step 1.
On a scale of about a month (four weeks), record the data of each posted themed picture on the days of the week at different times of the day. (In order to speed up the process, I posted two to three pictures at once. This won't affect the data as long as we don't posted many at one time. If we did so, people would probably only like the first few (the ones last posted) and skip and rest. Also, I decided to only record three weekdays in addition to the weekend: Monday, Wednesday, Friday, Saturday, & Sunday. If we did all of the weekdays, the data and charts would be too long and difficult to keep track off. However, we still get the basic part of the beginning, middle, and end of weekdays)

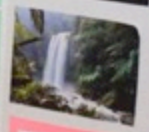
Step 2.
During each time, use a timer and wait one hour after posting.

Step 3.
After the hour is over, record the number of likes.

Step 4.
In order to make things easier, screenshot the page and delete the post in case if we lose our data and to stay organized.

Continue this process with all the themed pictures at the different days of the week during different times according to the chart.






	WEEK 1					WEEK 2					WEEK 3					WEEK 4				
	MON	WED	FRI	SAT	SUN	MON	WED	FRI	SAT	SUN	MON	WED	FRI	SAT	SUN	MON	WED	FRI	SAT	SUN
Animals	11	11	13	12	11	10	10	13	12	12	10	10	13	13	12	12	10	12	14	14
	4	7	8	10	11	7	7	8	9	10	7	9	7	10	8	8	8	9	10	9
	9	7	9	12	10	11	8	9	10	11	4	8	7	9	9	8	10	12	13	11
	10	6	8	10	9	10	8	8	9	9	9	7	8	9	10	10	9	11	11	12
	7	8	9	10	9	7	7	8	9	10	7	8	10	9	10	7	8	8	9	10
	5	5	6	7	8	6	4	5	6	5	4	5	5	6	7	5	4	6	7	6
	5	6	5	10	9	6	5	8	8	9	6	8	8	9	8	4	6	7	7	8
	10	8	11	13	12	10	9	10	12	12	8	8	9	10	11	9	8	8	10	12
	13	12	12	11	10	9	8	9	11	12	9	10	12	11	12	9	10	9	12	13
Humans	9	9	9	9	10	8	4	8	10	9	9	9	10	10	11	10	9	8	9	10
	5	5	7	11	11	8	7	8	8	9	6	6	8	9	10	8	8	6	8	9
	9	9	10	11	12	6	8	6	8	9	8	6	7	8	7	7	9	8	8	9
	6	7	8	9	7	4	6	4	7	7	4	5	6	6	5	5	4	4	5	6
	4	4	5	5	4	3	2	3	4	4	3	6	4	5	5	4	6	3	6	5
	11	10	11	10	12	11	9	10	12	11	11	10	10	12	11	10	11	12	11	12
	12	10	12	11	12	12	9	9	9	10	12	11	12	13	13	10	10	12	11	12
Plants	7	9	6	10	11	9	7	8	9	9	10	7	6	8	9	7	8	7	8	7
	7	8	9	9	11	7	5	8	8	9	8	5	5	6	8	8	7	6	8	8
	7	7	8	7	8	7	5	7	8	6	7	5	5	6	7	8	7	7	8	8
	11	10	9	11	10	10	8	10	12	11	11	9	8	9	10	11	11	10	10	11
	10	11	12	11	12	11	9	11	12	10	10	8	9	10	10	11	12	11	12	10
	7	7	8	9	10	8	7	8	9	10	7	7	8	9	10	7	8	8	9	10
	4	7	7	8	9	6	5	7	8	9	4	6	7	8	9	7	7	8	9	10
Food	7	6	7	8	9	7	5	6	7	8	7	6	7	8	9	8	7	8	9	10
	5	6	7	8	9	7	5	6	7	8	7	6	7	8	9	8	7	8	9	10
	5	6	7	8	9	7	5	6	7	8	7	6	7	8	9	8	7	8	9	10
	10	11	12	11	12	10	8	11	12	10	10	13	11	11	12	10	10	11	13	12
	9	8	7	10	11	9	6	7	8	9	8	7	6	7	8	9	8	9	10	10
Inanimate Objects	9	8	7	10	11	9	6	7	8	9	8	7	6	7	8	9	8	9	10	10
	6	6	6	7	8	6	4	5	6	6	6	5	4	5	6	7	5	6	7	6
	5	5	4	5	6	5	4	5	6	6	5	4	4	5	6	4	4	5	5	6
	3	3	3	5	6	3	3	2	3	4	4	3	2	4	5	4	3	5	6	5
	2	3	2	4	5	2	4	3	4	5	3	3	2	5	6	3	2	2	3	4
	5	5	4	5	6	5	4	5	6	4	5	4	6	6	5	5	4	6	5	4

Results:

As a result, the theme with the most likes was animals, the time with the most likes was 9 PM & 12 AM, and the days with the most likes were the weekends. The rates of the likes were quite constant and the likes on the different days of the weekdays didn't vary much. The theme with the least likes were inanimate objects, the times with the least likes were 3 AM and 6 AM, and the days with the least likes were the weekdays, somewhat more of Wednesday.

Conclusion:

In conclusion, my predictions were partially correct. One of the times with the most likes was 9 PM and the weekend had the most likes. The posts had zero likes, as expected. The posts of animals had the most likes and the posts of inanimate objects had the least likes. As I somewhat predicted, 3 AM didn't have many likes. 3 PM to 6 PM didn't have many likes. None of the posts had zero likes. This may be because more people posted around the same time.

Touching Memories

SECOND PLACE
WEST CONTRA COSTA SCIENCE FAIR

Question

What effect does touching an object have on one's ability to remember the object?

Hypothesis

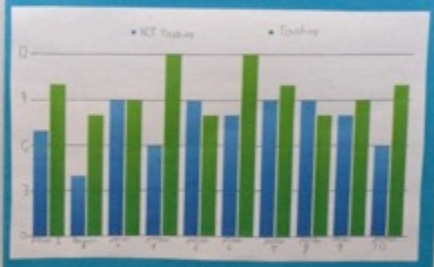
I think that when the people touch and look at the objects they will remember it better because I believe when you touch an object your brain remembers the texture/ feeling of the object and also pictures it.

Materials

1. 30 different household objects
2. 2 tables in 2 different rooms
3. to 15 volunteers
4. and a pencil

Procedure

1. Spread out 15 objects on each table in two different rooms. They should all be different items but things that you can find around your home.
2. Ask your first volunteer to close his or her eyes and go into the first room.
3. Instruct your volunteer to open his/her eyes when you say start. Then he or she will look at the table and try to memorize as many object as possible without touching them.
4. Time the volunteer for 30 seconds with the stopwatch. Say "stop" and have the volunteer close his/her eyes.
5. Take your volunteer into another room without any objects. Instruct him/her to say the objects he/she remembers. Give your volunteer 60 seconds to do this.
6. Ask your volunteer to close his/her eyes again and go into a different room with another table of objects.
7. This time, your volunteer is going to touch and look at the objects trying to memorize them. Say stop after 30 seconds, have the volunteer close their eyes.
8. Take your volunteer into a room without the objects or just cover the objects with a cloth. Tell them to say the objects he/she remembers and record the answers. Give them 60 seconds to do this.
9. Repeat steps 2-8 w/ your other volunteers.
10. Count the number of objects your volunteers remembered from the tables.



Data

Table 1: Just looking at the objects

Name	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6	Person 7	Person 8	Person 9	Person 10
book	x	x	x		x	x	x	x	x	
hat	x		x		x		x		x	
tie		x								
flip flop					x					
pants	x		x		x	x	x	x	x	
shirt	x	x	x		x	x	x	x	x	
shoe			x							
keys	x		x		x	x	x	x	x	
pencil										
pencil sharpener										
glue stick										
pen	x		x		x	x	x	x	x	
can opener										
magnet					x					
calculator	x									
notebook										
Total	7	4	5	6	9	8	9	9	8	6

Table 2: looking and touching at objects

Name	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6	Person 7	Person 8	Person 9	Person 10
calculator	x	x	x	x	x	x	x	x	x	x
camera	x	x	x	x	x	x	x	x	x	x
cookie	x	x	x	x	x	x	x	x	x	x
spoon	x	x	x	x	x	x	x	x	x	x
spatula	x	x	x	x	x	x	x	x	x	x
tie	x	x	x	x	x	x	x	x	x	x
gym shoe	x	x	x	x	x	x	x	x	x	x
flip flop	x	x	x	x	x	x	x	x	x	x
flowers	x	x	x	x	x	x	x	x	x	x
phone	x	x	x	x	x	x	x	x	x	x
cutting board	x	x	x	x	x	x	x	x	x	x
mug	x	x	x	x	x	x	x	x	x	x
soap dish	x	x	x	x	x	x	x	x	x	x
shoe	x	x	x	x	x	x	x	x	x	x
shoe	x	x	x	x	x	x	x	x	x	x
TV remote	x	x	x	x	x	x	x	x	x	x
pen	x	x	x	x	x	x	x	x	x	x
book	x	x	x	x	x	x	x	x	x	x
bottle	x	x	x	x	x	x	x	x	x	x
Total	10	8	9	9	12	8	12	10	8	9	10

Conclusion

My hypothesis was correct, when the people touched and looked at the object they remembered more objects when they touched the objects then just looking at it. I believe that if people use their 5 senses (sight, hearing, taste, touch, and smell) they will memorize more objects because the more senses involved in remembering information the more likely we are to remember it.

SECOND PLACE

WEST CONTRA COSTA SCIENCE FAIR

An Instrument to Create Emotions

Introduction

Walking in an art museum, staring down at you are many faces and expressions from the different artworks. These artworks are not alive, however it is without a doubt that they can they can have an emotional impact on us. My question is: "What responses do facial expressions in art create?" I want to know how humans respond to different facial expressions in drawings.

Since I have started drawing I have always caught my feelings changing according to the expressions in my artwork. Such as, when I draw a happy face I feel myself smiling and when I draw a grumpy face, I also feel myself frowning. I want to discover if facial expressions in art have an effect on others, maybe art isn't just "smudges and lines" on a paper, but an instrument that can cause deep emotional feeling inside.

I have always loved creating art that I hope could affect many people. After researching this topic, I have learned that humans' facial expressions can mirror their emotions. Humans are programmed in their brain to have (emotional) responses to anything they identify; this includes facial expressions. For example, if you see a frown at a scary face your brain believes that you might be in danger. Or when your "crush" flashes you a smile you feel your heart skip a beat. Through this project, I hope to conclude that facial expressions in art can cause different emotional responses in humans.

Hypothesis

If a facial expression in an artwork shows a certain emotion, then people observing this artwork, should be influenced by this emotion.

I assume this because I have personally experienced different emotions because of expressions in artworks.

Research / Background

According to my research, human brains have programmed responses to almost everything it identifies. The responses are usually assumed from memory relating to the identified subject (1). This also includes facial expressions.

Facial expressions are believed to most of the time mirror what humans are feeling, or basically their emotions. Emotions are a complex state of feeling that results in physical and psychological changes that influence our behavior. They are influenced by hormones, a type of "signaling" molecules that are released throughout the body to regulate and communicate between body parts.

Emotions are usually caused based on how the brain identifies events, objects and anything else that can be identified by the brain. There are also times when viewing art. These emotions might cause the viewer the pursue that's observed, whether it's positive or negative. The emotional reaction when viewing art is called "aesthetic emotion". It is always during the first time viewing an artwork. This is when the person that's observing the piece is actively engaged in the artwork. It's always the first impression during the first time viewing. This is known as the "aesthetic attitude" (2). This is when a person is observing an artwork for the first time. This is also known as "disinterested attitude" (3). This means that the viewer will feel the emotion conveyed by the facial expression in an artwork.

Facial expressions are the motion or positioning of the face's muscles. Different expressions convey different emotional states. Facial expressions are used to "express forms of nonverbal communication". Facial expressions are a form of nonverbal communication. Facial expressions are an important way to show how a person is feeling. The artist's emotions are also shown through their artwork. Facial expressions are also used to show how a person is feeling. Some of the most common facial expressions are: happiness, sadness, surprise, anger, fear, and disgust. These emotions have their corresponding universal facial expressions (4).

Materials

1. Sixteen drawings of expressions, eight of the viewers will be drawn, and the other eight shall be made.
2. One questionnaire survey, including instructions and questions.
3. Sixteen separate pieces of paper.
4. Pencils for recording the emotions of fear, sadness, anger, and disgust.

Question ?.!!

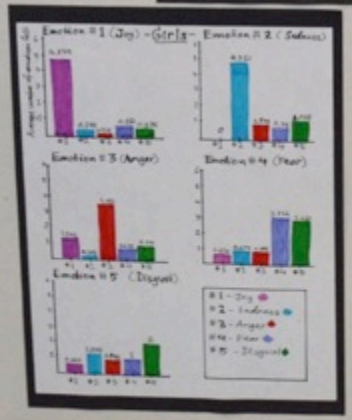
Can Facial Expressions in Art Affect Your Emotions?

Procedures

1. Create five drawings of different facial expressions. The five drawings will consist of one of these facial expressions expressing the five emotions: Joy, Sadness, Anger, Fear and Disgust. Label the images, #1through #5.
2. Then, create an emotions survey. On a piece of paper you will first write the instructions; "Study the given artwork. Focus on the facial expression and the emotion portrayed, and then answer the questions below. Do the same for all the five different artworks." Leave some space and write the questions: "1. What emotion do you think the character in the artwork is showing?" Be sure to leave space in between all the questions. Then, questions two to six, should be in this format; "From 0 to 10 how strongly do you feel (joy, sadness, fear, anger or disgust)? Zero being not at all and ten being very strongly." The last question will be: "7. Explain in more than one sentence why you think you would feel these emotions. Does this artwork remind you of something?"
3. Find 16 volunteers of which half are girls and half are boys.
4. Ask each volunteer to take a survey in a quiet room. Give them a piece of note paper, a pencil and the emotions survey. Now show them, one at a time, the drawings of the different emotions.
5. Tell them to look at the artwork. Then, to number on their separate piece of paper how much they feel each of the five emotions. Zero for not feeling the emotion at all, and ten for feeling the emotion very strongly.
6. Repeat step five for all of the five artworks. Then collect the volunteer's separate pieces of paper, emotion chart and pencil.
7. Repeat steps four to six for all of the sixteen volunteers.
8. Record all the data from the volunteers' separate pieces of papers. Calculate the average number each emotion is felt of the five pieces of artwork. Then, graph the data.

Survey Drawings

Data



Results

According to my data, the emotions portrayed in the drawings of the facial expressions are averagely the emotions most felt by the subjects.

For emotion #1 (joy), joy is the most felt emotion, at the average of 4.875 out of 10, and anger was the least, at 0.125, for girls. Boys also felt joy the most, at 6.750, but they felt disgust the least, at 0.125.

Emotion #2 (sadness) draws results of girls feeling sadness the most, at 4.750, and not feeling joy at all. Sadness was felt at the average of 0.250 and joy at 0.500 for boys.

For emotion #3 (anger) 3.5 is the average feeling of anger, and sadness is felt the smallest amount, at 0.375, for girls. For boys anger is felt most at 4.375 and joy is not felt at all.

However, with emotion #4 (fear), the average of emotions felt by girls are at a close tie. The amount of fear for girls is at 3.375, and amount of disgust is 3.250. For boys on artwork #4, fear is felt most, at 4.375, and anger is felt least at 0.625.

For emotion #5 (disgust), girls feel disgust the most at 2 and joy the least at 0.625. Boys feel disgust the most, at 4, and joy the least at 0.750. Also the boy's average number of emotion felt is higher than the girl's average.

Conclusion

My hypothesis was that the expressions in artworks can influence people to feel the emotion that is being shown.

Based on my results, this is true for the art showing joy, and sadness. I concluded that the volunteers feel more strongly the facial expressions portraying joy and sadness. However for the other emotions (anger, fear and disgust) it is ambiguous if the volunteers are feeling the emotions shown. The difference in the average number of emotions felt in the artworks showing anger, fear and disgust is not enough to prove if my hypothesis is correct.

I believe my project, if I should re-do it, should require more test subjects from a variety of ages, or just more subjects in general. I should also be sure that there will be no interruptions when the subjects are taking the survey, for it might affect the data.

Another experiment involving this subject I would be excited to perform, would be to compare facial expressions in artwork with color and artwork without color and the emotional responses they create.

Application

The results of this project may be used to improve moods in public places. I believe that putting up paintings/drawings of positive facial expressions at hospitals or other facilities would decrease the level of negative emotions felt. Maybe viewing the facial expressions may be swayed by the emotion portrayed in the artwork to feel happier. This may create a happier environment for the public.

Resources

7th Grade

Biological Science

Juicy Fruits

FOURTH PLACE

MIDDLE CHAFFEE COUNTY SCIENCE FAIR

Introduction

e many pre-teens, I tend to snack a lot after school. I would like to
something healthy to eat then, rather than carbs and salty snacks, or
r junk food. I think fruit might be the answer, but I want to find
ething that keeps me hydrated and feeling full. I found this
eriment to help me determine which fruits might have the highest
r content.

Materials

1. Accurate Scale (Weight Watchers model 3125)
2. Weighing Receptacle (cup, 90 grams)
3. Fruit: one watermelon, one pineapple, two pears, two apples
4. Knife and Cutting Board
5. Wire Cooking Racks (2)
6. Cookie Sheet
7. Oven

Background Information

The human body is composed of 80% water. Humans also get up to 20% of their daily water intake from food. Since fruit can also provide humans with vitamins, minerals, enzymes, carbohydrates and protein, I wanted to look at which fruit might give me the most water content as well.

Procedure

1. Wash all fruit.
2. Remove core, rinds, skins and all seeds from fruit to lessen variability of results. Only the water content of the pulp is being measured.
3. Cut fruit into cubes, at least 1-2" long.
4. Weigh the first sample. (Apple #1). Reweigh to verify.
5. Spread the slices in a single layer on a wire cooking rack, watermelon on a cookie sheet.
6. Repeat steps 4 and 5 for all eight samples of fruit.
7. Place cookie sheet with pineapple and the heat oven (210F).
8. Reverse trays, exchanging the heat for 90 minutes.
9. Remove samples and again double weigh them for accuracy.
10. Divide each sample's dry weight by its original weight. This number represents the final fruit's percentage of dry pulp.
11. Subtract this number from 1.00. This number represents the percentage water in #10 from 1.00.
12. Average water percentage together, and divide by two for each type of fruit.

(what is the water content of various types of fruit?)

Hypothesis

I believe that of the four fruits tested (watermelon, apple, pear and pineapple) that watermelon will have the highest water content and pears the lowest water content. This hypothesis is just based on personal observation: watermelon is very juicy and even has "water" in its name. Pears, on the other hand, are dry and mealy to me.

In this experiment the fruit is the Independent Variable and the water content is the Dependent Variable. The controlled variables would be the heat and the time in the oven

Results

The samples ranged from 17-32% water. Within each fruit type sample #1 and sample #2 were within about 3% of each other. See graphs.

We also tasted the dried fruit as a secondary experiment. The dried pineapple tasted closest to its original version. The apples were also still somewhat sweet. The pears had very little flavor, and the watermelon was slightly bitter. We think the flavor in the dried fruit might relate to the sugars that are left in it, but that would be a different experiment.

Conclusion

Antifungal Bacteria on the Arboreal Salamander

FOURTH PLACE
WEST CONTRA COSTA SCIENCE FAIR

Background

Batrachochytrium dendrobatidis, also known as Bd or the amphibian chytrid fungus, is a fungus that causes the disease chytridiomycosis in amphibians. The disease has devastated amphibian populations around the world, in a global decline towards extinctions. A recently described species, B. salamandrivorans, also causes chytridiomycosis and death in salamanders. Frogs in National Parks in California have been dying off quickly, due to chytrid fungus. That is why the parks request that visitors clean their shoes well before coming to the parks, so that the fungus isn't brought into the parks.

Some amphibian species can withstand chytridiomycosis infection, due to antifungal bacteria on their skin. These bacteria are Janthinobacterium lividum and Pseudomonas viridiflava. The red backed salamander, Plethondon cinereus, a common salamander in eastern North America, has these bacteria on its skin, and is not susceptible to chytrid fungus. *J. lividum* has already been used to help protect the California Red Legged Frog in the wild.

In my research, I did not find any other salamanders which have antifungal bacteria. I wondered if my pet salamander may have protective bacteria. He is an Arboreal Salamander, a salamander that lives only in California. His species name is Aneides lugubris, in the same family of salamanders as the red backed salamander (lungless salamanders, Plethodontidae). I found out that Janthinobacterium lividum bacteria have a unique purple color, and can be grown fairly easily. I wanted to culture bacteria from my salamander's skin to see if this anti-chytrid bacteria grows on his skin.

Hypothesis

The anti-fungal bacteria Janthinobacterium lividum lives on the skin of the Arboreal Salamander, Aneides Lugubris.

This is my pet salamander, Starve. I found him three years ago in my garden. He is a large male arboreal salamander. I keep him in a terrarium and feed him insects. He comes out only during the night. Arboreal salamander, Aneides lugubris, is a species native to California. The arboreal salamander and breathes through its tail, very sharp claws to trees.

Procedure

I will test my hypothesis by swabbing the skin of my salamander and growing what is picked up by the swab on nutrient agar. Instructions at labrat.com for growing *L. lividum* say to grow at 25°C on nutrient agar.

Agar preparation:

The lab formula for nutrient agar is 5g peptone, 3g meat extract and 15g agar in 1L water. I substituted a store bought protein powder for peptone, and beef broth cubes for meat extract.

1. 5g protein powder in 850ml of distilled water.
2. 3g beef broth cube in the solution from step 1, and heated to dissolve.
3. 5g of agar in 250ml of solution from step 2
4. Adjusted the pH to 7.0, with 'pH Up'.
5. Brought to 333 ml with distilled water
6. Boiled the solution
7. Poured one Oz of the solution into each petri dish

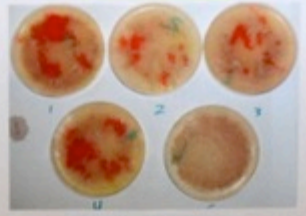
Collecting and growing bacteria

1. Used sterile wet cotton swabs to collect samples, rubbed lightly along salamander, two each on his topside and underside.
2. Ran the swabs along agar in petri dishes.
3. Incubated the petri dishes at 25°C for three days.
4. Place one petri dish with agar that has not been swabed in incubator

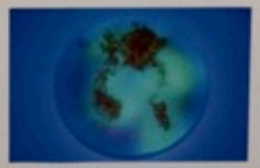
Materials

- Salamander
- Petri dishes
- Agar
- Protein powder
- Beef extract
- Distilled water
- Sterile cotton swabs
- Alcohol burner
- Ethyl alcohol
- Cooking Pot
- Incubator (egg incubator)
- Erlenmeyer flask
- Thermometer
- Vinyl gloves
- pH paper
- Acid and base
- Funnel
- Lighter
- Knife

Data



1. Topside #1
2. Underside #1
3. Underside #2
4. Topside #2
5. Control (no swab)



Dish #1 under UV light

Colony Morphology

Two types of bacteria were found on all plates:

Type 1: Form irregular, Elevation raised, Margin undulate, Color red-orange, fluorescent

Type 2: Form circular, Elevation flat, Margin undulate, Color milky grey, Not fluorescent

Discussion

No purple colonies were observed. I read only after I made my agar that *Janthinobacterium lividum* makes purple pigment only when glycerol is present. I will need to run the experiment again with glycerol.

There are not many bacteria that are orange-red on nutrient agar. Most of the orange-red bacteria I found in the ABIS Encyclopedia are types of Pseudomonas. From the colony morphology, the red-orange bacteria are raised and undulate, which are like Pseudomonas. I did not have Gram stain or a microscope to characterize further.

However, I noticed that the red-orange bacteria are fluorescent under UV light. I checked to see if the bacteria would fluoresce, since the other antifungal bacteria from salamander is *Pseudomonas viridiflava*, which is one of the 80 species of Pseudomonas that fluoresces. I observed fluorescence around the red-orange colonies. The red-orange bacteria is not *Pseudomonas viridiflava*, which has creamy white colonies.

The red-orange bacteria could be *Pseudomonas aureofaciens*, one of the only orange or red Pseudomonas bacteria, which also produces diffusible fluorescent pigment. Pseudomonas aureofaciens is also known to be antifungal.

Conclusion

Although I did not observe Janthinobacterium lividum, I cannot conclude that the Arboreal Salamander does not have this bacteria on its skin, because I need to run the experiment again with the nutrient to necessary see its purple color.

However, it is very possible that another bacteria I hadn't considered that has antifungal properties is on the skin of the Arboreal Salamander. This bacteria could be Pseudomonas aureofaciens or a similar strain. I will have to do further testing, or isolate the bacteria further and ask a lab to help identify the strain.

If the bacteria I identified from my salamander is the antifungal Pseudomonas aureofaciens or a similar strain, this bacteria could prove to be more useful than Janthinobacterium lividum (also a Pseudomonas) in combating Batrachochytrium dendrobatidis in California amphibians, as it is already adapted to grow naturally on the skin of at least one California amphibian species, Aneides lugubris.

References

FOURTH PLACE

WEST CENTRAL 2007 SCIENCE FAIR

A Smelly Situation

Question:

Which gender recognizes a particular smell the quickest?

Hypothesis:

I hypothesize that girls will be able to detect the scents the quickest because they are usually more sensitive to the way objects smell and men are usually less sensitive.

Introduction:

Did you know that humans can recognize about 10,000 different smells? Our olfactory epithelium is located in the nasal cavity and helps us be able to smell distinct scents. The purpose of my science fair project is to discover what sex, male or female, can identify a particular smell the quickest. According to recent studies, people are very sensitive to smell. I will test ten randomly chosen, same age subjects, both male and female, to see how fast they recognize a certain scent. I hypothesize that a girl will be able to detect scents quicker than boys because girls are usually more sensitive to the way objects smell and boys usually are less sensitive. Some studies suggest that women have a better sense of smell. A persons' sense of smell also changes over time. The sensors of smell and taste are chemical sensors because they detect chemicals in their environment. The process of smelling has three steps: odor molecules in the air are breathed in and dissolved in the mucus on the roof of the nasal cavity, the olfactory epithelium underneath the mucus detects the odors and send the information to the olfactory bulbs at the back of the nose, the olfactory bulbs send the information to the limbic system and cortex of conscious thought in the cortex so that we can respond to odors and access memories about them. Our sense of smell is closely linked to memory and emotion. I picked this project because I'm interested in how smell affects us in our daily life. It's interesting that women and females don't have the same sense of

Materials:

- ¼ tsp. edible juices or scented extracts such as lemon juice, orange juice, vanilla extract, peppermint extract
- 4 Tbs. water (separated into four parts)
- 4 cotton balls
- 4 small plastic bags with zipper seals (Ziplock® work well)
- 10 subjects, five of them must be girls and five must be boys (all people need to be around the same age)
- a notebook to record times and observations
- pencil or pen to record time
- stopwatch

Procedure:

1. Place one cotton ball in each bag.
2. Pour ¼ tsp. of each scented liquid into one of the bags that has a cotton ball. Do not mix liquids.
3. Add 1 Tbs. of water into each bag.
4. Close each bag.
5. Label each bag: (lemon, orange, vanilla, or peppermint)
6. Shake each bag until the cotton ball is completely soaked and every bag is well mixed. Let sit overnight.
7. Have one of your test subjects smell each scent as you tell them what it is. (Do not have more than one test subject in the room as it might affect the results)
8. Have your stopwatch ready and make sure to tell the person to say what the scent is as soon as they recognize it.
9. Place an open bag right under their nose with the opening at the top and tell them to smell as soon as the bag is positioned correctly. When they take their first breath start the stopwatch.
10. When they declare what the scent is, stop the stopwatch.
10. Write down how long it took them to smell smells in the same order.
Repeat with each smell. Never give anyone the
11. Repeat with each person.

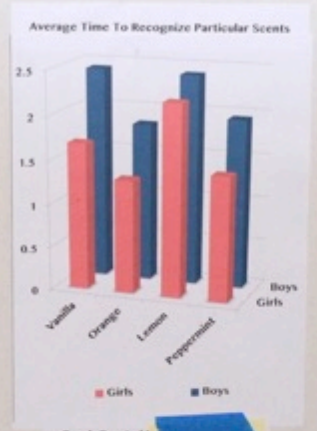
Conclusion:

In my hypothesis, I predicted that girls have a better sense of smell. I based my hypothesis on the idea that women are usually more careful about the way objects smell than men. My results indicate that my hypothesis should be considered correct. In my experiment, I found that women have a quicker and more accurate sense of smell. Because of the results of my experiment, I wonder if this is the same for all ages, if I were to conduct my experiment again, I would test different ranges of ages separately. The results of my experiment are important because they let us know why women can detect particular smells in everyday life, and men sometimes can't. If you are a woman and you smell something [illegible] next to you can't, you know [illegible]

Results (Girls)

	Vanilla	Orange	Lemon	Peppermint
Girl 1	1.53 sec.	0.71 sec.	1.88 sec.	1.16 sec.
Girl 2	1.30 sec.	1.35 sec.	1.56 sec.	1.81 sec.
Girl 3	1.85 sec.	1.68 sec.	1.43 sec.	1.58 sec.
Girl 4	1.73 sec.	2.21 sec.	3.56 sec.	0.75 sec.
Girl 5	1.63 sec.	0.81 sec.	2.59 sec.	1.15 sec.

Chart Created B



Results (Boys)

	Vanilla	Orange	Lemon	Peppermint
Boy 1	1.73 sec.	2.21 sec.	3.56 sec.	0.75 sec.
Boy 2	2.26 sec.	1.61 sec.	1.80 sec.	1.41 sec.
Boy 3	2.03 sec.	1.76 sec.	1.45 sec.	1.51 sec.
Boy 4	2.48 sec.	1.55 sec.	1.45 sec.	1.96 sec.
Boy 5	3.61 sec.	2.71 sec.	3.75 sec.	2.40 sec.

Chart Created B

FOURTH PLACE

WEST CONTRA COSTA SCIENCE FAIR

Touch Stimuli

How does the frequency of touch affect the degree of curling of snow pea tendrils?

Introduction:

Have you ever wondered how bean plants curl around their trellises? Or how morning glory plants can feel their way around a tree branch?

The cause of this curling is the plants' tendrils feeling stimulus. This experiment is on how the frequency of touch affects the degree of curling of snow pea tendrils.

Problem:

How does the frequency of touch affect the degree of curling of snow pea tendrils?

Hypothesis:

I think that the more frequent the touch is, the greater the degree of curling will be.

Materials:

- Pots
- Dirt
- Snow pea seeds
- Water
- 12 sticks
- Timer
- Pen
- Paper

Procedure Part 1: Growing the Plants

1. Fill a large pot with soil.
2. Form holes with your finger. Plant 15 seeds spaced 2 in. apart. Then, cover with 1-2 in. of soil.
3. Water the seeds regularly and keep the pots in a warm area, but out of direct sunlight.
4. It will take up to three weeks for the plants to grow and form tendrils.

Procedure Part 2: Experimenting with stimuli

1. Take 12 sticks and label them with numbers 1 through 12.
2. Select 12 tendrils and stick the sticks into the dirt next to them. Choose tendrils from various plants.
3. Keep track of the 12 tendrils. You may want to take a picture of the plants and label the tendrils in the picture.
4. Pick three tendrils that will receive no touch. These should not touch the stick or any other vine when curling. They should not touch the stick or any other vine when during the experiment.
5. Touch tendrils with the stick and remove with the exception of tendrils 4, 5, and 6. Touch tendrils 4, 5, and 6 every hour.
6. Touch tendrils 7, 8, and 9 three times per day (every 8 hours).
7. Touch tendrils 10, 11, and 12 one time per day.
8. Record the degree of curling every hour for 24 hours, then every 8 hours for the next 48 hours.

Table 1: Constant Touch

Time (hours)

Tendril	0	1	13	16	24	33	39	45	57
1	0°	0°	360°	360°	360°	360°	360°	360°	360°
2	0°	45°	90°	90°	90°	0° *	0°	0°	0°
3	0°	45°	90°	360°	360°	360°	360°	360°	360°
64	69	85	88	93	109	112	117	135	141
360°	360°	360°	360°	360°	360°	360°	360°	360°	360°
0°	0°	0°	0°	0°	0°	0°	0°	0°	0°
360°	360°	360°	360°	360°	360°	360°	360°	360°	360°

* Tendril straightened out after curling 90°

Table 2: Touch three times per day

Time (hours)

Tendril	0	1	13	16	24	33	39	45	57
4	0°	45°	45°	90°	90°	90°	90°	90°	360°
5	0°	45°	45°	45°	45°	45°	45°	45°	45°
6	0°	45°	45°	45°	90°	90°	90°	90°	90°
64	69	85	88	93	109	112	117	135	141
360°	360°	360°	360° *	360°	360°	360°	360°	360°	360°
45°	45°	45°	90°	360°	360°	360°	360°	360°	360°
90°	90°	90°	90°	90°	90°	90°	90°	270° *	270°

* Tendrils feel their way to the stick when they aren't supposed to have touch

Table 3: Touch one time per day

Time (hours)

Tendril	0	1	13	16	24	33	39	45	57
7	0°	0°	0°	45°	45°	45°	90°	90°	90°	90°
8	0°	0°	0°	45°	45°	45°	45°	45°	45°	90°
9	0°	0°	0°	0°	0°	0°	45°	45°	45°	45°
64	69	85	88	93	109	112	117	135	141
90°	90°	90°	360°	360°	360°	360°	360°	360°	360°
90°	90°	360°	360°	360°	360°	360°	360°	720°	720°
45°	45°	45°	45°	45°	45°	45°	45°	45°	45°

Table 4: No Touch

Time (hours)

Tendril	0	1	13	16	24	33	39	45	57
10	0°	45°	45°	45°	45°	45°	45°	45°	45°
11	0°	45°	45°	45°	45°	45°	45°	45°	45°
12	0°	45°	45°	45°	45°	45° *	45°	45°	45°
64	69	85	88	93	109	112	117	135	141
45°	45°	45°	45°	45°	45°	45°	45°	45°	45°
45°	45°	45°	45°	45°	45°	45°	45°	45°	45°
45°	45°	45°	45°	45°	45°	45°	45°	45°	45°

* One tendril split into three tendrils, all of which curled to 45° within two hours

Conclusion:

My hypothesis was not completely correct. I predicted that the tendrils with more frequent stimulus would curl more than the tendrils with less frequent stimulus. Instead, the tendrils with more frequent touch, 1, 2, and 3, curled faster than the tendrils with less frequent touch, but they all curled to approximately the same degree. All of the tendrils except for 1, 7, 8, and 9 curled to 45° by the third hour. All of the tendrils except for 9 curled to 45° by hour 13. Tendril 9 began curling at 33 hours. The more frequent the touch, the faster the tendrils curled.

The constant touch tendrils (1, 2, and 3) all curled to 90°. Tendrils 1 and 3 curled to 360° by the 16th hour. By hour 24, tendril 2 had curled 90°, but at the 27th hour, it was straight, at 0°. This did not happen to any of the other tendrils.

The tendrils that had touch three times per day (4, 5, and 6) had similar data. By hour three, they had all curled 45° and tendrils 4 and 6 were curled 90° by the 24th hour. Tendril 5 took a bit longer to curl to 90°. When I checked on the tendrils at hour 88, it was curled to 90°. At hour 93 it was curled to 360°. By hour 141, tendrils 4 and 5 were at 360° and 6 was at 270°.

The tendrils with touch one time per day (7, 8, and 9) had data similar to that of the three times per day tendrils. The main difference was that tendril 9 never curled more than 45°. Tendrils 7 and 8 had almost the same data. Both were at 45° by the 13th hour. Tendril 7 curled to 90° at hour 33, but it only curled that far at the 57th hour. Then, at hour 85, tendril 8 curled to 360°. The same happened to tendril 7 at the 88th hour. Tendril 8 went on to curl 720° at 138 hours while 7 and 9 remained at 360° and 45°.

The "No Touch" tendrils (10, 11, and 12) were all curled to 45° by hour 3 and stayed that way the whole time. My hypothesis was correct in this sense because the tendrils with no touch had a far lower degree of curling than the tendrils with constant touch. The interesting thing was that tendril 12 split into 3 separate tendrils, all of which curled to 45°. I can infer that this is because the tendril could not find anything to wrap around. The tendril split in three so it could cover more ground and have a better chance of finding support.

There were a few possible errors with the project. I had about 50 pea plants total, so they got in the way of my experiment. Some of the other plants may have touched, or some of the plants might have gotten extra stimulus which could throw off the results. I could have fixed this by experimenting with peas in separate pots.

Does time of day affect flexibility?

FOURTH PLACE

WEST CONTRA COSTA SCIENCE FAIR

troduction

Flexibility means to the absolute range of movement in a joint or series of joints, and length in muscles that cross the joints to reduce extending movement or motion. Flexibility varies between people particularly when there are observable in muscle length or multi joint muscles. Flexibility in some joints can be increased by stretching to maintain and improve how flexible you are. I hypothesize that people are most flexible and 6:00 pm, compared to 7:15 am and 5:00 am because they have been moving and stretching their bodies throughout the day.

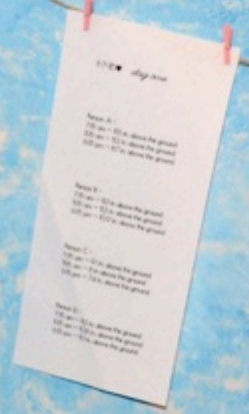
Procedure

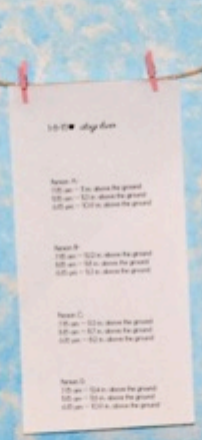
1. Gather at least 4 people
2. Have them go as far as they can into their splits
3. Measure the distance in their pelvis bone to the floor
4. record your data
5. Do step 2-4 at 7:15 am, 5:00 am, and 6:00 pm for at least 3 days

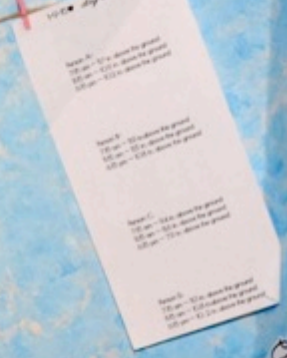
Materials

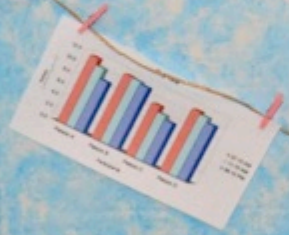
- At least 4 people, 2 wall 2 girls and 2 boys
- 1 Measuring tape
- A yard Ruler or meter
- A notebook to record your data

Conclusion









The Link Between Fingerprints & Ethnicity

THIRD PLACE
WEST CONTRA COSTA SCIENCE FAIR

Question

Hypothesis

Background Information

Materials

- 60 test subjects (15 African American, 15 Asian, 15 Caucasian, and 15 Hispanic)
- Hand wipes
- Tissues
- Black ink pad
- 75 copies of the survey(15 extra)
- Magnifying glass
- Notebook

Procedure

1. Have the test subjects take the survey.
   - "Have them answer the questions in the first part of the survey.
   - "Clean and dry their fingers with a hand wipe and a tissue for the second part of the survey.
   - " Have the test subject gently roll each of their fingers on the ink pad.
   - " Have the test subjects stamp their fingers in the boxes corresponding to each of the 10 fingers in the second part of the survey.
2. Repeat step 1 and gather more data.
3. Examine the fingerprints of the test subjects with a magnifying glass to determine whether it is a loop, whorl, or arch.
4. Calculate each subjects pattern index by assigning 1 point for each loop, 2 points for each whorl, and 0 points for each arch. The sum of these points is the pattern index.
5. Record and analyze data.

Data

Results

Ethnicity	LOOPS	WHORLS	ARCHES	Index
Asian	73%	23.6%	3.86%	12.07
African-American	68%	23.3%	8.67%	11.53
Caucasians	68.6%	25.3%	100%	8.93
Hispanic	60%	28%	12%	11.28
TOTAL	67.4%	22.55%	9.68%	11.2

Conclusion

References

YOU CAN MAKE WHAT OUT OF MILK

Purpose

Materials

Hypothesis

Procedure

Data Table

Conclusion

Research

SECOND PLACE

WEST CONTRA COSTA SCIENCE FAIR

Dry Skin, No More!

Problem

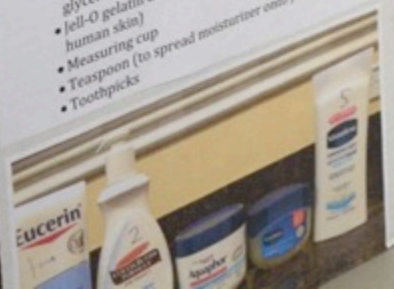
Dry skin can be a serious medical issue for some people. In severe cases, it can lead to exposed and damaged skin. Dealing with skin conditions such as eczema and psoriasis can be painful, inconvenient, d time consuming. The use of moisturizers helps to the and provide relief to cracked and bleeding n. There are various ointments, oils, creams, and ons to choose from, many of them claiming to al and soothe dry skin". It can be difficult to choose effective product with so many options. I found ructions on a version of this experiment at w.sciencebuddies.org. There are three main ups of moisturizer ingredients: occlusive agents, ollients, and humectants. Occlusive agents create a sical protective film barrier on the skin, keeping water in. Emollients work by filling in the cracks he skin to smooth out flakes and rough patches. ny occlusives are also emollients. Finally, nectants bring water to the skin's surface from rces nearby. Testing petroleum jelly, mineral oil, erin, and triethanolamine (common ingredients in commercial moisturizers) on Jell-O to determine how much moisture is lost throughout a period of time will help decide which ingredient aids the skin best in maintaining and absorbing moisture; thereby identifying the best product to use.

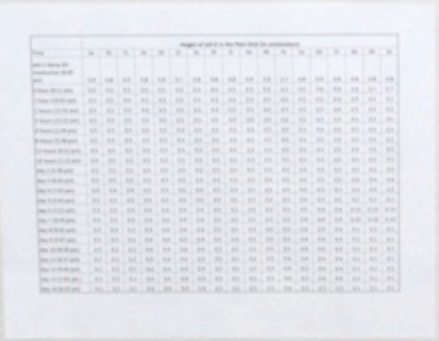
Hypothesis

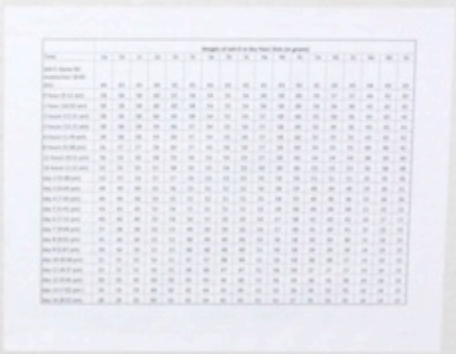
I think that Aquaphor, a moisturizing ointment containing mineral oil will be most effective in preventing the Jell-O (skin) from losing moisture. I have been using Aquaphor to moisturize irritated and dry eczema spots on my skin for the past year. From my personal experience, it has done an effective job in helping my skin repair and reduce bleeding and cracking on my hands, neck, arms, and nail cuticles.

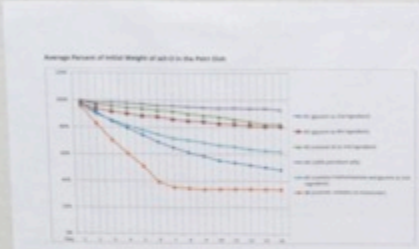
Materials

- Graduated cylinder (50 ml)
- Kitchen scale
- Ruler
- 18 Petri dishes
- 5 moisturizers (that contain triethanolamine, glycerin, petroleum jelly, and mineral oil)
- Jell-O gelatin dessert - 6 oz. package (model of human skin)
- Measuring cup
- Teaspoon (to spread moisturizer onto Jell-O)
- Toothpicks









Conclusion

My hypothesis was not supported. The Aquaphor was effective at retaining moisture, but the Vaseline (100% petroleum jelly) samples were about 7 to 10 grams heavier. Thus, petroleum jelly (an occlusive emollient), was most effective in minimizing water loss and protecting the skin, maintaining an average of 93% of the weight as well as height. Glycerin, a humectant, proved to be the least effective in bringing water to the surface from nearby sources. Both samples #1 & #5 had glycerin as the second ingredient and had performed worse than #2,which had glycerin as its sixth ingredient. The difference in the addition of triethanolamine in #5 can be seen starting from Day 4, where the gap between #5 & #1 took place.

Other than the controls, all the moisturizers maintained at or above 80% of weight by Day 4. Therefore, it would be safe to say that most moisturizers are effective given they are applied routinely. Heavy ointments are not always preferred by those who do not deal with severely dry skin.

Procedure

1. Label 18 petri dishes (1a, 1b, 1c to 6a, 6b, 6c). Each moisturizer will be tested in triplicate for more accurate results, including the 3 control (exposed Jell-O dishes).
2. Label each of the five moisturizers (1, 2, 3, 4, 5).
3. Prepare Jell-O dessert per instruction on package, pour 35 ml each into 18 petri dishes. Refrigerate for 4 hours or more until the Jell-O is firm.
4. Measure the height and weight of each petri dish. Record the data in a chart.
5. Apply 3 teaspoons of moisturizer to each of its corresponding petri dishes (Moisturizer 2 to petri dishes 2a, 2b, and 2c).
6. Measure the height and weight of each petri dish again. Record this data in a chart.
7. Measure the height and weight of the petri dishes in hour increments (1, 2, 3, 4, 8, 12, and 16 hours). After 16 hours, measure the height and weight of each petri dish once a day for two weeks. Record the data in a chart. Make observations and take photos.
8. At end of 14 days, use toothpicks to scrape the layer of moisturizer from the gelatin dessert to observe the softness or hardness of each Jell-O dish.
9. Calculate the percentage of initial weight and height of each petri dish and record data (height & weight of dish at each time point/height & weight of dish at zero hour).

Data Results

After 14 days of recording the weight, height, and observations on the Jell-O samples, I sorted the six types of samples from softest to hardest (A to F):

A. Vaseline Ointment (#4 containing 100% petroleum jelly)

B. Aquaphor Ointment (#3 containing mineral oil)

C. Palmer's Cocoa Butter Formula with Vitamin E Lotion (#2 containing glycerin as fourth ingredient)

D. Vaseline Intensive Care Lotion (#5 containing triethanolamine and glycerin as second ingredient)

E. Eucerin Skin Calming Creme (#1 containing glycerin as second ingredient)

F. Control (exposed Jell-O without any moisturizer)

The Jell-O coated in Vaseline Ointment and Aquaphor Ointment remained very soft and supple. The controls were very hard with little Jell-O left in the dish. The other three lotions and creams were somewhere in between, neither hard nor soft. The weight of the 18 petri dishes by day 14 varied from 57g to 14g. The height of the petri dishes ranged from 0.5 cm to 0.1 cm. As the line graphs to the left indicated, the less effective samples (#1,#5, and #6) were displaying a rapid loss in height starting Day 3. By Day 5, the control samples (Jell-O with no moisturizer) had begun to grow mold. The graphs for the weight and height were consistent for each of the moisturizers. Also, the amount of moisture lost corresponded proportionally to the softness of the Jell-O.

7TH GRADE

MATHEMATICS & COMPUTERS

FOURTH PLACE

WEST CONTRA COSTA SCIENCE FAIR

PROBLEM

Does the quantity of an object affect its strengths?

HYPOTHESIS

If an object is multiplied by thirty 30, than its strength will keep it from breaking/ripping.

INTRODUCTION

This experiment will show if a quantity of an object would it make it stronger or make it weaker. By testing different type of objects and the thickness, we can see if objects are the same strength or if adding more will make it harder to break. I decided to test paper and pasta to experiment since they are everyday items. There will be a specific number of the item that will be the ripping/breaking point and I am going to test what number that is and compare.

NUMBERS GAM

	30	25	20	15	10	5	Other
Paper	NO	NO	NO	NO	NO	Yes	Have to repeat 8 times
Cardstock Paper	NO	NO	NO	NO	NO	NO	Have to repeat 14 times
Glossy Paper	NO	NO	NO	Yes			
Pasta	300	250	200	150	100	50	Other
Pasta	NO	NO	Yes				Have to weigh out 240 pieces

RESULTS

SEE TABLE.

MATERIALS

- 30 Sheets Glossy Paper
- 30 Sheets Cardstock
- 30 Sheets Regular Printer Paper
- 2 Bags Regular Spaghetti

PROCEDURE

1. Predict what number the objects will rip/break out. This is the objects breaking/ripping point in numbers.
2. Start with 30 pieces of a type of paper (glossy, regular or cardstock) and see if you can rip it. Take away 5 pieces of paper if the previous stack could not rip. When you get to 15, add or subtract by 1 to find the papers breaking/ripping point.
3. After the paper, try to break the pasta. Since our prediction of 30 was easy, we went up by 50 to reach the breaking point.
4. Record your findings in your chart and compare.

CONCLUSION

In this experiment, the object was stronger when you increased its quantity and the object become weaker when its quantity became lower. My prediction was not accurate for the paper or the pasta. The paper was much lower than my prediction of 30. The glossy paper seemed flimsier but I thought the glossiness would have helped with the thickness. The pasta's breaking point was much higher than the predicted amount. I was surprised at how much pasta it took to keep it from breaking.

APPLICATION

This information is important because it shows how the strength of an object changed when you changed its quantity. This is helpful to others because it shows that if you change one thing then it would affect its results. Society can benefit from this by observing that one little thing affects almost everything.

Distance

THIRD PLACE

WEST CONTRA COSTA SCIENCE FAIR

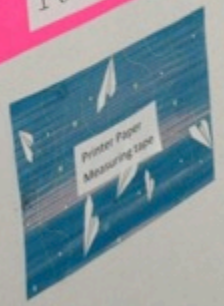
Introduction

I believe this project will be interesting and exciting. In this amazing project you will gain knowledge of what size a plane go the farthest. We will need printer paper, and measuring tape. We also need 3 sizes of paper planes such as regular size, half size, and forth of the size. I will examine this 10 times. I look forward to having good results

Hypothesis

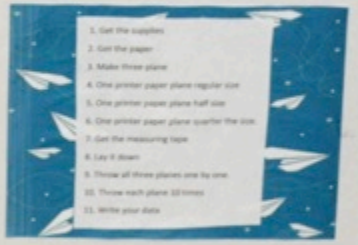
My hypothesis is that one quarter size will go farthest because it's less weight and small sizes.

Materials

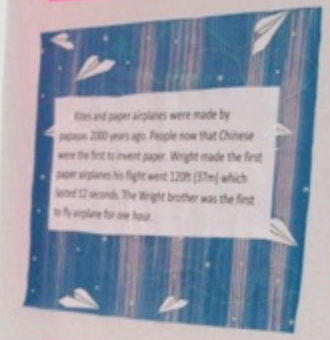


Question

Procedures

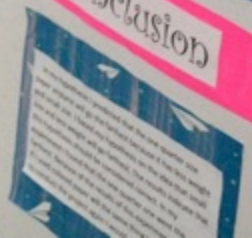


Research



Data

Conclusion



Bridge Weight Challenge

The Effect of Bridge Design on Weight Capacity

SECOND PLACE

Question

Which bridge design (Girder ridge or Arch Bridge) can hold ight with the least amount of nd?

Hypothesis

I think that the girder design bridge can hold more weight with less bend in the middle of the deck than an arch bridge. I think the straight beam support under the deck will help it to hold more weight with less bend.

Materials

- Plywood
- Eye hooks
- Wire
- Glue
- Screws
- Bricks
- Scale
- Tape measure
- Camera
- Saw
- Screwdriver
- Wire cutter

Procedure

1. Research Bridge types through the internet and books.
2. Decide on 2 bridge types that will be tested.
3. Plan and draw full scale bridge types.
4. Gather materials.
5. Build both Bridges following plans.
6. Put bridge outside on a flat surface and elevated on plywood and supports that are the same height.
7. Measure and document deck height in the middle of the Girder Bridge.
8. Test Girder Bridge by putting 6 bricks each weighing 5.5 pounds distributed across bridge deck to measure and document amount of bend at the center of the deck.
9. Measure and document deck height with 6 bricks.
10. Add 6 more bricks to bridge deck.
11. Measure and document deck height with 12 bricks.
12. Add 6 more bricks to bridge deck.
13. Measure and document deck height with 18 bricks.
14. Add 6 more bricks to bridge deck.
15. Measure and document deck height with 24 bricks.
16. Add 6 more bricks to bridge deck.
17. Measure and document deck height with 30 bricks.
18. Add 6 more bricks to bridge deck.
19. Measure and document deck height with 36 bricks.
20. Add 6 more bricks to bridge deck.
21. Measure and document deck height with 42 bricks.
22. Repeat steps 7-21 with arch bridge.
23. Examine final results and make a conclusion of your hypothesis.

Bend and Weight Capacity Table

(Distance Between Center Bend of Bridge and the Ground in inches)

Bridge Type	Starting Height (in inches)	6 Bricks	12 Bricks	18 Bricks	24 Bricks	30 Bricks	36 Bricks	42 Bricks	Total Bend (in inches)
Girder Bridge	3.3750	3.3125	3.2625	3.2500	3.2500	3.1875	3.1875	3.1250	0.2500
Arch Bridge	2.1875	2.1250	2.1250	2.1250	2.0625	2.0625	2.0625	2.0000	0.1875

* Each brick weighs about 5.5 lbs

Results

When you put the first six bricks on the 2 foot deck of the girder bridge you could only measure the slightest bend. When six more bricks were added I observed a slight bend in the deck. The bend stayed consistent with 18 and 24 bricks. With 30 bricks on the bridge the bend went to 3.1875 inches and stayed there with 36 bricks. At 42 bricks the bend extended down to 3.1250 inches.

To calculate the total bend I subtracted the height of the bend with no bricks and the height with 42 bricks. The total bend of the girder bridge 0.2500.

The arch bridge's 2 foot deck had a slight bend when six bricks were placed on it. The bend stayed the same when 12 and 18 bricks were placed on the bridge. When the bridge had 24 bricks the distance between the bottom of the bridge and the ground was 2.0625 inches. With 30 and 36 bricks the bend stayed the same. At 42 bricks, the bend to ground distance became exactly 2 inches. The total bend of the arch bridge was 0.1875 inches.

Conclusion

Although my hypothesis was proven incorrect, this experiment solved my problem. I felt that the girder bridge would carry more weight because it has a long supporting beam. After testing I realized that the arch bridge carried more weight because of the wires going from top to bottom were pulling the bridge up. The arch provided more support than a girder. Thus, a dual bridge design matters the amount of

WHAT MATERIALS BLOCK WiFi ?

FIRST PLACE

BEST DISPLAY

SCIENCE FAIR

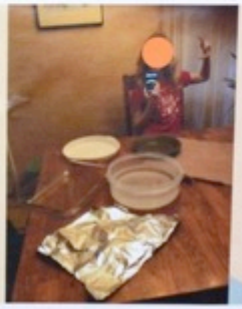
estion:

What materials block Wi-Fi?

I chose to do this activity because wifi is now as important to us as air. In order for our society to work properly, we need a sustainable amount of wifi so we can go on the internet. And we use the internet for everything, from watching cute cat videos on Youtube to going to your virtual office. If someone could block the Wifi on a global scale, then society would crash to the floor like glass.

Materials:

i. Wireless router
ii. Wireless device (in this case, it was a Galaxy S4, but it could be anything including a smartphone, laptop, iPad, etc.)
iii. Something that can show the strength of a Wi-Fi signal (in this case it was an app called Wifi analyzer)
iv. Aluminum foil
v. Aluminum baking pan
vi. Glass baking pan
vii. Cardboard
viii. Plastic
ix. Container with Water
x. Container without water
xi. Human Body



Observations:

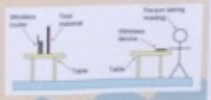
Hypothesis:

The aluminum baking pan will do the best job at blocking wi-fi.

According to my research, reflective objects do better at blocking radio signals. At the molecular level, since very few of the other materials are reflective, it will probably do the best.

Procedure:

i. Start out by measuring the usual signal strength that comes from your wireless router.
ii. Now, get one of the materials on the list to put in front of the wireless router and measure the signal strength. Do that 3 times per material on the list.
iii. Calculate the average dBm (decibel milliwatts) for every material and the control with no materials. Enter the average into your data table.
iv. Calculate the attenuation by subtracting the dBm from the control set.



Conclusion:

Observations:

7th Grade

Physical Science

FOURTH PLACE

WEST CONTRA COSTA SCIENCE FAIR

Hitting For The Maximum Distance

PROBLEM

At what angle from the horizontal should the batter hit the ball to get the maximum distance?

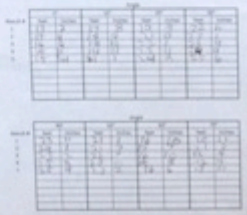
HYPOTHESIS

I have played baseball for 5 years and I think hitting the ball at a 50 degree angle will get the maximum distance because it's down the middle.

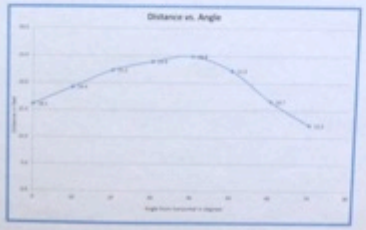
MATERIALS

- Baseball (plastic, wiffle balls)
- Pitching machine (that will catch the ball at different angles)
- Stopwatch (timers to measure pitching machine and glove distance from home at each angle)
- Protractor (to measure angles)
- Protractor (to measure distance)
- Tape measure (to keep track of each ball's distance)
- Notebook (to keep track of each ball's distance)
- Journal and pencil
- Calculator (to calculate the average distance of the measurements at each angle)

Raw Data



Distance vs. Angle



Angle in degrees

Result #	0	10	20	30	40	50	60	70
1	17.2	17.9	19.3	23.5	23.9	21.3	16.8	10.9
2	15.4	18.8	21.8	23.2	24.1	21.6	17.6	11.3
3	16.8	18.6	22.1	23.8	25.7	22.5	16.8	12.8
4	15.9	19.3	21.9	24.8	25.7	23.3	21.7	12.8
5	15.4	21.1	24.7	25.5	25.8	23.2	16.5	13.8
Average	16.1	19.1	22.0	25.9	24.6	21.7	18.7	12.3

Research

Research And Acknowledgements

Conclusion

In doing this experiment I found out that my hypothesis was incorrect. A ball hit at a 50 degree angle did not travel the farthest. It was actually a 30 degree angle that traveled the farthest. We had light winds and light rain the day we did the experiment. My results may vary slightly because of these weather conditions.

I discovered that out of all the angles I tested, that a 30 degree angle worked the best. Some angles were to low and others were two high. Between 40 degree and 50 degree angle the ball traveled the greatest distance. So I concluded that hitting a ball at a 30 degree angle would achieve the maximum distance.

PROCEDURE

1. Collect all materials needed for experiment.
2. Go to the park with a large grass field on a calm day.
3. Clamp pitching machine to telescope mount.
4. Use protractor to adjust mount so that pitching machine is horizontal (0 degrees).
5. Pitch ball 5 times.
6. Mark where ball lands and measure with measuring tape.
7. Record data in journal.
8. Use protractor to change angle 10 degree.
9. Repeat step 5-8 until you have completed 5 pitches at each angle (0, 10, 20, 30, 40, 50, 60, 70 degrees.
10. Enter journal entries into computer.
11. Calculate average of 5 measurements and of each angle. (Add up all 5 into then divide by 5 to get the average.)
12. Plot average distance vs. angle.
13. Draw smooth line through points.
14. Analyze graph to determine the angle at which the batter should hit the ball to get the maximum distance.

Results

FOURTH PLACE

WEST CONTRA COSTA SCIENCE FAIR

Electrocuting A Steel Sheep

How Many Electrons Does It Take To Ignite a Steel Wool Filament?

Problem

Hypothesis

Materials

Procedure

Results

Table of Trials

OHMS (Ω) RESISTANCE	BURNS	DOESN'T BURN	QUINTILLION ELECTRONS PER SECOND 6.24*(V/Ω)=2Ω
1.7 Ω	X		17.6 Q
1.8 Ω	X		16.8 Q
3 Ω	X		11.2 Q
5 Ω	X		8.0 Q
6.2 Ω	X		6.8 Q
10 Ω	X		4.7 Q
11.8 Ω	X		4.1 Q
15 Ω	X		3.7 Q
15 Ω	X		3.3 Q
20 Ω	**X**		**2.6 Q**
21.2 Ω		X	2.4 Q
23 Ω		X	2.2 Q
25 Ω		X	2.1 Q
30 Ω		X	1.8 Q
40 Ω		X	1.3 Q

Conclusion

EFFECT OF ELEVATION ON THE BOILING POINT OF WATER

FOURTH PLACE

MOST CENTRAL VALLEY SCIENCE FAIR

Introduction

My dad and I were sitting at the kitchen table when I noticed something on the side of a rice packet. It said to boil the water on high if you lived over 3,500 feet. I was curious why that was, so I asked my dad. He went on talking about pressure and altitude when I had an idea. I could use this as my science experiment! Soon I was looking up information, which you can see in the theory section, and conducting experiments.

Problem

How does elevation affect the boiling point of water?

Hypothesis

I think that as the altitude increases, the boiling point will increase too because of the pressure it would need to be hotter.

Procedure

1. Go to the elevation where you want to test.
2. Attach the propane gas to the stove and screw it on airtight.
3. Turn the stove on.
4. Put your pot on the stove and put the water in. (Keep in mind that the more water you put in the longer it will take to boil, but you will still get the same data. You just need enough water to make sure the thermometer is deep enough.)
5. After letting the water boil for a little while, put your thermometer in so that it is deep enough to get a good reading.
6. Read the thermometer.
7. Record your data.
8. Repeat these steps at different elevations.

Materials

- Propane camp stove
- Small stainless steel pot with lid
- Propane gas
- Thermometer

What I Did

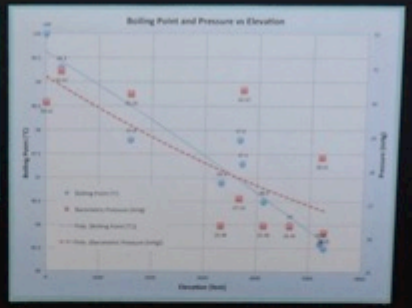
I started my science experiment on Palomar Mountain in the snow. We were visiting my cousins for Winter Break and it was the perfect opportunity to start my science fair project. On the way home to the Bay Area, we stopped at a couple of rest stops experiments on the way at different elevations. After Winter Break, when I was back in the Bay Area, I decided to do a couple more experiments at Marina Bay (sea level) and Grizzly Peak (1,600 feet).

Measuring Boiling Point of Water

Marina Bay at Sea Level

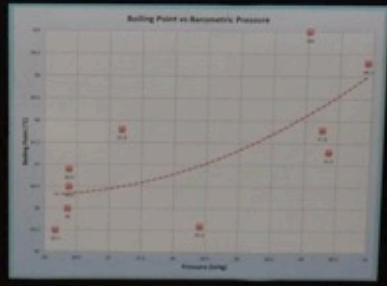
Palomar Mountain

Palomar Mountain in the Snow



Boiling Point Data

Location	Altitude (ft)	Boiling Point (°C)	Pressure (inHg)
Marina Bay	10	100	30.02
Central Valley	290	99.9	30.90
Grizzly Peak	1,600	97.8	30.26
Palomar Mtn	3,329	96.9	26.38
Palomar Mtn	3,668	97.8	27.19
Tajiri Pass	3,710	97.3	30.57
Palomar Mtn	4,130	96.2	26.58
Palomar Mtn	4,630	96	26.36
Palomar Mtn	5,210	95.6	26.41
Palomar Mtn	5,280	95.5	26.17



Results

I was very surprised when I saw the results. Instead of the boiling point going higher (as elevation increased) the boiling point went lower as the elevation increased.

Conclusion

My hypothesis is wrong. The boiling point went down instead of up as I had predicted. The boiling point is always lower when elevation increases no matter how much water you put in your pot. Since there's less pressure at higher altitudes, the boiling point doesn't have to be as high to push against the air pressure.

Theory

The normal boiling point for water is 98°C - 100°C. The boiling point of a liquid is the temperature at which the vapor pressure of the substance is equal to the pressure surrounding the liquid. When water boils, the molecules start to go crazy and get really active. When the water stops boiling, the molecules lose energy and lazily float around. When the pressure is lower than the standard atmospheric pressure (1 atmosphere), the boiling point is lower than normal. The boiling point is normal when the pressure is equal to the standard atmospheric pressure, and when the pressure is higher than 1-atmosphere, the boiling point is higher than normal.

Sources of Error

- The thermometer might not have been the best thermometer.
- The elevation reading in our car might not have been correct.
- Barometers not very accurate.
- It rained and didn't warm for boiling the water.

Further Tests

Other liquids

Add things to the water, like salt

Different glass containers

What Materials cause the most Friction?

Statement of Purpose

My project is on "What materials cause the most friction?" I expect to see the cube taking a large amount of time to slide down. I expect that this will be a very interesting project to do. I chose this topic because I want to learn more about friction and how it works.

FOURTH PLACE

Hypothesis

Materials

1)Glue (optional)
2)Tape
3)Piece of wood 1" x 8" x 36"*
4)Cube of wood 2" x 4" x 4"*
5)Ruler or yard stick
6)Stop watch
7)Materials to put on piece of wood such as
- ✓ Felt
- ✓ Aluminum foil
- ✓ Plastic wrap
- ✓ Cooking oil

Procedure

1. First make sure the wood is smooth and does not have any bumps.
2. Prop one end of the board onto a stack of books. Measure 8-10 inches and label the distance on each side.
3. Place the block of wood at the top of a ramp.
4. Release the block, do not push it. It should slide down by itself. If it does not slide increase the decline of the ramp by stacking more books.
5. Use a stopwatch to record the time it takes it to reach the other end of the board. As soon as you release it and it starts sliding start the stopwatch. Once it reaches the bottom stop the stopwatch. Repeat 2 more times.
6. Record the times in a chart and find the average of the 3 times.
7. Cover the surface of the piece of wood with material of choice, ex. Aluminum foil, and use tape to secure the foil. Repeat steps 3-6.
8. Coat the surface of the board with a thin layer such as oil. Repeat steps 3-6.
9. Choose a few more materials to test on the surface. Repeat steps 3-6.
10. From your chart compare your average times. What had the fastest time? What had the slowest time?
11. Calculate the speed for each trial using the average time.

Speed = distance/time

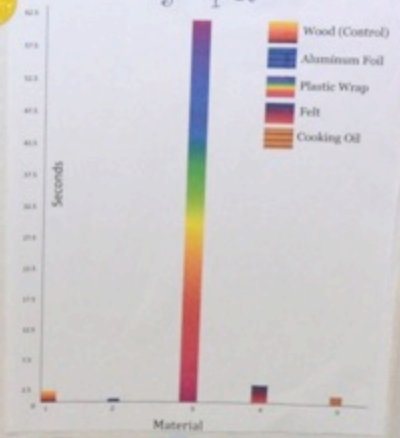
Results

There were four materials that were tested, including the control (). The average time for the control was 1.57 seconds. The aluminum foils average time was .63 of a second. An average time for the ramp for the plastic wrap. The felt took 3.34 seconds average. The final item, cooking oil, took a little a smaller amount of time to get the cube all way to slide down. So the first try it took 1.29 seconds to slide down. The aluminum foil was surprisingly easy to slide down. It had an average time of .63 of a second. The plastic wrap wasn't as smooth, having a mean of 62.33 seconds or 1 minute and 2.33 seconds.

Chart

MATERIAL	TRIAL 1	TRIAL 2	TRIAL 3	AVERAGE
WOOD	1.02 seconds	2.44 seconds	1.26 seconds	1.57 seconds
ALUMINUM FOIL	.62 seconds	.70 seconds	.56 seconds	.63 seconds
PLASTIC WRAP	83 seconds	50 seconds	54 seconds	62.33 seconds
FELT	1.18 seconds	3.70 seconds	5.15 seconds	3.34 seconds
COOKING OIL	1.28 seconds	.78 seconds	.74 seconds	.84 seconds

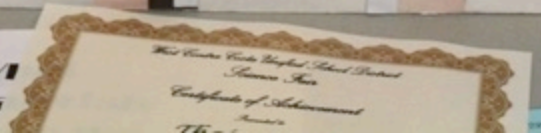
Graph



Research

Conclusion

Pictures



THE CORROSIVE PROPERTIES OF DIFFERENT LIQUIDS ON IRON

THIRD PLACE
WEST CONTRA COSTA SCIENCE FAIR

Statement of Purpose

- My project is about determining the corrosive properties of different liquids on iron. I thought that some liquids would make the iron rust more than others and some liquids may not lead to rust at all.

Hypothesis

- I thought that rubbing alcohol would make the iron rust faster than any of the other liquids. The rubbing alcohol I used was 50% isopropyl alcohol and 50% water. Since rust occurs when iron and oxygen are in the presence of water or air moisture, I thought the 50% of water in the alcohol would lead to more rust.

Experiment

- My experiment was about figuring out which liquid would make a disc of iron rust the fastest. I suspended the iron into cups of the liquid for 18 days. I had 6 cups, 5 with a liquid inside and 1 in air as the control.

Procedure

- Step 1: I cut 6 discs of iron and drilled holes into them.
- Step 2: I weighed all of the discs.
- Step 3: Next took some fishing wire and tied the iron onto a dowel.
- Step 4:Then I filled some cups up with the liquids. These were rubbing alcohol, vinegar, soda, bleach, orange juice, and just plain air.
- Step 5: Suspended the discs into the cups.
- Step 6: Took pictures daily of corrosion activity.
- Step 7: On the last day I cleaned the rust off of the discs.
- Step 8: I then weighed the discs again.

Fe


DAY 2

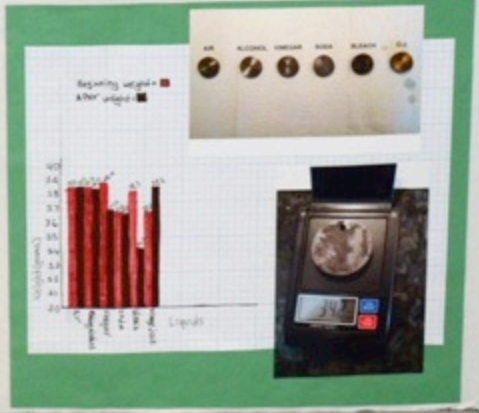

DAY 3


DAY 6


DAY 10


DAY 14


DAY 18



Results

	Beginning weight	After weight
Air	38.5 g	38.5 g
Rubbing alcohol	38.5 g	38.4 g
Vinegar	38.9 g	37.0 g
Soda	37.8 g	37.7 g
Bleach	38.8 g	34.2 g
Orange juice	38.7 g	38.5 g

Conclusion

- In conclusion, my hypothesis was wrong, it was actually bleach that had the most corrosive affect on the Iron. The iron disc in the bleach had the most loss of mass weight after the experiment.

THIRD PLACE

WEST CONTRA COSTA SCIENCE FAIR

Problem:

Hypothesis:

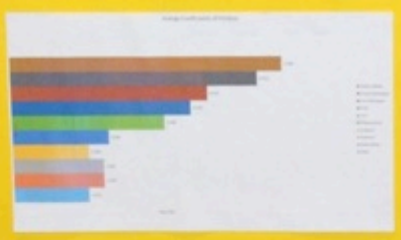
Materials:

Procedure:

MAY THE FORCE BE WITH YOU

Rough Material Data

Smooth or Slick Surfaces



Conclusion

References:

Freezing My Brass Off!

THIRD PLACE

WEST CONTRA COSTA SCIENCE FAIR

Materials

- a brass instrument(s)
- a tuning device that shows frequency
- a timer
- piece of paper and pencil
- 3 rooms/areas of different temperatures
- a thermometer (if necessary)
- musical skills/knowledge

Procedure

1. Take the brass instrument and materials to a room/area of 35 degree fahrenheit
2. Set the timer for six minutes and let the instrument sit
3. After the six minutes, tune the instrument (in the experiment, I used the trombone)
4. Play the instrument's "tuning note" and record the frequency shown on the tuning device. Do this three times
5. Take the instrument to another room/area of 50 degrees
6. Repeat steps 2 and 4
7. Take the instrument to a third room/area of 25 degrees (to keep change in temp consistent)
8. Repeat steps 2 and 4 and examine the results

Hypothesis

I hypothesize that cold weather does affect an instrument's pitch because I believe that temperature changes an instrument's physical stance, therefore changing its pitch.

Purpose

The purpose of this experiment is to find out if low temperatures affect a brass instrument's pitch.

Introduction

I, myself, play two instruments, the trombone and the tuba. In band, we tune all of our instruments so that we sound great playing as a group. Every time we tune, we tune inside of a classroom, where the temperatures never go below 60s. It's always crossed my mind how cold temperatures would affect instruments' pitches.

Results

Below is a table showing the trombone's pitch frequencies (in hertz) at the three different temperatures (25, 50, and 65 degrees)

	Area 1	Area 2	Area 3
1st time	233.1 hz	226.8 hz	229.4 hz
2nd time	233 hz	233.9 hz	228 hz
3rd time	235.2 hz	227.7 hz	229.3 hz
Average	233.4 hz	226.8 hz	228.8 hz

Conclusion

In conclusion, my hypothesis was correct; the experiment proved that low temperatures do affect the pitch of a brass instrument. I used my trombone (a brass instrument) in my experiment and I discovered that the colder the temperature, the flatter the instrument. Therefore, if I were to repeat the experiment, I would also test this with woodwind instruments to see if that would make a difference in the change of pitch in cold temperatures.

SECOND PLACE

WEST CHESTER AREA SCIENCE FAIR

HYPOTHESIS

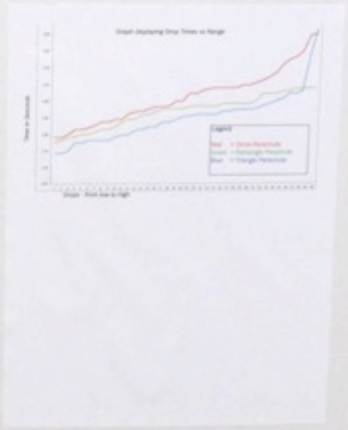
My hypothesis is that a circle parachute would fall the slowest. I think the circle parachute will go the slowest because the air will go inside the parachute instead of around it.

WHAT SHAPE CAUSES A PARACHUTE TO FALL THE SLOWEST?

RESULTS

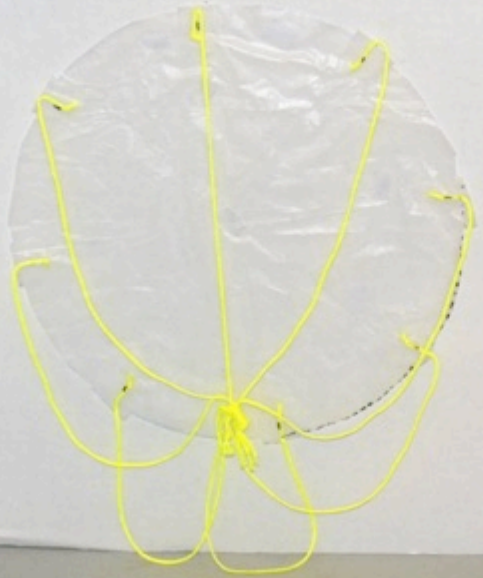
PROCEDURE

1. The shapes I used for this experiment were A) Circle, B) Equilateral Triangle, and C) Rectangle. To keep the shapes equal I used the surface area formula for each shape: for the circle: πr^2, for the equilateral triangle: $\frac{\sqrt{3}}{4} \times s^2$, for the rectangle: $A=W \times L$
2. For the circle, I used a 12 inch diameter parachute. For the rectangle, I used a 7.5 x 15 inch parachute. And last for the equilateral triangle I used a 16.2 inch parachute.
3. Each parachute had 8 holes around the edges for the strings. I used a little piece of tape to make sure the parachute won't rip from the string tied around the hole.
4. The length for each parachute string was 14 inches long. I used a set of keys on a carabineer for each parachute. The parachutes were dropped from a height of 14.5 feet high (from the ledge of Juan Crespo gym).
5. Each object was dropped 40 times from the ledge on the same day. I timed the parachute drop from when the parachute was released to when it landed and recorded the flight time using a stop watch. I recorded the time for each drop in a spread sheet log.
6. Drop times were entered into Excel and made a graph of the drops.



VARIABLES

- Manipulated variables: Shape of the parachutes. The shapes are circle, equilateral triangle, and rectangle.
- Responding variables: will be the time it takes for the object to fall due to the shape of the parachute.
- Controlled variables: the height the parachute will be dropped at, the weight of the object, and length of the string from the object to the parachute.



MATERIALS

CONCLUSION

How Temperature Affects Solar Cell Efficiency

Problem

How does a solar cell's temperature effect it's function?

Hypothesis

My hypothesis is that the solar cell will function the best at room temperature, second best in cold temperatures, and the worst in hot temperatures.

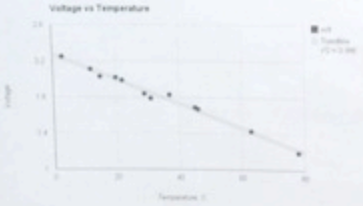
Materials

- 1 light tight box with a light bulb that is small enough not to cover /fore the sensor but big enough to use most of it's range. The light bulb should also meet the following requirements:
  - be able to plug into the wall because batteries will wear out over time)
  - the light produced should be as even as possible
  - the light bulb should not heat up because it could change the temperature in the box
  - the light has to be stationary because the distance and the distance and the direction have to be the same every time in order to achieve consistent brightness
- solar cell that is stationary in order to receive consistent amounts of light
- a volt meter (that fits the scale of your experiment) to measure solar cell function
- thermometer with long needle to measure approximate solar cell temperature
- several plastic bags with different proportions of water to change solar cell temperature

Procedure

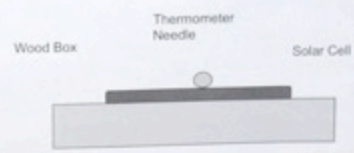
1. Assemble materials as shown in the picture.
   a. Inside light tight box place solar cell perpendicular to the light bulb and secure with tape underneath the cell.
   b. Run wires through the hole underneath the cell.
   c. Attach wires to volt meter.
   d. Place thermometer onto solar cell and secure to place with tape (tape to that it has good contact with the solar cell).
   e. Install light bulb.
2. Take reading in box to make sure the box is light tight.
   a. Turn off light bulb if it was on.
   b. Close box door tightly.
   c. Read voltage – it should be 0.00V.
3. Take readings at various temperatures.
   a. Place bag of water in box to achieve the room temperature reading (if water is room temp, then proceed right to thermometer and volt meter readings).
   b. Read temperature and voltage and record.
   c. Change bag of water.
   d. Remove bag of water.
   e. Repeat steps 3 a-d until you have taken readings at 10 different temperatures.

Voltage vs Temperature



Temp	Volts
3	2.25
12	2.11
15	2.03
20	2.02
22	1.99
29	1.84
31	1.79
37	1.83
45	1.69
46	1.67
63	1.43
78	1.19

Figure # Heat Transfer Speed Diagram



Conclusion

Project Overview

My hypothesis was incorrect. The solar cell functions the best at a colder temperatures, (at a temperature of 3 degrees celsius the the solar cell produced 2.25 volts) the worst at hot temperatures (at 78 degrees celsius the solar cell produced 1.19 volts)at and in the middle at room temperatures (at. 23 degrees celsius the solar cell produced 2.02 volts).The highest voltage (2.25) has about a 2.30 to one ratio to the lowest voltage produced (1.19). One interesting thing I found in my experiment is that all my data formed pretty close to a straight line which supports the idea that voltage is a function of temperature. I found that this line could be represented by the equation

$$V = -0.0125\,T + 2.273$$

where v equals volts and t equals temperature.

By solving for T you can even use my apparatus as a thermometer

$$T = -79.8\,(v - 2.273)$$

In other words, we can find the temperature if we know the voltage. Eventually my apparatus is an impractical thermometer.

I believe that one of the reason I found that the solar cell did best in cold temperatures and worst in hotter temperatures is that electronics in general tend to work a lot faster when they are cold and overheat when they are too hot. I think the same goes for the solar cell. I believe that when the solar cell was hot and producing less energy it was not because it was not collecting as much, but rather because it could not turn the light

8th Grade

Behavioral Science

SECOND PLACE

WEST CONTRA COSTA SCIENCE FAIR

Texting v.s. Talking: How Cell Phone Usage Affects Reaction Time

Question

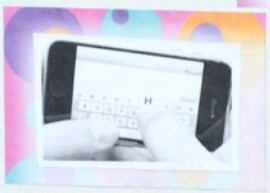
ow does talking on a cell phone fluence reaction time? How does texting affect reaction?

Hypothesis

If I test to see the reaction time of an individual during a text message or phone call, I predict that their reaction time will be slower rather than just having a conversation. Though between the two, I infer that your reaction time would be slower while texting, because you attention is focused on the screen of your cell phone or mobile device.

Materials

- Calculator
- Meter Stick
- [illegible] w/ cell phones
- [illegible] only five males and five



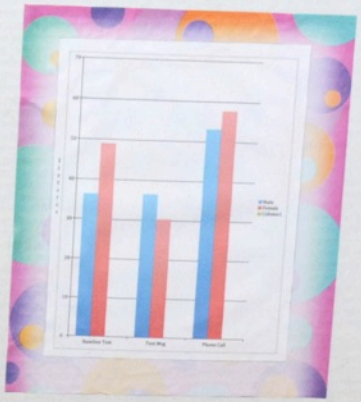
Data Analysis

Table

Test Subject	Baseline	Text Message	Phone Call	Average
Male 1	18	69	64	50.3
Male 2	87	36	42	55
Male 3	35	32	57	41.3
Male 4	22	22	55	33
Male 5	20	19	48	29

Test Subject	Baseline	Text Message	Phone Call	Average
Female 1	52	24	62	46
Female 2	50	23	64	45.6
Female 3	46	20	60	42
Female 4	49	52	59	53.3
Female 5	48	33	38	39.6

Graph



Conclusion

The results of this project were clear and evident. The baseline reactions stated that in general our reaction times were fairly quick. Though according to the results, as I predicted, our reaction times, for both the male and female were slower when the test subject was texting. The reaction times were drastically higher when having a phone call rather than conducting a text message. My hypothesis in this science project was accepted. I feel it was accepted for all the right reasons. Its clear we are able to hold our attention on a lot more things when during a phone call. Testing multiple people, whether or not their results were higher or lower than the others still played a huge role in the end result. It showed just how much it affected different people in order to form a whole. If any changes had to be made it be the way each reaction time was measured, and more convenient tool would have been preferred and easier. Once again, the results stated that our reactions times came at a faster pace when talking on the phone rather than texting.

Deja Hardy
Period: 7

Experimental Procedure

1. Place your thumb and index finger above the 100-centimeter mark on the meter stick. For each test subject, preform the following steps.
2. Ask the test subject to place his or her thumb and forefinger on either side of the meter stick at the 0 centimeter mark. When you drop the stick the test subject will attempt to catch it by closing his/her thumb and forefinger
3. Test baseline reaction first. Drop the meter stick and record the distance (in centimeters) that the stick falls before the test subject is able to stop it.
4. Preform five trials and calculate the average score.
5. Repeat the test. This time, ask the test subject to speak to someone on a cell phone while you conduct the experiment
6. Preform five trials and calculate the average score.
7. Repeat the test. This time, ask the test subject to send a text message (with one hand) while you conduct the experiment
8. Preform five trials then calculate the average score.
9. Repeat steps 2- 8 for multiple male and female test subjects.
10. Evaluate your data and calculate each participant's average reaction time for each experiment. Use the formula: $d=0.5at^2$. Solve for t when d equals distance traveled by meter stick and t equals the accelerations due to gravity constant (9.8 meters per second squared)
11. Evaluate your results. Which of cell phone usage affects reaction time the most? How does texting affect reaction time [illegible]

TECHNOLOGY TAKING OVER?

DOES TEXTING AND SOCIAL MEDIA AFFECT SOMEONE'S ABILITY TO READ FACIAL EXPRESSION

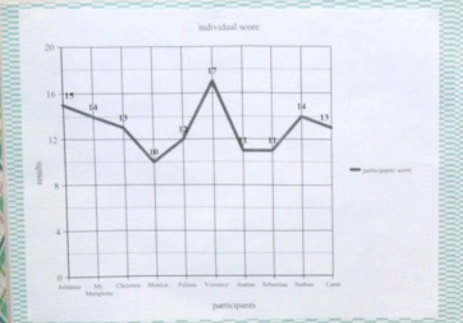
HYPOTHESIS

I HYPOTHESIZE THAT THE PEOPLE WHO USES SOCIAL MEDIA AND TEXT MORE OFTEN WILL BE LESS ABLE TO READ FACIAL EXPRESSION. PEOPLE WHO ARE MORE CONNECTED TO SOCIAL NETWORKS/TEXTING INTERACT WITH OTHER PEOPLE LESS OFTEN, SO THEY MIGHT NOT BE ABLE TO READ FACIAL EXPRESSION AS WELL

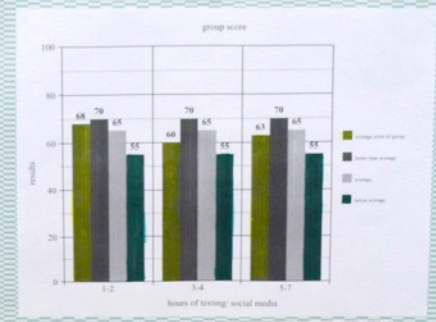
MATERIALS

- GROUP OF PEOPLE DIFFERENT GENDERS /AGE
- UC BERKELEY'S ASSESSMENT ON FACIAL EXPRESSION: HTTP://GREATERGOOD.BERKELEY.EDU/EI_QUIZ/
- SOME FORM OF TECHNOLOGY TO TAKE THE ASSESSMENT

DATA



SCORES OF INDIVIDUALS WHO TOOK THE UC BERKELEY'S ASSESSMENT ON READING FACIAL EXPRESSION. VERENICE ORTIZ SCORED THE HIGHEST OF ALL THE PARTICIPANTS. SHE USED NO SOCIAL MEDIA AND ONLY TEXTED FOR AN HOUR OR LESS PER DAY.



SCORE OF THE PARTICIPANTS GROUPED INTO 3 GROUPS. THE ASSESSMENT ITSELF WAS SCORED OUT OF 20. I FIGURED GRAPHING SCORES THAT WERE BASED OFF 100 WOULD BE EASIER SO I GOT THE PERCENTAGE OF THE GROUPS AVERAGE AND GRAPHED IT. THIS GRAPH ALSO DISPLAYS THE AVERAGE, BETTER THAN AVERAGE, AND BELOW AVERAGE SCORE.

PROCEDURE

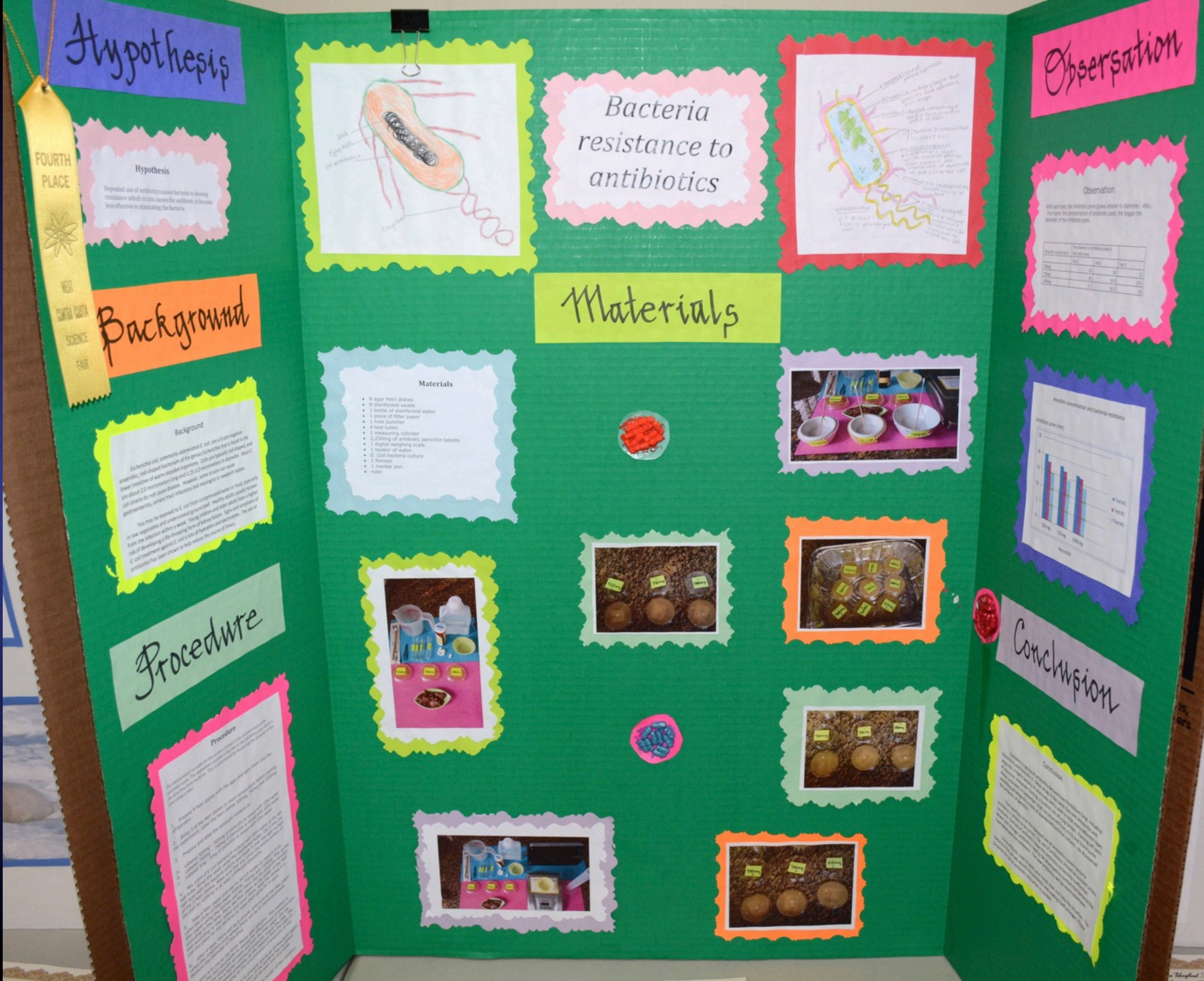
FIRST I WOULD ASK FOR VOLUNTEERS. THEN I WOULD ASK THEM HOW MANY HOURS OF TEXTING AND SOCIAL MEDIA THEY USE PER DAY. I WOULD RECORD THAT DOWN. THEN I WOULD ASK THEM TO TAKE THE ASSESSMENT. I TOOK DOWN THEIR ANSWER FOR EACH QUESTION, ALONG WITH THE CORRECT ANSWER. I WOULD RECORD THEIR FINAL SCORE AT THE END AND COMPARE THEIR SCORE TO THE AVERAGE PERSON'

RESULTS

THE AVERAGE PERSON'S SCORE IS 65. I GROUPED THE 10 PEOPLE INTO 3 DIFFERENT GROUPS. THE GROUPS WERE PEOPLE WHO USED SOCIAL MEDIA AND TEXTS FOR ABOUT 1-2 HOURS, 3-4 HOURS, AND 5-7 HOURS. IN MY HYPOTHESIS I STATED THAT PEOPLE THAT USES MORE SOCIAL MEDIA AND TEXTS MORE OF THE GROUP THAT USES THE MOST

8th Grade

Biological Science



Hypothesis
FOURTH PLACE
WEST CONTRA COSTA SCIENCE FAIR
Hypothesis
Repeated use of antibiotics causes bacteria to develop resistance which in turn causes the antibiotic to become less effective in eliminating the bacteria.
Background
Background
Procedure
Procedure
Bacteria resistance to antibiotics
Materials
Materials
9 agar Petri dishes
9 disinfected swabs
1 bottle of disinfected water
1 piece of filter paper
1 hole puncher
4 test tubes
1 measuring cylinder
2,250mg of antibiotic penicillin tablets
1 digital weighing scale
1 beaker of water
E. Coli bacteria culture
1 forceps
1 marker pen
ruler
Obsersation
Observation
Conclusion
Conclusion

Yogurt Culture

FOURTH PLACE
WEST CONTRA COSTA SCIENCE FAIR

Procedure

Problem: What environment does yogurt culture grow best in?

Discussion: Yogurt is a heathy and popular food item but it can be expensive. Fortunately, it's alive and can be grown. The yogurt culture contains Streptococcus Thermophilus, Lactobacillus Bulgarious, Lactobacillus Acidophilus, Bifidus, and Lactobacillus Casei, which are all microscopic organisms that help grow the culture.

Hypothesis: Since yogurt is alive, giving it the things it needs to stay alive will make it grow. Based on my initial internet research, I think the culture will grow best in a temperature of 130 degrees Fahrenheit, keeping the same temperature over 20 hours.

Materials: 2% Yogurt, 1% milk, gas fired oven, scale, pot, thermometer, litmus paper, clock, measuring cup(240ml), and a spoon.

Procedure: The procedure involves a repeated process of combining a growth medium (milk) with a starter culture (yogurt) of measured initial amounts and then comparing the qualitative and quantitative results for the best growth of the starter culture. Three runs will be performed: a Control, Variable A, and Variable B. Procedures for the three runs are detailed below.

Control Procedure

- Pour half a gallon of 1% milk into a clean pot;
- Boil milk to 110 degrees Fahrenheit and measure and record the temperature with a thermometer;
- Mix in yogurt culture with milk until consistent;
- Pre-heat a gas oven to warm;
- Turn off oven. The pilot light of the gas oven will maintain the oven temperature at 90 degrees Fahrenheit;
- Put the pot containing solution into oven;
- Wait 15 hours;
- Measure yogurt density. Using a scale, measure the weight of the cup of yogurt and subtract the weight of the measuring cup. Then divide the value by the volume of the yogurt;
- Measure the pH of the yogurt using litmus paper by comparing it to the pH scale; and
- Record data and observations.

Variable A Procedure: In this procedure, I will increase temperature and testing duration and investigate.

- Pour half a gallon of 1% milk into a clean pot;
- Boil milk to 180 degrees Fahrenheit and measure the temperature with a thermometer;
- Mix in yogurt culture with milk until consistent;
- Pre-heat a gas oven to warm;
- Turn off oven. The pilot light of the gas oven will maintain the oven temperature at 90 degrees Fahrenheit;
- Put the pot containing solution into oven;
- Wait 10 hours and record visual results;
- Return the pot to the oven for another 10 hours;
- Measure yogurt density. Using a scale, measure the weight of the cup of yogurt and subtract the weight of the measuring cup. Then divide the value by the volume of the yogurt;
- Measure the pH of the yogurt using litmus paper by comparing it to the pH scale; and
- Record data and observations.

Variable B Procedure: I will decrease temperature and testing duration and investigate.

- Pour half a gallon of 1% milk into pot;
- Boil milk to 90 degrees Fahrenheit and measure the temperature with a thermometer;
- Mix in yogurt culture with milk until consistent;
- Pre-heat gas oven to degrees;
- Turn off oven.The pilot light of the gas oven will maintain the oven temperature at 90 degrees Fahrenheit;
- Put the pot containing solution into oven;
- Wait 5 hours and record visual results;
- Return the pot to the oven for another 11 hours;
- Measure yogurt density. Using a scale, measure the weight of the cup of yogurt and subtract the weight of the measuring cup. Then divide the value by the volume of the yogurt;
- Measure the pH of the yogurt using litmus paper by comparing it to the pH scale; and
- Record data and observations.

Results: Qualitative and quantitative results are summarized below based on the three runs.

Visual Observations

- **Control Product**: A consistent and uniform white liquid. The product tasted sour (acidic).
- **Variable A Product**: The initial product appears to be very inconsistent with culture gathered in the middle of solution, and floating at the top. After an additional 10 hours, the product became more consistent and thick. The product tasted less sour (acidic).
- **Variable B Product**: The initial product was fairly consistent, but contained groupings of culture. After an additional 11 hours, the product became more spread out and thick. The product tasted sour (acidic).

Quantitative Results:
The tables show the ratio between temperature versus density and testing duration and density

Conclusion:

I conclude that the best environment for yogurt to grow is in a temperature of about 110 degrees Fahrenheit and to keep it warm for about 20 hours. For the yogurt culture to grow, the environment's temperature must be cooler than 180 degrees Fahrenheit and slightly higher than 90 degrees Fahrenheit. In Variable A, the culture had gathered in the center, possibly because of the higher temperature, especially near the walls of the pot. It was also less acidic than the control because some of the culture was killed by the high heat. In Variable B, the culture was inconsistent because the culture couldn't grow at that low of a temperature. After a second duration for both variables, however they had become more consistent and dense.

From this experiment I learned how culture grows. If we used a thermometer that gave more accurate readings, the experiment would have been better. The results partly supported my hypothesis. I said that 130 degrees Fahrenheit would be the best temperature for growth, but 110 degrees Fahrenheit seemed to be the best. I also said that making the yogurt stay in the heated environment for a long duration would let it grow most, this was correct.

From just 5.3 ounces of yogurt culture and a half a gallon of milk at a total of $5, I made half a gallon of culture overnight. I saved $15 and I can buy more milk to make even more yogurt with the yogurt I already made.

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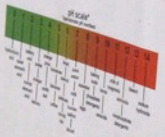
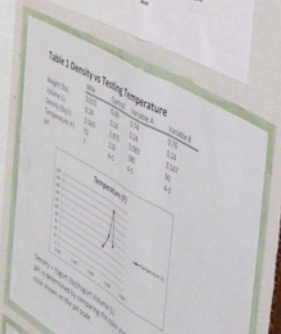
http://en.wikipedia.org/wiki/Lactobacillus_delbrueckii_subsp._bulgaricus
http://en.wikipedia.org/wiki/Lactobacillus_acidophilus
http://en.wikipedia.org/wiki/Bifidus_factor
http://en.wikipedia.org/wiki/Lactobacillus_casei

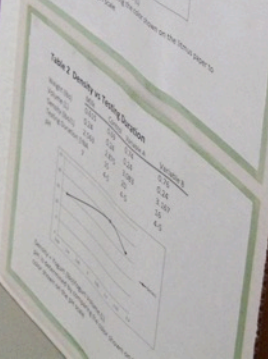
Control Product

Variable A Product

Variable B Product







FOURTH PLACE

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Conservation Pay$

Problem

Can a Low-Flow faucet aerator really save water?

Hypothesis

I believe that the Low-Flow aerators will save water as stated on the packaging.

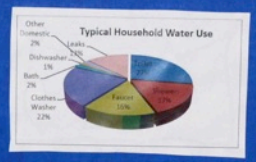
Research

General

Specific

Materials

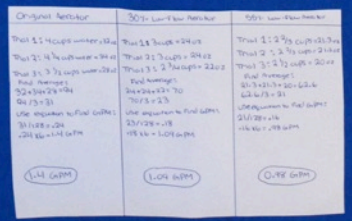
- Stopwatch
- Original Faucet
- 30% Water saving aerator
- 55% Water saving aerator
- Sink
- Bowl
- Measuring Cup
- Calculator
- Tape

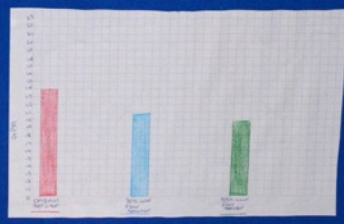


Procedure

1. Shop for Low-Flow faucet aerator at store.
2. Turn faucet on to level that you usually use.
3. Mark point to which you turned on faucet with tape.
4. Put empty bowl in sink.
5. Turn water to level you previously marked with tape.
6. Let water run for 10 seconds. Use stopwatch to time it.
7. Pour water from bowl to measuring cup to measure how much water was collected in 10 seconds.
8. Record findings.
9. Repeat process two more times.
10. Install 30% Low-Flow aerator.
11. Repeat steps 5-8 three times.
12. Install 55% Low-Flow aerator.
13. Repeat steps 5-8 three times.

Data





Results

This science project has taught me that conserving will save you money. Conserving water is one thing I can do that not only helps me, as an individual, but helps the Earth as well.

Conclusion

My hypothesis was correct. The Low-Flow faucet aerator did function as advertised, water use was reduced. The 55% Low-Flow faucet aerator had a much lighter water flow compared to the other two aerators. The screen in the aerator allows air to combine with water and control the flow. This results in less water coming out of the faucet each minute, which will ultimately save you money.

Helpful Tips

FOURTH PLACE

WEST CONTRA COSTA SCIENCE FAIR

TINY TITANS

CAN SILVER NANOPARTICLES NEUTRALIZE E.COLI BACTERIA?

Introduction

Did you know that nanoparticles, called Silver, can kill bacteria? A variety of consumer products are advertised to contain these antibacterial nanoparticles nowadays. A nanometer is one billionth of a meter long (really, really tiny), and a nanoparticle is usually only a few nanometers in diameter. How can something so small destroy bacteria that is approximately 700-1400 nanometers across? Is Silver really that affective? In this experiment, I will be growing some E. Coli bacteria and investigate the effectiveness of the antibacterial activity of silver nanoparticles when the silver nanoparticles are used at different concentrations.

Background

Silver, has been shown to be very affect against destroying other bacteria and microbes. In other words, is an antibacterial or antimicrobial. The discovery of silver was not recently made. For millennia, silver was thought to have many special properties to fight diseases and help healing process by many people. Only recently have scientists started to understand how the properties of silver (also called nanosilver) work. Currently, Scientists think that silver ions, individual charged ions, can interrupt important chemical bonds in bacteria and that disrupts important cellular functions that bacteria need to live. If silver itself works for destroying bacteria, why use nanoparticles made of silver to destroy bacteria? Scientists believe that in addition to giving off silver ions, nanosilver can also be absorbed by bacteria, causing them to burst. If this is true, and it remains an active area of research, then nanosilver would have two mechanisms for killing bacteria compared to large, solid pieces of silver. If so, then nanosilver may have either greater or more varied effects on different bacteria as compared to solid silver.

Hypothesis

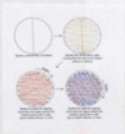
If nanosilver were to be applied onto a plate if growing E. Coli bacteria, a zone of inhibition would appear around the area where the nanosilver was applied on. If this is correct, then the bacterial plate with the 500,000 µg/L (undiluted) concentration of colloidal silver should have the largest zone of inhibition.

Materials

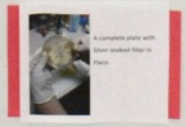
- Liters, graduated cylinder
- 25ml, graduated cylinder
- Metric, graduated cylinder
- Filter paper
- Tweezers
- 5 antibacterial nutrient agar media plates, 125 x 15 mm
- Compound bag of colored paper clips
- Compound bag of colored paper clips (E. coli K12)
- Permanent marker
- Lab gloves
- Measuring cup
- Paper towels
- 50 mL of distilled water
- 50 mL of colloidal silver, 500 PPM
- Transparent tape
- Tweezers
- Graduated cylinder
- Ruler

Procedure

1. Find a clean workspace. Make sure all materials are clean and sterile.
2. Put on a pair of gloves.
3. Wipe down workspace with paper towel soaked in 70% isopropyl rubbing alcohol.
4. Using a permanent marker, label the five food jars #1 to #5.
5. Using the 25 milliliter (mL) graduated cylinder, measure and pour 22.5 mL of distilled water (from a new, unopened container) into each of jars #2, #3, #4, and #5.
6. Using the 25 mL graduated cylinder, measure and pour 25 mL of the colloidal silver solution from the original bottle into jar #1.
7. Transfer 2.5 mL of the undiluted solution from jar #1 to jar #2 using the medicine dropper
8. Transfer 2.5 mL of the 50,000 µg/L solution from jar #2 to jar #3.
9. Transfer 2.5 mL of the 5,000 µg/L solution from jar #3 to jar #4.
10. Transfer 2.5 mL of the 500 µg/L solution from jar #4 to jar #5.
11. The food jar should look as follow with concentration of 500,000 µg/L, 50,000 µg/L, 5,000 µg/L, 500 µg/L, and 50 µg/L (Left to right).
12. Punch 15 circles from a filter paper (or coffee filter paper) with the hole punch.
13. Using clean tweezers, place three filter paper circles (that was just punched with the hole punch) into each baby food jar (#1 through #5). Let them soak until needed.
14. Lay out five of the nutrient-agar prepared media plates. Place the plates upside down on the clean counter or table and use the permanent marker to label the back of each one, #1 through #5.
15. After labeling them, flip the plates over so that the lid is on top. Take off your gloves and put on a new pair of disposable gloves.
16. Use the cotton swab to streak the five labeled nutrient agar plates with the E. Coli K12 bacteria from the tube.
17. Spread the *E. coli* over the surface of the agar plate, as shown in figure below.
18. Repeat step 17 until all five plates are swabbed with the E. coli K12 bacteria.
19. Place the three filter circles from each numbered jar onto the corresponding plate so that each plate looks like the one in figure below.
20. Make sure all plates are closed (with the lids on top). Secure the lid on each agar plate using a few pieces of clear tape.
21. Place the plate in an undisturbed area, with no sunlight, for several days.
22. Clean up the area where you spread the *E. coli* K12 bacteria on the plates. Sterilize the countertop or table surface and anything that touched the *E. coli*.
23. Check on the plates every day after starting the experiment. Look for any bacterial colonies. They should look like small, whitish spots.
24. Look at each plate to see if there is a zone of inhibition around the filter circles, as shown in figure below.
25. Flip the plates so that they are upside down and use a ruler to measure the width of any zones of inhibition you see on the plates.
26. After finish making observations, sterilize the plates by soaking them in a 10% bleach solution for at least 1 to 2 hours. Discard the plates in the trash.
27. Analyze your results.



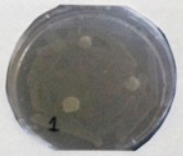
Swabbing bacteria onto the plate.

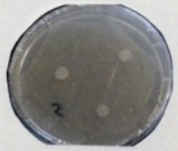


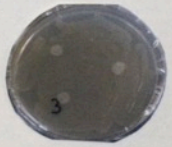
A complete plate with Silver soaked filter in Place.

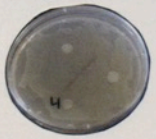
Results

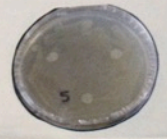
Time	Observation
48 Hours	Bacteria began to grow in the plates. No zone of inhibition is visible for any concentration of nanosilver.
One week	Bacteria continue to grow without any zone of inhibition. Photos below show the state of the bacteria at the end of the week.











Conclusion

The results of this experiment was very much unexpected. It completely opposed my initial hypothesis, which stated that the nanosilver would be able to create a zone of inhibition among the bacteria. The result showed that the nanosilver had no effect, whatsoever, on the E. coli bacteria. This result could be due to the fact that the concentration of the nanosilver solution was not high enough. Another factor can be that the filter paper failed to absorb the nanosilver correctly and the amount of solution in the paper was insufficient. Using a higher concentration of colloidal silver or allowing more absorbing time for the filter paper might lead to a more successful experiment in the future.

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Thanks to Mr. Wilson for allowing me to borrow his materials needed for the project.

E. coli, nanosilver, and other materials provided by Carolina Biological Supply company.

Special thanks to my dad and mom for encouraging me and for funding this project.

What's next?

After learning about this project, there are other experiments you can perform to extend this project. Testing nanosilver on a variety of other bacteria can yield more data about nanosilver and how it works. Several experiments can also be made using a higher of concentration of nanosilver.

FOURTH PLACE

WEST CONTRA COSTA SCIENCE FAIR

Glucose in Citrus Fruits

Problem: Does the ratio of: weight of liquid to total weight of fruit affect the glucose level in the liquid?

Hypothesis: Yes, I do think that the ratio of liquid to total weight will affect the glucose level in a fruit.

Materials:

- 3+half lemons
- 3+ half limes
- 3+ half oranges (These three fruits can be substituted out with any other citrus fruits.)
- scale
- bowl (Make sure you know the weight of the bowl.)
- 9+ Diastix Reagent Strips for Urinalysis
- timer
- lemon squeezer (optional)

Procedure:

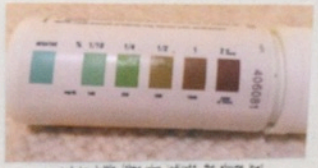
1) Find the weight of the bowl you are using. You will need to know its weight so you can subtract it out later.
2) Weigh you first half lemon and record its weight. Then record the weight of all the juice inside of this half lemon and record. This is where you'll subtract the weight of your bowl from the juice's weight.
3) Find the number of milligrams per decilter (mg/dL) by dipping the blue-ish end of the test strip into the juice. Then, after 30 seconds, compare the new color on the end of the test strip to the colors on the side of the test strip bottle and look for the number of mg/dL and record.
4) Repeat steps 2 and 3 twice more for the lemon.
5) Repeat steps 2-4 for the time and the orange.

Results:

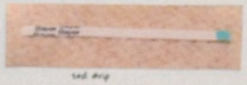
Table 1:

Fruit	Total Weight (grams)	Weight of Liquid (grams)	Liquid to Total (%)	Glucose Level (milligrams per decilitter)	Notes
Lemon 1	64	32	50	250	
Lemon 2	55	29	53	250-500	
Lemon 3	48	28	48	100-250	
Lime 1	41	21	51	250-500	
Lime 2	44	27	61	500-1000	
Lime 3	47	11	23	250	not very ripe
Orange 1	121	62	51	500-1000	wrapped in plastic for over a week
Orange 2	159	71	45	500-1000	
Orange 3	139	64	46	1000	
Bowl	100				

test strip box



test strip bottle (these colors indicate the glucose level in mg/dL)



test strip

Conclusion:

My hypothesis was correct. In the case of the lemons, all the ratios of liquid to the total weight were about 50% and the mg/dL's were all in the ballpark of 250. However for the lime, I had three drastically different ratios and mg/dL's that varied as well. The low percentage (Lime 1) had a corresponding low amount of mg/dL's while the high percentage (Lime 3) had a corresponding high amount of mg/dL's. The more neutral percentage had mg/dL that was more or less in the middle of those of the low and high percentages. And as for the oranges, all the percentages were near the 50% mark and all the mg/dL's were close to 500 or 1000.

There were a few things that could have possibly slightly altered my results. The first two deal with the actual fruits. Lime 3 was not very ripe at all and as a result it had a lot less juice than the other two limes. Also, Orange 1 had been in the refrigerator wrapped in plastic wrap for over a week now so its 5% more liquid to total weight than Orange 3 could have been because of this. Possible errors about the experiment include: leftover water in the testing bowl, other types or leftover juice in the testing bowl, not all of the fruit's juice in the testing bowl, and leftover pulp in the testing bowl resulting in possible inaccurate measures.

After each time I took a weight in my glass testing bowl, I cleaned out the bowl by just rinsing it and then drying it with a rag. During this process, I may not have collected all of the water thus resulting in the evt fruit's weights to be slightly off. Similarly, there could have still been leftover juice from the fruit before, whether it was the same fruit or not, I would get the concentration values off. As for the problem with the lack of juice in the testing bowl I could have not quite gotten all of the juice that was in the fruit and again this would be shown with wrong concentration numbers. And finally, I am not 100% sure how much the pulp of each fruit weighs but there was definitely pulp from the fruit in each testing sample. The oranges had a considerable amount more pulp than the other two and perhaps this made the juice appear heavier on the scale.

In conclusion, I discovered that ratio of the fruit's weight to the fruit's total weight does affect the glucose level in the fruit: the lower the percentage, the lower the glucose level, and the higher the percentage, the higher the glucose level.

THIRD PLACE
★
WEST CONTRA COSTA SCIENCE FAIR

WATER

PURPOSE AND INTRO

The purpose of this experiment is to test the chemical properties of water taken from different sources. Lots of people might think that all water is the same, but that might not be true. I was curious to see if the water that comes from our faucet was the same as creek water and rain water.

The water to be tested will be taken from five different sources, including standing rain water, tap water, local creek water, hot tub water, and water from San Pablo Reservoir. Each water source will be tested for PH level, chlorine level, calcium hardness, and total alkalinity. Taylor brand water quality test kits will be used.

The water will be tested according to Taylor's instructions. Data will be recorded and observations and conclusions will be made from there.

HYPOTHESIS

I think that even though all water looks the same, there will be a lot of differences in test results. I also think that the the water taken from natural sources like the rain water, creek water, and reservoir water will not contain many chemicals, such as chlorine.

RESEARCH

Water Quality:

Water quality is generally a measure of the condition of water as it pertains to the requirements of ecosystems and living species. Basically is the water good enough to support living things. Essentially water quality is made up of the physical, biological, chemical and radiological traits of the water.

PH:

PH is a measure of how acidic or basic a solution is. Solutions with a PH less than 7.0 are considered acidic. Solutions with a PH greater than 7.0 are considered basic. Water that is acidic can be harmful to people and animals and corrosive to plumbing and other equipment that has water in it.

Alkalinity:

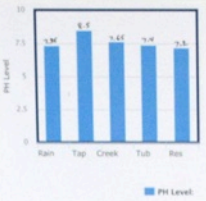
Alkalinity in water refers to the water's ability to resist subtle changes in PH level.

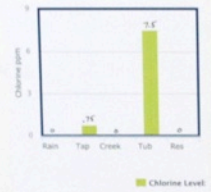
Calcium Hardness:

Hard water is water that has a high mineral content. It becomes hard when it passes through rocks or soil that contain calcium, limestone, and chalk. Hard water isn't harmful to drink, but can cause the buildup of scale and do damage to boilers, cooling towers, and other equipment.

Chlorine:

Chlorine is a chemical element and a number 17 on the periodic table. Chlorine can kill bacteria and because of this, in 1918 the U.S. government called for all water supplies to be disinfected with chlorine.

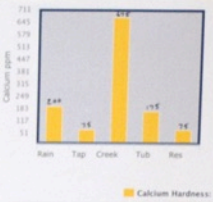


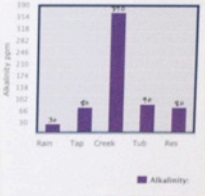


PROCEDURES

First I collected water samples from my five sources: Standing rain water, tap water, local creek water, hot tub water, and water from San Pablo Reservoir. We planned to test the samples in that order and decided to test the PH level, then chlorine level, then calcium hardness, and finally the total alkalinity of each one.

Then I got out the test kits from Taylor and followed the directions closely for each test. I used the proper dropper bottles with reagent chemicals for each test, adding the required amount of drops to the carefully measured samples. With some of the tests I had to compare colors of the samples with a color chart to get the results and with others I had to note how many drops of reagent caused the color to change. All of the results were recorded in columns on a note pad.






WATER SAMPLES / TEST KITS


TESTING INSTRUCTIONS


TESTING CALCIUM


TESTING PH


TESTING ALKALINITY


WAITING FOR A TEST


COLOR COMPARISON


TAYLOR TEST KIT

OBSERVATIONS

PH:

The water sample with the highest PH level was the tap water. The lowest PH level was found in the reservoir water. The two samples with the most similar PH were hot tub water at 7.4 and rain water at 7.35. This was surprising to me because hot tub water is treated but rain water is not. The good thing was that all water samples tested with a PH above 7.0 so none were acidic.

CHLORINE:

As I had predicted in my hypothesis, all natural sources of water had no chlorine at all. The highest ppm (parts per million) was 7.5 in the hot tub sample and the lowest was 0 ppm in the rain, creek, and reservoir water. Tap water just had a little chlorine, only .75 ppm which is just enough to so that it is suitable for drinking. The hot tub water needs to have higher levels of chlorine because the hot water is a breeding ground for harmful bacteria.

CALCIUM HARDNESS:

Reservoir and tap water both had the lowest calcium levels at just 75 ppm. The highest level of calcium was in the creek water sample at 675 ppm, probably because the creek water spends a lot of time flowing over rocks containing minerals and this increases its hardness.

ALKALINITY:

The range of alkalinity was 30 to 370 ppm. The lowest sample was rain water at 30 ppm and the highest was creek water at 370 ppm. For best water quality, alkalinity should be in the 80 to 120 ppm range. This means that the tap water, hot tub water, and reservoir water is of the best quality in the group.

SUMMARY AND CONCLUSIONS

After doing all of the tests on the water samples, it was really clear that there are many differences in the variety of water sources around us, even though the water in all five of my sample containers looked exactly alike.

Some of the differences I guessed ahead of time, like the absence of chlorine in the natural water sources but other differences were only able to be found by testing.

I learned that while natural water sources are not acidic and are good for watering plants and crops, they do need to be treated for other uses like drinking and use in pools or hot tubs. I also learned that our reservoir water comes from a source in the mountains that was specifically chosen for its quality and needs very little treatment to be suitable for drinking. It's levels are all very close where they need to be even before being treated.

I enjoyed learning about how to test water and finding out almost all the differences.

REFERENCE WORKS / SOURCES

1. Water Quality Association, www.wqa
2. PH Wikipedia page online
3. Alkalinity Wikipedia page online
4. Calcium Wikipedia page online
5. Chlorine Wikipedia page online
6. Jess Hall of age. Water Distribution Plumbing
7. Taylor test kit instructions, page

MICROWAVE RADIATION

THIRD PLACE

WEST CONTRA COSTA SCIENCE FAIR

PURPOSE

I expected to discover by doing this experiment is how microwave radiation affects plant life, fungi and bacteria. I had previously heard that a kitchen sponge exposed to microwaves for long enough will kill the bacteria on it. I chose to do this experiment to learn if microwave radiation will slow or prohibit the growth of plant life, fungi and bacteria, and how long it will take to do so.

HYPOTHESIS

Plant life, fungi and bacteria exposed to microwave radiation for 30 seconds will have negative effects on their growth.

RESEARCH

Microwave appliances are very common in the United States. They have been sold since 1946. What most people don't know is that they heat food with non-ionizing electromagnetic radiation, also known as microwaves. Microwaves have a frequency higher than radio waves, but lower than infrared light.

The electromagnetic radiation causes the polarized molecules in food to rotate and build up this energy. Dielectric heating occurs when water, fat and other substances in food absorb energy from the microwaves. Water molecules have electric dipoles. This means there is a partial positive charge at one end and a partial negative charge at the other end. The molecules rotate as they attempt to align with the alternating electric field of the microwaves. The rotating molecules hit other molecules, and energy in the form of heat is produced. Radiation produced by microwave appliances is non-ionizing radiation does not have the ener

MATERIALS

1. Packet of radish seeds
2. Four Styrofoam cups
3. Sterilized potting soil
4. Eight small paper plates
5. Ruler
6. Jar of baker's yeast
7. Measuring spoons
8. Measuring cups
9. Water
10. Four small bowls
11. Four prepared Petri dishes with agar
12. Four sterilized cotton swabs
13. Gloves
14. Well used soccer ball
15. 1200 watt microwave
16. Plastic storage container
17. Heat lamp with a clamp
18. Heating Pad
19. Electric throw
20. Small cardboard box
21. Thermometer
22. Paper & pencil
23. Camera

PROCEDURE

1. Plant 30 radish seeds ½" deep in a Styrofoam cup. Put them in a sunny location. This is the control sample.
2. Place 30 more radish seeds on a small paper plate. Microwave the seeds for 5 seconds.
3. Plant these seeds ½" deep in another cup and place in the same location as the control group.
4. Repeat steps 2 and 3 for two more samples, except microwave one group of seeds for 15 seconds and the other for 30 seconds.
5. Water the samples 2 tablespoons of water the same time every day and make sure they are in a sunny location.
6. Take pictures and note if and how quickly the samples grow.
7. Measure out 2 ¼ teaspoons of baker's yeast and place in a small bowl. Add ¼ cup water that is 110 F. Stir. This is the control sample.
8. Take note on how long it takes for the yeast to bubble up. How vigorous is the reaction?
9. Measure out another 2 ¼ teaspoons of yeast onto a plate. Microwave it for 5 seconds.
10. Mix this yeast into another bowl with ¼ cup of 110 F water. Repeat step 8.
11. Repeat steps 9 and 10, except microwave one sample for fifteen seconds and the other for thirty seconds.
12. Wearing gloves use a sterilized cotton swab to collect a sample of bacteria from a soccer ball and swab it onto a prepared Petri dish. Seal the dish and label it control.
13. Swab another sample from the soccer ball. Smear it onto the Petri dish. Seal and label the dish 5 seconds.
14. Repeat step 13 for the other two samples, except label one 15 seconds and the other 30 seconds.
15. Place the Petri dishes in the small cardboard box. Close the box and wrap a layer of aluminum foil around it. Place the small cardboard box into the plastic storage container. Clamp the heat lamp onto the side of the container. Place the heating pad underneath of the plastic storage container. Cover the storage container with a heated throw. Place a thermometer into the container. Try to keep the temperature in the storage container above 80 F, but below 100 F. Leave the samples alone for 48 hours.
16. Take the sample out labeled 5 seconds and microwave it for 5 seconds. Place it back into the cardboard box
17. Repeat step 16 for the other two samples, except microwave one for 15 seconds and the other for 30 seconds.
18. After another 48 hours, take out all the samples. Note the growth of colonies of bacteria.
19. Analyze all the data collected or observed.

DATA

Table 1: Results from the yeast experiment

Time micro-waved for	Temperature of water	How long it took for the reaction to visibly start	Appearance of the reaction
Control (not micro-waved)	110 F	5 minutes 30 seconds	Lots of bubbles, mixture is thick and frothy
5 seconds	110 F	5 minutes 10 seconds	Lots of bubbles, mixture is thick and frothy
15 seconds	110 F	5 minutes 50 seconds	Lots of bubbles, the mixture is thick and frothy
30 seconds	110 F	7 minutes	very few bubbles, mixture is thin

Table 2: Results from the radish seed experiment

Time micro-waved for	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11
Control (Not micro-waved)	Planted	No visible growth	No visible growth	Seeds starting to sprout	Visible growth	Visible growth	Visible growth	Visible growth	Visible growth	Visible growth	Approx 4" tall
5 seconds	Planted	No visible growth	No visible growth	Seeds starting to sprout	Visible growth	Visible growth	Visible growth	Visible growth	Visible growth	Visible growth	Approx 4" tall
15 seconds	Planted	No visible growth	No visible growth	Seeds starting to sprout	Visible growth	Visible growth	Visible growth, Visible growth	Visible growth	Visible growth	Visible growth	Approx 4" tall
30 seconds	Planted	No visible growth	No visible growth	Seeds starting to sprout	Visible growth	Visible growth	Visible growth, Visible growth	Visible growth	Visible growth	Visible growth	Approx 4" tall

Table 3: Results of the Petri dish experiment

Time micro-waved for in second half of the experiment	Results for petri dishes after 48 hours Not micro-waved	Results for petri dishes 48 hours after being micro-waved for the given time
Control	Small, yellowish and white dots of bacteria growing	Bacteria colonies have increased in size and quantity.
5 seconds	Small, yellowish and white dots of bacteria growing	Bacteria colonies have increased in size and quantity.
15 seconds	Small, yellowish and white dots of bacteria growing. Bacteria colonies present look larger than the other petri dishes.	No visible bacteria growth
30 seconds	Small, yellowish and white dots of bacteria growing. Bacteria colonies present look larger than the other petri dishes.	No visible bacteria growth

Results

The results of the radish seed part of my experiment are that over eleven days of observation, microwaves of up to 30 seconds have no effect on the future plant life of radish seeds. The seeds in all of the cups sprouted on the 4th day and by the 11th day all growth was approximately 4" tall.

The results of the fungi (yeast) part of my experiment are that micro waves up to 15 seconds have little effect on fungi. The control sample took 3 minutes and 30 seconds for the reaction to begin. The 5 second yeast sample took 3 minutes and 10 seconds for the reaction to begin. The 15 second yeast sample took 3 minutes and 50 seconds to bubble and the 30 second yeast sample took 7 minutes for the reaction to start. The yeast exposed to microwaves for 30 seconds took the longest for the reaction to start.

The results of the Petri dish part of my experiment are that micro waves of up to 5 seconds do not have any effect on bacteria growth. Bacteria in the Petri dishes exposed to 15 and 30 seconds of microwaves are completely killed, all growth was prohibited.

My results for all three parts of the experiment indicate that microwaves can affect the growth of bacteria, fungi and possibly plant life when exposed to microwaves.

CONCLUSION

My hypothesis was that plant life, fungi (yeast), and bacteria exposed to microwave radiation for 30 seconds will have negative effects on their growth. My results indicate that my hypothesis is not always true. All of the radish seeds exposed to no microwaves and exposed to up to 30 seconds of microwaves sprouted and began to grow all at the same rate. The yeast experiment supported my hypothesis because the reaction of the yeast exposed to microwaves for 30 seconds took the longest to start and the reaction was very weak. The from dish experiment also supported my hypothesis; however, the bacteria exposed to microwaves for 15 seconds were completely killed off. I think that water content in the nutrient agar is why the bacteria were killed after 15 and 30 seconds of being exposed to the microwaves. The nutrient agar began to build in the microwave after 15 seconds. I think the heat generated from the irradiating molecules in the agar solution is what helped to kill the bacteria.

If I am going to conduct this experiment

Roots on the move

THIRD PLACE

Problem

ow do roots grow when the seed's orientation changed?

Materials

- Paper towels
- 15 petri dishes
- Radish seeds
- 3 petri dish holders
- Marker
- Tape
- Camera
- Notebook
- Water
- 3 post-it notes
- potato chip bag clip

Procedure

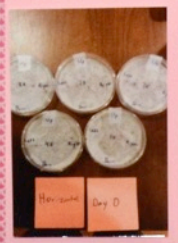
1. Cut 15 paper towel circles to the size of the petri dish. Dampen them with water and place each in the bottom of 15 petri dishes.
2. Place 4 seeds in the center of each paper towel in a line, spaced equally from each other.
3. Tape the sides shut.
4. Mark the first 5 petri dishes 1-5. These will be the vertical set.
5. Mark the next 5 petri dishes 1-5. These will be the horizontal set.
6. Mark the last 5 petri dishes 1-5. These are the rotating set. Label the top, right, down, left and center on the ground of each petri dish so you know which direction each seed is facing.
7. Place the petri dishes in the holders over them. Mark the dish holders, "Horizontal", "Vertical", and "Rotating" with a post-it note.
8. Place the "Vertical" holder flat on a table so the dishes remain vertical in the holder.
9. Place the "Horizontal" holder upright by propping it on the potato chip clip so that the dishes will be flat in the holder.
10. Place the "Rotating" holder flat on the table as well so that the dishes are vertical in the holder.
11. Observe the dishes every day. Add water to the towels if they have dried out.
12. Rotate the dishes in the "Rotating" holder clockwise 90° every two days.
13. Record the observations in a notebook and take pictures.

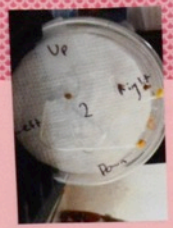
Observations

Day	Horizontal Petri Dishes	Vertical Petri Dishes	Rotating Petri Dishes
1	Most seeds have sprouted.	Most seeds have sprouted.	Most seeds have sprouted.
2	Roots are growing down.	Roots growing down.	Roots growing down. Look like the vertical dishes.
3	Roots have grown longer, almost touching the opposite side of the petri dish.	Roots have grown longer down toward the bottom of the petri dish.	Rotate the dishes 90° clockwise. Roots have grown longer. Still look like the vertical dishes.
4	Roots have hit the opposite side of the petri dish and are starting to spread out on the bottom.	Roots have grown much longer down.	Roots are growing, but have changed direction. They have turned toward counterclockwise (in the new "down" direction).
5	Roots are spreading out more in the dish.	Roots have almost reached the bottom of the petri dish.	Roots growing down. Rotate the dishes 90° clockwise again.
6	Roots have nowhere to go. They are tangling together at the bottom.	Roots have grown straight to the bottom of the dishes and then start spreading out.	Roots have changed direction again. They have turned counterclockwise and look like they are curling in a "U" shape.
7	Roots are all tangled in the dish.	Roots have nowhere to go and are curling around at the bottom of the dish.	Roots have curled more. Rotate the dishes 90° clockwise.

Observation Summary

Orientation	Summary	Drawing
Horizontal	The seeds in the horizontal dishes grew straight down. Since there wasn't much room for them to grow in the direction of gravity, the roots grew straight down until they hit the opposite side of the petri dish and then grew by spreading out in the bottom of the dish.	
Vertical	The seeds in the vertical dishes all sprout and grow straight toward the bottom of the dish. When they finally hit bottom, the roots start spreading out around the bottom of the dish.	
Rotating	The seeds in the rotating dishes start out like the vertical dishes, but when I rotated them, the roots would change direction too. I rotated the dishes in a clockwise direction. The roots changed direction by turning in a counterclockwise direction. I think if I continued this experiment, the roots would continue turning and curling around like a little pig's tail.	





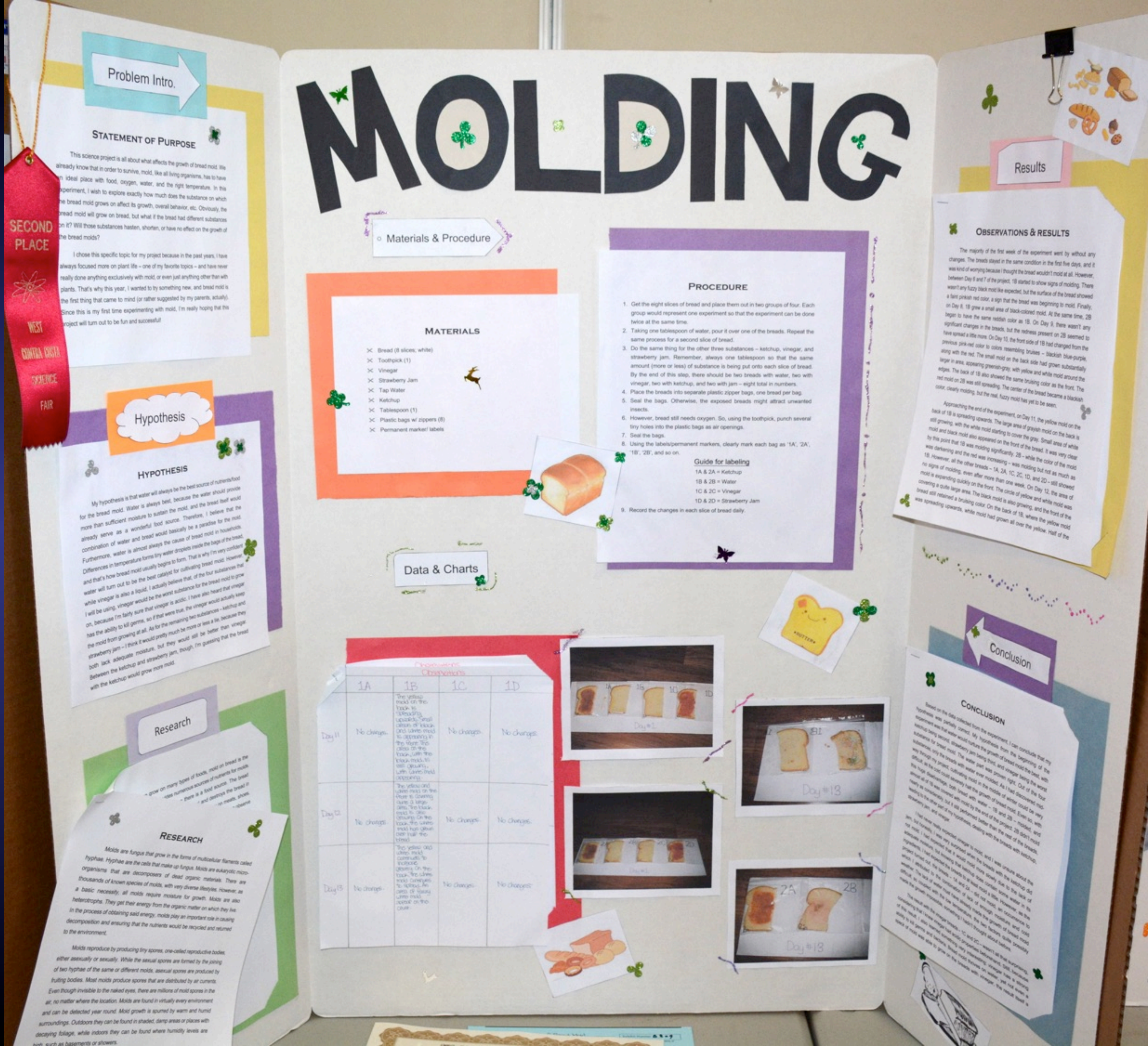
Conclusion

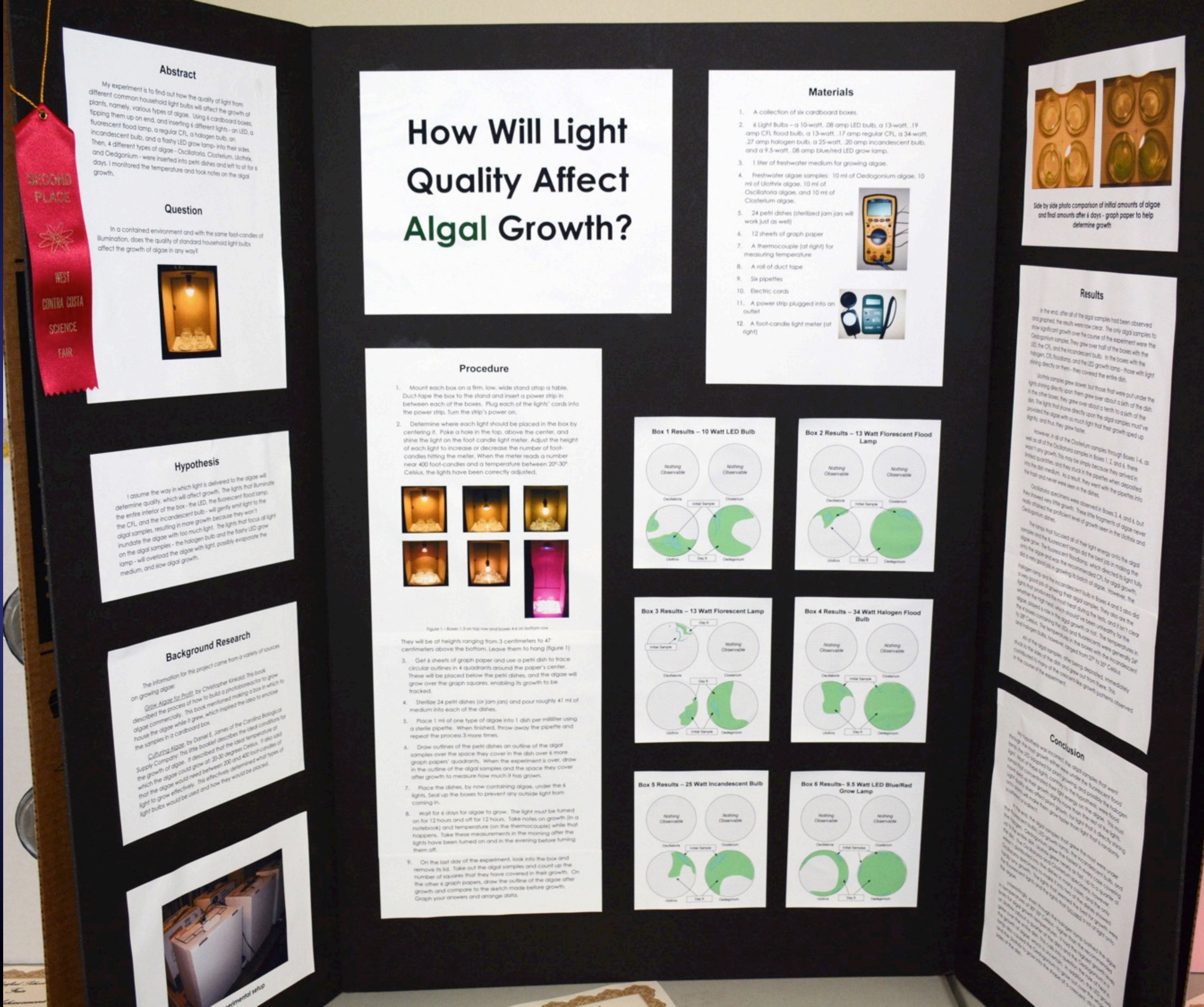
My hypothesis was correct. The rotating roots changed direction as they grew due to the pull of gravity. They always grew toward the "down" position. Each time I rotated the dish, there was a new "down" and the roots would turn toward that direction. I rotated the dish clockwise 90° at each turn. I rotated the dish 90° counterclockwise. The roots would start turning clockwise, but it was the opposite.

In both the horizontal and vertical controls environment, the seeds sprouted and grew in the down direction. The horizontal seeds grew to the opposite side of their petri dish quickly as they grew toward the down points to grow. Once it hit the opposite side, the roots would continue to grow along the bottom of the dish. The vertical roots had longer to go until they hit the bottom, but the horizontal seeds once the roots hit the bottom of the dish, they would grow and expand out along the bottom of the dish.

If I continued this experiment, the horizontal and vertical environments would have a change of roots along the bottom of the dish. I think the rotating dishes would have curled spirals where the roots curl or turn.

Real life connection is each turn that the plant curls like a pig's tail.


MOLDING
Problem Intro.
STATEMENT OF PURPOSE
This science project is all about what affects the growth of bread mold. We already know that in order to survive, mold, like all living organisms, has to have an ideal place with food, oxygen, water, and the right temperature. In this experiment, I wish to explore exactly how much does the substance on which the bread mold grows on affect its growth, overall behavior, etc. Obviously, the bread mold will grow on bread, but what if the bread had different substances on it? Will those substances hasten, shorten, or have no effect on the growth of the bread molds?
I chose this specific topic for my project because in the past years, I have always focused more on plant life – one of my favorite topics – and have never really done anything exclusively with mold, or even just anything other than with plants. That's why this year, I wanted to try something new, and bread mold is the first thing that came to mind (or rather suggested by my parents, actually). Since this is my first time experimenting with mold, I'm really hoping that this project will turn out to be fun and successful!
SECOND PLACE
WEST CONTRA COSTA SCIENCE FAIR
Hypothesis
HYPOTHESIS
Research
RESEARCH
Materials & Procedure
MATERIALS
Bread (8 slices; white)
Toothpick (1)
Vinegar
Strawberry Jam
Tap Water
Ketchup
Tablespoon (1)
Plastic bags w/ zippers (8)
Permanent marker/ labels
PROCEDURE
1. Get the eight slices of bread and place them out in two groups of four. Each group would represent one experiment so that the experiment can be done twice at the same time.
2. Taking one tablespoon of water, pour it over one of the breads. Repeat the same process for a second slice of bread.
3. Do the same thing for the other three substances – ketchup, vinegar, and strawberry jam. Remember, always one tablespoon so that the same amount (more or less) of substance is being put onto each slice of bread. By the end of this step, there should be two breads with water, two with vinegar, two with ketchup, and two with jam – eight total in numbers.
4. Place the breads into separate plastic zipper bags, one bread per bag.
5. Seal the bags. Otherwise, the exposed breads might attract unwanted insects.
6. However, bread still needs oxygen. So, using the toothpick, punch several tiny holes into the plastic bags as air openings.
7. Seal the bags.
8. Using the labels/permanent markers, clearly mark each bag as '1A', '2A', '1B', '2B', and so on.
Guide for labeling
1A & 2A = Ketchup
1B & 2B = Water
1C & 2C = Vinegar
1D & 2D = Strawberry Jam
9. Record the changes in each slice of bread daily.
Data & Charts
1A
1B
1C
1D
Day 11
Day 12
Day 13
No changes
Day #13
2A
2B
Results
OBSERVATIONS & RESULTS
Conclusion
CONCLUSION


SECOND PLACE
WEST CONTRA COSTA SCIENCE FAIR
Abstract
My experiment is to find out how the quality of light from different common household light bulbs will affect the growth of plants, namely, various types of algae. Using 6 cardboard boxes, tipping them up on end, and inserting 6 different lights - an LED, a fluorescent flood lamp, a regular CFL, a halogen bulb, an incandescent bulb, and a flashy LED grow lamp- into their sides. Then, 4 different types of algae - Oscillatoria, Closterium, Ulothrix, and Oedgonium - were inserted into petri dishes and left to sit for 6 days. I monitored the temperature and took notes on the algal growth.
Question
In a contained environment and with the same foot-candles of illumination, does the quality of standard household light bulbs affect the growth of algae in any way?
Hypothesis
I assume the way in which light is delivered to the algae will determine quality, which will affect growth. The lights that illuminate the entire interior of the box - the LED, the fluorescent flood lamp, the CFL, and the incandescent bulb - will gently emit light to the algal samples, resulting in more growth because they won't inundate the algae with too much light. The lights that focus all light on the algal samples - the halogen bulb and the flashy LED grow lamp - will overload the algae with light, possibly evaporate the medium, and slow algal growth.
Background Research
The information for this project came from a variety of sources on growing algae:
Grow Algae for Profit, by Christopher Kinkaid: This book described the process of how to build a photobioreactor to grow algae commercially. This book mentioned making a box in which to house the algae while it grew, which inspired the idea to enclose the samples in a cardboard box.
Culturing Algae, by Daniel E. James of the Carolina Biological Supply Company: This little booklet describes the ideal conditions for the growth of algae. It described that the ideal temperature at which the algae could grow at: 20-30 degrees Celsius. It also said that the algae would need between 200 and 400 foot-candles of light to grow effectively. This effectively determined what types of light bulbs would be used and how they would be placed.
How Will Light Quality Affect Algal Growth?
Procedure
1. Mount each box on a firm, low, wide stand atop a table. Duct-tape the box to the stand and insert a power strip in between each of the boxes. Plug each of the lights' cords into the power strip. Turn the strip's power on.
2. Determine where each light should be placed in the box by centering it. Poke a hole in the top, above the center, and shine the light on the foot candle light meter. Adjust the height of each light to increase or decrease the number of foot-candles hitting the meter. When the meter reads a number near 400 foot-candles and a temperature between 20°-30° Celsius, the lights have been correctly adjusted.
Figure 1 – Boxes 1-3 on top row and boxes 4-6 on bottom row
They will be at heights ranging from 3 centimeters to 47 centimeters above the bottom. Leave them to hang (figure 1)
3. Get 6 sheets of graph paper and use a petri dish to trace circular outlines in 4 quadrants around the paper's center. These will be placed below the petri dishes, and the algae will grow over the graph squares, enabling its growth to be tracked.
4. Sterilize 24 petri dishes (or jam jars) and pour roughly 41 ml of medium into each of the dishes.
5. Place 1 ml of one type of algae into 1 dish per milliliter using a sterile pipette. When finished, throw away the pipette and repeat the process 3 more times.
6. Draw outlines of the petri dishes an outline of the algal samples over the space they cover in the dish over 6 more graph papers' quadrants. When the experiment is over, draw in the outline of the algal samples and the space they cover after growth to measure how much it has grown.
7. Place the dishes, by now containing algae, under the 6 lights. Seal up the boxes to prevent any outside light from coming in.
8. Wait for 6 days for algae to grow. The light must be turned on for 12 hours and off for 12 hours. Take notes on growth (in a notebook) and temperature (on the thermocouple) while that happens. Take these measurements in the morning after the lights have been turned on and in the evening before turning them off.
9. On the last day of the experiment, look into the box and remove its lid. Take out the algal samples and count up the number of squares that they have covered in their growth. On the other 6 graph papers, draw the outline of the algae after growth and compare to the sketch made before growth. Graph your answers and arrange data.
Materials
1. A collection of six cardboard boxes.
2. 6 Light Bulbs – a 10-watt, .08 amp LED bulb, a 13-watt, .19 amp CFL flood bulb, a 13-watt, .17 amp regular CFL, a 34-watt, .27 amp halogen bulb, a 25-watt, .20 amp incandescent bulb, and a 9.5-watt, .08 amp blue/red LED grow lamp.
3. 1 liter of freshwater medium for growing algae.
4. Freshwater algae samples: 10 ml of Oedogonium algae, 10 ml of Ulothrix algae, 10 ml of Oscillatoria algae, and 10 ml of Closterium algae.
5. 24 petri dishes (sterilized jam jars will work just as well)
6. 12 sheets of graph paper
7. A thermocouple (at right) for measuring temperature
8. A roll of duct tape
9. Six pipettes
10. Electric cords
11. A power strip plugged into an outlet
12. A foot-candle light meter (at right)
Box 1 Results – 10 Watt LED Bulb
Box 2 Results – 13 Watt Florescent Flood Lamp
Box 3 Results – 13 Watt Florescent Lamp
Box 4 Results – 34 Watt Halogen Flood Bulb
Box 5 Results – 25 Watt Incandescent Bulb
Box 6 Results– 9.5 Watt LED Blue/Red Grow Lamp
Side by side photo comparison of initial amounts of algae and final amounts after 6 days - graph paper to help determine growth
Results
In the end, after all of the algal samples had been observed and graphed, the results were now clear. The only algal samples to show significant growth over the course of the experiment were the Oedogonium samples. They grew over half of the boxes with the LED, the CFL, and the incandescent bulb. In the boxes with the halogen, CFL floodlamp, and the LED growth lamp - those with light shining directly on them - they covered the entire dish.
Ulothrix samples grew slower, but those that were put under the lights shining directly upon them grew over about a sixth of the dish. In the other boxes, they grew over about a tenth to a sixth of the dish. The lights that shone directly upon the algal samples must've provided the algae with so much light that their growth sped up slightly, and thus, they grew faster.
However, in all of the Closterium samples through Boxes 1-6, as well as all of the Oscillatoria samples in Boxes 1, 2, and 6, there wasn't any growth. This may be simply because they arrived in limited quantities, and they stuck in the pipettes when deposited into the dish medium. As a result, they went with the pipettes into the trash and never were seen in the dishes.
Oscillatoria specimens were observed in Boxes 3, 4, and 6, but they showed very little growth. These little fragments of algae never really attained the proficient level of growth seen in the Ulothrix and Oedogonium dishes.
The lamps that focused all of their light energy onto the algal samples and the fluorescent lamps did the best job in making the algae grow. The fluorescent floodlamp, which directed its light fully onto the algae and was the recommended CFL for algal growth, did a very good job in growing its batch of algae. However, the halogen lamp and the incandescent bulb in Boxes 4 and 5 also did a very good job of growing their algal samples. They also are the lights that produced the most heat during the tests, and it isn't clear whether the high heat, which should've been unhealthy for the algae, played a role in the algal growth or not. The temperatures in the 4 boxes containing the LEDs and fluorescents were generally 24° to 28° Celsius. The temperatures in the boxes with the incandescent and halogen bulbs, however, ranged from 27° to 35° Celsius.
All of the algal samples, after being deposited, immediately stuck to the sides of the dish and grew out from there. This contributed to many of the crescent-like growth patterns observed in the course of the experiment.
Conclusion

8th Grade

Mathematics & Computers

Question???

FOURTH PLACE

WEST CENTRAL DISTRICT SCIENCE FAIR

-Who out of men & Women can remember the most numbers???

1 2 3

The End!

This Experiment closes my hypothesis as I was correct about womens attention span being shortened. While men become victorious in their reign as ruler....

Go Men!

Materials

1. 6 participants 2 for 3 trials (all people must be around the same age)
2. Pen / pencil
3. paper / or a writable and readable piece
4. Selected #'s that go up one each time
5. Calm & focus

Procedures

1. Collect your participants.
2. Individually test your participants
3. Record your data and make sure participants are calm & around the same age.
4. Have a set of #'s to give the participants.

Hypothesis

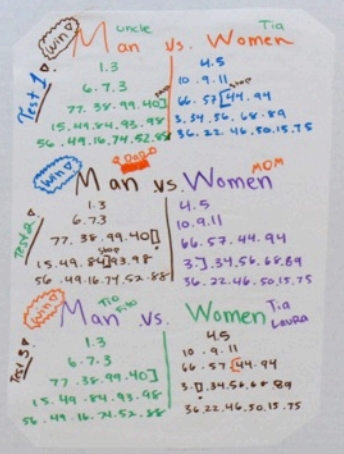
-My Hypothesis: I believe men will beat women in the memory game because of the simple fact that women are so pre-occupied with other things that they want be on the test.

Data!

Round 1 Uncle vs. Aunt
8 after | 7 after.

Round 2 Dad vs. MOM
9 after | 10 after.

Round 3 Uncle Fitz vs. Tia Laura
9 after | 7 after.



FACTS!!!

Men!!!

- Men cry on average 6 to 17 times a year.
- Men can think about absolutely nothing for hours.

Women

- A Women cries 30 and 64 times a year.
- Women spend nearly one year deciding what to wear.

FUN Facts

Don't Fret: Measuring Guitar String intervals

Hypothesis

I believe there is a formula to calculate the frequency of the next note on a guitar string.

Problem

I want to know if there is a mathematical formula to calculate the difference between each note heard when playing the frets on a guitar string.

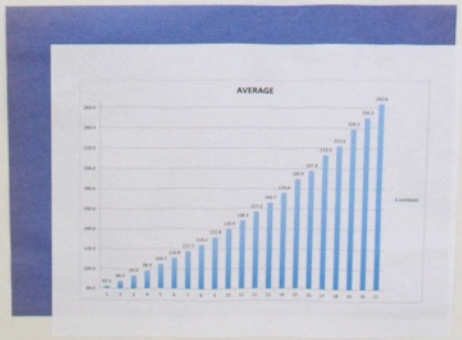
Materials

- Acoustic guitar
- Guitar tuner, or any tuning software that can detect the frequencies of notes. I used an app called Tunable on an iPhone
- pen or pencil
- notebook or piece of paper

Procedure

1. Tune your guitar to the standard where A = 440.
2. Play the low E String 3 times and record it each time.
3. Repeat step 2 for all the notes on that string. there should be 21 notes in all, including the open string and 20 fretted notes. (Each fret is one half step up in a chromatic scale)
4. Determine the average for each of the fretted notes that you measured.
5. Now use your mathematical knowledge to explore the idea that there really is a formula.

FRET	1	2	3	AVERAGE	Difference	the Differences	Next Note Diveded by previous Note
0	82.3	82.4	82.1	**82.3**			
1	88.3	87.8	87.9	**88.0**	5.7		1.0697
2	93.5	93.7	93.1	**93.4**	5.4	-0.30	1.0617
3	98.3	98	98.9	**98.4**	5.0	-0.47	1.0532
4	104.5	104.7	104.8	**104.7**	6.3	1.30	1.0637
5	110.8	111	110.6	**110.8**	6.1	-0.13	1.0586
6	117.3	117.8	117.9	**117.7**	6.9	0.73	1.0620
7	124.3	124.2	124.1	**124.2**	6.5	-0.33	1.0555
8	131.7	132.5	131.3	**131.8**	7.6	1.03	1.0609
9	139.9	139.8	140.1	**139.9**	8.2	0.60	1.0620
10	148	148.1	148.7	**148.3**	8.3	0.17	1.0596
11	157.3	157.7	157	**157.3**	9.1	0.73	1.0612
12	166.3	167.1	166.8	**166.7**	9.4	0.33	1.0597
13	176.8	176.5	176	**176.4**	9.7	0.30	1.0582
14	190	189.9	189.7	**189.9**	13.4	3.73	1.0761
15	197.8	197.4	198.1	**197.8**	7.9	-5.53	1.0416
16	212.5	212.4	214.7	**213.2**	15.4	7.53	1.0780
17	222.7	222.9	222.3	**222.6**	9.4	-6.00	1.0442
18	238.6	239.7	239.4	**239.2**	16.6	7.17	1.0746
19	249.2	249.4	251.9	**250.2**	10.9	-5.67	1.0457
20	256.4	267.2	267.2	**263.6**	13.4	2.50	1.0537
					No clear pattern	Unclear information	21.200 < Sum of above results
							1.060 < Average of that sum



Conclusion

My hypothesis was correct as I discovered there was a formula. I found that multiplying the frequency of one fret by 1.060 will give a very close approximation of the frequency of the next fret up. There being the formula. This experiment was a lot of fun to do because not only was I incorporating music, but I was also involving math, two of my favorite things.

Results

In the tables you can see how I progressed to find my answer. I started with the data collected by recording the frequencies at each fret. I then calculated the average for each, then the difference between them. Because I felt I needed more information, I then found the difference of differences.

When that still didn't seem to be conclusive, I tried dividing one fret's frequency by the previous one. I did this for each of them. They were close, but different. From these numbers, I calculated the average and came up with the number of 1.060.

When I tested this number, on the High E String of the guitar, my formula worked.

8th Grade

Physical Science

How Do Different Temperatures Impact a Magnet's Strength?

Problem

How does the strength of a Magnet vary with in different temperatures?

Hypothesis

My hypothesis is that the freezer and ice/water bath test will attract more paperclips than the control and boiling water tests. I think this because cold temperatures actually increase the magnetism of a magnet. Plus at a certain high temperatures the material loses all magnetic properties and it cannot be gained back by cooling the magnet.

Materials and Equipment

- Large (ceramic) magnet like the 4 ¾ inch diameter ring magnet Tongs for holding magnets (preferably plastic)
- Thick heat-resistant glove or oven mitts that fit over your hands (not holders)
- Standard #1 metal paper clips (3 boxes of 1,000 each)
- Flat surface or plate at least 3 inches wider than the diameter of your magnet
- Digital scale with 0.1g increments. A digital scale that would be suitable: the Ozeri Weigh Mill 500 BLK Digital Pocket Scale.
- Small bowl or container, to be used as a "measuring bowl" in which to collect paper clips and measure their weight
- Thermometer (minimum range: -30 to 120°C)
- Freezer
- Ice cubes (about 3 trays worth)
- Large plastic bowl (your magnet needs to fit in the bowl)
- Water
- Stove or hot plate, for heating water
- Pot in which to heat water. Choose a pot that is not ferromagnetic so your magnet is not attracted to the pot. Your magnet needs to fit completely into the pot.
- Lab notebook

Procedure

Freezing test

1. Place your magnet in the freezer for about 30 minutes.
2. Place your thermometer in the freezer.
3. Prepare your pile of paper clips
4. Take the magnet out, measure its strength and put it instantly back where you got it from for this test so it is ready for your next trial.
5. Leave your magnet for at least 10 minutes to equilibrate with the test temperature again.
6. Repeat steps 3–5 four more times for a total of five trials.
7. Take your thermometer out of the freezer and record the temperature of your freezer in the data table in your lab notebook. Take your magnet out of the freezer.

Ice/water bath test

8. In a large plastic bowl, prepare a bath of water and ice cubes.
9. Place your magnet in the bowl. Make sure it is completely submerged.
10. Leave it in the ice/water bath for at least 10 minutes, evaluating intermittently if the bath needs extra ice. Note: Since the room is warmer than your ice/water bath, heat will flow from the room to the bath, melting your ice. To keep the temperature of the bath at 0°C, you might need to replenish the ice.
11. Repeat steps 3–6. While you do so, keep an eye on the ice/water bath, making sure it always contains some ice.
12. Use your thermometer to measure the temperature of the ice/water bath and record your findings in your data table. Take your magnet out of the water/ice bath.

Control test

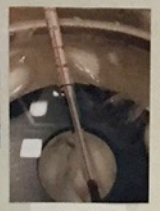
13. Let your magnet and thermometer sit out at room temperature for at least 30 minutes.
14. Repeat steps 3–6. *Note*: In this case, you do not need the additional 10 minutes between trials, as the magnet stays at room temperature all the time.
15. Use your thermometer to measure the room temperature and record your findings in your data table in your lab notebook

Boiling Water test

16. Put a pot with plenty of water on the stove and bring it to a soft boil.
17. Use tongs to put the magnet in the water. You will also use the tongs to take the magnet out of the water. Leave the magnet in the water for at least 20 minutes to equilibrate.
18. Repeat steps 3–6. But make sure that you are keeping the water at a soft boil.
19. Use your thermometer to measure the temperature of the boiling water and record your findings in your data table in your lab notebook. Take the magnet out of the water. Let the water cool and safely dispose it.

The control test

Freezer Test



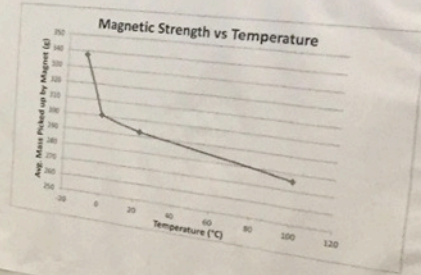
The Ice/Water Bath Test

Boiling Water test

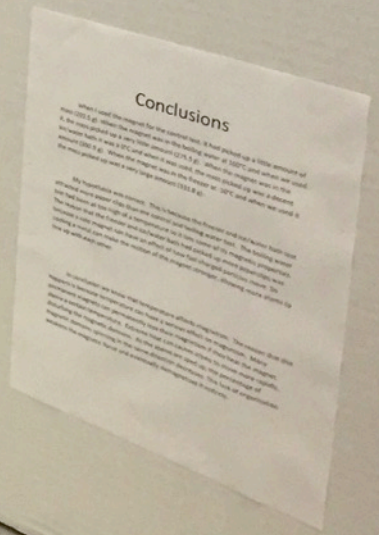
A size comparison of the magnet

Results

	Freezer	Ice/Water Bath	Control	Boiling Water
Temperature (°C)	-10	0	21	100
Trial 1 (g)	331.8	323.7	291	281.8
Trial 2 (g)	322.9	287.3	308.3	312.8
Trial 3 (g)	340.4	345.4	317.1	271.3
Trial 4 (g)	348.4	270.7	283.9	256.7
Trial 5 (g)	345.3	275.5	262.3	254.9
Average (g)	337.8	300.5	292.5	275.5



Conclusions



Mini - Motor

FOURTH PLACE

NORTH DAKOTA SCIENCE FAIR

Statement of Purpose

This is an engineering science experiment. In it I expect to learn how to make an electromagnet to build a simple motor. I will also find out the effect of simple changes on the operation of the motor. I will test different coil sizes and the number of magnets used. My original idea for a project was to try and make a battery out of a potato. I choose this experiment instead because it looked cool and fun. I thought it would be a better and more interesting project.

Problem

How to make a simple motor using magnets and a battery.

Hypothesis

I think a bigger electromagnet and more than one permanent magnet will make the motor run faster and better. To test this, I will make multiple coils by wrapping the wire 10 times, 15 times, and then 20 times. I will then try each one using one magnet then two magnets.

Research

A motor is a device used to convert electrical energy to mechanical energy that creates motion. Motors are found in most electrical devices and are a very important part of our world today. An electric motor uses the attracting and repelling properties of magnets to create motion. Electric motors use the magnets ways of responding to each other to create the spinning motion. There are two different types of magnets, a permanent (fixed) magnet and a temporary (electromagnet).

The electromagnet or temporary magnet is placed on an axel so it may spin freely. When it is positioned within the magnetic field of a permanent magnet and creates a temporary magnetic field around itself. This creates an attracting and repelling force causing the electromagnet to spin. This is now an electric motor. This basic principle is how motors work and is called Ampere's Law. This law states that a wire carrying an electric current produces a magnetic field around itself. To create a motor that will spin continuously the current needs to flow only when the coil is in the right position. This is accomplished by using a split ring commutator. This is a ring that is split in two pieces and is connected to the coil. The current flows into the coil through one piece of the split ring and out through the other piece. The split ring is positioned so that the current flows only when the coil is in the correct position. When the coil spins around and the current flows in the opposite direction, the magnetic field around the coil changes direction. This causes the coil to continue spinning as the magnetic fields attract and repel each other. The split ring continues to change the direction of the current flow each time the coil spins around. This is how motors continue to spin.

Materials and Equipment

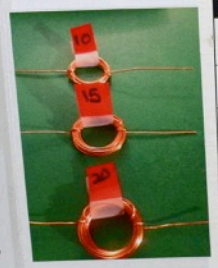
- Insulated enamel coated 22 gage magnet wire
- D Battery
- 2 Large metal safety pins
- Electrical tape
- Large marker cap
- Wire cutters
- Sharpie pen
- Double sided foam tape
- Hobby knife
- 2 Round magnets
- Cardboard platform
- Post-it tape
- Notebook

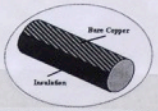
Procedure

1. Create the electromagnet for motor
   a. Wrap wire neatly around marker 10 times to make coil
   b. Leave at least 2 inches of wire on each end
   c. Slide the coiled wire off of the marker
   d. Wrap the end of the wire around the coil a couple times to hold it together on each side
   e. Point the wires in opposite directions of the loop making sure they are straight across from each other, this will be the axel
   f. Using the knife strip the insulating enamel coating off the top half only off of each end of the wire
   g. Repeat steps A-F wrapping coil 15 and 20 times to make additional electromagnet coils
2. Make the axel supports
   a. Tape large safety pins securely to each end the battery using electrical tape
   b. Make sure the pins are straight vertically with the loop ends pointing up
3. Place magnet(s) on top of battery (add additional magnets if needed
4. Secure battery to cardboard platform using double sided foam tape
5. Inset each axel end of the electromagnet into the loops of the axel supports
6. To get the motor started give the coil a spin if needed

Motor Data

Experiment Number	Coil Size (Number of times wire wrapped around marker)	Number of Magnets Used	Observations and Results
1	Ten	One	It only took 2 tries to get the motor started spinning on it's own. From the front view it looked like it was spinning pretty fast but from the side it appeared a little slower. It continued to run on it's own for about 2 minutes until I stoped it.
2	Fifteen	One	After several attempts I was able to get the coil to spin however it kept sliding to one side and stopping. When I finally got it to spin continuously it only lasted about 5-6 seconds then stopped & wobbled back & forth.
3	Twenty	One	Even after many tries I could not get the coil to spin on it's own, it just bounced back and forth. It seems like the coil is too heavy for the strength of the single magnet to be able to make it spin.
4	Ten	Two	The coil started spinning right away without me even having to give it a spin. It ran fast and strong enough to shake the motor on the platform and I could actualy hear it running.
5	Fifteen	Two	When I put the coil on it started to bounce back & forth but I had to give it a spin to get it started. It also ran fast and strong but did not apear to have as much speed as the 10 coil.
6	Twenty	Two	As soon I put it on it started to spin but was wobbly, I think because of the weight. It spun for a few seconds then stopped. I was able to get it going again with push and it continued to spin on it's. As it spun the weight of the electromagnet coil made the motor wobble.





This drawing shows how the axles should be stripped

Q: What is Ampere's law?

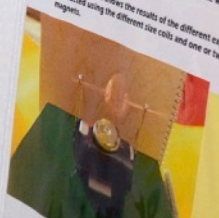
A: A wire carrying an electric current produces a magnetic field around itself.

Observations and Results

The motor was fairly easy to construct. It was a little difficult to hold the safety pins straight and tape them in place. When making the electromagnet, the bigger the coil (more times I wrapped it around) the harder it was to keep the coils tight and together. The wire also kept bending so I had keep making adjustments to the axel of the coil to keep it straight and centered over the permanent magnet so it would be able to spin.

Sometimes when the motor started running, the electromagnet coil would slide on the axel to one side. Each time this happened, the center of the coil would bump the side of the motors axel supports and cause it to stop spinning. To spin properly the axel must be straight and the coil centered over the permanent magnet with the weight even. This will create the magnetic field and allow the motor to continue to spin. I corrected this issue by making the necessary adjustments to the coils, axel and axel supports as needed. This fixed the problem. When I got it on track it was thrilling and exciting to see it work and actually keep spinning on its own. If you listen closely you can even hear the motor running. It sounded like wind and vibration, kind of like the sound of a small fan.

The data table shows the results of the different experiments I conducted using the different size coils and one or two permanent magnets.



Conclusion

My hypothesis was proven to be partially right because more magnets made the motor work better and faster. The bigger coils also made the motor work better and faster. I was surprised that the smaller coil with more wraps around it was able to get going faster and spin more consistently than the bigger coil with less wraps around it. I think this is because the smaller coil was lighter and easier to get spinning. The 10 coil did have a couple of times in a row where it would spin for a couple minutes but it seemed like it was more luck than anything. I think the 15 coil would have worked better if I had made the coil smaller. I think the 20 coil was too heavy and the magnetic field was too strong for the single magnet to overcome. I think the 20 coil would work better if I had used a stronger magnet or more magnets. I was surprised that the motor was able to run on its own for so long. I thought it would run for a few seconds and then stop. I was also surprised that the motor was able to run with the weight of the electromagnet coil on it. I thought the weight would be too much for the motor to handle.

FOURTH PLACE

WEST CONTRA COSTA SCIENCE FAIR

Hypothesis

I think Gatorade will contain more electrolytes.

Introduction

My project is about which drink contains more electrolytes. I chose this project because I thought it would be fun use the equipment. The objective of this project is to see whether or not a sports drink provides more electrolytes than other beverages and water. My brother plays on really hot days and the electrolytes will keep him from overheating. I want to see which would be better for him to drink. I hope to learn a lot from this project.

Materials

- Amp meter/Digital
- 2 Alligator clip leads
- 5 feet of 24 gauge copper wire
- 9 v battery
- 9 v battery clip
- Disposable plastic straw
- Scissors
- 8 ceramic bowls
- Masking tape
- Distilled water room temperature
- Tap water room temperature
- Gatorade room temperature
- Orange juice room temperature
- Chocolate milk room temperature
- Colored paper
- A table/ graph
- Paper towel
- Masking tape
- Pencil/ paper

Problem

?

TO GATORADE

OR

NOT TO GATORADE

?

Procedure

1. Cut 2 6-inch pieces of bare copper wire.
2. Cut 2 inch plastic straw.
3. Wrap one of the pieces of the wire around the 1-inch tube of plastic. Leave 2 inches of the wire unwrapped.
4. Do the same thing with the other wire on the other side of the tube.
5. Set that aside for a moment.
6. With wire cutters, remove one alligator clip from each end of the black and red wires.
7. Attach the end of the red wire that does not have an alligator clip to the positive battery terminal.
8. Attach the end of the black wire with an alligator clip to the negative terminal of the battery.
9. Copper wires attached to battery terminal
10. Clip the black wire alligator clip onto one of the bare copper wires on the plastic tube.
11. Take out the amp meter. Attach it to the setup by first clipping the alligator clip on the red wire to the red terminal on the amp meter.
12. Clip the alligator clip without a wire onto the other side of the tube with the 2 copper wires.
13. Attach the black terminal of the amp meter to that alligator clip, as well. The independent alligator clip should be holding both a copper wire and the black terminal of the amp meter. Conducting the test
14. Pour 50 mL of orange juice and sports drink into the plastic bowls or cups.
15. Fill a cup or bowl full of distilled water.
16. Submerge only the plastic tube with the copper wire into the orange juice.
17. Submerge the copper wire setup in orange juice
18. Read and record the number on the amp meter here
19. Rinse the copper wire and plastic tube by dunking in distilled water.
20. Repeat steps 14 and 15 for each liquid.
21. Once you get your numbers convert the micro amps to milliamps.

Results

In trial 1, 2 and 3 that chocolate milk contained the most electrolytes with the highest average of 107.13. The next highest was orange juice with an average of 73.97. The Gatorade came in 3rd place with an average of 43.23. Tap water had an average of 6.27. In last place was distilled water with an average of 0.04. The electrolytes in the distilled water were so low that it doesn't show up on the data chart.

	trial one	trial two	trial three	average
distilled h20	0.04	0.05	0.04	0.04
tap h20	5.79	6.70	6.40	6.27
gatorade	42.30	40.40	47	43.23
orange juice	86.90	88.0	86.90	87.27
chocolate milk	104	107	110.40	107.13

Conclusion

In conclusion, chocolate milk has more electrolytes than orange juice, Gatorade, tap water and distilled water. I thought Gatorade would have more electrolytes promoting Gatorade. Out of the sports drinks tested, I was surprised that Gatorade had the least electrolytes. I was surprised that orange juice had more electrolytes than Gatorade. Out of the beverages tested, I was surprised that orange juice had more electrolytes than water. Gatorade had the least electrolytes. I was surprised that orange juice had more electrolytes than Gatorade. What I suggest if you do this project, you put the straw in the middle, have someone [illegible] you put the straw in the middle, have someone [illegible] challenge will give you [illegible] challenge will give you [illegible] challenge will give you [illegible]

ZAP! Tesla coil properties

THIRD PLACE ★ WEST CONTRA COSTA SCIENCE FAIR

Introduction

The Tesla Coil is a unique electrical machine invented by Nikola Tesla. It uses a resonating frequency and produces an electrical field strong enough to light up fluorescent lights (depending on the size of the Tesla Coil) up to twenty feet away. However, it is best known for its beautiful arcs of electricity coming from the topload of the device that jump to any conductive object nearby.

I chose to build a Tesla Coil and test its function for my project because I have never built anything involving electrical engineering by myself before. This project idea seemed interesting to me and, although time-consuming, would help me understand the layout of electrical circuits and magnetic fields better. At first, I did not understand how the coil worked, but I learned about the coil and its circuits.

This project, however, did not come without danger. I took precautions at all times while running the coil to ensure that I would not electrocute myself or set fire to something. The spark gap of the coil can be dangerous to touch if it has not been discharged, even if the coil is turned off. Obviously, experimenting with any electrical circuit is slightly dangerous and may result in electrocution if you are not careful. This is why it is important to not touch the exposed end of wires that have not been discharged yet.

Problem

Will changing the topload size of a Tesla Coil change the strength of the electrical field it generates or change the arc length from the topload?

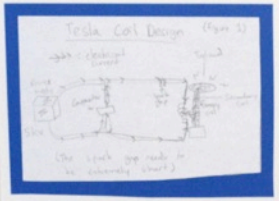
Hypothesis

I believe that a larger topload size will cause the arc length to diminish. Because the electricity comes in short bursts after the spark gap fires, there is a limited amount of electricity running through the topload at a given moment. If the topload has a larger volume, this electricity will be distributed over a larger volume, therefore causing the amount of electricity at any point on the topload to go down. This will result in a smaller arc length. However, the strength of the electrical field will probably not be affected because it is the same amount of electricity overall, no matter how thin it is spread, which will roam from the top of the Tesla Coil in the form of an electrical field.

Materials

1. Tesla Coil
2. Fluorescent light bulbs
3. Kitchen knife (rubber or wooden handle)
4. Earth ground for building Tesla Coil
5. Dry atmosphere to improve spark visibility
6. Optional: rubber gloves to prevent shocking

Procedure

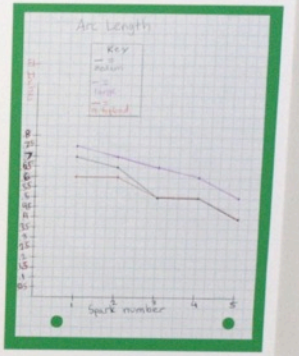


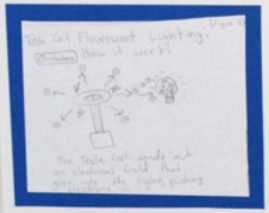
Top load arc length (top 5 each condition)

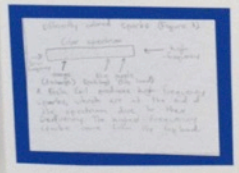
Top load	Spark 1	Spark 2	Spark 3	Spark 4	Spark 5	Sum
Medium	0.7 in	0.65 in	0.5 in	0.5 in	0.4 in	2.75
Large	0.75 in	0.7 in	0.65 in	0.6 in	0.5 in	3.2
None	0.6 in	0.6 in	0.5 in	0.5 in	0.4 in	2.6

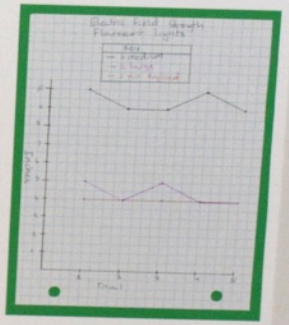
Flourescent lights: electric field strength

Top load	Distance 1	Distance 2	Distance 3	Distance 4	Distance 5
Medium	10 in	9 in	9 in	10 in	9 in
Large	5 in	4 in	5 in	4 in	4 in
None	4 in	4 in	4 in	4 in	4 in









How It Works

The Tesla Coil uses a simple circuit to release its spectacular sparks and electrical field (Figure 1). The power source is usually a high-voltage generator that produces a very high voltage but low-amp current. The electricity goes through the circuit until it reaches the capacitors, which store electricity until the spark gap fires, completing the circuit and moving the electricity on to the primary coil (the outer coil with larger wire). Then, the electromagnetic charge traveling down the coil triggers a magnetic field that starts moving in a perpendicular direction, therefore causing a charge to travel up the very thin wire that is the secondary coil, wrapped around the PVC pipe. This charge then travels up to the topload, where it can be drawn out in the form of an arc of electricity using a conductive material (preferably metal). This is what you see when you test the arc length by turning the coil on and drawing out a purple spark. The blue spark in the spark gap that you can see is the air ionizing and a spark of electricity jumping across the spark gap to complete the circuit. The reason I discharge the spark gap with a metal knife rubber handles is that if the spark gap does not fire and electricity is left on one side the remaining electricity could deliver a harmful shock if I were to brush against it by accident before it is discharged. Discharging the spark gap draws out the remaining electricity, leaving none to shock you. I learned a lot about circuits from building a Tesla Coil and looking at its design more closely, giving me insight into electrical engineering.

Conclusion

Color, Heat, and Energy

SECOND PLACE
WEST CONTRA COSTA SCIENCE FAIR

Problem

Which color absorbs the most heat and how can we use this information to collect more energy from a solar updraft tower?

Introduction

A solar updraft tower is a concept dating back hundreds of years. The idea is that since hot air rises, we can concentrate this rising air into one spot and use it to generate energy. A solar updraft tower consists of a dome with a tube projecting out from the center up with several propellers in the tube. With the legs holding the structure above the ground, the air can enter the structure into the dome. From there, the hot air rises and is then directed towards the tube. When the hot air projects up the tube, it spins the propellers, which are connected to the generators, creating energy that people can then use to power different items. This method is just beginning to be looked into as an energy source again. The solar updraft tower definitely provides a more eco-friendly system of collecting energy and if worked on, could become a sustainable source of energy.

Hypothesis

I think that the color black absorbs a lot more heat than the color white, and that we can use this property to increase the efficiency of a solar updraft tower. Based on this theory, using a black base underneath the solar updraft tower should provide the most energy.

Materials

black spray paint, blue spray paint, red spray paint, white spray paint, 5 clear plastic containers, a small thermometer, a 250 watt heat light bulb, a timer, two large trash bags (one white and one black), a clear plastic circular box of 2 ft in diameter, a clear plastic tube (2 ft tall and 1.5 inches in diameter), black dust
tape, thin tissue paper, 5 pegs (app. ½ inch tall and ¼ inch wide)

Procedure

Testing Color Absorbance (Figure 1):

1. Paint 4 of the plastic containers, 1 black, 1 blue, 1 red, 1 white, and let dry.
2. Set up your heat lamp 2 feet above the ground or another flat surface (do not place over a wooden surface).
3. Let your heat lamp warm up for 10 minutes.
4. Place the small thermometer in a container of your choice.
5. Place the chosen container underneath the heat lamp for 3 minutes.
6. Remove the container from underneath the heat lamp and record the temperature on the thermometer.
7. Repeat Steps 4-7 for each container
8. Repeat the experiment a minimum of 5 times for more accurate results.

Constructing the Solar Updraft Tower (Figure 2):

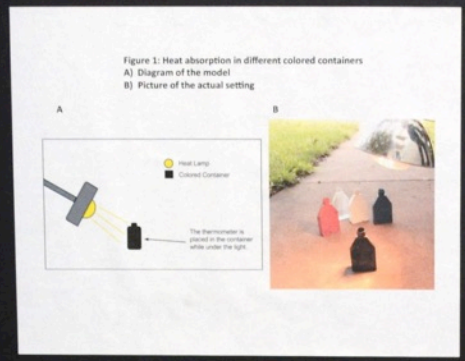
1. Cut a 1.5 inch diameter circular hole in the center of the clear plastic circular box.
2. Fit the tube into the hole so that none of the tube is in the box, all of the tube should be coming off of the box. If necessary, add a little bit of tape to hold up the tube.
3. Glue the 5 pegs to the bottom of the circular box in different areas to hold the box above the ground.

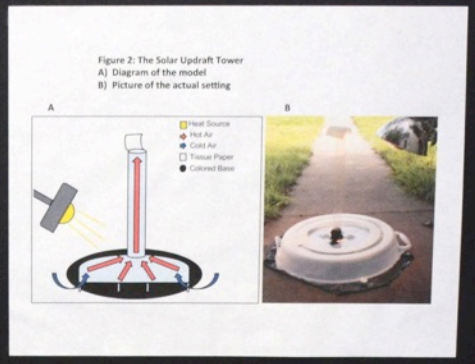
Experimenting with the Solar Updraft Tower, Part 1:

1. After testing the color absorbance, get a large trash bag of the colors that absorbed the least and the most heat (white and black).
2. Cut the trash bags so that they are the same, circular shape as the base of the box.
3. Place one of the bags on the ground, then place the solar updraft tower on top of it.
4. Mount the heat lamp about 2 feet above the ground so that the edge of the solar updraft tower is underneath it.
5. Tape the side of a piece of thin tissue paper to the top of the solar updraft tower and let the lamp heat up the base of the solar updraft tower for 10 minutes.
6. Start the timer for 3 minutes. Every time the air from the solar updraft tower lifts the tissue paper, gently push it back down.
7. Record how many times the tissue paper is lifted in 3 minutes.
8. Repeat steps 3, 5, and 7 with the other colored trash bag or base.
9. Repeat steps 3, 5, and 7 without a base and place the solar updraft tower directly on the ground (in this case the ground was red, therefore creating a red base).
10. Repeat this part of the project 3 times.

Experimenting with the Solar Updraft Tower, Part 2:

1. Tape one piece of tissue paper square to the top of the solar updraft tower. Continue to add on square until the tissue paper no longer lifts off of the tower. Record how many squares could be lifted before coming out of the tower.
2. Repeat step 1 using all 5 bases (white trash bag, black trash bag, and bare, red ground).





Results

In this project I tested the effects of color on heat absorption and how I could use this information to increase the amount of energy collected from a solar updraft tower. After placing several different colored containers under a heat lamp and taking the internal temperature of each container after 3 minutes (Figure 1), I observed that black absorbed the most heat at an internal temperature of 95 degrees Fahrenheit while white absorbed the least heat at an internal temperature of 84 degrees Fahrenheit (Figure 3). Although I did use a clear container with no paint as an attempted control variable, it did not have the same thickness as the other containers (paint versus no paint), therefore questioning the validity of this control. Ideally, a good control would have been a container with clear paint.

I then decided to use the results of the first experiment and see if they were applicable to a solar updraft tower. I constructed a simple model of a solar updraft tower based on the fact that hot air rises and cold air does not (Figure 2). By using different colored bases, my objective was to heat up air coming into the structure. The hot air projected into the tube would then spin propellers and create energy. For my specific model, there was not enough of an air flow to spin propellers so I used a slightly different system where sheets of tissue paper were placed at the top of the tube and lifted by its airflow. I measured the amount of energy by two different ways. First, I determined the number of tissue paper squares that could be lifted by each base (Table 1). Then, I measured the number of times one square of tissue paper was lifted in 10 minutes (Figure 4). The black base provided enough air to lift 3 sheets of tissue paper at once and lifted one sheet an average of 7.7 times in 10 minutes while the white base only lifted 1 sheet of tissue paper and only lifted one sheet an average of 2 times in 10 minutes. This information indicates that the color black collects a lot more heat than the color white.

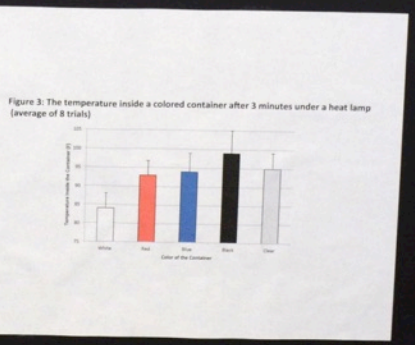
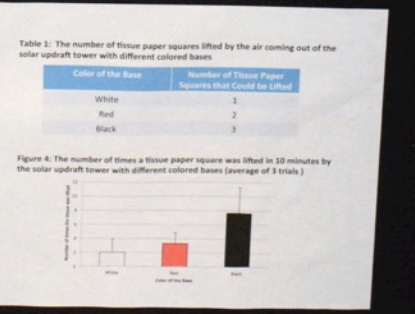


Table 1: The number of tissue paper squares lifted by the air coming out of the solar updraft tower with different colored bases

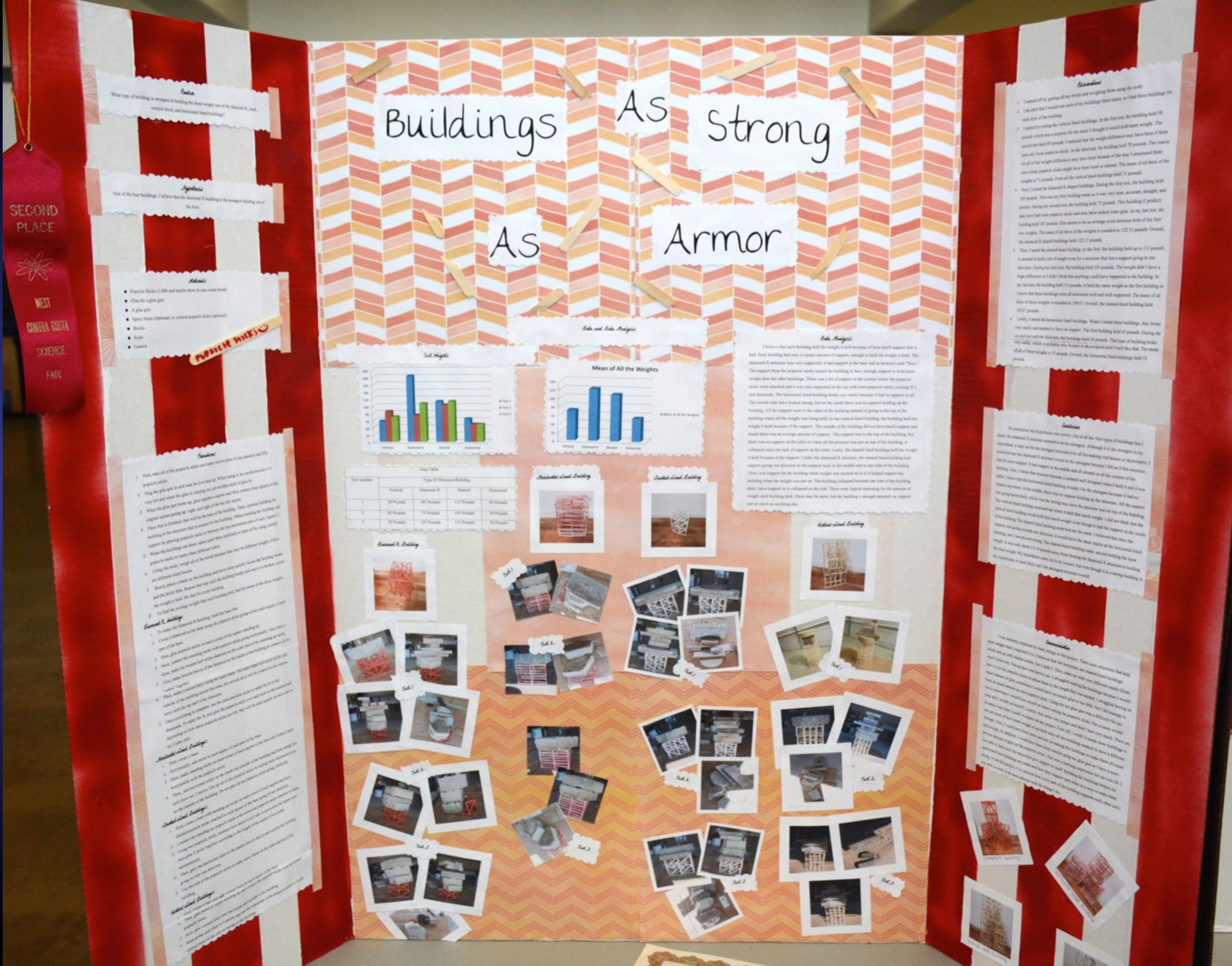
Color of the Base	Number of Tissue Paper Squares that Could be Lifted
White	1
Red	2
Black	3



Conclusion

In this project I measured the effects of color on heat absorption and found that dark containers absorb more heat than light containers (Figure 3). I then decided to see if these observations applied to an energy generating system. Compared with my previous results, I observed that a solar updraft tower with a black base provided more energy than one with a white base. These results indicate the importance of color in many different fields, especially relating to energy.

There are currently plans of building a solar updraft tower in Arizona. As far as some, based on my research, there are no plans of using a black base to increase the amount of energy collected. This should definitely be considered because of the potential energy collected. This should definitely be considered. Also, the effects of color on heat absorption is often overlooked but its importance is everywhere from the color you're wearing today and the color of the tennis court you're playing on to the color of your car in the summer and the color of the base your solar updraft tower lies on.


Buildings As Strong As Armor
SECOND PLACE
WEST CONTRA COSTA SCIENCE FAIR
Mean of All the Weights

The Hyperloop Hang-up

Problem: Can transportation capsules overcome the Kantrowitz limit, in a partial vacuum tube environment?

esis: I think with a little tweaking, the capsules can overcome the fluid choke point. s a bullet train design, such as the hypothetical Hyperloop, would be able to overcome cushion build-up in front of the capsule.

tion/ Additional Information: Elon Musk's Hyperloop inspires this project. The rig up is a modified model of instructions I found on Instructables. The rig is meant to g-Pong balls, not cardboard tubes, but it was easily adapted.

k himself saw this problem stating, "moving at high speed through a tube containing a minimum tube to pod area ratio below which you will choke the flow. What this ot if the walls of the tube and the capsule are too close together, the capsule will o syringe and eventually be forced to push the entire column of air in the system." not allow the capsule to reach the much hoped for top speed of 760 miles per ach 1, or anywhere close.

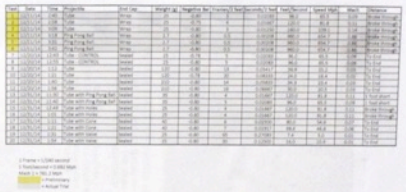
Materials:

1 - 6 foot pipe with an interior diameter of 1.5 inches
1 - Vacuum pump (used for servicing refrigerators, but can also can evacuate air)
Epoxy
Lots of assorted tape
Cardboard tubes
Eye protection
1.5 in PVC pipe tee
Gift-wrap plastic sheets
Cardboard sheets
Large binder clips
Knife on a pole
Slow Motion Camera (iPhone)

Procedure: (This does not include the construction of the rig)

1. Cut two squares out of the cardboard about 3 by 3 inches.
2. Cut a circle in the cardboard with a diameter of about 2.75 in
3. Cut a piece of plastic wrap and place it on the square, over the circle, and tape it down tightly.
4. Assemble the sandwich of cardboard, plastic wrap, then cardboard, and secure it with large binder clips.
5. Tape the end you want to fire at with three pieces of packing tape, and set up slow motion camera pointed at tube.
6. Place a cardboard tube in the breach, and turn on the vacuum pump, and put on eye, and eye protection.
7. Quickly put the gift-wrap sandwich on the end, so it covers the end of the tube.
8. Wait for the pressure to go down, until it hovers at a pressure of around -0.8 bar.
9. Stand back, and pump the plastic with the knife.
10. Repeat steps 3-9 until enough data has been recorded.

The Pressure Setup



The Set-Up

The Plastic-Wrap Seal (For Trials)

Marks Left In A Piece of Wood By A Tube

The Vacuum Tube

Tube Sled at an aluminum can

Results: I tested seven different designs. The Control was just a plain cardboard tube. I tested two designs with Higher Weight, 120 g and 210 g, to see if the extra inertia would overcome the cushion. The Ping-Pong Balls on the end of the tube were to see if it would improve the aerodynamics. The bullet train inspired Cone design was another attempt to improve aerodynamics. The Valve design was to see if the valve could relieve the front air pressure build up when it became greater than the pressure pushing the tube. The Tube with Holes design was a concept to disperse the front air pressure to the sides, creating an additional air cushion to reduce the friction of the capsule against the pipe wall.

During the preliminary trials, the muzzle was also covered in plastic wrap, allowing the projectile to shoot out. However, during the actual tests, the end was securely sealed with three layers of heavy-duty tape. This created the air cushion at the end that the design concepts attempted to overcome.

The table summarizes the different design's results, with the chart showing the average of the two trials per design. The Tube with Holes design was the clear winner. This model was the only one that broke through the seal both times it was tested. Not only did the tube shoot through the pipe, but also kept going for ten feet outside the tube. The Ping-Pong Ball design also beat the control by an average of 6 Mph, but could not break the seal. The shocker was that that the higher 210 g weight design went faster than the lower 120 g weight, but this might have been an outlier. The Valve design failed and broke up both times.

Explanation:

The principles at work are air pressure and air resistance. When the plastic is punctured, the air wants to fill in the vacuum of the tube, but there is a tube in the way, causing the tube to rapidly accelerate. It keeps going until the last foot of the pipe when the cushion of residual air pinned down by the tube slows it down, not puncturing the tape. This air cushion can be manipulated by changing the shape of the tube, the more aerodynamic the tube, the less of an air cushion, and vice versa. The main problem for the Hyperloop (besides the price) is the fluid choke that does not allow the capsule to reach supersonic speeds. Then again at the end of the tube, the air pressure would stop the capsule about 3.47 miles from the end, but if the air cushion were not there, the capsule would speed to a very tragic end. This is what Mr. Musk was talking about, the choke point needs to high enough to avert catastrophe, but also get the capsule to the end of the tube. Hence this project.

Conclusion: My hypothesis was correct. I came up with a design that beat the control. The Tube with Holes design was an unexpected winner with both speed and distance. The best design had a combination of friction reduction and reduction of the front air cushion. This result supports the Hyperloop design, which uses air cushion "skis" to eliminate rolling friction. As noted in a description of the Hyperloop design in Wikipedia:

"In the Hyperloop concept, an electrically driven axial fan and air compressor would be placed at the nose of the capsule in order to "actively transfer high pressure air from the front to the rear of the vessel," resolving the problem of high speed transport in a tube that is not a hard vacuum. wherein pressure builds up in front of the vehicle, slowing it down. A fraction of the air is shunted to the sides for additional air pressure, augmenting that gained assembly from its inlet shape." - Musk, Or The Hyperloop

FIRST PLACE
WEST CENTRAL BASIN
SCIENCE FAIR

10th Grade

Biological Science

How Well can you Smell ?

SECOND PLACE
WEST CONTRA COSTA SCIENCE FAIR

My science fair project

What my science fair project will be about is: how well do people in different age groups smell the same items and how well do they get most of them right out of ten. What my objective is to see what age group that I put together have a better sense of smell, because at different ages your sense of smell changes from good to bad or from bad to good.

Hypothesis

Do people of ages 30 and over have a better sense of smell because they have more life experiences compared to ages 13-17 and ages 18-29?

Materials

- 10 people ages 13-17
- 10 people ages 18-29
- 10 people ages 30 and over
- Blind fold
- Scissors
- 3 pieces of Paper
- A pen; to write
- Zip block bags
- A lunch box
- 10 containers with lids
- 10 items for the testers to smell
  - Flowers
  - Rose Marie
  - Cinnamon
  - Lemons
  - Perfume
  - Alcohol
  - Chocolate
  - Hand soap
  - Taco seasoning
  - Coffee beans

Procedure

1. Get 10 containers
2. Get the 10 items that you gathered for the 30 people to smell and cut the items up to fit in the small containers, then close the containers to keep the smell from fading.
3. Get your lunch bag that's flat and put your containers so they won't tip and open.
4. Make a chart on a pieces of paper; so you can put an "X" if they got it wrong
5. Make that same chart for the other age groups (2 more charts)
6. get 10 people that are ages 13-17 (teens)
7. get 1 person out of the 10 people and blindfold them, make sure the NO OTHER PERSON IS IN THE ROOM or they will know the answers
8. Tell them that "there will be some smells that are similar but there not, each container is different and you can't use any other senses but your nose; you can't touch the items with your nose either. You also have to tell your answer out loud, "I don't know" is not an answer"
9. Make them smell the items 1-10 blindfolded.
10. As they tell you there answer out loud, you mark down if they got it wrong or right.
11. Repeat steps 6-10 again to the other 9 people left from that age group and record all their answers down on the chart
12. Get 10 people ages 18-29 (young adults)
13. Repeat steps 7-10 again to the people ages 18-29 and record their answers on another sheet of paper
14. Get 10 people ages 30 and over (middle age)
15. Repeat steps 7-10 again to the people ages 30 and over and record their answers on another sheet of paper
16. After getting all the people to smell 10 items and seeing your recoding on what they got right and what they got wrong, calculate how many each age groups got more items right and how many got more items wrong.
17. Make a graph showing your result

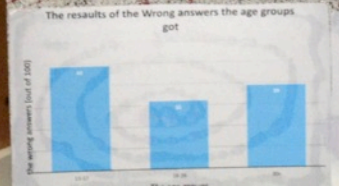
Key to my chart

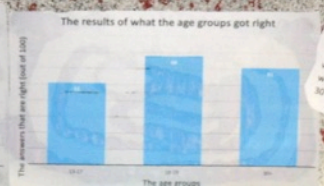
→ Check box means the person smelling got it right!

→ X means the person smelling got it wrong!

Conclusion

In conclusion, my hypothesis did not match with my results. Ages 30 and older did get a better score than ages 13-17 but not ages 18-29. I'm still very shocked that ages 13-17 got the lowest score. This experiment was fun and to see people's reactions when they smelled the items. I recommend this experiments for many people so they can test their friends and family to see how well they smell simple house hold items.





My Result

After testing my experiment I found out that ages 30 and up do have a better sense of smell than ages 13-17 but not as better as ages 18-28. There are some people ages 30 and up with a great sense of smell, which is good, when you're that age. I'm shocked that ages 13-17, which is my age group have a worse sense of smell than 18-29 or ages 30 and older. My hypothesis did not match with my results.

SECOND PLACE

WEST CONTRA COSTA SCIENCE FAIR

Portal To The Present

Question:

Are Lemon sharks and Sand Tiger sharks from the paleocene similar to their present day relatives?

Hypothesis:

Both Lemon Sharks and Sand Tiger Sharks have not changed physiology since the paleocene.

Intro:

Sharks are the ultimate predators. This experiment's goal is to prove that Lemon sharks and Sand Tiger sharks have not changed much since the paleocene era. This experiment will be using teeth as a basis in this investigation because they are abundant and many shark tooth fossils have been found.

The paleocene epoch (meaning old recent) was a geologic time period that started just after the cretaceous. It lasted from 65 million years ago to 56 mya and is part of the cenozoic time era. Sand tiger sharks and lemon sharks first appeared during this time period, but have they changed since then?

Materials:

- Fossil shark teeth (Sand Tiger shark and Lemon shark)
- Magnifying glass
- A detailed photo of a modern shark tooth (Sand Tiger shark and Lemon shark)

Procedure:

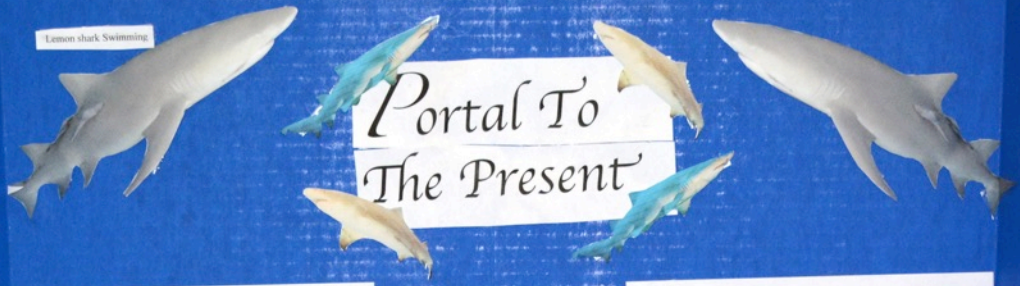
1. Get a hold of some fossilized shark teeth (In this experiment Sand Tiger shark and Lemon sharks were used)
2. Acquire a detailed photo of Tiger shark teeth to use as a comparison.
3. Compare the Sand Tiger shark fossil tooth and the photo: the shape and size of the cusplets, root lobes, crown, crown tip, serrations, and bourlettes.
4. Note the similarities and/or differences in the teeth.
5. Repeat steps 3 and 4 with several other Sand Tiger shark teeth fossils with the same photo.
6. After having compared the key features of the teeth, move on to the Lemon Shark.
7. Find a good photo of a Lemon Shark tooth to use in a comparison.
8. Compare the fossil tooth to the picture: the shape and size of the cusplets, root lobes, crown, crown tip, serrations and bourlettes.
9. Note the differences and/or similarities in the teeth.
10. Repeat steps 8 and 9 with other fossil teeth of this shark specie.
11. Once done with both comparisons analyze all data and draw a conclusion.

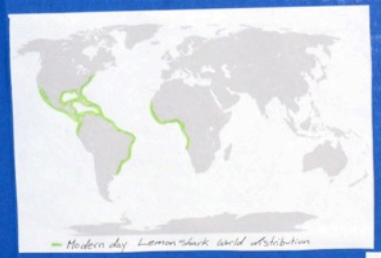
Moderndday Lemon Sharks

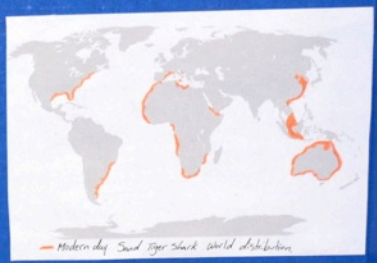
Modern day Lemon sharks developed behaviors and adaptations that allow them to survive. At an average length of 3.5 meters (11 feet), these sharks thrive in tropical coastal areas such as the areas around florida. They are carnivores and have been especially adapted to hunting and eating crustaceans, rays and fish. One technique Lemon Sharks use to hunt is churning up the sand at the bottom of the ocean and reefs to make their prey scurry or to make them visible.

The structure of a Lemon Shark's tooth is perfect for the type of prey it eats. It's pointed, wide, and flat, making it easier to catch fast moving prey. The shark would pursue his prey and clench onto it with it's teeth, either killing it or giving it critical damage that would weaken it. Their teeth have small serrations on the sides and larger serrations at the top near the root lobe. This feature would allow them to have a better grip on their prey.

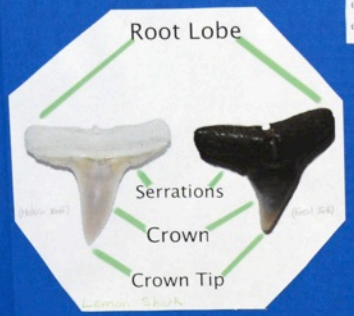
Lemon sharks are usually yellowish brown in color. This color helps them to blend in with their habitat. They give birth to an average of 4 to 17 pups which they do not take care of. However, they do form social groups where the

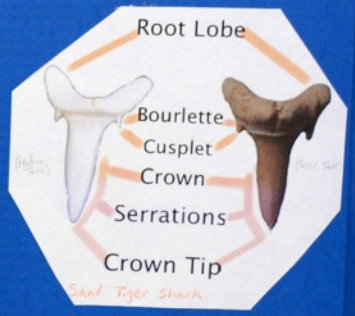






The tooth on the right of each picture is one of the fossil teeth I used in this experiment. The tooth on the left of each picture is the photo I used as a comparison. All the parts are labeled so that one may compare the two specimens.





Lemon Shark Fossil Teeth Findings

The Lemon Shark teeth, both the fossil and the modern, have very much in common. First off, they both have very large serrations on the bottom of the root lobe on both sides. There are also smaller serrations on the sides of the crown. Another thing that is very apparent, is the curvature of the root lobe at the top (see the picture labeled in green). The "dip" was very shallow, especially in comparison to the Sand Tiger shark teeth, which have a much larger "dip." However, at the root lobe on the modern tooth, there is a bump that is not on the fossil. I compared this with other Lemon shark teeth and fossils and concluded that this was just because of the way the tooth fell out of the mouth. On the other teeth this section was smooth. Both teeth also lacked a bourlette and a cusplet which are normally located under the root lobe.

Sand Tiger Shark Fossil Teeth Findings

The fossil and the modern teeth of the Sand Tiger shark almost completely matched. They had a large outward pointing root lobe with a large dip. The two teeth also had a distinct bourlette and cusplet under the root lobe. As for the serrations, they ran down the entire side of the teeth starting from under the root lobe to the crown tip. However, the crown itself was smooth.

Another feature that was similar in the two teeth was in the crown itself. The crown would start out after the root lobe and become wider up until the center of the tooth's crown, then it would become smaller until it reached the crown tip. The root lobes in the Sand Tiger shark were much thicker and curved than the lemon shark's.

Moderndday Sand Tiger Sharks

Moderndday Sand Tiger sharks grow to an average length of 3 meters (10 feet). They are carnivores and their diet typically consists of fish that are found where they live. In rare cases they will eat smaller sharks. Sand Tiger sharks are found in moderate temperature waters like the coastal areas around Africa and Australia. These sharks have teeth that are especially adapted to catching fish.

The teeth of a Sand Tiger shark are long, narrow, and pointed. They have an overall shape that is slightly triangular. They have a large dip at the root lobe (the top of the tooth) and have serrations along the tooth's crown. Unlike the lemon shark, the Sand Tiger shark has a bourlette and a cusplet located directly under the root lobe. Interestingly, the tooth's size gets wider around the middle of the tooth's crown then gets narrower until it reaches the crown tip.

Sand Tiger sharks are brownish in color which match perfectly with their surroundings. Like lemon sharks they are social animals and can be found in groups. Sand Tiger sharks give birth to live young. Bizarrely, inside the womb the more developed shark pups will eat their siblings. Sand Tiger sharks are shy creatures and spend much of their time hiding. The chances of them attacking are very slim unless provoked.

Conclusion

From the findings of this experiment one may conclude that these two shark species (Lemon and Sand Tiger) have not changed physiologically since the paleocene. Although the color and composition of the fossil and modern teeth were different due to fossilization, the size and shape of the fossil teeth were nearly identical to those of the modern teeth of the same species. This shows that the sharks' diet and hunting patterns have not changed since the paleocene. In nature, living things evolve and adapt to their surroundings. For example, adapting to a different hunting style or hunting different prey would have affected the shape and structure of the shark's teeth. If the environment in which a creature lives in does not change, then that organism has no need to change.

Since the fossils and modern day teeth shared all the minute details, down to some of the smallest details, one may conclude that Lemon and Sand Tiger sharks have not changed physiology since the paleocene.

Information/Research Sources:

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Photo Sources:

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10th Grade

Physical Science

Candle Race

THIRD PLACE
WEST CONTRA COSTA SCIENCE FAIR

Hypothesis

The white candle is going burn faster because it doesn't have dye to make it colorful.

Materials

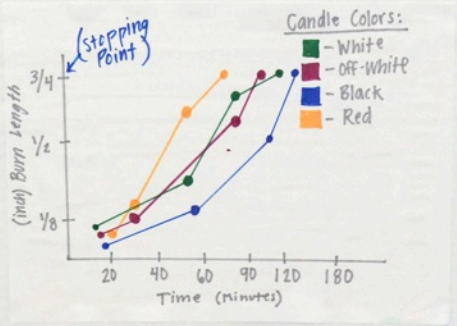
- candles (Red, White, off-white, and black)
- Lighter
- Scissors
- Modeling Clay
- Ceramic plate
- Stop Watch
- Pencil
- Notebook (to record results)

Procedure

1. Make sure all candle wicks are equal in length
2. Mark the candle about ¼ of an inch down
3. Place some clay on the plate. It should cover the plate all the way at about a ½ inch thick.
4. Push candles into clay, putting them 1-2 inches apart
5. Get your stop watch ready and light one of the candles
6. As soon as the candle is lit start the stop watch
7. Record the time when the candle melts to the line.
8. Repeat for each candle
9. Record results in Notebook
10. Compare each result when done

Duration

- 1st Red: 1 hour 13 minutes
- 2nd Off-white: 1 hour 36 minutes
- 3rd White: 1 hour 50 minutes
- 4th Black: 2 hours 4 minutes



Observations

- Red candle is burning faster than the others.
- I've noticed that the angle of the candle affects the way it burns.
- Beginning to concave.
- Burning deeper in the inside than the outside.
- Flames have gotten larger.
- Candle's wax is draining from the side of the candle through a melted slit
- Red is burning faster than the rest
- Red was first to melt

Results

At first, the white candle was burning a lot faster than the rest, but then the off-white began to melt mysteriously faster than the rest. After about 30 minutes or so the red began melting profusely and was passing the off-white and the others by about 1/8th of an inch. The red finished first at 1 hour 13 minutes. The off-white got second at 1 hour 36 minutes. The white got third at 1 hour and 50 minutes. The red got fourth at a very slow, 2 hours 4 minutes. My hypothesis was wrong; the white candle didn't melt first, the red one did.

SECOND PLACE

WEST CONTRA COSTA SCIENCE FAIR

Leaky Clues to Dam Design

Introduction

Electricity has truly shaped our world as it is today. It has enabled us to create technology that makes our lives easier, such as phones and computers. In today's world, a popular way to create electricity is through hydropower, using water as a source of power. To create electricity, the flow or the fall of water needs to contribute sufficient [illegible] of pressure to turn the blades of a turbine and run a generator. Through dams, we dam and raise great height to form pressure. To create a [illegible]mount of pressure for a generator to run, the [illegible]shore a lot of water, causing the reservoir height [illegible]refore creating greater water pressure. [illegible]e experiment, I will be creating a model of a dam [illegible]t to find where the water pressure is at its [illegible]reate electricity, I will drill holes at different [illegible]he dam will, and determine at which height will [illegible]reatest pressure based on the distance of the [illegible]ing from the hole.

Question

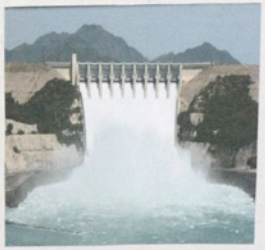
[illegible]w does reservoir height affect [illegible]ydroelectric power production?

Hypothesis

If the height of the reservoir is taller, then it will produce a more powerful hydroelectric power production through the great water pressure a taller reservoir will provide.

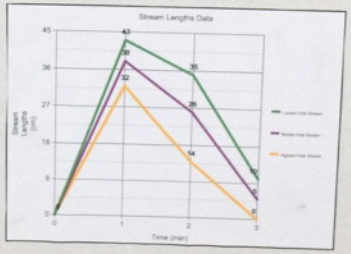
Materials

- PVC pipe with cap
- Hot water
- Permanent marker
- Ruler, metric
- Drill
- Duct tape
- Tape measure
- Graduated cylinder, or bucket or [illegible]
- Timer
- Lab notebook
- [illegible]



Data

Time (min)	Lowest Hole Stream Length (cm)	Middle Hole Stream Length (cm)	Highest Hole Stream Length (cm)	Reservoir Height (cm)
0	0	0	0	60
1	43	38	32	42
2	35	26	14	37
3	10	5	0	19



Procedures

Preparing your PVC pipe

1. Draw the PVC pipe out so that it's clean.
2. With the ruler and the permanent marker, make three marks on the wall of the PVC pipe. Drill each mark until it pokes through the wall of the PVC pipe.
   1. Make the first mark in the center of the wall, 7 inches up from the bottom.
   2. Make the second mark 2 inches to the left of the center mark and 2 inches up from the bottom.
   3. Make the third mark 2 inch to the right of the center mark and 12 inches up from the bottom.
3. Cover the three drilled holes with a strip of duct tape, pressing on the tape gently to seal the hole.
4. Take the PVC pipe to the area where you plan to do the teaching, such as a [illegible], a garage, or an outdoor area where it is safe to experiment with [illegible]flowing water.

Testing the PVC pipe

1. Fill the drawn in your lab notebook what you think will happen when you fill the [illegible] pipe up with water and measure the years of four ropes.
2. Place three fish tubes, or your lab notebook.
3. Place your PVC pipe in the test area on top of the wagging wheel, elevated system, [illegible] or [illegible].
4. Extend a rope measure from the base of the PVC pipe out about 10 inches and [illegible] so that it rests in about in front of the PVC pipe.
5. Fill the PVC pipe up to the top with tap water.
6. Set your timer ready and record to zero.
7. Remove the duct tape from the PVC pipe and immediately start the timer. This will be your starting time (time is 0 min).

8. Measure and write down the length of each stream of water in the data table. Then immediately refill the PVC pipe to the top with water. Measure the height of the reservoir (from the bottom of the PVC pipe to the surface of the water), and record the measurement in the data table.
9. Repeat steps 7 and 8 each minute until the last of water in the PVC pipe reaches the bottom of the lowest hole.

Analyzing Your Data Table

1. Make a line graph using the data table. Put time (min) on the x-axis and stream length (cm) on the y-axis. Be sure to label the axes. Plot each of the three stream lengths over time on the same graph. Use a different color for each stream.
2. Write down the slope of each line. Which stream length had the steepest slope? Which stream length had the smallest slope? What does the slope tell you about the stream length over time? Is it the same or different for each hole?

Results

The result I have received after my experiment is that the lowest hole stream spurt out water at a longer distance than both the middle and highest hole stream. The middle hole stream did, however, spurt at a longer distance than the highest hole stream. In all, the water spurt out of the lowest hole stream for a longer amount of distance and time compared to the other two holes.

Conclusion

My results do not support my hypothesis of the taller reservoir height producing a more powerful hydroelectric power. The results I received proved the exact opposite of my hypothesis. I surmise that the lower reservoir height produced a greater water pressure than the taller reservoir height.

11th Grade

Behavioral Science

Does Chewing Gum Help Increase Speed & Accuracy?

FOURTH PLACE
WEST CENTRAL COUNTY SCIENCE FAIR

Objective:

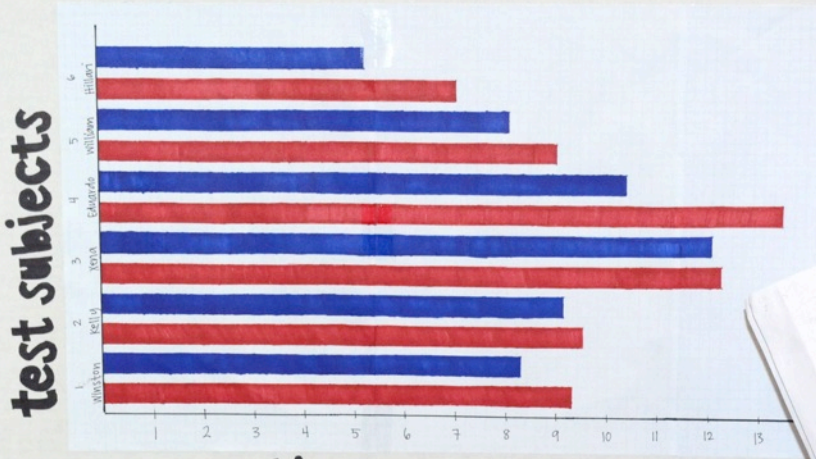
to determine whether chewing gum can help people with focus and concentration

Hypothesis:

chewing gum does help you stay focus and helps with concentration - may improve memorization

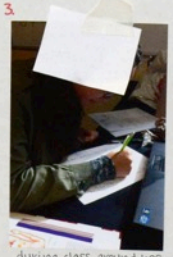
Materials:

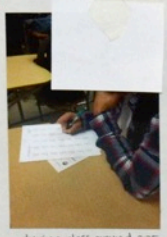
- test subjects (five people)
- gum
- pencils
- timer
- math worksheets
- paper for recording & analyzing data

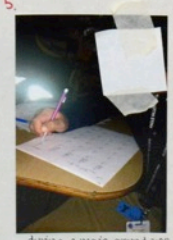


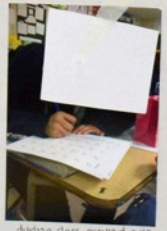
1. 
at home around 9:30 (quiet noise level)

2. 
at lunch around 12:30 (normal/loud noise level)

3. 
during class around 1:20 (normal noise level)

4. 
during class around 2:25 (loud noise level)

5. 
during a movie around 5:00 (low noise level)

6. 
during class around 2:40 (normal/loud noise level)

Data-Recordings

Test Subject	Wkst 1	Wkst 2	Difference
Winston	9:30.43	8:30.04	1:00.39
Results	3	3	-2
Kelly	9:55.50	9:09.95	0:45.55
Results	2	4	-2
Xena	12:20.83	11:01.29	0:19.54
Results	3	3	0
Eduardo	15:36.85	10:24.21	5:12.64
Results	3	2	5
William	8:59.48	8:01.99	0:58.09
Results	3	10	-3
Hillary	6:59.43	5:19.56	1:39.23
Results	1	1	0

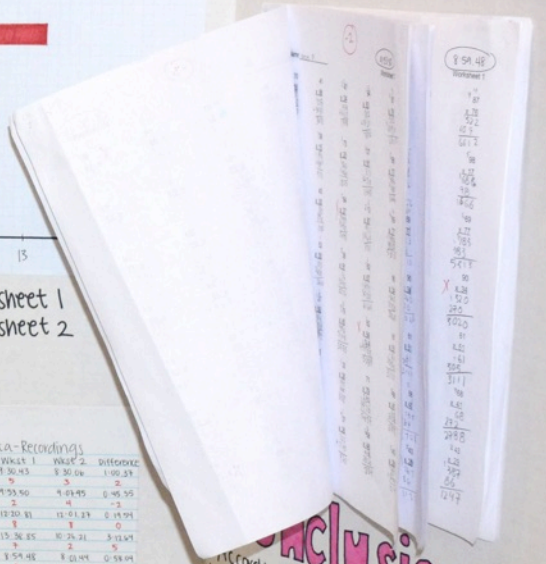
factors:

- environments
- gum flavors
- pencils
- time limits
- time of day

Procedures:

1. give each test subject two different math worksheets
2. have subjects complete both worksheets but chewing gum while completing one of the worksheets
3. record how long it took to complete each of the worksheets
4. Score worksheets for number of problems correct
5. Analyze results

Results:



Conclusion:

According to my project, chewing gum does help with focus and concentration. All test subjects including myself have finished Worksheet 2 faster than Worksheet 1 and some improved their scores. There were different factors that contributed to this experiment causing different results. For example, the different environments and flavor of gum seem to play a huge role. Those who chose to chew mint flavored were more concentrated than those who chose watermelon. Test subjects seem to be more distracted during Worksheet 1 even in the environments they were put into. Mistakes made in Wkst 1 were completely wrong unlike Wkst 2 answers were off by one number. Overall, chewing gum did help with concentration throu

FOURTH PLACE

MST CENTRAL OHSA SCIENCE FAIR

IS THAT A REAL SMILE?

Objective

To determine whether people can tell the difference between a real (genuine) and a fake (forced) smile by looking at photographs of varying smiles.

Question

Can people tell the difference between a fake (forced) and a real (genuine) smile by looking at photos of a person's smile?

Abstract

When you take a picture is your smile real or do you fake it? There are those people who genuinely smile and there are those who smile to be polite. There are also those people who can't take a smile and those who don't. If you were there when the pictures were being taken it may be easier to tell whether the smiles are real or not. For this experiment you are only given a snapshot of when the picture was being take and with only that information we can find out if people are able to tell the difference between the smiles.

Background

When you smile for a picture do you really mean it or are you just smiling to be polite or look happy? Many people may fake a smile and sometimes there are those who can fake a smile really well that it actually looks genuine. There are also those people who you could tell right off the bat that they're faking a smile. In person it may be easier to tell what kind of smile they have because you are able to look at how they are behaving. When you look at how someone acts it helps you determine what kind of mood they may be or what they may be feeling to help determine what kind of smile they have. When you look at how they act in person you don't have those options seconds, when they see all the different pictures you are given, how in the volunteers that may all the information you are given, and interpret each smile different. They may, and they might be right but there are also times when two smiles can be completely different. There may be times when the smile does not go together with how the person is acting or the timing is off and vice versa. It's not always so cut and dry. You want to be able to tell the difference between the two smiles and you don't get that. It's not how you want it to be. Sometimes the camera doesn't capture it right. It may not be the timing is the point of when a person may




Data

Person #	Pic #1	Pic #2	Pic #3	Pic #4	Pic #5	Pic #6	Pic #7	Pic #8	Pic #9	Pic #10	# correct
1	F	R	F	F	R	R	F	F	R	F	5
2	F	R	F	F	R	R	F	F	R	F	5
3	F	R	F	F	R	R	F	F	R	F	5
4	F	R	F	F	R	R	F	F	R	F	5
5	F	R	F	F	R	R	F	F	R	F	5
6	F	R	F	F	R	R	F	F	R	F	5
7	F	R	F	F	R	R	F	F	R	F	5
8	F	R	F	F	R	R	F	F	R	F	5
9	F	R	F	F	R	R	F	F	R	F	5
10	F	R	F	F	R	R	F	F	R	F	5
11	F	R	F	F	R	R	F	F	R	F	5
12	F	R	F	F	R	R	F	F	R	F	5
13	F	R	F	F	R	R	F	F	R	F	5
14	F	R	F	F	R	R	F	F	R	F	5
15	F	R	F	F	R	R	F	F	R	F	5
16	F	R	F	F	R	R	F	F	R	F	5
17	F	R	F	F	R	R	F	F	R	F	5
18	F	R	F	F	R	R	F	F	R	F	5
19	F	R	F	F	R	R	F	F	R	F	5
20	F	R	F	F	R	R	F	F	R	F	5
21	F	R	F	F	R	R	F	F	R	F	5
22	F	R	F	F	R	R	F	F	R	F	5
23	F	R	F	F	R	R	F	F	R	F	5
24	F	R	F	F	R	R	F	F	R	F	5
25	F	R	F	F	R	R	F	F	R	F	5
26	F	R	F	F	R	R	F	F	R	F	5
27	F	R	F	F	R	R	F	F	R	F	5
28	F	R	F	F	R	R	F	F	R	F	5
29	F	R	F	F	R	R	F	F	R	F	5
30	F	R	F	F	R	R	F	F	R	F	5
31	F	R	F	F	R	R	F	F	R	F	5
32	F	R	F	F	R	R	F	F	R	F	5
33	F	R	F	F	R	R	F	F	R	F	5
34	F	R	F	F	R	R	F	F	R	F	5
35	F	R	F	F	R	R	F	F	R	F	5
36	F	R	F	F	R	R	F	F	R	F	5
37	F	R	F	F	R	R	F	F	R	F	5
38	F	R	F	F	R	R	F	F	R	F	5
39	F	R	F	F	R	R	F	F	R	F	5
40	F	R	F	F	R	R	F	F	R	F	5

F- Fake smile
R- Real smile

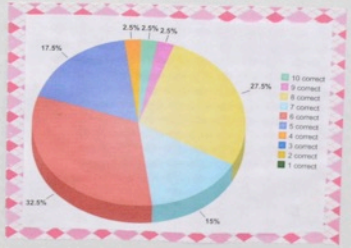
*Highlighted letters means that is the wrong answer.





Results

Possible number of correct guesses	Number of people who got that amount correct (40 people total)	Percentage
10	1	2.5%
9	1	2.5%
8	11	27.5%
7	6	15%
6	13	32.5%
5	7	17.5%
4	1	2.5%
3	0	0%
2	0	0%
1	0	0%
0	0	0%



Hypothesis

If I show 40 volunteers ten pictures of people varying fake and real smiles and have them guess what kind of smile it is I think everyone will get 4 or more right- at least 10% of the volunteers will get 4 right , 40% will get 5 or 6 right, 45% will get 7 or 8 correct and 5% will get 9 or 10 right.

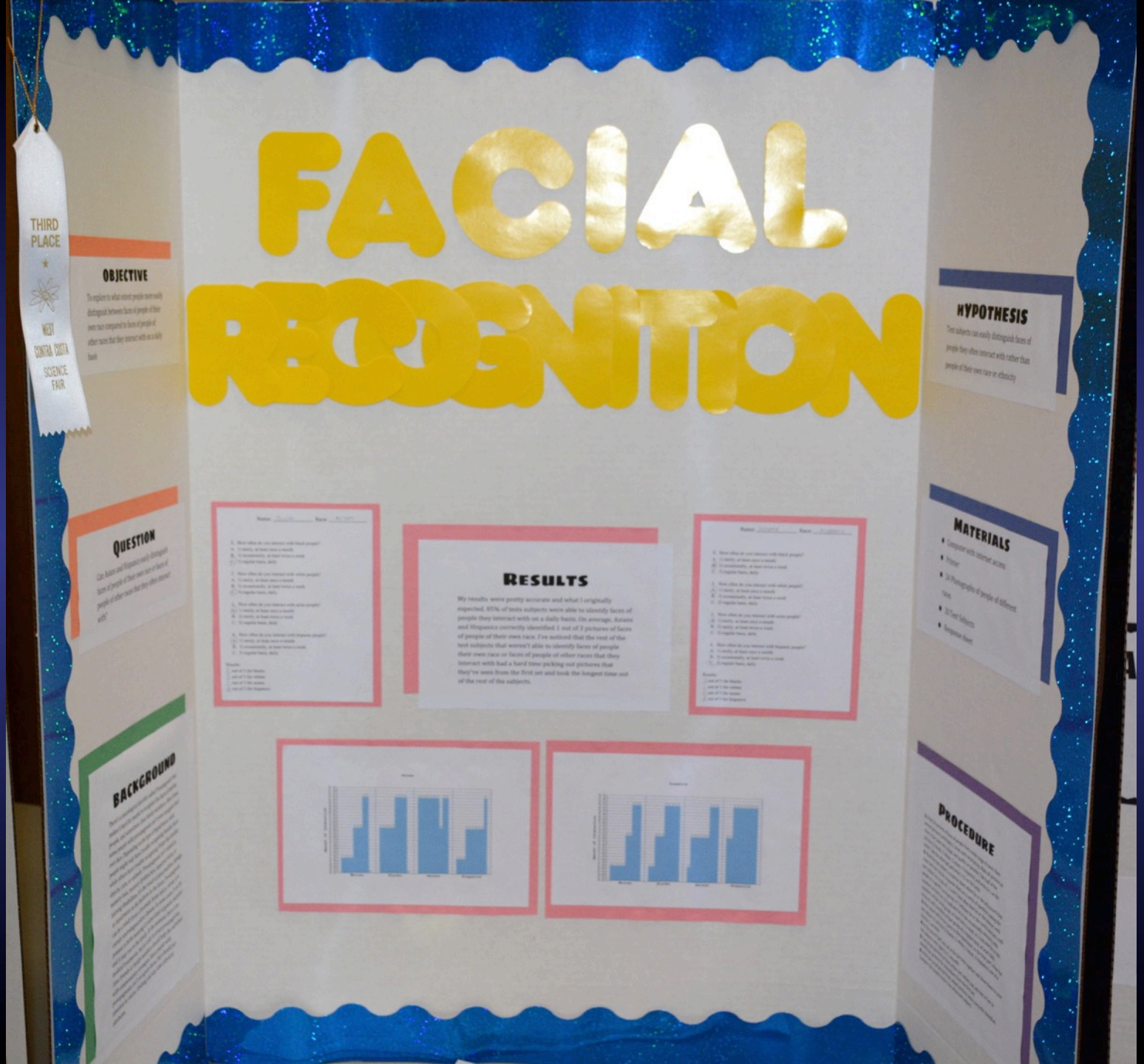
Materials

- 40 volunteers
- At least 10 pictures of people varying real and fake smiles
  - You can get them from the internet or you can take your own pictures
- Camera - if you decide to take your own pictures
- Graph paper or notebook - to record your volunteers answers

Procedure

1. Find or take at least 10 pictures of people smiling and print out.
   - Make sure you know whether the person's smile is genuine or forced.
2. Once the pictures you found or took show your volunteer the pictures one at a time.
3. For each picture ask your volunteer if they think the smile is real (genuine) or fake (forced).
   - Make sure you record all of your volunteer's answers for every picture.
4. Repeat Step 2 and 3 for every volunteer.
5. You can do this step if you go or wait until the very end. Calculate the number of correct answers for every volunteer.

Conclusion


THIRD PLACE
WEST CONTRA COSTA SCIENCE FAIR
FACIAL RECOGNITION
OBJECTIVE
QUESTION
BACKGROUND
HYPOTHESIS
MATERIALS
PROCEDURE
RESULTS
My results were pretty accurate and what I originally expected, 85% of tests subjects were able to identify faces of people they interact with on a daily basis. On average, Asians and Hispanics correctly identified 1 out of 3 pictures of faces of people of their own race. I've noticed that the rest of the test subjects that weren't able to identify faces of people their own race or faces of people of other races that they interact with had a hard time picking out pictures that they've seen from the first set and took the longest time out of the rest of the subjects.

Are Your Choices Biased?

by Grecia Ortiz

THIRD PLACE ★

WEST CONTRA COSTA SCIENCE FAIR

Question

Are your involuntary movements biased?
Do you think that your favorite color can affect the color of M&Ms you pick up without thinking?

Hypothesis

My Hypothesis is that your motor coordination is affected by personal preferences, like your favorite color.

Objective

To test and figure out whether color preferences affect repetitive tasks that require motor coordination, like picking up small objects quickly.

Materials

- 50 M&Ms of each color
- Large bowl
- Participants
- Sandwich baggies
- Permanent markers
- Notebook

Data

Chart #1

Favorite Color M&M	Number of M&M's Chosen of Each Color						Total Number of M&M 's Chosen
	Red	Orange	Yellow	Green	Blue	Brown	
Red	36	18	25	14	18	9	120
Orange	3	5	3	1	6	3	20
Yellow	4	3	5	3	2	3	20
Green							
Blue	3	7	7	3	11	9	40
Brown							

This chart shows the number of M&M's picked out sorted by the favorite color of the person. It is the overall tally of all the colored M&M's picked for that category, followed by the total number of M&M's chosen. This data shows how there were more M&M's picked out of the favorite color, then any other color. 6 people picked red, 1 person picked orange, 1 person picked yellow, 2 picked blue and none chose green.

Chart #2

Favorite Color M&M	Percentage of M&M's Chosen of Each Color					
	Red	Orange	Yellow	Green	Blue	Brown
Red	30%	15%	19%	13%	15%	7.5%
Orange	15%	25%	15%	5%	25%	15%
Yellow	20%	15%	25%	15%	10%	15%
Green						
Blue	15%	17.5%	17.5%	7.5%	21.5%	15%
Brown						

This chart shows the normalized data in percentages. The percentages were found by dividing the number of M&M's chosen for each color by the number of total M&M's chosen out for that same color. With the data in percentages it is much easier to see that more M&M's were picked of the person's favorite color. The experiment is pretty accurate due to the fact that the people were asked to do random tasks, then after they were finished they were asked their favorite color. This reduces the chance of biased data, due to the subject thinking of his or her favorite color

Procedure

1. Place the M&Ms in the large bowl. (50 of each)
2. Ask the first participant to pick out M&Ms as quickly as possible only using two fingers and putting the other hand behind them, placing the M&Ms on the table.
3. When they get to 20 M&Ms on the table ask them to stop.
4. Ask them their favorite color and write it on the baggie and place the M&Ms they took out inside of it.
5. Replace the M&Ms the participant took out of the bowl.
6. Repeat steps 2-5 for the rest of the participants.
7. Collect data and make calculations.

Results

From my work I learned that our involuntary choices are particularly biased. In the data it shows that generally you pick out more M&Ms of the same color as your favorite color.

Conclusion

My hypothesis was correct. According to the data personal preferences do affect our involuntary motor movements.

MEASURING YOUR TASTE THRESHOLD

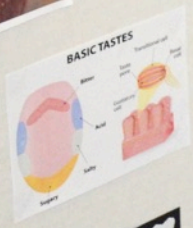
SECOND PLACE
WEST CONTRA COSTA SCIENCE FAIR

OBJECTIVE

To determine your threshold of taste for sweetness, sourness, and saltiness and to find the lowest concentration of solution that still has a distinct taste for salt, sugar, and vinegar.

BACKGROUND

Our taste perception is peculiarly sensitive and is a protective sense. Your taste threshold is known to be genetic of specific receptors. The definition of taste threshold is the minimum concentration at which sensitivity of taste is possible because of our taste buds. Taste buds are located on small bumps on the tongue called papillae. There are specific parts made up of about 50 to 150 taste receptor cells. There are specific parts where you can detect a primary taste: sweetness on the tip, saltiness on the front edge, bitterness on the back, and sourness on the sides of your tongue. In this experiment, it will present taste thresholds for sweet, sour, and salty solutions. This experiment will be tested on 4 individuals with a certain age, ranging from 5-70 years old because different ages have different tastes. The test will start with a 10% solution and use the process of serial dilution to make series of solutions, each 10-fold weaker than the proceeding one (1%,0.1%,0.01%). This will show the highest and lowest concentration of a person's taste threshold out of the three solutions.



HYPOTHESIS

I believe that people will taste salt and vanger the best at any concentration because salt is an ionic bond which has a stronger taste than sugar and vinegar is a strong acid that usually stands at attention.

MATERIALS

- Table salt or sodium chloride (10g)
- Granulated sugar or sucrose (10g)
- Vinegar (20mL)
- Water, preferably distilled
- Stirring rod or spoon
- Gram balance
- 100 mL graduated cylinder
- 10mL graduated cylinder
- Cotton swabs (atleast 12)
- Paper or plastic cups (atleast 12)
- Paper towels (at least 12)
- Volunteers
- Lab Notebook

AGE: 18

Substance	10%	1%	0.1%	0.01%
sucrose	+	–	–	–
sodium chloride	+	+	+	–
vinegar	+	+	+	–

AGE: 5

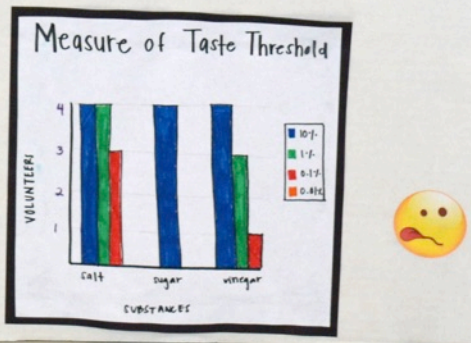
Substance	10%	1%	0.1%	0.01%
sucrose	+	–	–	–
sodium chloride	+	+	+	–
vinegar	+	+	–	–

AGE: 91

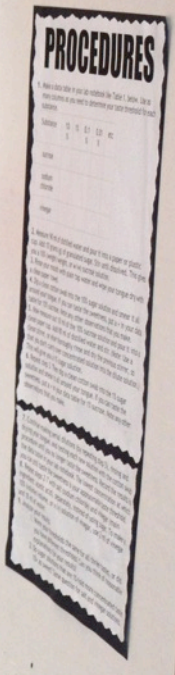
Substance	10%	1%	0.1%	0.01%
sucrose	+	–	–	–
sodium chloride	+	+	+	–
vinegar	+	+	–	–

AGE: 75

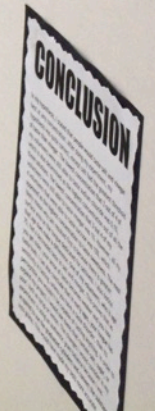
Substance	10%	1%	0.1%	0.01%
sucrose	+	–	–	–
sodium chloride	+	+	–	–
vinegar	+	–	–	–



PROCEDURES

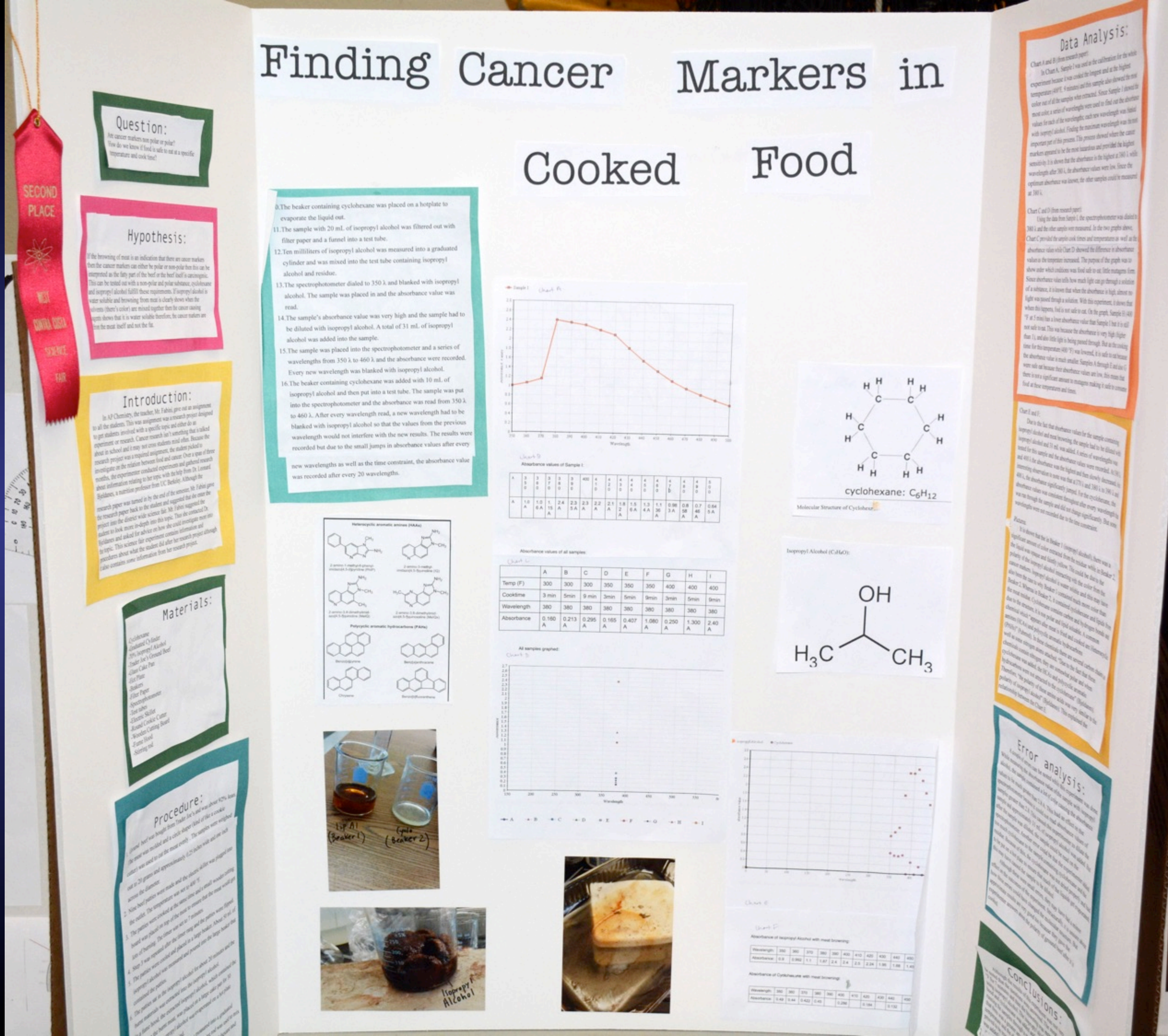


CONCLUSION



11th Grade

Biological Science


Finding Cancer Markers in Cooked Food
SECOND PLACE
Question:
Are cancer markers non polar or polar?
How do we know if food is safe to eat at a specific temperature and cook time?
Hypothesis:
Introduction:
Materials:
Procedure:
0.The beaker containing cyclohexane was placed on a hotplate to evaporate the liquid out.
11.The sample with 20 mL of isopropyl alcohol was filtered out with filter paper and a funnel into a test tube.
12.Ten milliliters of isopropyl alcohol was measured into a graduated cylinder and was mixed into the test tube containing isopropyl alcohol and residue.
13.The spectrophotometer dialed to 350 λ and blanked with isopropyl alcohol. The sample was placed in and the absorbance value was read.
14.The sample's absorbance value was very high and the sample had to be diluted with isopropyl alcohol. A total of 31 mL of isopropyl alcohol was added into the sample.
15.The sample was placed into the spectrophotometer and a series of wavelengths from 350 λ to 460 λ and the absorbance were recorded. Every new wavelength was blanked with isopropyl alcohol.
16.The beaker containing cyclohexane was added with 10 mL of isopropyl alcohol and then put into a test tube. The sample was put into the spectrophotometer and the absorbance was read from 350 λ to 460 λ. After every wavelength read, a new wavelength had to be blanked with isopropyl alcohol so that the values from the previous wavelength would not interfere with the new results. The results were recorded but due to the small jumps in absorbance values after every new wavelengths as well as the time constraint, the absorbance value was recorded after every 20 wavelengths.
Heterocyclic aromatic amines (HAAs)
Polycyclic aromatic hydrocarbons (PAHs)
Absorbance values of Sample I
Absorbance values of all samples:
A B C D E F G H I
Temp (F) 300 300 300 350 350 350 400 400 400
Cooktime 3 min 5min 9 min 3min 5min 9min 3min 5min 9min
Wavelength 380 380 380 380 380 380 380 380 380
Absorbance 0.160 A 0.213 A 0.295 A 0.165 A 0.407 A 1.080 A 0.250 A 1.300 A 2.40 A
All samples graphed:
Wavelength
cyclohexane: C_6H_{12}
Molecular Structure of Cyclohexane
OH
H_3C
CH_3
IP Al (Beaker 1)
Cyclo (Beaker 2)
Isopropyl Alcohol
Absorbance of Isopropyl Alcohol with meat browning:
Absorbance of Cyclohexane with meat browning:
Data Analysis:
Error analysis:
Conclusions:

11th Grade

Physical Science

How Can Periodic Trends Help Predict Properties of Undiscovered Elements?

Hypothesis

We hypothesize that using Einstein's mass-energy equivalence formula ($E=mc^2$), we can identify an energy trend in the periodic table that we can later on use to find the properties of undiscovered elements.

Research

For our research, we read about Einstein's energy-mass equivalency formula. Einstein suggested that the formula for kinetic energy of a moving object should be as follows:

$$E = \frac{mc^2}{\sqrt{1-\left(\frac{v}{c}\right)^2}}$$

However, even when the velocity of an object in a vacuum is zero, energy remains positive. Reduced to the simplest form, this same equation becomes what we known today as one of the most famous equations known today:

$$E = mc^2$$

Simply put, this equation tells us that mass and energy are two forms of the same thing, i.e. mass is just a bundle of energy and the nucleus of an atom is just an oven of energy that is held together by many strong forces.

Our research also included the extended periodic table, which is just a proposed periodic table with proposed elements but no masses or isotopes for them.

Procedure

We have also come across a plausible theory and equation that can help us predict the masses of undiscovered elements. So than we got to work and used Einstein's energy mass equivalence formula to find the ratio between the energy of Hydrogen and Helium which we can use as a constant throughout the periodic table.

$$E = mc^2$$

$E = energy$

$M = mass$

$C = speed\ of\ light = 2.99792458\ m/s$

$C^2 = 8.987551579 \times 10^{16}\ m^2s^{-2}$

$Energy\ of\ Hydrogen = (1.00794g)(8.987551579 \times 10^{16}\ m^2s^{-2}) = 9.05951 \times 10^{16}\ J$

$Energy\ of\ Helium = (4.002602g)(8.987551579 \times 10^{16}\ m^2s^{-2}) = 3.597359 \times 10^{17}\ J$

$Ratio\ of\ Energy = \frac{Energy\ of\ Helium}{Energy\ of\ Hydrogen} = 2.519121997704 \approx 10^{17} = constant$

After we found the constant, we were able to use the constant to predict the mass of the next element by using this formula:

$$\frac{Energy\ of\ given\ element}{c^2} \times constant = mass\ of\ next\ element$$

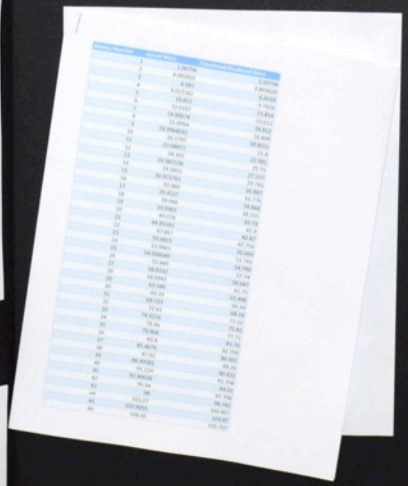
$$\frac{Energy\ of\ helium}{c^2} \times constant = \frac{3.597359277 \times 10^{17}\ J}{8.987551579 \times 10^{16}\ m^2s^{-2}} \times 2.519121997704 \approx 10^{17} = 6.804g$$

Then we found our accuracy to the actual mass to see if the equation works.

$$Percent\ Error = \frac{Calculated\ mass\ of\ lithium - Actual\ Mass\ of\ Lithium}{Actual\ Mass\ of\ Lithium} \times 100\%$$

$$\frac{6.804g - 6.941g}{6.941g} \times 100\% = -1.95\%\ error$$

Data/Calculations



When we continued using the equation for further elements, we thought that instead of checking whether our predictions matched the standard mass of the atom, we should check the isotopes. We found that our predictions almost exactly matched the masses of either a stable isotope or one on the longest-lasting isotopes for each element.

$Ds = (281 \times c^2 + constant)/c^2 = isotope\ for\ element\ 111 = mass\ number\ 283$

$Rg = (283 \times c^2 + constant)/c^2 = isotope\ for\ element\ 112 = mass\ number\ 285$

$Uub = (285 \times c^2 + constant)/c^2 = isotope\ for\ element\ 113 = mass\ number\ 287$

$Uuq = (287 \times c^2 + constant)/c^2 = isotope\ for\ element\ 114 = mass\ number\ 289$

$Uup = (289 \times c^2 + constant)/c^2 = isotope\ for\ element\ 115 = mass\ number\ 291$

$Uuh = (293 \times c^2 + constant)/c^2 = isotope\ for\ element\ 116 = mass\ number\ 293$

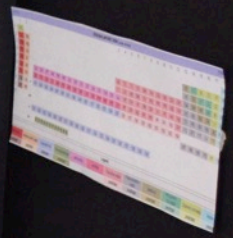
$Uus = (293 \times c^2 + constant)/c^2 = isotope\ for\ element\ 117 = mass\ number\ 295$

$Uuo = (295 \times c^2 + constant)/c^2 = isotope\ for\ element\ 118 = mass\ number\ 297$

$Uue = (297 \times c^2 + constant)/c^2 = isotope\ for\ element\ 119 = mass\ number\ 299$

$Ubn = (299 \times c^2 + constant)/c^2 = isotope\ for\ element\ 120 = mass\ number\ 301$

$Ubu = (305 \times c^2 + constant)/c^2 = isotope\ for\ element\ 121 = mass\ number\ 309\ (predicted)$



Conclusion

CAN YOUR BODY TEMPERATURE TELL THE TIME OF THE DAY?

TEMPERATURE!

SECOND PLACE

	Day 1			Day 2			Day 3		
	Trial 1	Trial 2	Trial 3	Trial 1	Trial 2	Trial 3	Trial 1	Trial 2	Trial 3
9:30 a.m.	98.0 °F	98.8°F	96.3°F	96.3°F	96.3°F	96.5°F	96.8°F	97°F	97.1°F
12:30 a.m.	97.5°F	97°F	97.2°F	97°F	97.4°F	97.6°F	94.7°F	96.2°F	96.8°F
3:30 a.m.	97.8°F	98°F	97.8°F	97.2°F	97.8°F	97.8°F	97.8°F	97.1°F	97.5°F
6:30 a.m.	97.8°F	97.2°F	98.6°F	98.6°F	98.6°F	97.1°F	97.7°F	96.8°F	97.3°F
9:30 a.m.	85.6°F	94.9°F	85°F	96.8°F	97.1°F	97.1°F	96.8°F	96.9°F	97.1°F

REACTION!

	Day 1		Day 1		Day 1	
	Temperature	Reaction	Temperature	Reaction	Temperature	Reaction
9:30 a.m.	98.8°F	0.98 s	96.3°F	0.92 s	96.8°F	0.97 s
12:30 a.m.	97.2°F	0.91 s	97.1°F	0.89 s	97.3°F	0.93 s
3:30 a.m.	97.8°F	0.97 s	97.8°F	0.94 s	97.5°F	0.96 s
6:30 a.m.	98.6°F	0.94 s	97.1°F	0.90 s	97.7°F	0.95 s
9:30 a.m.	97.1°F	0.96 s	96.8°F	0.93 s	97.1°F	0.97 s

AVERAGE!

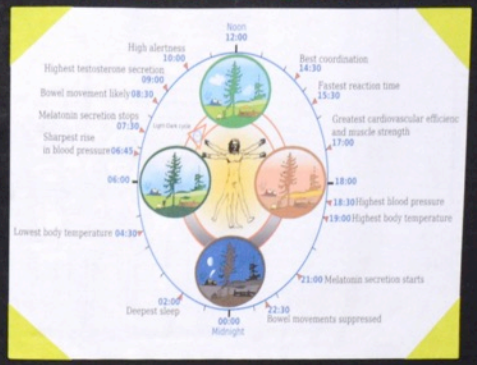
	Day 1			Day 2			Day 3		
	Trial 1	Trial 2	Trial 3	Trial 1	Trial 2	Trial 3	Trial 1	Trial 2	Trial 3
9:30 a.m.	98.0 °F	98.8°F	96.3°F	96.3°F	96.3°F	96.5°F	96.8°F	97°F	97.1°F
12:30 a.m.	97.5°F	97°F	97.2°F	97°F	97.4°F	97.6°F	94.7°F	96.2°F	96.8°F
3:30 a.m.	97.8°F	98°F	97.8°F	97.2°F	97.8°F	97.8°F	97.8°F	97.1°F	97.5°F
6:30 a.m.	97.8°F	97.2°F	98.6°F	98.6°F	98.6°F	97.1°F	97.7°F	96.8°F	97.3°F
9:30 a.m.	85.6°F	94.9°F	85°F	96.8°F	97.1°F	97.1°F	96.8°F	96.9°F	97.1°F

Have you ever had to adjust to a new time zone and noticed that it takes a while before you start to feel normal again? By shifting your sleep and activity schedule, you have altered the pattern of your body's circadian rhythms. Human beings, like many other living things, have a number of internal processes that show a distinct circadian rhythm. The most obvious is our sleep cycle, with activity during the day, followed by sleep during the night. Circadian rhythms have also been demonstrated in humans for changes in body temperature, heart rate, alertness, and physical performance in sports.

In order to stay healthy and to function efficiently, living things must coordinate their internal processes with the external world. The most obvious feature of our environment that most creatures have to respond to is the daily cycle of light and dark. Biological processes that follow this 24-hour cycle, such as our sleep-wake cycle, are said to follow a circadian rhythm. One of the best-known circadian rhythms in humans is the daily change in body temperature. We tend to be at our coolest in the early morning and at our warmest in the late afternoon and early evening. The controlling regulator for these cyclic processes within the body is thought to be the hypothalamus, which is in the brain.

Any change in the circadian cycle (such as jet lag and other conditions associated with travel) requires a certain period for readjustment. Jet lag can cause excessive sleepiness and a lack of daytime alertness in people who travel across time zones. Another factor that can affect circadian rhythm is work schedule. For instance, people who work at night are more prone to on-the-job injuries because their circadian rhythm is off-balance with the light and dark times of day.

In this science project, I measured how body temperature and reaction time vary throughout the course of a day. For 3 days I measured my temperature and my reaction time 5 times a day, every 3 hours.



HYPOTHESIS!

Based on my research about Circadian Rhythm I think that our body does have a pattern in its temperature and in its reaction time throughout the day. So unless it's altered, then the temperature and reaction time should be about the same around the same time every day. Also according to the picture given about Circadian Rhythm I think that my reaction time will be the fastest in the middle of the day, around 3:00 pm.

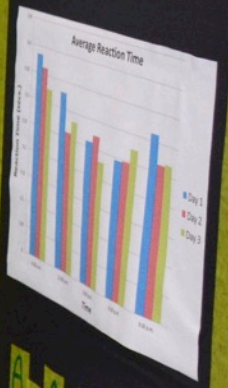
CONCLUSION!

My hypothesis was right. Our bodies have a pattern they follow every day, and unless it is altered then both the temperature and the reaction time are the same around certain times of the day. In my own temperature there was very little difference, it only changed when I drank cold drinks. My reaction time was also the around the same all 3 days at certain times of the day. It was the lowest in the morning and the fastest in the middle of the day, just how I stated in my hypothesis.

PVHS!

TEMPERATURE!

REACTION!



ANALYSIS!

The Nose Knows Smell, But How About Taste?

SECOND PLACE
WEST CONTRA COSTA SCIENCE FAIR

Responses with Nose Plugs On

Food	Person 1	Person 2	Person 3	Person 4
Water	Water	Water	Water	Water
Salt Water	Salt	Sour Milk	Salt Water (like water)	Salt
Water with Cinnamon	Cinnamon	Water	Cinnamon	(Felt texture)
Orange Juice	Can't Identify	Sour	Sour	Sour
Lemon Juice	Sour	Lemon (Sour)	Sour	Sour
Yogurt	Can't Identify	Yogurt (felt the texture)	Can't identify	(Felt the texture)
Ranch	Rotten Milk	Sour, like rotten milk	Rotten milk	Yogurt with salt
Ketchup	Kind of sour	Sweet and sticky	Can't Identify	Ketchup
Mustard	Mustard (bitter)	Really sour	Can't Identify	Salty
Caramel	Sweet	Very sweet	(Felt texture)	Honey
Banana Pudding	Sweet (felt texture)	Can't identify	Sweet	Can't Identify
Strawberry	(felt the seeds)	(felt the seeds)	Sour and sweet	Can't Identify
Cream Cheese	A bit sour	Butter (smooth)	Can't identify	Bitter
Granola	Oatmeal	Crunchy, like wheat	Can't Identify	Granola
Almonds	Some type of nut	Can't identify	Can't Identify	Hazelnut
Chips	Chips (Salty)	Can't identify Crunchy like rice	Can't Identify	Corn Flakes

Responses without Nose Plugs

Food	Person 1	Person 2	Person 3	Person 4
Water	Water	Water	Water	Water
Salt Water	Salt Water	Really sour	Salt Water	Salt Water
Water with Cinnamon	Water w/Cinnamon	Cinnamon (Smells it)	Cinnamon (Smells it)	Cinnamon (Smells it)
Orange Juice	Sour	Sour	Orange Juice	Orange Juice
Lemon Juice	Lemon Juice	Lemon Juice	Lemon Juice	Lemon Juice
Yogurt	Can't Identify	Sour	Yogurt	Yogurt
Ranch	Can't Identify	Ranch	Ranch	Ranch
Ketchup	Can't Identify	Ketchup	Ketchup + Milk	Ketchup
Mustard	Mustard	Mustard	Caramel	Yogurt
Caramel	Honey (sweet)	Syrup	Banana	Banana
Banana Pudding	Banana (sweet)	Banana	Strawberry	Strawberry
Strawberry	Sour	Strawberry	Butter	Butter
Cream Cheese	Cream Cheese	Butter	Can't identify	Granola
Granola	Granola	Granola	Peanuts	Hazelnut
Almonds	Almonds	Almonds	Cracker	Corn Flakes
Chips	Chips	Rice Crispies		

Procedures

Background Information

All foods taste flavorful because the surface of the tongue hosts up to 10,000 specialized microscopic taste buds designed to detect salty, sweet, sour, or bitter sensations. Combined together, these signals send wonderfully distinct messages to the brain so we can differentiate the subtle taste of hundreds of different flavors. Taste is truly a sensory bonanza, but is it totally limited to the tongue? We know that some things affect taste, and being sick is the most familiar example. We simply do not taste food as well when our heads are stuffy and our noses are clogged. Your ability to smell comes from specialized sensory cells, called olfactory sensory neurons, which are found in a small patch of tissue high inside the nose. These cells connect directly to the brain. Each olfactory neuron has one odor receptor. Microscopic molecules released by substances around us—whether it's coffee brewing or pine trees in a forest—stimulate these receptors. Once the neurons detect the molecules, they send messages to your brain, which identifies the smell. There are more smells in the environment than there are receptors, and any given molecule may stimulate a combination of receptors, creating a unique representation in the brain. These representations are registered by the brain as a particular smell.

Smells reach the olfactory sensory neurons through two pathways. The first pathway is through your nostrils. The second pathway is through a channel that connects the roof of the throat to the nose. Chewing food releases aromas that access the olfactory sensory neurons through the second channel. If the channel is blocked, such as when your nose is stuffed up by a cold or flu, odors can't reach the sensory cells that are stimulated by smells. As a result, you lose much of your ability to enjoy a food's flavor. In this way, your senses of smell and taste work closely together. Without smell, foods tend to taste bland and have little or no flavor. Some people who go to the doctor because they think they've lost their sense of taste are surprised to learn that they've lost their sense of smell instead.

Your sense of smell is also influenced by something called the common chemical sense. This sense involves thousands of nerve endings, especially on the moist surfaces of the eyes, nose, mouth, and throat. These nerve endings help you sense irritating substances—such as the tear-inducing power of an onion—or the refreshing coolness of menthol.

Hypothesis

My hypothesis was right because the fact that my volunteers covered their noses did not allow them to guess all of the foods right. Since the aromas that the food released while they were chewing it didn't reach their nose, the brain was not able to identify what food it was. Although sometimes they came pretty close they could not quite get it right because they were basing their guess off of the texture of the food. I did notice that the oldest one of my volunteers was pretty close to getting all of them right so experience did play an important role in this experiment.

Conclusion

Based on my research I think that covering the noses of my volunteers while they taste the food will definitely have an impact on whether or not they can identify the food because the olfactory sensory neurons will not go through the "second pathway" which is through the roof of our throat to the nose. My volunteers will not be able to identify certain foods. I also think that experience will make a difference. So the older the person the more they will be used to tasting certain foods even without smelling them.

Accuracy - Points

Food	Person 1	Person 2	Person 3	Person 4
Water	2	2	2	2
Salt Water	2	0	2	2
Water with Cinnamon	2	1	2	2
Orange Juice	2	1	2	2
Lemon Juice	2	2	2	2
Yogurt	0	2	0	2
Ranch	0	1	2	0
Ketchup	0	0	2	0
Mustard	2	0	0	2
Caramel	1	1	2	2
Banana Pudding	2	0	2	0
Strawberry	2	1	0	0
Cream Cheese	1	1	2	0
Granola	1	1	2	2
Almonds	1	2	0	2
Chips	2	1	0	0
Total	21	16	25	24

Accuracy - With Nose Plugs On

Accuracy - Without Nose Plugs

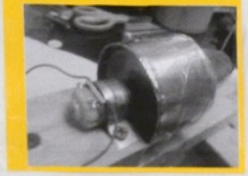
Analysis

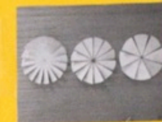
Factors of Thrust From Directed Airflow

By Hao Yang He

INTRODUCTION AND QUESTION

Have you ever played with a blowdryer? If you did, chances are that you would've discovered an opposite force pushing from the direction of the airflow. If you are familiar with Newton's third law, you should understand the basic concept of "Thrust". Thrust is a force that takes advantage of Newton's third law and is generated through the acceleration of a gas or fluid. This force can be seen commonly in the physics and properties of numerous types of engines, specifically the engines of aircraft. Take a turboprop engine for example. Propeller engines take fan blades to accelerate air behind the engine. Although other processes contribute to the overall amount of thrust produced, a majority of these engines take this basic principle of directed airflow to generate thrust. But what factors determine the amount of thrust? Fanblades? Amount of input power? Direction of the airflow? What combination of these factors can result in the highest amount of thrust?





HYPOTHESIS

If given the variables stated in the question, I believe that air accelerated due to a combination of the largest amount of fan blades, a convergent duct and a greater amount of power would generate the largest amount of thrust.

MATERIALS

- DC motor
- 3 Fan pieces, 8, 12, and 16 blades(crafted from aluminum sheets)
- 3 or more AA Batteries to supply power (1.5 volts each)
- Amp meter or multimeter, to measure current and determine input power (watts)
- Milligram Balance(20g - 0.001 g)
- A stand to properly position everything in place
- A Calculator
- One convergent, divergent and a normal, cylindrical air duct with consistent diameters and input-output size ratios.

PROCEDURE

1. The gathering of materials and objects was done due to the need for testing different factors and variables.
2. Three fan pieces, each consisting of either 8, 12, or 16 fan blades were carefully crafted out from lightweight aluminum sheets. Each piece was then tightly fastened onto a 2 mm diameter axle where equal weight distribution and consistent blade pitch(45 degrees) was ensured.
3. Using the amp meter, the current(amps) was measured while the DC motor and battery were operating. One 1.5 volt battery resulted in 0.1166 amps and thus generates around 0.175 watts. Two batteries result in 0.35 watts.
4. The fan piece consisting of 8 fan blades, the convergent duct and one AA battery that produces 0.175 watts were set up. It was arranged so that the fan piece is firmly attached to the shaft of the DC motor and the fan is positioned right in the intake of the convergent duct (the larger end).
5. The electronic balance was placed at the end of the duct perpendicular to the path of airflow. Resetting the balance assured that the it read 0.000 grams at the start of every test.
6. One AA battery was then attached to the wires of the DC motor. The positive and negative ends of the battery was positioned so that the fan would spin in the direction that accelerated the air towards the back. [illegible]
7. The balance then picked up the amount of force pushed against it. The duration of each test was 10 seconds and the highest amount of thrust obtained from the balance during that time (in grams) was recorded.
8. Steps 4 to 7 were repeated except for the change in input power(0.175-0.35 watts), the amount fanblades (8, 12, 16) and the type of air duct(convergent, divergent or normal). Each scenario and possibilities of these factors were tested.
9. The results were collected and put on a chart. The results were also graphed.

CONCLUSION

ERROR ANALYSIS

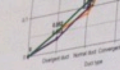
This experiment consisted of many possible systematic and random errors. To list off the systematic errors, lets start off by discussing the obstacles that might have gotten in the way of the airflow. During the experimental process, the intake end of both types of air ducts were partially blocked off by the stand that housed the motor and the fan. This stand potentially could have interfered with the true amount of airflow possible for the fan to take in. Due to this flaw, the resulting thrust created might be a smaller amount to the true thrust able to be created. In addition to obstacles of the airflow, the components tested in this experiment are not guaranteed to be precise. They are not laser cut or machine crafted but purely handcrafted. As a result, imprecisions in the performance of the fanblades and ducts could've resulted in the formation of drag which is baneful to the actual results we want. Battery life is also a systematic error that took place. Throughout the experiment, only a handful of the same batteries were reused, therefore the motor could've taken in different amount of electricity and power per trial. The electronic balance also posed a level of uncertainty in its detections. Throughout the experiment, the distance from the balance to the outtake area were kept consistent but that cannot be certain. This transitions into random errors. Because the balance is based on a milligram scale, any small movement or even breeze of wind can alter the precision. A couple of trials were approximate guesses due to this error. Finally, there are the infamous calculation errors such as rounding averages and comparing sums. This is a basic gist of what might've got into the way of obtaining a pure result in this experiment.

FURTHER SUGGESTIONS AND RESEARCH

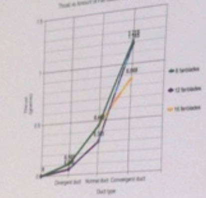
If I were to repeat this experiment or a similar one again, I would fix all the flaws listed in the error analysis as best as possible as well as add in more topics of research and experimentation. For instance, next time, I could focus on what happens if I were to change the shape of the air ducts. What type of thrust would occur. This will introduce new variables and objects to consider. I could also get my hands on a couple of different motors and compare power usage. The use of fanblades and their designs can also be further investigated.

OF FAN BLADES VS INPUT POWER(WATTS) VS TYPE OF DUCT

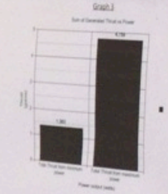
	Number of fan blades (8,12,or 16)	Battery input power (0.175 or 0.35 watts)	Duct Type (Convergent, Divergent or Normal)	Thrust Produced (grams)	Average Thrust Produced (grams)



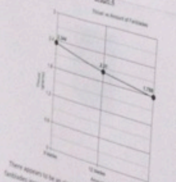
Graph 2



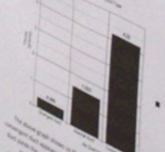
Graph 3



Graph 4



Graph 5



12th Grade

Biological Science

MOUTHWASH BACTERIA VS

THIRD PLACE

WEST CONTRA COSTA SCIENCE FAIR

PURPOSE

We want to find out which type of mouthwash kills the most oral bacteria.

HYPOTHESIS

We hypothesize that Listerine will kill the most oral bacteria because it contains thymol and alcohol which are substances that kill and prevent all type of bacteria.

RESEARCH

Listerine

- Water
- Alcohol 21.6%
- Poloxamer 407
- Benzoic acid
- Sorbitol
- Sodium benzoate
- Zinc chloride
- Sodium benzoate

Scope

- Alcohol 15%
- Water
- Polysorbate 80
- Sorbitol
- Glycerin
- Sodium benzoate
- Sodium saccharin
- Sodium benzoate

Crest

- Water
- Glycerin
- Hydrated silica
- Sorbitol
- Poloxamer 407
- Flavor
- Sodium saccharin
- Sodium benzoate

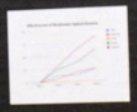
Colgate

- Water
- Glycerin
- Hydrated silica
- Sorbitol
- Poloxamer 407
- Flavor
- Sodium saccharin
- Sodium benzoate

DATA/ANALYSIS

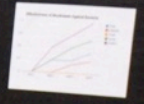
DISH 1

	Colgate	Listerine	Crest	Scope	Control
Day 1	0	0	0	0	0
Day 2	0.3	0.1	0	0.4	0.5
Day 3	0.5	0.4	0	0.6	1
Day 4	0.6	0.5	0	1	1.4



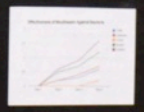
DISH 2

	Colgate	Listerine	Crest	Scope	Control
Day 1	0	0	0	0	0
Day 2	0.3	0	0.3	0.6	
Day 3	0.5	0.2	0.5	0.8	
Day 4	0.8	0.5	0.8	1.2	



DISH 3

	Colgate	Listerine	Crest	Scope	Control
Day 1	0	0	0	0	0
Day 2	0.3	0	0.3	0.6	
Day 3	0.4	0.4	0.5	1	
Day 4	0.6	0.5	0.8	1.4	



DISH 4

	Colgate	Listerine	Crest	Scope	Control
Day 1	0	0	0	0	0
Day 2	0.3	0.2	0.3	0.6	
Day 3	0.5	0.4	0.5	0.7	
Day 4	0.6	0.7	0.8	1.4	

CONCLUSION

Given our research and observations of our experiment. We found that Crest was the most efficient. Containing clinically proven anti-microbial agent, cetylpyridinium chloride (CPC), which is attracted to bacteria in your mouth, crest effectively fights plaque, gingivitis and bad breath. This efficiently conquers gingivitis. CPC is the active ingredient in Crest Pro-Health Rinse that has been recognized as safe and effective by an FDA advisory panel.

Crest contains no alcohol. At high concentrations, alcohol can cause dry mouth. In effect causes bad breath in women and stimulate germs. It kills 80% of germs that cause plaque and gingivitis without the burn of alcohol.

We conclude that Crest is the best choice in mouthwash because alcohol is not the solution. Crest is the best mouthwash to use compared to other leading brands because it contains no alcohol. At high concentrations, alcohol can cause dry mouth. In effect causes bad breath in women and stimulate germs. It kills 80% of germs that cause plaque and gingivitis without the burn of alcohol.

MATERIALS

- 4 petri dishes
- 20 cotton swabs
- scope mouthwash
- total mouthwash
- listerine mouthwash
- crest mouthwash

PROCEDURE

ANIMAL MAGNETISM

Can magnetic fields increase the regenerative rate of planaria?

SECOND PLACE
WEST CONTRA COSTA SCIENCE FAIR

Abstract

It is truly amazing that when we, humans, cut ourselves, nothing more then a scar would be left after a few days of healing. This healing process is nothing when compared to the regenerative ability of planaria. They are able to regrow their entire form just from fraction of their body. Combined with the idea that a magnetic field can generate electrical currents to effect of cell function, this project tests the effect of magnetic field intensity on planaria's regenerative ability.

Background

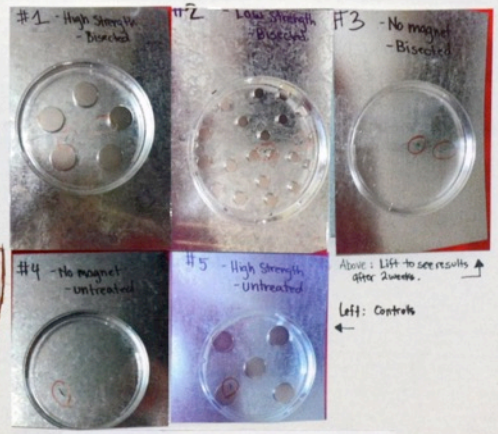
Planaria are flatworms that live in freshwater. They are simple organisms with three tissue layers (endoderm, mesoderm, and ectoderm) but no body cavity. Planarians have a number of cell types, tissues and simple organs that are homologous to our own cells, tissues and organs. However, regeneration has attracted the most attention. Very small pieces of the planaria, estimated to be as little as 1/279th of the organism it is cut from, can regenerate back into a complete organism over the course of a few weeks. New tissues can grow due to pluripotent stem cells that have the ability to create all the various cell types.

Materials

(5) Petri Dishes
(5) 4x6 Sheet Metal
(10) Large Neodymium Magnets, 2.25lb force
(30) Small Neodymium Magnets, 2.2lb force
Tweezers
Scalpel
Spring Water
(5) Brown Planaria, from Carolina Biology

Hypothesis

If I bisect planaria and place them in a petri dish on top of neodymium magnets, their regenerative ability will be enhanced. The planaria with the fastest regenerative rate will be the on with the highest strength of magnets in this test.



Procedure

1) Divide the planaria into 5 groups:

#1	Bisected	High strength magnet, plain sheet metal
#2	Bisected	Low strength magnet, plain sheet metal
#3	Bisected	No magnet, plain sheet metal underneath
#4	Untreated	No magnet, plain sheet metal underneath
#5	Untreated	No magnet, plain sheet metal underneath

2) Label the magnet sheet and place magnets on appropriate sheet. Space the magnet out evenly over an area about the size of a petri dish
3) Place it on ice to immobilize and anesthetize the animal.
4) Using the scalpel, make the cut midway between the anterior and posterior of the animal.
5) Place the bisected pieces into the petri dishes containing spring water.
6) Change 10%, or more if necessary, every few day.
7) Observer planaria and record measurements over a two-week period.

Data & Observation

	Day 1	Day 5	Day 9	Day 13
#1 Tail	5mm	7mm	8mm	9mm
#1 Head	4mm	4mm	5mm	10mm
#2 Tail	4mm	5mm	6mm	10mm
#2 Head	5mm	4mm	10mm	9mm
#3 Tail	4mm	5mm	7mm	8mm
#3 Head	4mm	4mm	7mm	9mm

Only data were not possible due to immeasurable growth

- The planaria with the highest strength of magnet were visibly larger in with
- The head end grew back their tail much faster
- They all retained full function
- The control group had no measurable or visible change
- Tail dropping (when planaria fragment themselves) occurred but were removed

Conclusion

The measurements are extremely approximated due to the contracting and expanding movements of the planaria. Their immediate size also affected the measurements. If planaria genuinely do not end dying until they need to reproduced in appropriate. This occurred until they need to reproduced in result, however despite that, the tail end were able to fully regrow. There was no noticeable difference between planaria that were outside the magnetic field and those that were completely within the magnetic field. The partially magnet planaria however there was still distinct differences between the planaria. However there was still distinct differences between the magnets. I had assumed that the only be due to my estimate of about than I had assumed that 20 mm. It is due to my estimate of have done to see the next amount of strength. What will be problems to the magnet and effect on the planaria. Which then the planaria covered the area of magnets for all the samples were not visible members of a vacuum and further research in this area is necessary.

Bibliography & Credits

12TH GRADE

PHYSICAL SCIENCE

Does an increased concentration of isopropyl alcohol solution lead to cosmic rays which are visible for a longer period of time within a diffusion cloud chamber?

THIRD PLACE

WEST CONTRA COSTA SCIENCE FAIR

Question

Does an increased concentration of isopropyl alcohol solution lead to cosmic rays which are visible for a longer period of time within a diffusion cloud chamber?

Hypothesis

My prediction was that an increased alcohol concentration for a cloud chamber could lead to more cosmic rays that will decay slower, and thus will be visible for a longer period of time. This is because the felt will absorb the alcohol at in increased rate within the cloud chamber. Certain alcohol solutions do not register any sort of cosmic rays since it only reacts with radon, which do not have origins beyond the Earth's atmosphere. This makes the produced alpha particles appear as short, fat bursts through the cloud chamber. The amount of muons as well as the time in which it is visible will be higher since a cosmic ray will bump up with a particle which is very high up in the atmosphere, meaning that the tracks left behind in the cloud chamber will be longer in length and will thus be visible for a longer period of time.

Materials

- Clear plastic tub (this can be of any volume, the one for this experiment was 5 liters)
- Container base-sized Felt (or any other material that is absorbent like paper towels)
- Isopropyl alcohol of varying concentrations from 90% and more (the percentages for this experiment were 90%, 95%, 99%, and 100% and they were all in containers of 475 mL each)
- ~10 kg of crushed frozen CO_2 or dry ice
- Hot water bottle with 500 mL of hot water at 359K
- A light source (a flashlight was used for this experiment)
- Tape or glue
- A timer

Procedure

Felt was trimmed to be the same area and shape of the base of the tub and it was attached with glue so that it would be securely fastened. The felt was then soaked in the 90% solution of isopropyl until it was completely saturated. The felt was then drained of any excess alcohol. The lid of the tub was then placed on top of the dry ice. Since the dry ice was staying intact with the lid, an additional box or container was not needed. The tub was flipped upside down where the felt-covered base was on top, and the mouth of the tank was placed on top of the lid. The tub was then covered by a black blanket and the lights of the room in which the experiment took part in were switched off. After 10 minutes, a flashlight was shined into the tank and the cosmic ray particle tracks were recorded in quantity and time duration. Each solution tested had a data collection time of 30 minutes. The process was repeated for the 95%, 99%, and the 100% solutions respectively.

Data Collection

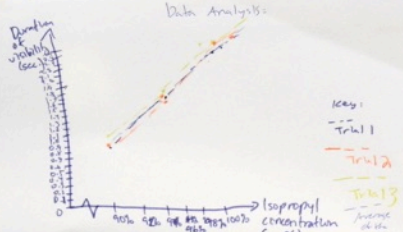
Concentration of isopropyl alcohol in percentages	Quantity of muons detected with long, thin tracks (number of ¼ tracks)	Quantity of alpha particles detected with short, fat tracks
90%	18	39
95%	26	36
99%	33	30
100%	38	31

Concentration of isopropyl alcohol in percentages	Average length of time the muon tracks were visible	T2	T3
90%	Trial 1: 0.89 seconds	0.93 sec	1.01 sec
95%	Trial 1: 1.65 seconds	1.58 sec	1.89 sec
99%	Trial 1: 2.36 seconds	2.46 sec	2.28 sec
100%	Trial 1: 2.41 seconds	2.78 sec	2.71 sec

*Note that the detected alpha particles from radon are not cosmic rays and muons are cosmic rays. Thus, the length of time the alpha particles are visible would be negligent as the purpose of this experiment is particle detection from extraterrestrial cosmic rays. Radon exists in very low concentrations and the air and has a minuscule radioactivity. A data sheet with the duration for the visibility of each track per solution can be obtained by e-mailing Kevin Mahoney at kevin.mahoney@sbcglobal.net

Cloud chamber showing signs of muons and alpha particles during the experiment.

Data Analysis:



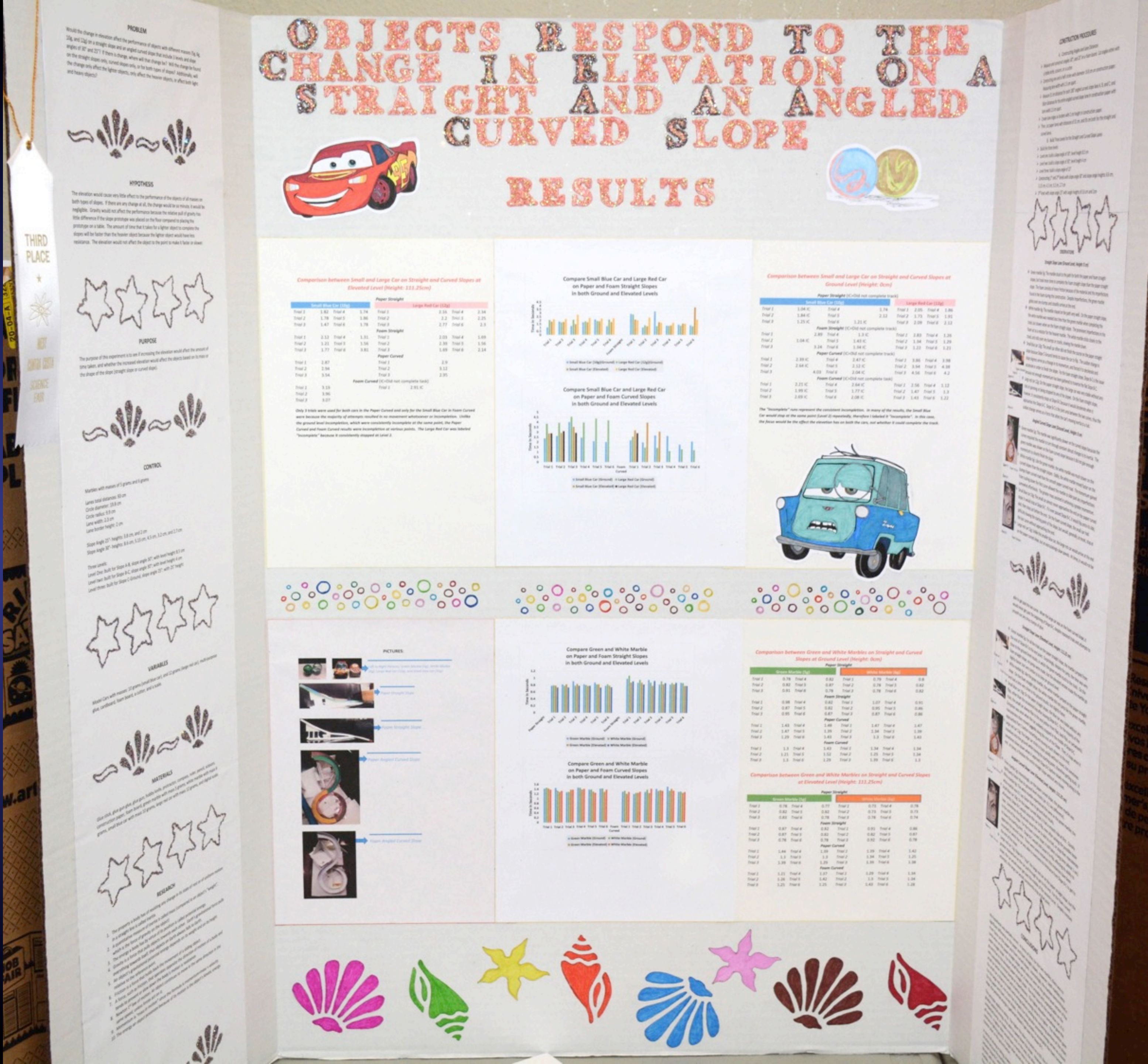
There is a linear correlation present.

Conclusion

My hypothesis was generally correct. The alcohol saturated in the felt evaporates at an increased in higher concentrations but this alcohol turns back into a liquid once it approximates the dry ice, which creates a cloud-like effect within the tub. This air near the bottom of the tank becomes supersaturated at a faster rate when higher concentrations of isopropyl alcohol are used, which is right below the atmospheric dew point. The atmospheric alcohol then clings onto surrounding matter in the form of droplets. When the particles entered the cloud chamber, it bumped into the atmospheric molecules which in turn released electrons and transformed the molecules into charged ions. The droplets were formed when the atmospheric alcohol attracts and thus clings to the ions. The rate of released electrons increases and the electronegativity of the ions and the alcohol droplets are higher with increased molarities of isopropyl alcohol solution, meaning that higher energy and more muons exist in greater numbers and are visible for longer periods of time in higher molarities.

Error analysis:

There may have been a different volume of alcohol which was absorbed by the felt, which may have skewed results in slight significant digits. There could have also been muons which may have been misidentified for electrons and positrons, although this would have been extremely unlikely since these generally have a more zig-zagged and curved track. The biggest margin of error in relation would have probably been the inclusion of unstable particles at the beginning of the visibility period, which is later resolved into more stable particles after a fleeting phenomenon. Also, the timer was not precise beyond the thirds of a second, but this is considered adequate for the purposes of this experiment. Other errors have been taken care of by proper planning, careful, scientific research and human errors have been taken care of by proper stacking and shielding the tank.



OBJECTS RESPOND TO THE CHANGE IN ELEVATION ON A STRAIGHT AND AN ANGLED CURVED SLOPE
RESULTS
PROBLEM
HYPOTHESIS
PURPOSE
CONTROL
VARIABLES
MATERIALS
RESEARCH
THIRD PLACE
Comparison between Small and Large Car on Straight and Curved Slopes at Elevated Level (Height: 111.25cm)
Compare Small Blue Car and Large Red Car on Paper and Foam Straight Slopes in both Ground and Elevated Levels
Compare Small Blue Car and Large Red Car on Paper and Foam Curved Slopes in both Ground and Elevated Levels
Comparison between Small and Large Car on Straight and Curved Slopes at Ground Level (Height: 0cm)
PICTURES:
Compare Green and White Marble on Paper and Foam Straight Slopes in both Ground and Elevated Levels
Compare Green and White Marble on Paper and Foam Curved Slopes in both Ground and Elevated Levels
Comparison between Green and White Marbles on Straight and Curved Slopes at Ground Level (Height: 0cm)
Comparison between Green and White Marbles on Straight and Curved Slopes at Elevated Level (Height: 111.25cm)

chemistry of carbohydrates

SECOND PLACE
WEST CONTRA COSTA SCIENCE FAIR

question

What are carbohydrates?

Which foods contain carbohydrates & in what forms are they present?

research

What are carbohydrates?

Carbohydrates, or carbs, are molecules containing carbon, oxygen and hydrogen. They can be either simple or complex. Simple carbs are monosaccharides and disaccharides. Monosaccharides are a single sugar molecule, while disaccharides are two simple sugar molecules linked together. More complex carbs are called polysaccharides and are multiple sugar molecules linked together.

How are carbohydrates produced?

Carbohydrates are produced through the process of photosynthesis, where carbon dioxide and water react with each other in the presence of light and chlorophyll to produce a simple carbohydrate and oxygen.

What do carbohydrates do?

- store energy in the form of starch (photosynthesis in plants) or glycogen (in animals and humans)
- provide energy through metabolism pathways and cycles
- supply carbon for synthesis of other compounds
- form structural components in cells and tissues

In the body, carbohydrates are used by one's metabolism, or the chemical processes that occur within a living organism in order to maintain life. Catabolic processes are ones in which complex carbs are broken down into simple compounds through oxidization. Anabolic processes are ones in which complex carbs are built via reduction reactions.

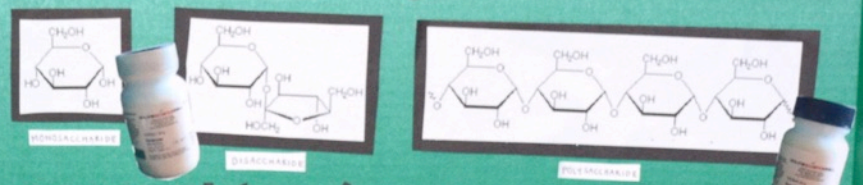
DIAGRAM SUMMARIZING THE CHEMISTRY OF CARBOHYDRATES

hypothesis

To exhibit the chemistry of carbohydrates, I will be performing an experiment that will demonstrate how to identify which form of carbohydrate, if any, are present within a given substance.

I will be using the reagents, Benedict's solution and iodine solution. The color change (or lack thereof) that occurs when each substance is mixed with the reagent will indicate the type of carbohydrate present.

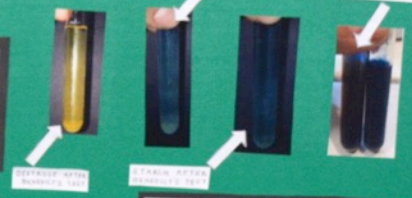
Drawing on my research, I predict that the table sugar and powdered sugar will be monosaccharides. Because of apple juice's high sugar content, I expect it to be some simple carbohydrate, either a monosaccharide or a disaccharide. Honey, I predict to be some simple carbohydrate, although it is a liquid, it is thick like some foods containing starch.



results/data

Results of Tests with Known Carbohydrates

Tube	Carbohydrates	Benedict's color after heating	Benedict's test (+ or -)	Iodine color after addition	Iodine test (+ or -)
1	Monosaccharide (dextrose solution)	Yellow	+	Rust	-
2	Disaccharide (sucrose solution)	Light blue	-	Rust	-
3	Polysaccharide (starch solution)	Blue	-	Dark blue	+



Results of Tests with Unknown Carbohydrates

Tube	Carbohydrates	Benedict's test (+ or -)	Iodine test (+ or -)	Type of Carbohydrate
1	Honey	+	-	Monosaccharide
2	Table Sugar	-	-	Disaccharide
3	Apple Juice	+	-	Monosaccharide
4	Powdered Sugar	-	-	Disaccharide

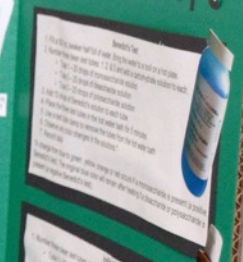
conclusion

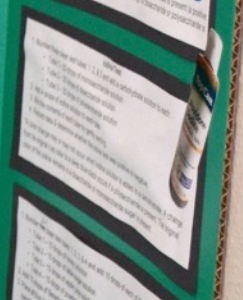
The results I gathered from the experiment are consistent with the research I have done on carbohydrates. However, they disprove my hypothesis. Contradictory to my predictions, both the table sugar and powdered sugar produced negative Benedict's Test and Iodine Test results. They both turned out to be disaccharides. Also my predictions about the apple juice and honey were incorrect. They tested positive in the Benedict's Test and negative in the Iodine Test. I did not identify the presence of a polysaccharide because I lacked a starch item, such as bread or pasta.

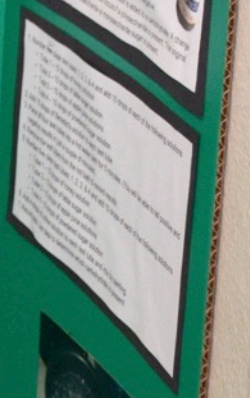
materials

- test tubes
- iodine solution
- water
- monosaccharide solution
- test tube holder
- Benedict's solution
- beaker
- disaccharide solution
- dropper
- various carbohydrate solutions
- stirrer
- polysaccharide solution

experiment/ procedure







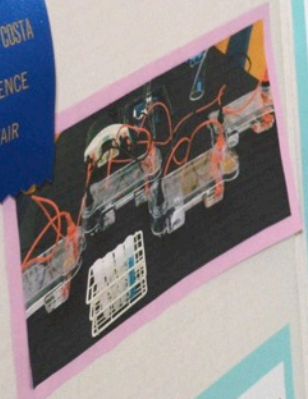
DO DIFFERENT SALTS HAVE DIFFERENT LEVELS OF ELECTRICAL CONDUCTIVITY?

FIRST PLACE
WEST CONTRA COSTA SCIENCE FAIR

INTRODUCTION

Think of salt as bottled white crystals that we season our food with. Or, the common table salt, sodium chloride (NaCl), is only one of many. In chemistry, a salt is any ionic compound that results from the neutralization reaction of an acid and base. Since they are made of electrically charged ions, they can conduct electricity when dissolved. My project concerns the relative conductivity of different salts.

I used electrolysis to test the conductivity of four different salts: lithium chloride (LiCl), calcium chloride ($CaCl_2$), aluminum chloride ($AlCl_3$), and copper chloride ($CuCl_2$). By using electrolysis, I was able to compare the conductivities of each salt by measuring the strength (amperage) of the current that ran through each salt in solution.



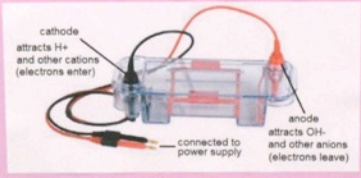
HYPOTHESIS

I predicted that salts containing ions with higher charges will be more conductive because they have more valence electrons. I also thought a transition metal might conduct electricity better than other kinds of metals. So I predicted in my experiment that the order of increasing conductivity for these salts would be as follows: $LiCl < CaCl_2 < AlCl_3 < CuCl_2$.

EXPERIMENT

MATERIALS:

1 M LiCl,	Gel electrolysis box,
1 M $CaCl_2$,	Power Supply,
1 M $AlCl_3$,	Four 15-mL conical tubes,
1 M $CuCl_2$,	Analytical balance
Distilled water,	



PROCEDURE:

1. Clear the table and set up four electrolysis gel boxes.
2. Fill the boxes with 250 mL of distilled water.
3. Now, gather the salts to create a complete 10-mL solution of each salt with a concentration of 1 Molarity. This is so each solution has the same number of molecules, and since each salt has one anion, each solution will have the same number of anions when they dissolve.
4. To get solutions with equal concentrations of each salt, I had to calculate for the mass of each salt I would need to measure out for a 10-mL solution of 1 M concentration. This involved dimensional analysis using the molar masses of each salt:

LiCl = 42.394 g/mol

$1\ M = \left(\frac{1\ mol\ LiCl}{1\ L}\right)\left(\frac{1\ L}{1000\ mL}\right)\left(\frac{42.394\ g}{1\ mol}\right)\left(\frac{10}{10}\right) = 0.434$ g/10mL solution

$CaCl_2$ = 110.98 g/mol

$1\ M = \left(\frac{1\ mol\ CaCl2}{1\ L}\right)\left(\frac{1\ L}{1000\ mL}\right)\left(\frac{110.98\ g}{1\ mol}\right)\left(\frac{10}{10}\right) = 1.110$ g/10mL solution

I only had aluminum chloride hexahydrate, so I first had to subtract the amount of water already in the salt molecules to get the amount of salt itself:

$AlCl_3 \cdot 6H_2O$ = 241.436 g/mol - 6(18.016 g/mol) = 133.34 g

$1\ M = \left(\frac{1\ mol\ AlCl3}{1\ L}\right)\left(\frac{1\ L}{1000\ mL}\right)\left(\frac{133.34\ g}{1\ mol}\right)\left(\frac{10}{10}\right) = 1.333$ g/10mL solution

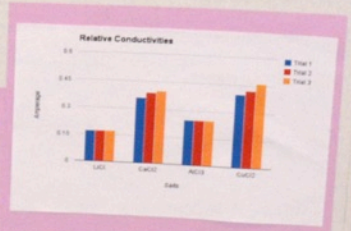
$CuCl_2$ = 134.45 g/mol

$1\ M = \left(\frac{1\ mol\ CuCl2}{1\ L}\right)\left(\frac{1\ L}{1000\ mL}\right)\left(\frac{134.45\ g}{1\ mol}\right)\left(\frac{10}{10}\right) = 1.345$ g/10mL solution

5. Using the calculations, measure out the appropriate mass of each salt on an analytical balance. Put the salt into a conical tube, label it, and add distilled water to the tube up to the 5 mL mark. Shake the tube to dissolve the salt, then fill the tube up to 10 mL. Repeat with each salt until there are four solutions.
6. When the solutions are prepared, mix each solution into their respective electrophoresis gel boxes.
7. Connect all gel boxes to the power supply. Plug the power supply into a power outlet.
8. Turn on the power supply and set it to 100V and run the current for 20 seconds. Looking at the monitor on the power supply, record the amperage of the current.
9. To do another trial of running a current through the solution, pour out the water from the gel box into a large beaker, and then pour it back into the gel box to mix up the solution again. Then run the current through again. Do this twice with each solution to get three trials per salt.

DATA

Salt	Anion Group	Current (Trial 1)	Current (Trial 2)	Current (Trial 3)
H_2O (control)	n/a	0 amp	0 amp	0 amp
LiCl	1A	.17	.17	.17
$CaCl_2$	2A	.36	.39	.40
$AlCl_3$	3A	.25	.25	.25
$CuCl_2$	11	.40	.42	.46



What's up with the precipitate?

Interestingly, a precipitate formed on the cathode side of the gel box when it was running $CuCl_2$. This must have been a result of OH^- from the lysis of water combining with Cu^{2+} ions, becoming copper (II) hydroxide, as represented by this ionization equation:

$CuCl_{2\,(aq)} + H_2O_{(l)} \rightarrow Cu^{2+} + 2Cl^- + H^+ + OH^- \rightarrow Cu(OH)_{2\,(s)} + HCl_{(aq)}$

After researching $Cu(OH)_2$ I found that it is supposed to be a blue color, but the precipitate in the gel box was mostly black colored. Further research revealed that copper hydroxide turns black when exposed to moisture, as it forms copper (II) oxide.

$Cu(OH)_{2\,(s)} + H_2O_{(l)} \rightarrow CuO_{(s)} + 2\,H_2O$

ANALYSIS

As shown in the chart, the order of salts by increasing current is as followed: $LiCl < AlCl_3 < CaCl_2 < CuCl_2$. A noticeable oddity is that $CaCl_2$ had a lower conductivity than $AlCl_3$, even though Ca^{2+} has fewer charge than Al^{3+}. This is the only inconsistency with my hypothesis.

Upon further research, it seems that $AlCl_3$ has rather low conductivity due to the environments surrounding its bonding. The electronegativity of Al is much closer to Cl than the other anions. As such, when $AlCl_3$ is a bonds broke during electrolysis, there wasn't much conductivity due to the weak bonds' charge. The reason why $CuCl_2$ produced a higher current than $LiCl$ despite their lower difference in electronegativity is that there are more electrons released and oxidized in $CuCl_2$ than $LiCl$.

NEW QUESTIONS

- There might be an inconsistency in my experiment: Aluminum, Calcium, and Lithium are all in different periods. Could this have also been a factor in their ionic conductivities?
- The labs containing $CaCl_2$ and $CuCl_2$ become very warm when a current is running in water, but there was no noticeable temperature change with the other salts. What makes these two salts react differently?
- When are running electrolysis, which ions are responsible for the current? Is it related to their charge?

Bio-Rad Awards

WHAT MATERIALS BLOCK WiFi ?

FIRST PLACE
WEST DAKOTA YOUTH SCIENCE FAIR

estion:

What materials block Wi-Fi?

I chose to do this activity because wifi is now as important to us as air. In order for our society to work properly, we need a sustainable amount of wifi so we can go on the internet. And we use the internet for everything, from watching cute cat videos on Youtube to going to your virtual office. If someone could block the Wifi on a global scale, then society would crash to the floor like glass.

Hypothesis:

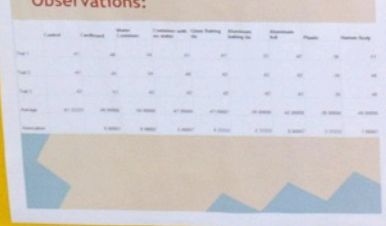
The aluminum baking pan will do the best job at blocking wi-fi.

According to my research, reflective objects do better at blocking radio signals at the molecular level. Since very few of the other materials are reflective, it will probably do the best.

Materials:

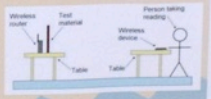
I. Wireless router
II. Wireless device (in this case, it was a Galaxy S4, but it could be anything including a smartphone, laptop, iPad, etc.)
III. Something that can show the strength of a Wi-Fi signal (in this case it was an app called Wifi analyzer)
IV. Aluminum foil
V. Aluminum baking pan
VI. Glass baking pan
VII. Cardboard
VIII. Plastic
IX. Container with Water
X. Container without water
XI. Human Body

Observations:



Procedure:

I. Start out by measuring the usual signal strength that comes from your wireless router.
II. Now, get one of the materials on the list to put in front of the wireless router and measure the signal strength. Do that 3 times per material on the list.
III. Calculate the average dBm (decibel milliwatts) for every material and the control with no materials. Enter the average into your data table.
IV. Calculate the attenuation by subtracting the dBm from the control set.



Observations:

Conclusion:

How Temperature Affects Solar Cell Efficiency

FIRST PLACE
BEST
MARIA PATEL
SCIENCE
FAIR

Problem

How does a solar cell's temperature effect it's function?

Hypothesis

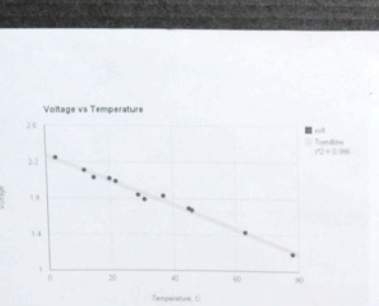
My hypothesis is that the solar cell will function the best at room temperature, second best in cold temperatures, and the worst in hot temperatures.

Materials

- 1 light tight box with a light bulb that is small enough not to over flow the sensor but big enough to use most of it's range. The light bulb should also meet the following requirements:
  - be able to plug into the wall (because batteries will wear out over time)
  - the light produced should be as even as possible
  - the light bulb should not heat up because it could change the temperature in the box.
  - the light has to be stationary because the distance and the distance and the direction have to be the same every time in order to achieve consistent brightness
- solar cell that is stationary in order to receive consistent amounts of light.
- a volt meter (that fits the scale of your experiment) to measure solar cell function.
- thermometer with long needle to measure approximate solar cell temperature
- several plastic bags with different temperatures of water to change solar cell temperature

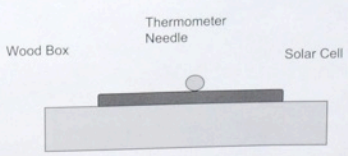
Procedure

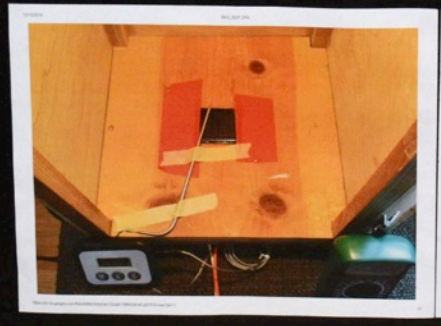
1. Assemble materials as shown in the picture.
   a. Inside light tight box place solar cell opposite to the light bulb and secure with tape on edges.
   b. Run wires through the hole underneath the cell.
   c. Attach wires to volt meter.
   d. Place thermometer onto solar cell and secure in place with tape so that it has good contact with the solar cell.
   e. Install light bulb
2. Take reading in dark to make sure the box is light-tight.
   a. Turn off light bulb if it was on
   b. Close box door tightly
   c. Read voltage. It should be 0.00V
3. Take readings at various temperatures.
   a. Place hot/cold bag of water on sensor (for room temperature reading, don't place any bags and proceed with step 3, through e.)
   b. Read temperature on thermometer until it stops changing for 1 minute
   c. Turn on light
   d. Remove bag of water
   e. Open box door tightly. Read voltage and record temperature on thermometer until it stops changing for 1 minute
   f. Repeat steps a. through e. with the temperature set immediately



Temp	Volts
3	2.25
12	2.11
15	2.03
20	2.02
22	1.99
29	1.84
31	1.79
37	1.83
45	1.69
46	1.67
63	1.43
78	1.19

Figure #: Heat Transfer Speed Diagram





Conclusion

Project Overview

My hypothesis was incorrect. The solar cell functions the best at a colder temperatures, (at a temperature of 3 degrees celsius the the solar cell produced 2.25 volt) the worst at hot temperatures (at 78 degrees celsius the solar cell produced 1.19 volts)at and in the middle at room temperatures (at. 20 degrees celsius the solar cell produced 2.02 volts).The highest voltage (2.25) has about a 1.90 to one ratio to the lowest voltage produced (1.19). One interesting thing I found in my experiment is that all my data formed pretty close to a straight line which supports the idea that voltage is a function of temperature. I found that this line could be represented by the equation:

$$V = -0.0135\,T + 2.273$$

where v equals volts and t equals temperature.

By solving for T you can even use my apparatus as a thermometer.

$$T = -73.8\,(V - 2.273)$$

In other words, we can find the temperature if we know the voltage. Essentially my apparatus is an impractical thermometer.

I believe that one of the reason I found that the solar cell did best in cold temperatures and worst in hoter temperatures is that electronics in general tend to work a lot faster when they are cold and overheat when they are too hot. I think the same goes for the solar cell. I believe that when the solar cell was hot and producing less energy it was not because it was not collecting as much, but rather because it could not turn the light

TECHNOLOGY TAKING OVER?

DOES TEXTING AND SOCIAL MEDIA AFFECT SOMEONE'S ABILITY TO READ FACIAL EXPRESSION

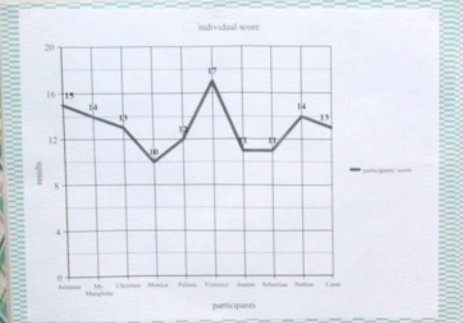
HYPOTHESIS

I HYPOTHESIZE THAT THE PEOPLE WHO USES SOCIAL MEDIA AND TEXT MORE OFTEN WILL BE LESS ABLE TO READ FACIAL EXPRESSION. PEOPLE WHO ARE MORE CONNECTED TO SOCIAL NETWORKS/TEXTING INTERACT WITH OTHER PEOPLE LESS OFTEN, SO THEY MIGHT NOT BE ABLE TO READ FACIAL EXPRESSION AS WELL

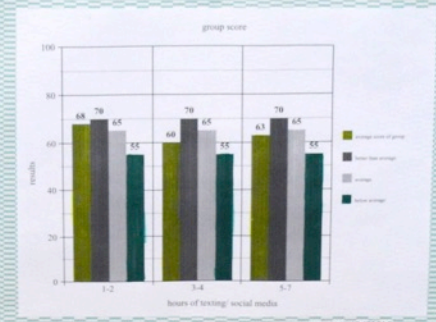
MATERIALS

- GROUP OF PEOPLE DIFFERENT GENDERS /AGE
- UC BERKELEY'S ASSESSMENT ON FACIAL EXPRESSION: HTTP://GREATERGOOD.BERKELEY.EDU/EI_QUIZ/
- SOME FORM OF TECHNOLOGY TO TAKE THE ASSESSMENT

DATA



SCORES OF INDIVIDUALS WHO TOOK THE UC BERKELEY'S ASSESSMENT ON READING FACIAL EXPRESSION. VERENICE ORTIZ SCORED THE HIGHEST OF ALL THE PARTICIPANTS. SHE USED NO SOCIAL MEDIA AND ONLY TEXTED FOR AN HOUR OR LESS PER DAY.



SCORE OF THE PARTICIPANTS GROUPED INTO 3 GROUPS. THE ASSESSMENT ITSELF WAS SCORED OUT OF 20. I FIGURED GRAPHING SCORES THAT WERE BASED OFF 100 WOULD BE EASIER SO I GOT THE PERCENTAGE OF THE GROUPS AVERAGE AND GRAPHED IT. THIS GRAPH ALSO DISPLAYS THE AVERAGE, BETTER THAN AVERAGE, AND BELOW AVERAGE SCORE.

PROCEDURE

FIRST I WOULD ASK FOR VOLUNTEERS. THEN I WOULD ASK THEM HOW MANY HOURS OF TEXTING AND SOCIAL MEDIA THEY USE PER DAY. I WOULD RECORD THAT DOWN. THEN I WOULD ASK THEM TO TAKE THE ASSESSMENT. I TOOK DOWN THEIR ANSWER FOR EACH QUESTION, ALONG WITH THE CORRECT ANSWER. I WOULD RECORD THEIR FINAL SCORE AT THE END AND COMPARE THEIR SCORE TO THE AVERAGE PERSON'

RESULTS

THE AVERAGE PERSON'S SCORE IS 65. I GROUPED THE 10 PEOPLE INTO 3 DIFFERENT GROUPS. THE GROUPS WERE PEOPLE WHO USED SOCIAL MEDIA AND TEXTS FOR ABOUT 1-2 HOURS, 3-4 HOURS, AND 5-7 HOURS. IN MY HYPOTHESIS I STATED THAT PEOPLE THAT USES MORE SOCIAL MEDIA AND TEXTS MORE OF THE GROUP THAT USES THE MOST

Don't Fret: Measuring Guitar String intervals

Hypothesis

I believe there is a formula to calculate the frequency of the next note on a guitar string.

Problem

I want to know if there is a mathematical formula to calculate the difference between each note heard when playing the frets on a guitar string.

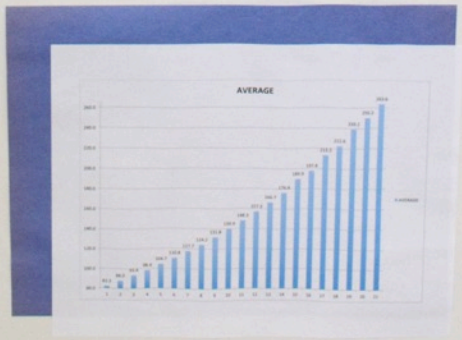
Materials

- Acoustic guitar
- Guitar tuner, or any tuning software that can detect the frequencies of notes. I used an app called Tunable on an iPhone
- pen or pencil
- notebook or piece of paper

Procedure

1. Tune your guitar to the standard where A = 440.
2. Play the low E String 3 times and record it each time.
3. Repeat step 2 for all the notes on that string. there should be 21 notes in all, including the open string and 20 fretted notes. (Each fret is one half step up in a chromatic scale)
4. Determine the average for each of the fretted notes that you measured.
5. Now use your mathematical knowledge to explore the idea that there really is a formula.

FRET	1	2	3	AVERAGE	Difference	the Differences	Next Note Diveded by previous Note
0	82.3	82.4	82.1	**82.3**			
1	88.3	87.8	87.9	**88.0**	5.7		1.0697
2	93.5	93.7	93.1	**93.4**	5.4	-0.30	1.0617
3	98.3	98	98.9	**98.4**	5.0	-0.47	1.0532
4	104.5	104.7	104.8	**104.7**	6.3	1.30	1.0637
5	110.8	111	110.6	**110.8**	6.1	-0.13	1.0586
6	117.3	117.8	117.9	**117.7**	6.9	0.73	1.0620
7	124.3	124.2	124.1	**124.2**	6.5	-0.33	1.0555
8	131.7	132.5	131.3	**131.8**	7.6	1.03	1.0609
9	139.9	139.8	140.1	**139.9**	8.2	0.60	1.0620
10	148	148.1	148.7	**148.3**	8.3	0.17	1.0596
11	157.3	157.7	157	**157.3**	9.1	0.73	1.0612
12	166.3	167.1	166.8	**166.7**	9.4	0.33	1.0597
13	176.8	176.5	176	**176.4**	9.7	0.30	1.0582
14	190	189.9	189.7	**189.9**	13.4	3.73	1.0761
15	197.8	197.4	198.1	**197.8**	7.9	-5.53	1.0416
16	212.5	212.4	214.7	**213.2**	15.4	7.53	1.0780
17	222.7	222.9	222.3	**222.6**	9.4	-6.00	1.0442
18	238.6	239.7	239.4	**239.2**	16.6	7.17	1.0746
19	249.2	249.4	251.9	**250.2**	10.9	-5.67	1.0457
20	256.4	267.2	267.2	**263.6**	13.4	2.50	1.0537
					No clear pattern	Unclear information	21.200 < Sum of above results
							1.060 < Average of that sum



Conclusion

My hypothesis was correct as I discovered there was a formula. I found that multiplying the frequency of one fret by 1.060 will give a very close approximation of the frequency of the next fret up. There being the formula. This experiment was a lot of fun to do because not only was I incorporating music, but I was also involving math, two of my favorite things.

Results

In the tables you can see how I progressed to find my answer. I started with the data collected by recording the frequencies at each fret. I then calculated the average for each, then the difference between them. Because I felt I needed more information, I then found the difference of differences.

When that still didn't seem to be conclusive, I tried dividing one fret's frequency by the previous one. I did this for each of them. They were close, but different. From these numbers, I calculated the average and came up with the number of 1.060.

When I tested this number, on the High E String of the guitar, my formula worked.

The Hyperloop Hang-up

Problem: Can transportation capsules overcome the Kantrowitz limit, in a partial vacuum tube environment?

esis: I think with a little tweaking, the capsules can overcome the fluid choke point. s a bullet train design, such as the hypothetical Hyperloop, would be able to overcome cushion build-up in front of the capsule.

tion/ Additional Information: Elon Musk's Hyperloop inspires this project. The rig up is a modified model of instructions I found on Instructables. The rig is meant to g-Pong balls, not cardboard tubes, but it was easily adapted.

k himself saw this problem stating, "moving at high speed through a tube containing a minimum tube to pod area ratio below which you will choke the flow. What this ot if the walls of the tube and the capsule are too close together, the capsule will o syringe and eventually be forced to push the entire column of air in the system." not allow the capsule to reach the much hoped for top speed of 760 miles per ach 1, or anywhere close.

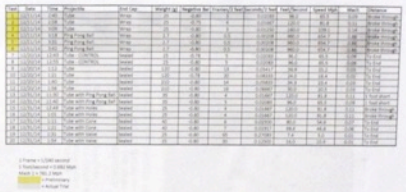
Materials:

1 - 6 foot pipe with an interior diameter of 1.5 inches
1 - Vacuum pump (used for servicing refrigerators, but can also can evacuate air)
Epoxy
Lots of assorted tape
Cardboard tubes
Eye protection
1.5 in PVC pipe tee
Gift-wrap plastic sheets
Cardboard sheets
Large binder clips
Knife on a pole
Slow Motion Camera (iPhone)

Procedure: (This does not include the construction of the rig)

1. Cut two squares out of the cardboard about 3 by 3 inches.
2. Cut a circle in the cardboard with a diameter of about 2.75 in
3. Cut a piece of plastic wrap and place it on the square, over the circle, and tape it down tightly.
4. Assemble the sandwich of cardboard, plastic wrap, then cardboard, and secure it with large binder clips.
5. Tape the end you want to fire at with three pieces of packing tape, and set up slow motion camera pointed at tube.
6. Place a cardboard tube in the breach, and turn on the vacuum pump, and put on eye, and eye protection.
7. Quickly put the gift-wrap sandwich on the end, so it covers the end of the tube.
8. Wait for the pressure to go down, until it hovers at a pressure of around -0.8 bar.
9. Stand back, and pump the plastic with the knife.
10. Repeat steps 3-9 until enough data has been recorded.

The Pressure Setup



The Set-Up

The Plastic-Wrap Seal (For Trials)

Marks Left In A Piece of Wood By A Tube

The Vacuum Tube

Tube Sled at an aluminum can

Results: I tested seven different designs. The Control was just a plain cardboard tube. I tested two designs with Higher Weight, 120 g and 210 g, to see if the extra inertia would overcome the cushion. The Ping-Pong Balls on the end of the tube were to see if it would improve the aerodynamics. The bullet train inspired Cone design was another attempt to improve aerodynamics. The Valve design was to see if the valve could relieve the front air pressure build up when it became greater than the pressure pushing the tube. The Tube with Holes design was a concept to disperse the front air pressure to the sides, creating an additional air cushion to reduce the friction of the capsule against the pipe wall.

During the preliminary trials, the muzzle was also covered in plastic wrap, allowing the projectile to shoot out. However, during the actual tests, the end was securely sealed with three layers of heavy-duty tape. This created the air cushion at the end that the design concepts attempted to overcome.

The table summarizes the different design's results, with the chart showing the average of the two trials per design. The Tube with Holes design was the clear winner. This model was the only one that broke through the seal both times it was tested. Not only did the tube shoot through the pipe, but also kept going for ten feet outside the tube. The Ping-Pong Ball design also beat the control by an average of 6 Mph, but could not break the seal. The shocker was that that the higher 210 g weight design went faster than the lower 120 g weight, but this might have been an outlier. The Valve design failed and broke up both times.

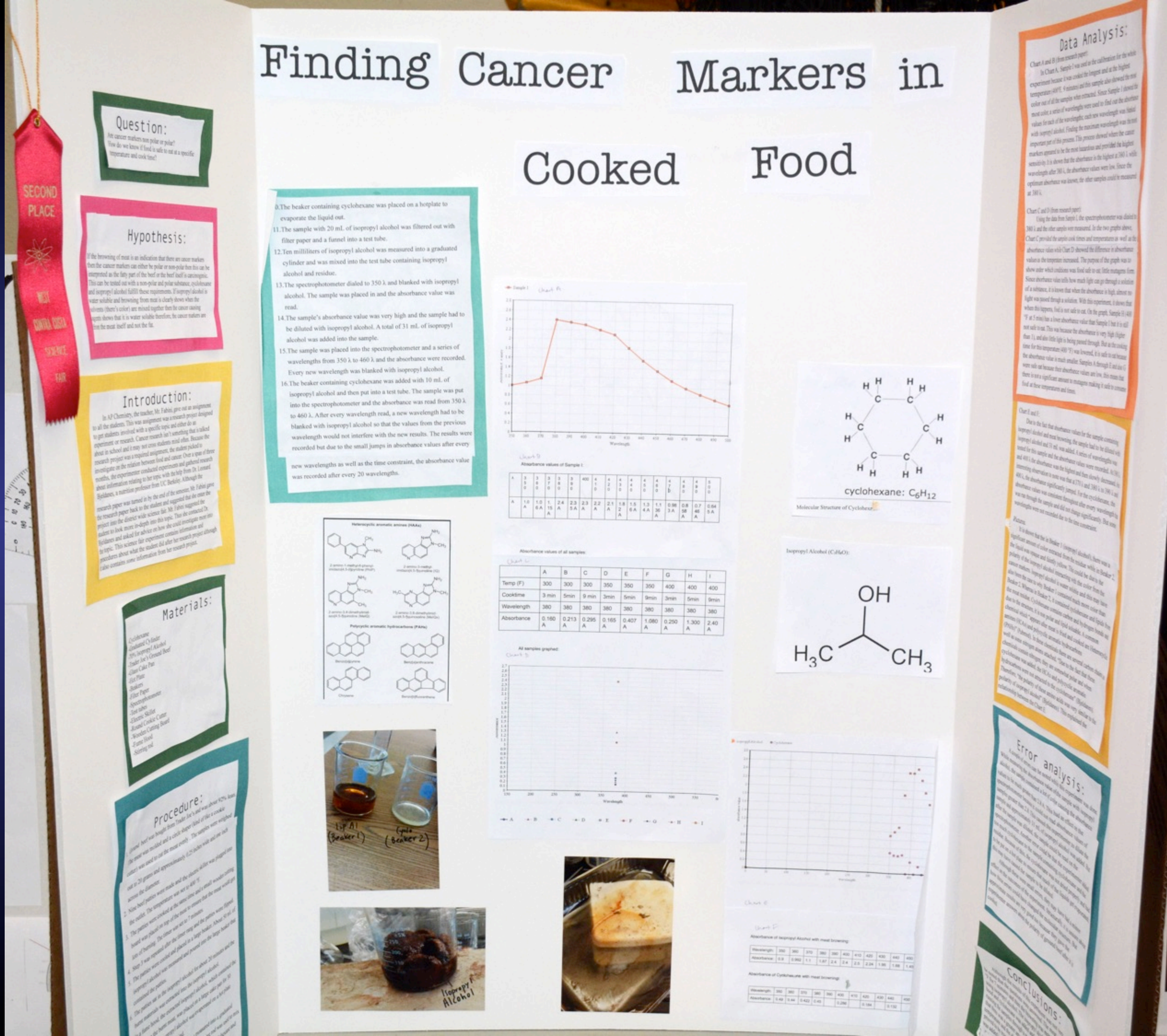
Explanation:

The principles at work are air pressure and air resistance. When the plastic is punctured, the air wants to fill in the vacuum of the tube, but there is a tube in the way, causing the tube to rapidly accelerate. It keeps going until the last foot of the pipe when the cushion of residual air pinned down by the tube slows it down, not puncturing the tape. This air cushion can be manipulated by changing the shape of the tube, the more aerodynamic the tube, the less of an air cushion, and vice versa. The main problem for the Hyperloop (besides the price) is the fluid choke that does not allow the capsule to reach supersonic speeds. Then again at the end of the tube, the air pressure would stop the capsule about 3.47 miles from the end, but if the air cushion were not there, the capsule would speed to a very tragic end. This is what Mr. Musk was talking about, the choke point needs to high enough to avert catastrophe, but also get the capsule to the end of the tube. Hence this project.

Conclusion: My hypothesis was correct. I came up with a design that beat the control. The Tube with Holes design was an unexpected winner with both speed and distance. The best design had a combination of friction reduction and reduction of the front air cushion. This result supports the Hyperloop design, which uses air cushion "skis" to eliminate rolling friction. As noted in a description of the Hyperloop design in Wikipedia:

"In the Hyperloop concept, an electrically driven axial fan and air compressor would be placed at the nose of the capsule in order to "actively transfer high pressure air from the front to the rear of the vessel," resolving the problem of high speed transport in a tube that is not a hard vacuum. wherein pressure builds up in front of the vehicle, slowing it down. A fraction of the air is shunted to the sides for additional air pressure, augmenting that gained assembly from its inlet shape." - Musk, Or The Hyperloop

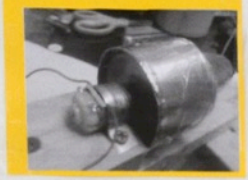
FIRST PLACE
WEST CENTRAL BASIN
SCIENCE FAIR

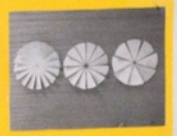

Finding Cancer Markers in Cooked Food
SECOND PLACE
Question:
Hypothesis:
Introduction:
Materials:
Procedure:
0.The beaker containing cyclohexane was placed on a hotplate to evaporate the liquid out.
11.The sample with 20 mL of isopropyl alcohol was filtered out with filter paper and a funnel into a test tube.
12.Ten milliliters of isopropyl alcohol was measured into a graduated cylinder and was mixed into the test tube containing isopropyl alcohol and residue.
13.The spectrophotometer dialed to 350 λ and blanked with isopropyl alcohol. The sample was placed in and the absorbance value was read.
14.The sample's absorbance value was very high and the sample had to be diluted with isopropyl alcohol. A total of 31 mL of isopropyl alcohol was added into the sample.
15.The sample was placed into the spectrophotometer and a series of wavelengths from 350 λ to 460 λ and the absorbance were recorded. Every new wavelength was blanked with isopropyl alcohol.
16.The beaker containing cyclohexane was added with 10 mL of isopropyl alcohol and then put into a test tube. The sample was put into the spectrophotometer and the absorbance was read from 350 λ to 460 λ. After every wavelength read, a new wavelength had to be blanked with isopropyl alcohol so that the values from the previous wavelength would not interfere with the new results. The results were recorded but due to the small jumps in absorbance values after every new wavelengths as well as the time constraint, the absorbance value was recorded after every 20 wavelengths.
Absorbance values of Sample I:
Absorbance values of all samples:
| A | B | C | D | E | F | G | H | I
Temp (F) | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400
Cooktime | 3 min | 5min | 9 min | 3min | 5min | 9min | 3min | 5min | 9min
Wavelength | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380
Absorbance | 0.160 A | 0.213 A | 0.295 A | 0.165 A | 0.407 A | 1.080 A | 0.250 A | 1.300 A | 2.40 A
All samples graphed:
cyclohexane: C6H12
Molecular Structure of Cyclohexane
Isopropyl Alcohol (C3H8O)
OH
H3C
CH3
Heterocyclic aromatic amines (HAAs)
Polycyclic aromatic hydrocarbons (PAHs)
Ip Al (Beaker 1)
Cyclo (Beaker 2)
Isopropyl Alcohol
Data Analysis:
Error analysis:
Conclusions:

Bill Tobin Award

Factors of Thrust From Directed Airflow

By Hao Yang He





INTRODUCTION AND QUESTION

Have you ever played with a blowdryer? If you did, chances are that you would've discovered an opposite force pushing from the direction of the airflow. If you are familiar with Newton's third law, you should understand the basic concept of "Thrust". Thrust is a force that takes advantage of Newton's third law and is generated through the acceleration of a gas or fluid. This force can be seen commonly in the physics and properties of numerous types of engines, specifically the engines of aircraft. Take a turboprop engine for example. Propeller engines take fan blades to accelerate air behind the engine. Although other processes contribute to the overall amount of thrust produced, a majority of these engines take this basic principle of directed airflow to generate thrust. But what factors determine the amount of thrust? Fanblades? Amount of input power? Direction of the airflow? What combination of these factors can result in the highest amount of thrust?

HYPOTHESIS

If given the variables stated in the question, I believe that air accelerated due to a combination of the largest amount of fan blades, a convergent duct and a greater amount of power would generate the largest amount of thrust.

MATERIALS

- DC motor
- 3 Fan pieces, 8, 12, and 16 blades(crafted from aluminum sheets)
- 3 or more AA Batteries to supply power (1.5 volts each)
- Amp meter or multimeter, to measure current and determine input power (watts)
- Milligram Balance(20g - 0.001 g)
- A stand to properly position everything in place
- A Calculator
- One convergent, divergent and a normal, cylindrical air duct with consistent diameters and input-output size ratios.

PROCEDURE

1. The gathering of materials and objects was done due to the need for testing different factors and variables.
2. Three fan pieces, each consisting of either 8, 12, or 16 fan blades were carefully crafted out from lightweight aluminum sheets. Each piece was then lightly fastened onto a 3 mm diameter axle where equal weights distribution and consistent blade pitch(0 degrees) was ensured.
3. Using the amp meter, the current(amps) was measured while the DC motor and battery were operating. One 1.5 volt battery resulted in 0.1166 amps and thus generates around 0.175 watts. Two batteries result in 0.35 watts.
4. The fan piece consisting of 8 fan blades, the convergent duct and one AA battery was set up. It was arranged so that the bottom of the fan piece is firmly attached to the shaft of the DC motor and the fan is positioned right in the middle of the convergent duct (the larger end). The electronic balance was placed at the end of the duct perpendicular to the direction of airflow. Resetting the balance ensured that the it read 0.000 grams at the start of every test.
5. The electrical wires were attached to the wires of the DC motor. The positive and negative ends of the battery was positioned so that the fan would spin in the direction that pushed the air towards the back.
6. One AA battery was then attached to the wires and connected so that the fan would spin in the direction that pushed the air towards the back.
7. The balance then picked up the amount of force produced by the airflow. The duration of each test was 10 seconds and the highest amount of thrust obtained from the balance during that time (in grams) was recorded.
8. Steps 4 to 7 were repeated except for the change in input power(0.175-0.35 watts), the amount fan blades (8, 12, 16) and the type of air duct(convergent, divergent or normal). Each variation and possibilities of these factors were tested.
9. The results were collected and put on a chart. The results were also graphed.

ERROR ANALYSIS

This experiment consisted of many possible systematic and random errors. To list off the systematic errors, lets start off by discussing the obstacles that might have gotten in the way of the airflow. During the experimental process, the intake end of both types of air ducts were partially blocked off by the stand that housed the motor and the fan. This stand potentially could have interfered with the true amount of airflow possible for the fan to take in. Due to this flaw, the resulting thrust created might be a smaller amount to the true thrust able to be created. In addition to obstacles of the airflow, the components tested in this experiment are not guaranteed to be precise. They are not laser cut or machine crafted but purely handcrafted. As a result, impressions in the performance of the fanblades and ducts could've resulted in the formation of drag which is baneful to the actual results we want. Battery life is also a systematic error that took place. Throughout the experiment, only a handful of the same batteries were reused, therefore the motor could've taken in different amount of electricity and power per trial. The electronic balance also posed a level of uncertainty in its detections. Throughout the experiment, the distance from the balance to the outtake area were kept consistent but that cannot be certain. This transitions into random errors. Because the balance is based on a milligram scale, any small movement or even breeze of wind can alter the precision. A couple of trials were approximate guesses due to this error. Finally, there are the infamous calculation errors such as rounding averages and comparing sums. This is a basic gist of what might've got into the way of obtaining a pure result in this experiment.

CONCLUSION

From the results of this experiment, I can draw the conclusion that each factors I have tested do produce significant alterations of the force it generates. In my hypothesis, I have guessed that the largest quantity of fan blades, a convergent duct and the greatest level of input power would contribute to the greatest thrust and the greatest level of thrust. From the results, I have confirmed that my hypothesis is correct. Not every factor I have tested has the greatest impact on the thrust, but each factor does contribute to the overall thrust. The largest amount of thrust produced was from the largest amount of fan blades, a convergent duct and a larger amount of input power. Although I have not tested many other sub-factors that determine the amount of thrust, there are many possibilities that can be derived from the results of the experiment. For example, the results of the experiment suggest that a higher amount of fan blades will produce more thrust. It might be possible that a fan with more blades will produce even more thrust. Or it might be possible that a fan with more blades will produce less thrust. Further experimentation is required to find out the true nature of these factors affecting the airflow.

FURTHER SUGGESTIONS AND RESEARCH

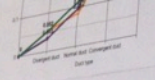
If I were to repeat this experiment or a similar one again, I would fix all the flaws listed in the error analysis as best as possible as well as add in more topics of research and experimentation. For instance, next time, I could focus on what happens if I were to change the shape of the air ducts. What type of thrust would occur. This will introduce new variables and objects to consider. I could also get my hands on a couple of different motors and compare power usage. The use of fanblades and their designs can also be further investigated.

OF FAN BLADES VS INPUT POWER(WATTS) VS TYPE OF DUCT

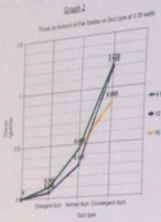
Number of fan blades (8,12,or 16)	Battery input power (0.175 or 0.35 watts)	Duct Type (Convergent, Divergent or Normal)	Thrust Produced (grams)	Average Thrust Produced (grams)
Trial one	8	0.175	Normal	0.113 g	
Trial two	8	0.175	Normal	0.106 g	0.114 g
Trial three	8	0.175	Normal	0.121 g	
Trial one	8	0.175	Convergent	0.399 g	
Trial two	8	0.175	Convergent	0.386 g	0.397 g
Trial three	8	0.175	Convergent	0.406 g	
Trial one	8	0.175	Divergent	0.042 g	
Trial two	8	0.175	Divergent	0.064 g	0.052 g
Trial three	8	0.175	Divergent	0.051 g	
Trial one	8	0.35	Normal	0.410 g	
Trial two	8	0.35	Normal	0.477 g	0.463 g
Trial three	8	0.35	Normal	0.422 g	
Trial one	8	0.35	Convergent	1.142 g	
Trial two	8	0.35	Convergent	1.117 g	1.131 g
Trial three	8	0.35	Convergent	1.387 g	
Trial one	8	0.35	Divergent	0.116 g	
Trial two	8	0.35	Divergent	0.081 g	0.103 g
Trial three	8	0.35	Divergent	0.097 g	

Number of fan blades (8,12,or 16)	Battery input power (0.175 or 0.35 watts)	Duct Type (Convergent, Divergent or Normal)	Thrust Produced (grams)	Average Thrust Produced (grams)
Trial one	16	0.175	Normal	0.082 g	
Trial two	16	0.175	Normal	0.093 g	0.084 g
Trial three	16	0.175	Normal	0.078 g	
Trial one	16	0.175	Convergent	0.211 g	
Trial two	16	0.175	Convergent	0.245 g	0.218 g
Trial three	16	0.175	Convergent	0.198 g	
Trial one	16	0.175	Divergent	0.075 g	
Trial two	16	0.175	Divergent	0.101 g	0.052 g
Trial three	16	0.175	Divergent	0.079 g	
Trial one	16	0.35	Normal	0.540 g	
Trial two	16	0.35	Normal	0.417 g	0.467 g
Trial three	16	0.35	Normal	0.413 g	
Trial one	16	0.35	Convergent	0.836 g	
Trial two	16	0.35	Convergent	0.947 g	0.868 g
Trial three	16	0.35	Convergent	0.821 g	
Trial one	16	0.35	Divergent	0.131 g	
Trial two	16	0.35	Divergent	0.114 g	0.103 g
Trial three	16	0.35	Divergent	0.124 g	

Number of fan blades (8,12,or 16)	Battery input power (0.175 or 0.35 watts)	Duct Type (Convergent, Divergent or Normal)	Thrust Produced (grams)	Average Thrust Produced (grams)
Trial one	12	0.175	Normal	0.092 g	
Trial two	12	0.175	Normal	0.096 g	0.096 g
Trial three	12	0.175	Normal	0.111 g	
Trial one	12	0.175	Convergent	0.228 g	
Trial two	12	0.175	Convergent	0.181 g	0.197 g
Trial three	12	0.175	Convergent	0.171 g	
Trial one	12	0.175	Divergent	0.056 g	
Trial two	12	0.175	Divergent	0.037 g	0.055 g
Trial three	12	0.175	Divergent	0.072 g	
Trial one	12	0.35	Normal	0.359 g	
Trial two	12	0.35	Normal	0.351 g	0.303 g
Trial three	12	0.35	Normal	0.198 g	
Trial one	12	0.35	Convergent	1.156 g	
Trial two	12	0.35	Convergent	1.205 g	1.145 g
Trial three	12	0.35	Convergent	1.194 g	
Trial one	12	0.35	Divergent	0.066 g	
Trial two	12	0.35	Divergent	0.09 g	0.058 g
Trial three	12	0.35	Divergent	0.084 g	

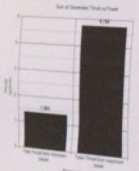


Graph 2



To start off, I looked towards the relationship between power and thrust produced. It apparent that the thrust scale for 0.35 watts graph is way higher compared to the 0.175 watts graph above. In a more precise proportion, I summed up the total average thrust produced for the given power and the following graph resulted.

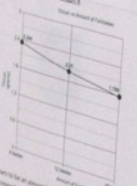
Graph 3



It is evident that the total sum of thrust generated through maximum power(0.35 watts) produces nearly 4 times as much thrust compared to minimum power. For example, take the 8 bladed fan piece and compare the resulting thrust as a result of adding another battery. The average thrust quadrupled from 0.114 grams to 0.463 grams. This effect is no doubt caused by an increase in force to spin the DC motor at a higher 'RPM'. As a result, the fan spins faster and accelerates a larger amount of air. This clearly demonstrates the transfer of energy represented in thermodynamics.

No we can see in graphs 1 and 2, the same trends tend to occur for divergent ducts as well as different amounts of fan blades. I again added up all the average values of thrust resulting from the different amounts of fanblades and produced the following graph.

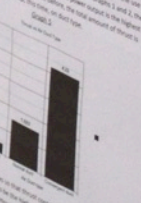
Graph 4



There appears to be an almost linearly decreasing trend as the amount of fanblades increased. In graphs 1 and 2, we can observe that the 8 bladed fan piece dominates over the 12 bladed and 16 bladed in thrust production. Take the 12 bladed and 16 bladed crown paths and the 12 bladed ends up taking the lead in most. This result could've been affected by the slower rotation errors but it seems plausible. This result could've been affected by slower rotation speeds but creating more forces mechanically in lower rpm ranges. Although the 8 bladed fan piece created more amounts of turbulence, it may account to surface area and amount of drag. Creating more amounts of turbulence may account to increasing drag and produce less amounts of thrust. Although this was significant, the type of each duct tested did not appear to be significant. Although slight variations could've occurred, the duct types appeared to be different performed in each fanblade piece.

Throughout the experiment, all the tests were done through the presence of either a convergent, normal or divergent duct. What effect did these duct types have on the amount of thrust produced? What differences can be found from the use of each duct type? To find out the answer to these questions, in Graphs 3 and 4, the average values of thrust were used to compare the different duct types. From the graphs, the convergent duct had the highest amount of thrust produced, and the normal duct had the lowest. The next amount of thrust to adjust up, but not down, was the divergent duct.

Graph 5



This graph shows us that most confirmed through the use of a convergent duct, the thrust produced is significantly higher than the thrust produced by a divergent duct. This is because the convergent duct is designed to accelerate the air as it passes through the duct. This is done by the duct's decreasing diameter. As the air is accelerated, the air pressure is also increased. This is why the convergent duct is the most effective duct for producing thrust. The divergent duct is the opposite of the convergent duct. It is designed to decelerate the air as it passes through the duct. This is done by the duct's increasing diameter. As the air is decelerated, the air pressure is also decreased. This is why the divergent duct is the least effective duct for producing thrust. The normal duct is neither accelerating nor decelerating the air as it passes through the duct. This is why the normal duct is in between the convergent and divergent duct in terms of thrust produced.

Hal Magarian Award

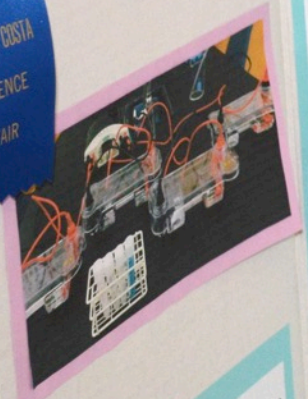
DO DIFFERENT SALTS HAVE DIFFERENT LEVELS OF ELECTRICAL CONDUCTIVITY?

FIRST PLACE
WEST CONTRA COSTA SCIENCE FAIR

INTRODUCTION

Think of salt as bottled white crystals that we season our food with. Or, the common table salt, sodium chloride (NaCl), is only one of many. In chemistry, a salt is any ionic compound that results from the neutralization reaction of an acid and base. Since they are made of electrically charged ions, they can conduct electricity when dissolved. My project concerns the relative conductivity of different salts.

I used electrolysis to test the conductivity of four different salts: lithium chloride (LiCl), calcium chloride ($CaCl_2$), aluminum chloride ($AlCl_3$), and copper chloride ($CuCl_2$). By using electrolysis, I was able to compare the conductivities of each salt by measuring the strength (amperage) of the current that ran through each salt in solution.



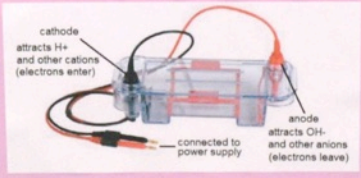
HYPOTHESIS

I predicted that salts containing ions with higher charges will be more conductive because they have more valence electrons. I also thought a transition metal might conduct electricity better than other kinds of metals. So I predicted in my experiment that the order of increasing conductivity for these salts would be as follows: $LiCl < CaCl_2 < AlCl_3 < CuCl_2$.

EXPERIMENT

MATERIALS:

1 M LiCl,	Gel electrolysis box,
1 M $CaCl_2$,	Power Supply,
1 M $AlCl_3$,	Four 15-mL conical tubes,
1 M $CuCl_2$,	Analytical balance
Distilled water,	



PROCEDURE:

1. Clear the table and set up four electrolysis gel boxes.
2. Fill the boxes with 250 mL of distilled water.
3. Now, gather the salts to create a complete 10-mL solution of each salt with a concentration of 1 Molarity. This is so each solution has the same number of molecules, and since each salt has one anion, each solution will have the same number of anions when they dissolve.
4. To get solutions with equal concentrations of each salt, I had to calculate for the mass of each salt I would need to measure out for a 10-mL solution of 1 M concentration. This involved dimensional analysis using the molar masses of each salt:

LiCl = 42.394 g/mol

$1\ M = \left(\frac{1\ mol\ LiCl}{1\ L}\right)\left(\frac{1\ L}{1000\ mL}\right)\left(\frac{42.394\ g}{1\ mol}\right)\left(\frac{10}{10}\right) = 0.434$ g/10mL solution

$CaCl_2$ = 110.98 g/mol

$1\ M = \left(\frac{1\ mol\ CaCl2}{1\ L}\right)\left(\frac{1\ L}{1000\ mL}\right)\left(\frac{110.98\ g}{1\ mol}\right)\left(\frac{10}{10}\right) = 1.110$ g/10mL solution

I only had aluminum chloride hexahydrate, so I first had to subtract the amount of water already in the salt molecules to get the amount of salt itself:

$AlCl_3 \cdot 6H_2O$ = 241.436 g/mol - 6(18.016 g/mol) = 133.34 g

$1\ M = \left(\frac{1\ mol\ AlCl3}{1\ L}\right)\left(\frac{1\ L}{1000\ mL}\right)\left(\frac{133.34\ g}{1\ mol}\right)\left(\frac{10}{10}\right) = 1.333$ g/10mL solution

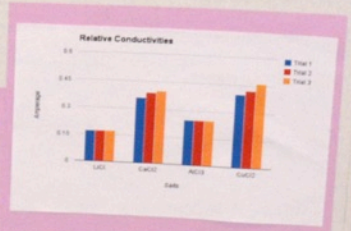
$CuCl_2$ = 134.45 g/mol

$1\ M = \left(\frac{1\ mol\ CuCl2}{1\ L}\right)\left(\frac{1\ L}{1000\ mL}\right)\left(\frac{134.45\ g}{1\ mol}\right)\left(\frac{10}{10}\right) = 1.345$ g/10mL solution

5. Using the calculations, measure out the appropriate mass of each salt on an analytical balance. Put the salt into a conical tube, label it, and add distilled water to the tube up to the 5 mL mark. Shake the tube to dissolve the salt, then fill the tube up to 10 mL. Repeat with each salt until there are four solutions.
6. When the solutions are prepared, mix each solution into their respective electrophoresis gel boxes.
7. Connect all gel boxes to the power supply. Plug the power supply into a power outlet.
8. Turn on the power supply and set it to 100V and run the current for 20 seconds. Looking at the monitor on the power supply, record the amperage of the current.
9. To do another trial of running a current through the solution, pour out the water from the gel box into a large beaker, and then pour it back into the gel box to mix up the solution again. Then run the current through again. Do this twice with each solution to get three trials per salt.

DATA

Salt	Anion Group	Current (Trial 1)	Current (Trial 2)	Current (Trial 3)
H_2O (control)	n/a	0 amp	0 amp	0 amp
LiCl	1A	.17	.17	.17
$CaCl_2$	2A	.36	.39	.40
$AlCl_3$	3A	.25	.25	.25
$CuCl_2$	11	.40	.42	.46



What's up with the precipitate?

Interestingly, a precipitate formed on the cathode side of the gel box when it was running $CuCl_2$. This must have been a result of OH^- from the lysis of water combining with Cu^{2+} ions, becoming copper (II) hydroxide, as represented by this ionization equation:

$CuCl_{2\,(aq)} + H_2O_{(l)} \rightarrow Cu^{2+} + 2Cl^- + H^+ + OH^- \rightarrow Cu(OH)_{2\,(s)} + HCl_{(aq)}$

After researching $Cu(OH)_2$ I found that it is supposed to be a blue color, but the precipitate in the gel box was mostly black colored. Further research revealed that copper hydroxide turns black when exposed to moisture, as it forms copper (II) oxide.

$Cu(OH)_{2\,(s)} + H_2O_{(l)} \rightarrow CuO_{(s)} + 2\,H_2O$

ANALYSIS

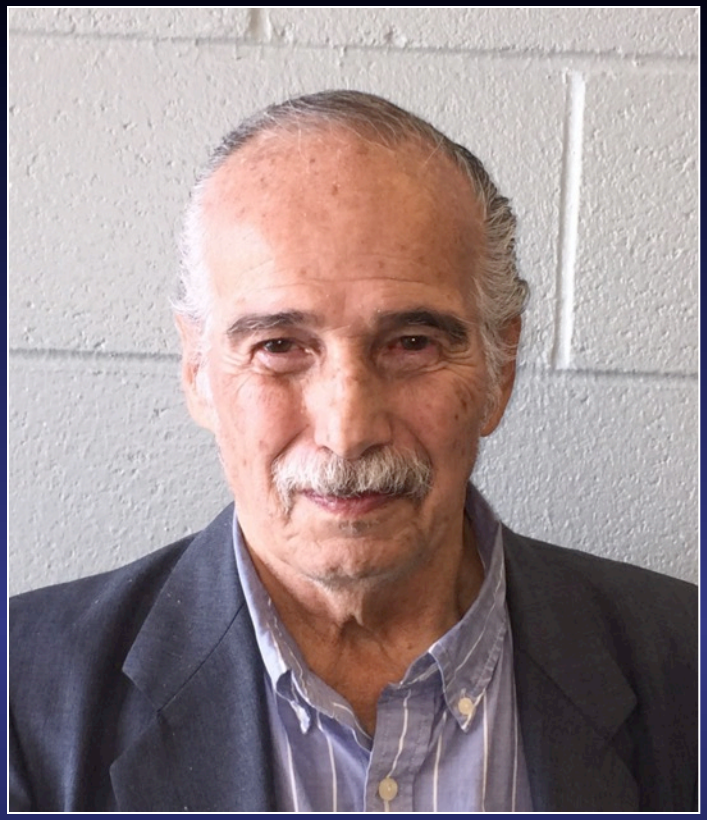
As shown in the chart, the order of salts by increasing current is as followed: $LiCl < AlCl_3 < CaCl_2 < CuCl_2$. A noticeable oddity is that $CaCl_2$ had a lower conductivity than $AlCl_3$, even though Ca^{2+} has fewer charge than Al^{3+}. This is the only inconsistency with my hypothesis.

Upon further research, it seems that $AlCl_3$ has rather low conductivity due to the environments surrounding its bonding. The electronegativity of Al is much closer to Cl than the other anions. As such, when $AlCl_3$ is a bonds broke during electrolysis, there wasn't much conductivity due to the weak bonds' charge. The reason why $CuCl_2$ produced a higher current than $LiCl$ despite their lower difference in electronegativity is that there are more electrons released and oxidized in $CuCl_2$ than $LiCl$.

NEW QUESTIONS

- There might be an inconsistency in my experiment: Aluminum, Calcium, and Lithium are all in different periods. Could this have also been a factor in their ionic conductivities?
- The labs containing $CaCl_2$ and $CuCl_2$ become very warm when a current is running in water, but there was no noticeable temperature change with the other salts. What makes these two salts react differently?
- When are running electrolysis, which ions are responsible for the current? Is it related to their charge?

Special Award



Norm Seraphin
WCCSF Director
1991-2014

Congratulations to all the participants!

Thank you for coming!

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J. Iwawaki
2015