ALL SAINTS SCHOOL
SCIENCE FAIR
2017

2017 All Saints 1st science fair

Keith Zawadzki

6th grader Myla
8th grader Kazmer

student participation by grade

GRADE	platform	2017	2018	2019	2020	2021	April 2022
PreK	classroom	classroom	classroom	classroom	Hermann	cancelled	~~too late~~
K	classroom	classroom	classroom	classroom	Hermann	cancelled	~~too late~~
1st	classroom	classroom	classroom	classroom	Hermann	cancelled	~~too late~~
2nd	voluntary at home	12	13	7	cancelled	cancelled	tbd
3rd	voluntary at home	25	14	20	cancelled	cancelled	tbd
4th	voluntary at home	14	11	15	cancelled	cancelled	tbd
5th	voluntary at home	6	1	18	cancelled	cancelled	tbd
6th	classroom in 2020+	2	0	4	Shufelt	cancelled	Shufelt
7th	classroom	Shufelt	Shufelt	Shufelt	Shufelt	cancelled	Shufelt
8th	classroom	Shufelt	Shufelt	Shufelt	Orr	cancelled	~~too late~~
	voluntary students	59	39	64	cancelled	cancelled	tbd

All Saints Science Fair Assembly
January 2020:
Alex Zerbe- The Zaniac!

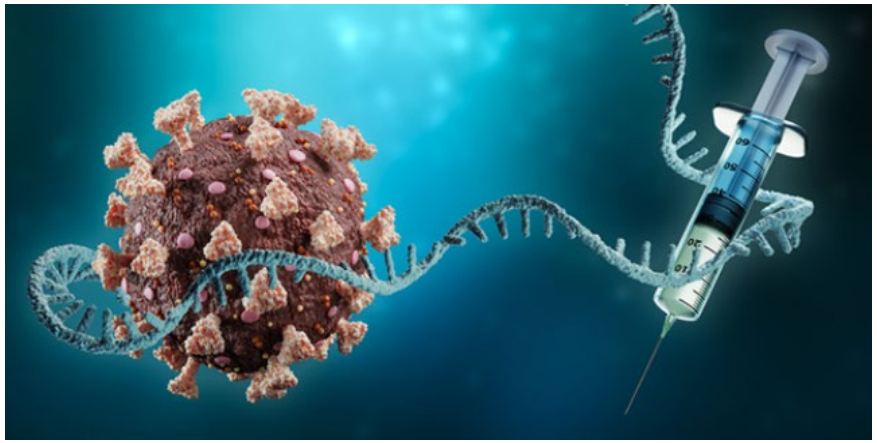
SCIENCE FAIR IS BACK FOR 2022!

1) No science fair assembly in 2022
2) Grades 6-7 are mandatory part of curriculum
3) Grades 2-5th are voluntary participation.
   -MAX GROUP allowed = 2 students.

What do all Science & Technology breakthroughs and achievements have in common?

SpaceX – satellites, Mars?

Healthcare, vaccines



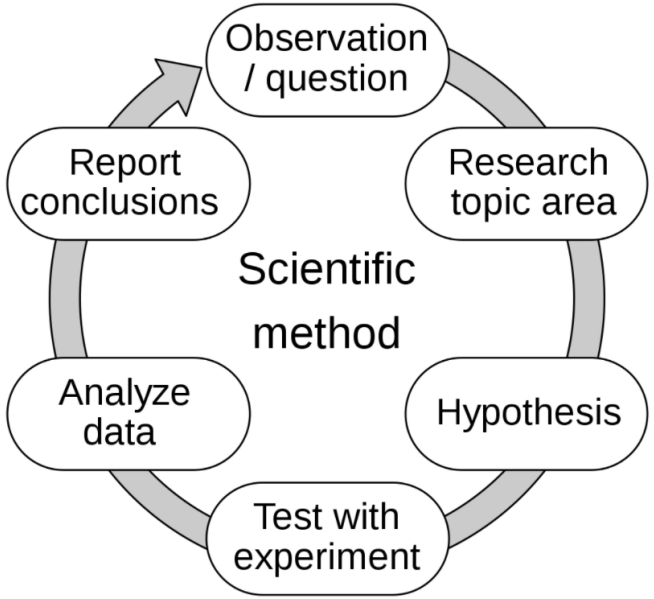
Autonomous driving

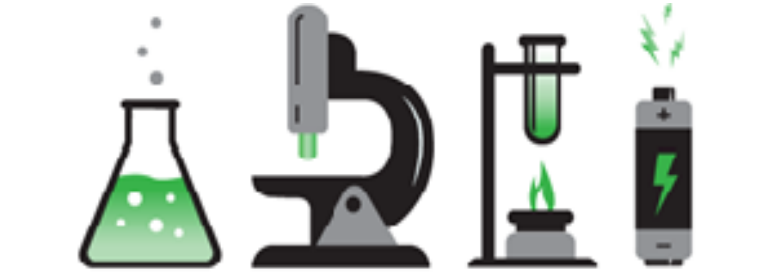
Metaverse, social media, entertainment

NETFLIX

TikTok

The Scientific Method





ALL SAINTS SCHOOL

SCIENCE FAIR

2022 key dates

Friday, March 11th	Grade 2-5 classrooms will receive Science Fair info & registration form from 6th grade guest speakers.
Wednesday, March 16th	7-8pm Online Science Fair Info Night ZOOM meeting for grade 2-5 parents (students welcome also). -> goal tonight is to get grade 2-5 students registered for the science fair !
Friday, April 1st	8:30-9:30am Science Fair help session available in the library for grade 2-5 registered participants.
Wednesday, April 20th	All Saints Science Fair! Project drop off in morning and open house and awards from 6:30 - 7:30pm.

www.allsaintsportland.com/sciencefairpacket

oral presentation option:

2nd-5th graders have 3-5 min oral presentation option.

Present project to 1-2 judges during school hours on day of Science Fair (April 20th).

ALL SAINTS SCIENCE FAIR REGISTRATION FORM

1. Student Participant Name: _____

2. Student Grade and Teacher: _____

3. Parent name: _____

4. Parent Signature: _____

☐ Yes, the student will participate in the optional 3-5 minute oral presentation of their Science Fair project.

☐ I (parent) am interested in volunteering to support the science fair as a judge, student help session and/or to help setup/break down the fair. My email =_____

Please bring **completed tear-off section** to the front office or email keith.e.zawadzki@intel.com.

2018: 33 oral presenters / 39 total students grade 2-6

2019: 54 oral presenters / 64 total students grade 2-6

Merit Awards

Merit awards for best trifold project ($10 fred meyer)

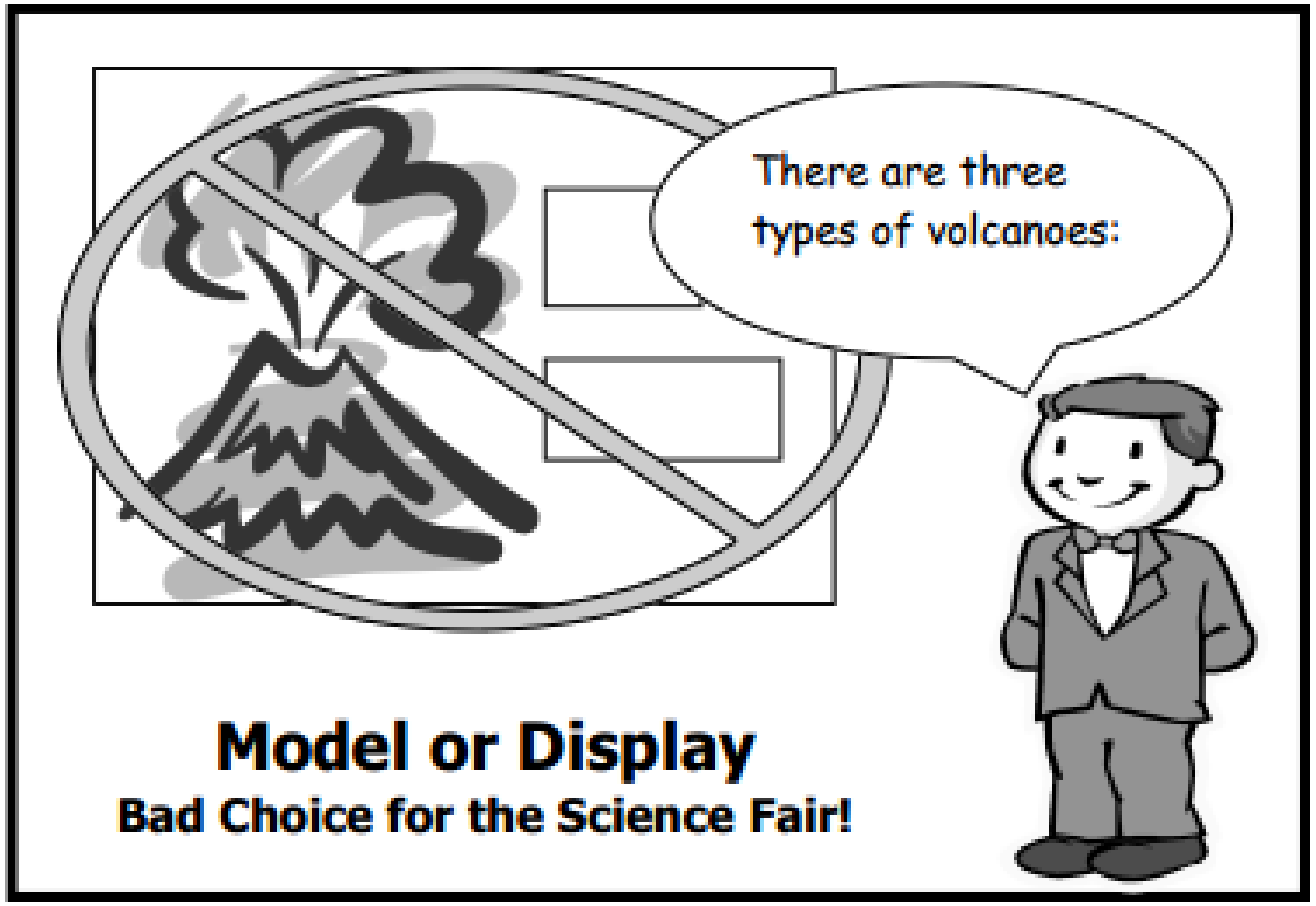
Merit awards for best oral presentations ($10 fred meyer)

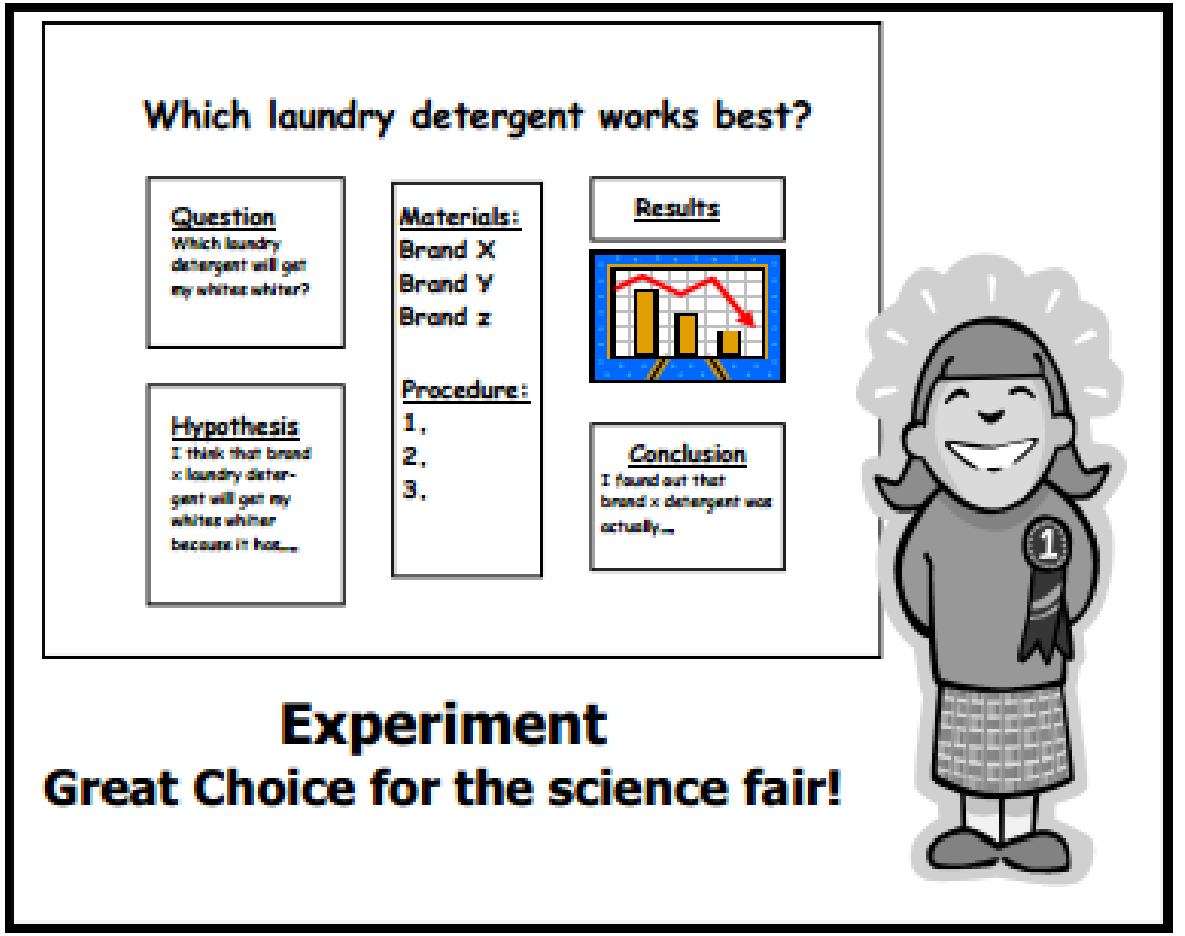
All oral presentations received BASKIN ROBBINS gift card in 2018.

2019 23 MERIT WINNERS:

2nd grade = Andy Acevedo, Rowan Eddy
3rd grade= Myla Zawadzki, Harper Brinkley, Stella Fox, Noelle Moody, Vivienne McCarron, Lily Dixon, Daniela Scott
4th grade = Isabella Maltese, Carmen Zonca, Isla Hoffelt
5th grade= Brady Vinh, Rowen Nicholson, Gabrielle Jones, Finn Sweeney
6th grade= Jack Francis
7th grade= Brooke Posner, Jenny Chang, Maleaha Goudreau, Max Klein
8th grade= Corinne Toyooka, Kaiden Janssen

2 TYPES OF SCIENCE PROJECTS





Project focus is on SCIENTIFIC METHOD:

experimenting and measuring results!

SCIENCE FAIR REVIEW

End Goal: Tri-fold cardboard display highlighting scientific method (school supplies tri-fold boards in April)

Project Title

Step 1: Question

Ask a question.

Step 2: Research

Conduct background research. Write down your sources so you can cite your references.
It is key to understand what **scientific theory or laws** already exist to create an "educated guess".

Step 3: Hypothesis

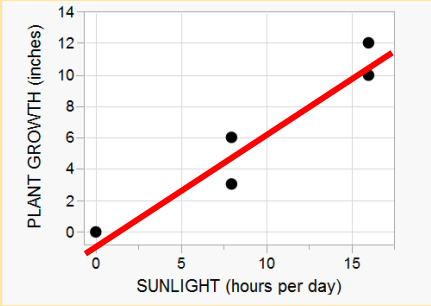
Propose a hypothesis. This is an educated guess about what you expect based on your research.

Step 4: Experiment

Design and perform an experiment to test your hypothesis. An experiment has an independent and dependent variable. You change or control the independent variable and record the effect it has on the dependent variable. Reminder to choose independent and dependent variables that are easy to measure…NUMBERS!

Step 5: Data and Analysis

Record observations/data and create graphs/plots to help illustrate the results. Strong analysis provides explanation of results and correlation to the research and hypothesis.



Step 6: Conclusion

Conclude whether to accept or reject your hypothesis. Make recommendations on what you would do for future or repeat experiments.

NAME
GRADE
TEACHER

JUDGING RUBRIC

Student name:_____

Scientific Method	key content & checklist	Meets expectation	Improvement recommendation?
1) Question	○ clearly stated ○ has scientific relevance or application ○ unique or creative		
2) Research	○ Displayed on board clearly ○ Cites reference ○ Research that helps address the question ○ Includes scientific history, principles or laws		
3) Hypothesis	○ Displayed on board clearly and neatly ○ States what you think will happen based science learning from research section ○ Includes a picture or plot to help explain expected result		
4) Experiment Plan	○ Clearly states how hypothesis was tested ○ Includes detailed materials list ○ Includes a control group to measure/reference against ○ Includes a picture or drawing		
5) Data and Analysis	○ Displayed on board clearly and neatly ○ Chart or table of results that shows how the variable impacts the response ○ Clearly labels axis and units on the plot or table ○ Analysis compares the results with the hypothesis ○ Analysis states how the scientific research properly helped or did not help predict the result		
6) Conclusion	○ Displayed on board clearly and neatly ○ States if hypothesis is right or wrong ○ Recommends how to improve result or experiment		

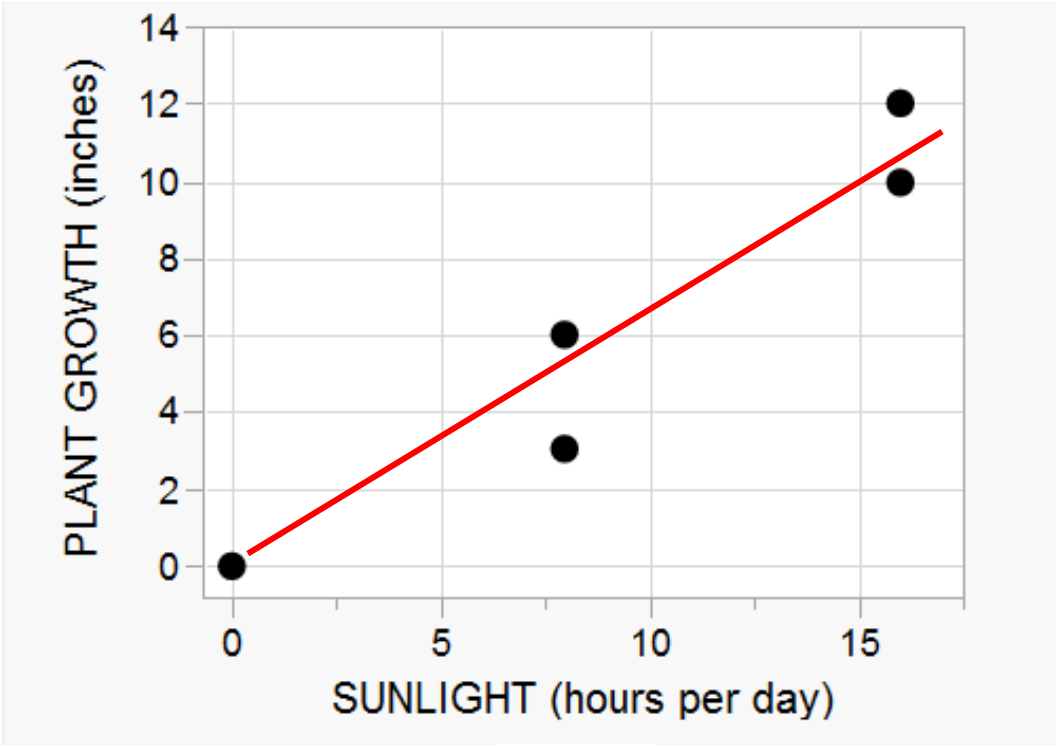
JUDGING RUBRIC

Student name: JON MYERS

Scientific Method	key content & checklist	Meets expectation	Improvement recommendation?
1) Question	○ clearly stated ○ has scientific relevance or application ○ unique or creative	✓	
2) Research	○ Displayed on board clearly ○ Cites reference ○ Research that helps address the question ○ Includes scientific history, principles or laws	✓	Need to add physics explaining different color light impact on photosynthesis.
3) Hypothesis	○ Displayed on board clearly and neatly ○ States what you think will happen based science learning from research section ○ Includes a picture or plot to help explain expected result	✓	
4) Experiment Plan	○ Clearly states how hypothesis was tested ○ Includes detailed materials list ○ Includes a control group to measure/reference against ○ Includes a picture or drawing	+ Great detailed description of expt to test hypothesis. Nice picture of expt setup.	
5) Data and Analysis	○ Displayed on board clearly and neatly ○ Chart or table of results that shows how the variable impacts the response ○ Clearly labels axis and units on the plot or table ○ Analysis compares the results with the hypothesis ○ Analysis states how the scientific research properly helped or did not help predict the result	+ Clearly labeled summary plot to show results. Excellent analysis to connect results to photosynthesis in research.	
6) Conclusion	○ Displayed on board clearly and neatly ○ States if hypothesis is right or wrong ○ Recommends how to improve result or experiment	✓	given the problem isolating light sources among groups, how would you fix this next time?

PROJECT IDEAS- where to start?

Easiest way to start the project is to start at the END:
expected plot of the quantitative response vs quantitative variable.



PROJECT IDEAS- page1

#	Theme	Question	Data to measure	Reference
1	chemistry: reactions	Are enzymes the key to laundry stain removal?	qualitative: ability for different detergents and enzymes to remove different stain types	https://www.sciencebuddies.org/science-fair-projects/project-ideas/Chem_p039/chemistry/are-enzymes-in-laundry-detergents-effective-stain-removers
2	chemistry: reaction rates	Can you slow down or speed up a chemical reaction?	reaction speed vs reactant size/temperature	https://www.education.com/science-fair/article/reaction-speed-particle-size/
3	chemistry: reactions	Can you make a battery out of fruit or vegetables?	electrical current(Amps) vs fruit type/nail coatings [need ammeter]	https://www.teachengineering.org/activities/view/cub_energy2_lesson04_activity2
4	chemistry: reactions	What percentage of air is oxygen?	perform experiment to estimate about of oxygen in air	https://www.sciencebuddies.org/science-fair-projects/project-ideas/Weather_p004/weather-atmosphere/oxygen-content-of-air-rust#summary
5	physics: gravity, forces, mechanical advantage	How do elevators work and can you increase the maximum weight?	mechanical advantage vs #/size of pulleys [need spring scale]	https://www.teachengineering.org/activities/view/cub_simple_lesson05_activity1
6	physics: gravity, forces	What is the best water dam design to produce the most power?	distance water spouts out vs water depth, hole size	https://www.education.com/science-fair/article/earth-science_squirter1/
7	physics: gravity, forces	What is the best launch angle for height or distance?	catapult launch distance or height vs angle/object weight/force	https://www.sciencebuddies.org/science-fair-projects/project-ideas/Phys_p085/physics/use-a-catapult-to-storm-castle-walls
8	physics: potential vs kinetic energy	How to design a roller coaster?	marble coaster speed or time(kinetic energy) vs tower height(potential energy)	https://www.teachengineering.org/activities/view/duk_rollercoaster_music_act
9	physics: gravity, forces	What is the best airplane design?	flight distance vs wing size/shape/weight	https://www.teachengineering.org/activities/view/cub_airplanes_lesson06_activity1
10	physics: electromagnetism	How do you create an electromagnet?	# of paper clips vs # of coils	https://www.teachengineering.org/activities/view/cub_mag_lesson2_activity1
11	physics: electrical conduction	What materials conduct electricity?	electrical current(Amps) vs material [need ammeter]	https://www.sciencebuddies.org/science-fair-projects/project-ideas/Elec_p018/electricity-electronics/conductors-insulators-basic-circuit

PROJECT IDEAS- page2

#	Theme	Question	Data to measure	Reference	2019
12	physics: thermal conduction	What materials are best for keeping items hot or cold?	Measure how fast heat is lost from various containers – glass, plastic, metal. Do the same materials which conduct electricity also conduct heat?	https://www.steampoweredfamily.com/activities/heat-transfer-projects-for-kids-stem-activities/	K 2019
13	physics: thermal conduction	How does land affect local temperatures?	Measure temperatures in different environments: NSEW of building, over road, over grass, basement, attic, etc.		
14	physics: gravity, forces, pressure	What is barometric pressure and how does it change versus location?	Measure the barometric pressure at various places (mountain/hill, in valley, various levels of elevator) vs elevation (smart phone app).	https://easyscienceforkids.com/make-your-own-barometer/	
15	physics: magnetism	How do you create a magnetic chain reaction?	distance/speed ball travels vs # of magnets	https://www.scienceproject.com/projects/detail/Free/FG043.asp	
16	physics: bernoulli's principal	How does wind impact air pressure?	time for objects to collide vs separation distance/temperature/wind speed	https://www.sciencebuddies.org/science-fair-projects/project-ideas/Aero_p039/aerodynamics-hydrodynamics/bernoulli-principle#procedure	
17	physics: properties of matter	What objects float versus sink?	Plot sink or float vs density (values > 1 sink, and < 1 float). Density= wt/volume and volume can be determined by displacement of water. Compare different woods, different metals, alloys, pennies before/after 1982	https://easyscienceforkids.com/all-about-sink-and-float/	1st 2019
18	physics: properties of matter	How do dissolved substances change the density, boiling/freezing point of water?	test float or sink objects in tap water. Retest as you add more salt to change the density.	https://sciencing.com/water-density-science-experiments-8029220.html	
19	life sciences: photosynthesis	How to optimize plant growth?	plant growth vs amount of water/light/soil pH/color of light	https://education.seattlepi.com/experiment-ideas-photosynthesis-6593.html	
20	life sciences: human body	How Does Heart Rate Change with Exercise?	Measure heart rate (phone app) vs activities, try different sample groups including gender(boy vs girl), age (kids vs adults)	https://www.sciencebuddies.org/science-fair-projects/project-ideas/Sports_p006/sports-science/heart-rate-change-with-exercise#summary	preK 2019
21	life sciences & physics	What is the best sports drink?	electrical current(Amps) vs sports drink [need ammeter]	https://www.sciencebuddies.org/science-fair-projects/project-ideas/Chem_p053/chemistry/electrolyte-challenge-orange-juice-vs-sports-drink#summary	
22	biology	What household objects have the most germs?	bateria growth after X days vs sample [need purchase petri dishes prefilled with agar]	https://www.scienceproject.com/projects/detail/Free/FG043.asp	

A copy is available on All Saints url:
www.allsaintsportland.com/sciencefairpacket

SCIENCE FAIR REVIEW

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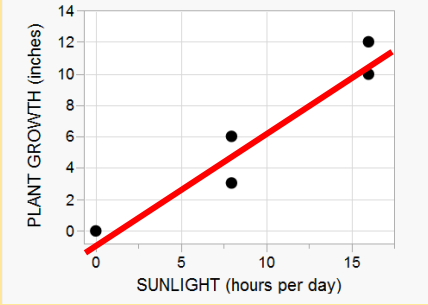


Step 6: Conclusion

Conclude whether to accept or reject your hypothesis. Make recommendations on what you would do for future or repeat experiments.

NAME
GRADE
TEACHER

Step by Step simple plant growth experiment

PLANT GROWTH EXPERIMENT

INDEPENDENT VARIABLE=amount of water

DEPENDANT VARIABLE= plant height

Step 1: Question

Does more water make plants grow faster?

PLANT GROWTH EXPERIMENT

INDEPENDENT VARIABLE=amount of water

DEPENDANT VARIABLE= plant height

Step 2: Research

(what is the key scientific law or principal that may help explain experimental outcome?)

photosynthesis: the process by which green plants and some other organisms use sunlight to synthesize foods from carbon dioxide and water.

PLANT GROWTH EXPERIMENT

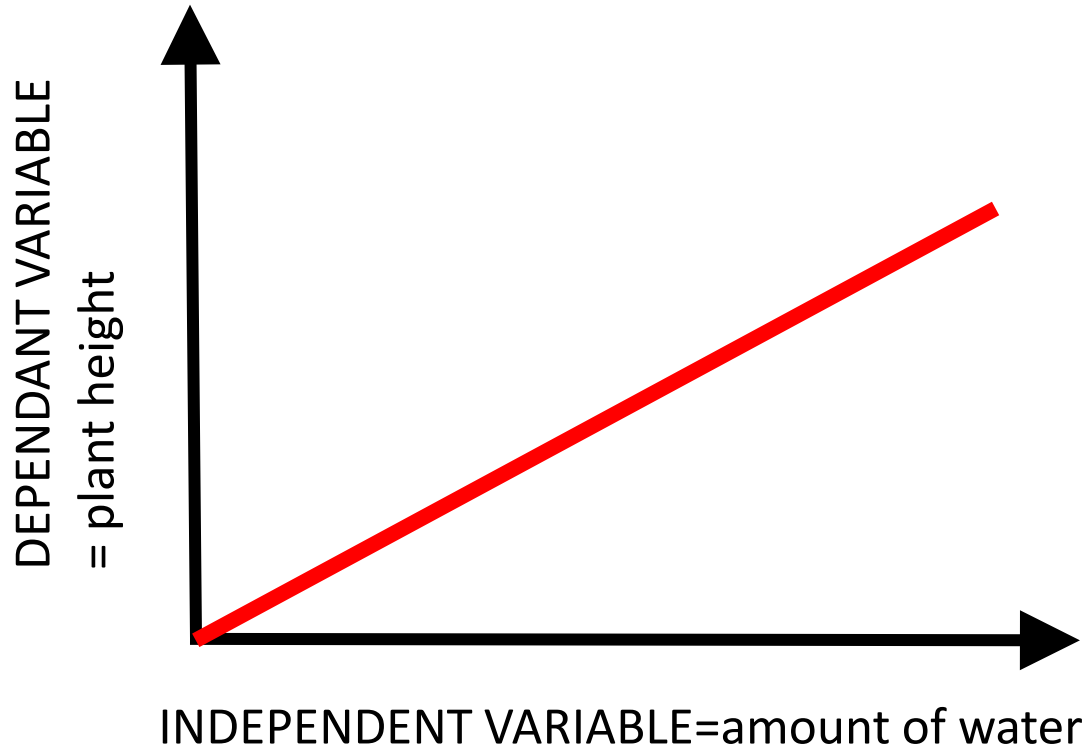
INDEPENDENT VARIABLE=amount of water

DEPENDANT VARIABLE= plant height

Step 3: Hypothesis

(Connecting the dots between research and experiment expectation)

I hypothesize more water will make plants grow taller because of photosynthesis!



PLANT GROWTH EXPERIMENT

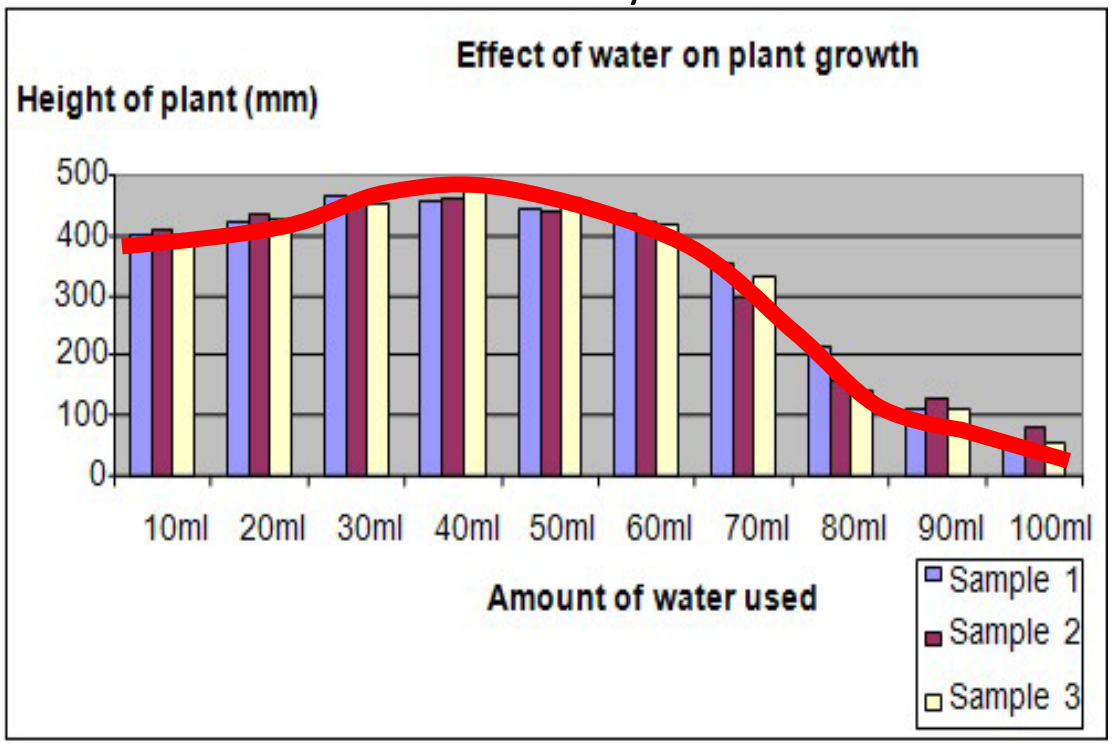
Step 5: Data & Analysis

It is OK that the initial hypothesis was not completely correct!

MORE RESEARCH = The process called respiration combines oxygen and the food created during photosynthesis to produce usable energy.

ANALYSIS = Too much water can prevent plant roots from absorbing oxygen.

After 10 days

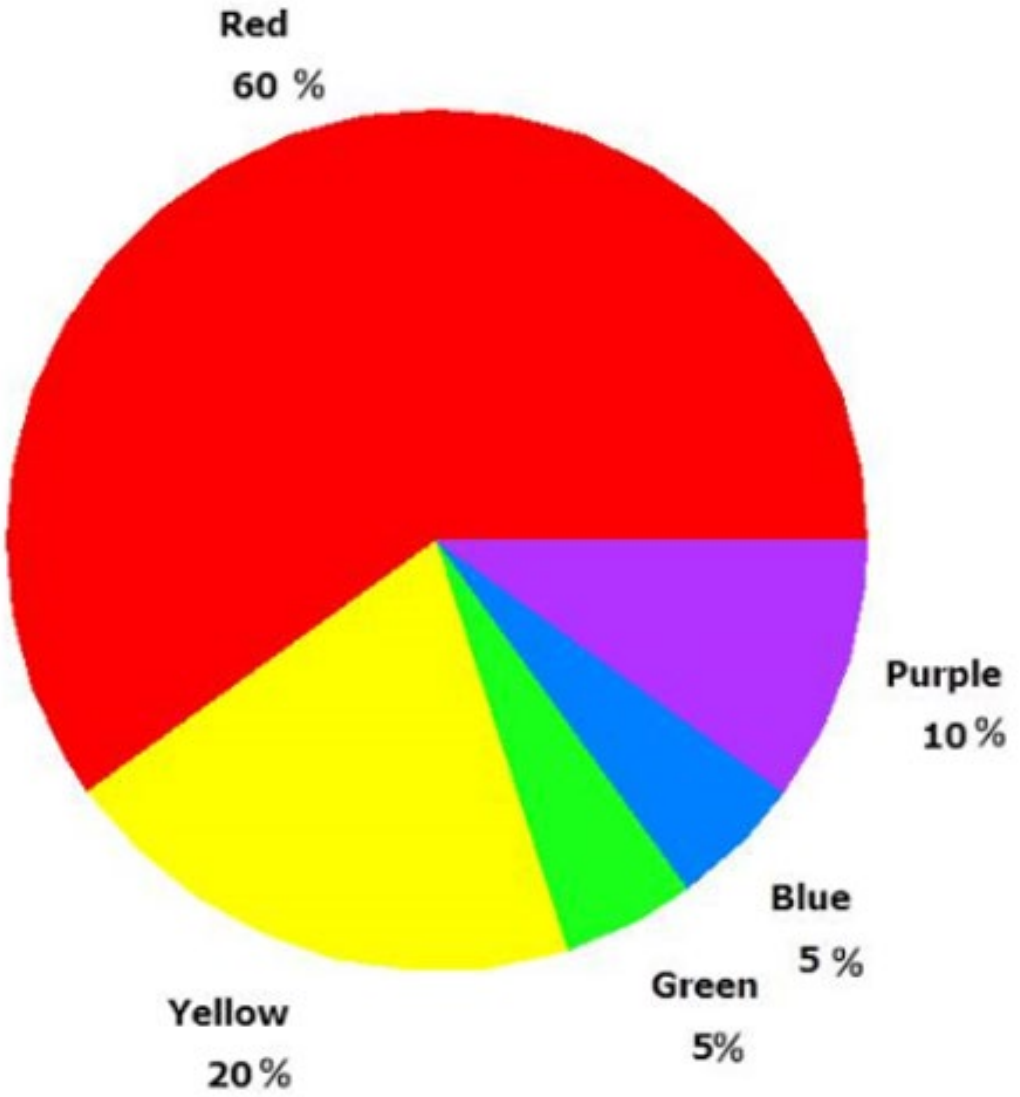


Other easy experiments

Life Sciences: Birdfeeder project idea

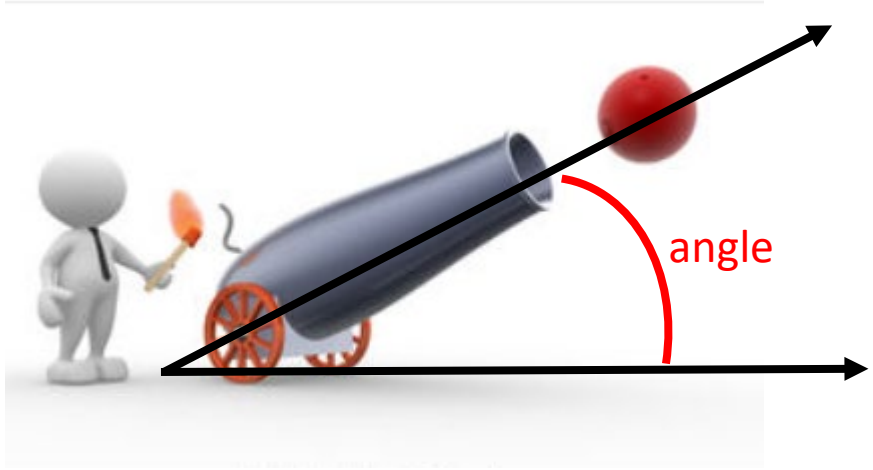
VARIABLE = color of bird feeder

RESPONSE= number of visits

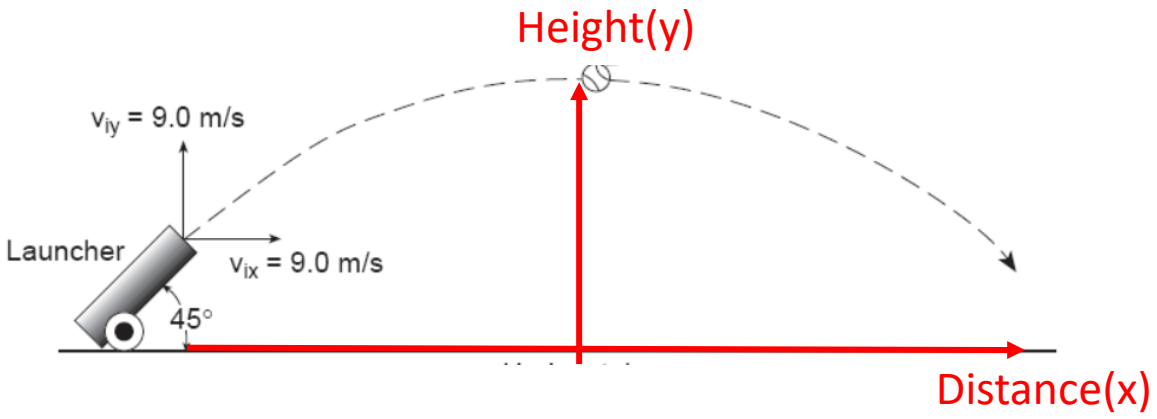


Physics: Forces and Motion- catapult experiment idea

VARIABLE = launch angle

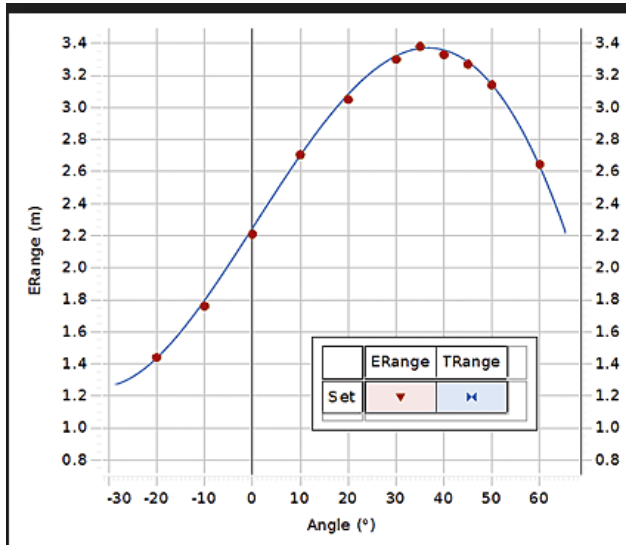


RESPONSE= height and distance



DATA RESULTS:

Plot distance(response) vs launch angle (variable)



Question: what angle is best for shooting the longest distance?

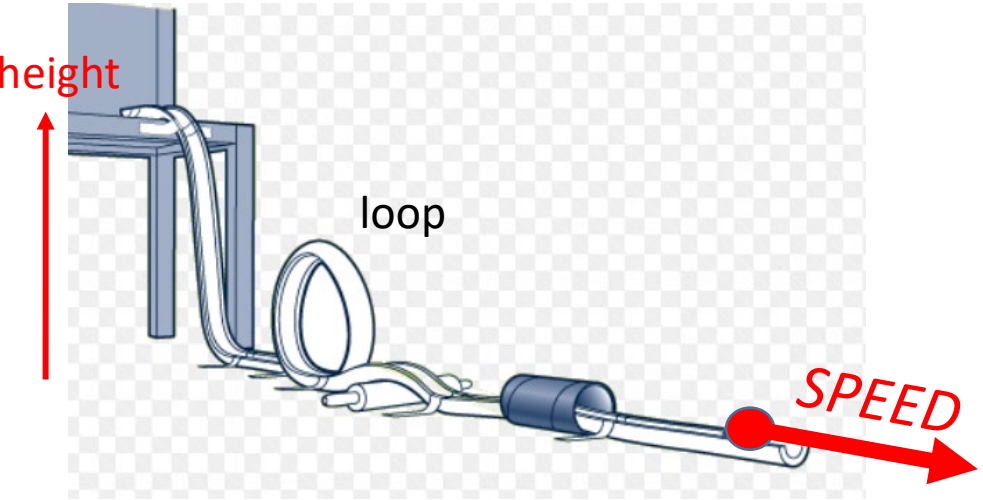
Question: what angle is best for achieving height?

Question: what happens when the ball is heavier?

2018 Physics: Potential vs Kinetic energy – marble roller coaster

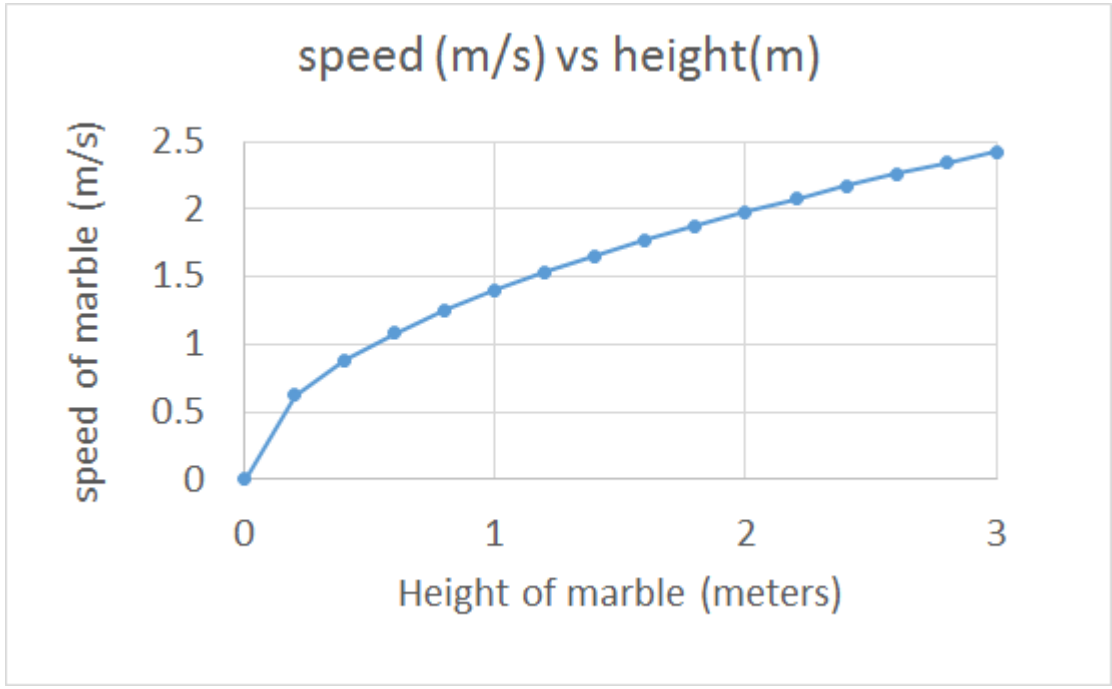
VARIABLE = starting height

RESPONSE= speed (kinetic energy)



DATA RESULTS:

Plot speed(response) vs starting height (variable)



Question: what happens when you make the loop bigger?

Question: can you make the loop too big so ball does make it to the finish?

Step by Step simple heart rate experiment

Step 1: Question

Does your heart beat change with different activities?

Do girls have a different heart rate than boys?

VARIABLE=activity

RESPONSE TO MEASURE= heart beat

Step 2: Research

Without oxygen, your body cannot live.

1) breathe air in, oxygen fills your lungs

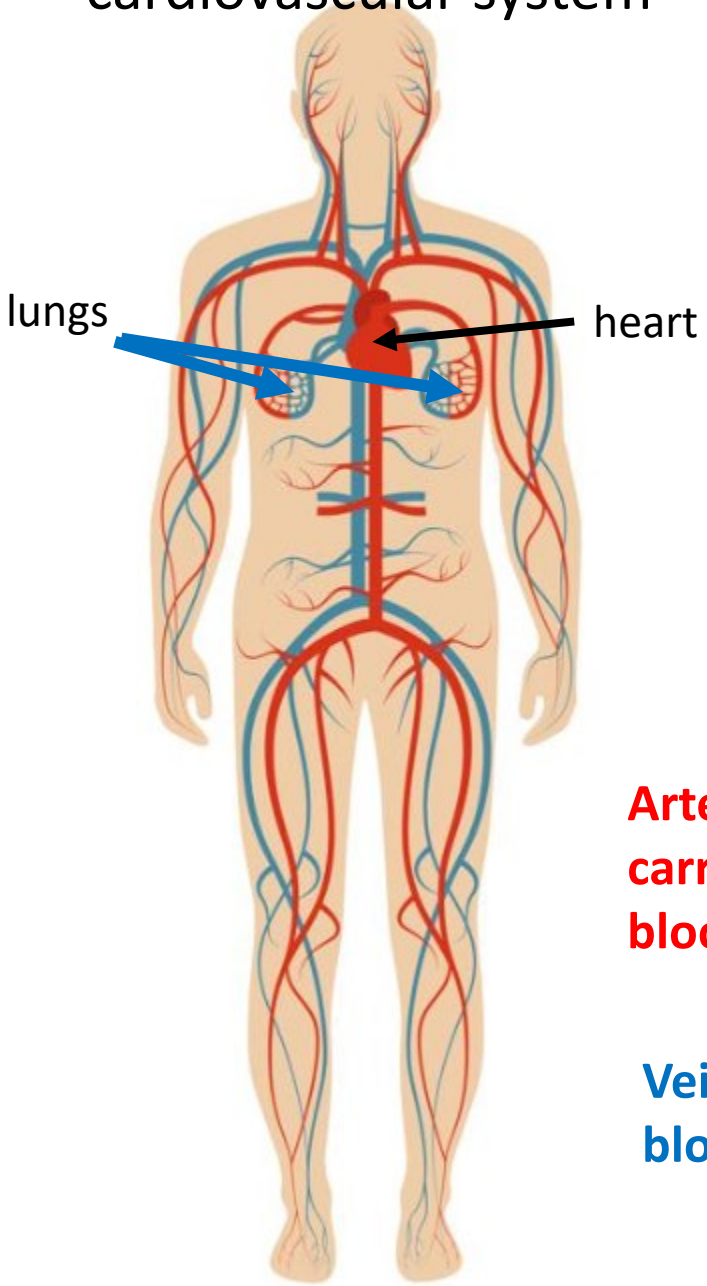
2) Lungs transfer oxygen into your blood

3) **Your heart pumps the oxygen-rich blood through arteries (red tubes in picture) to your muscles, brain, and other organs.**

4)Your organs use the oxygen to live and then the blood is returned to lungs through veins (blue tubes in picture) to get more oxygen.

5) When you exercise, your body needs MORE OXYGEN. FASTER BREATHING. FASTER HEART BEAT!

cardiovascular system



Arteries carry oxygen-rich blood to organs.

Veins carry blood back to heart.

Step 3: Hypothesis

The more we use our muscles to move our bodies, the more oxygen our muscles need and the faster we breathe and faster our heart beats.

Hence, our hypothesis is the higher intensity activities will make our heart beast faster for both boys and girls.

Step 4: Experiment

1) Sit in a chair for 5 minutes to let your body rest and your heart rate return to normal “resting heart rate”.

2) Measure your resting heart rate.

3) Perform different activities for 3 minutes and measure your heart rate. Be sure to rest 5 minutes in-between activities to let your heart return to normal resting heart rate.

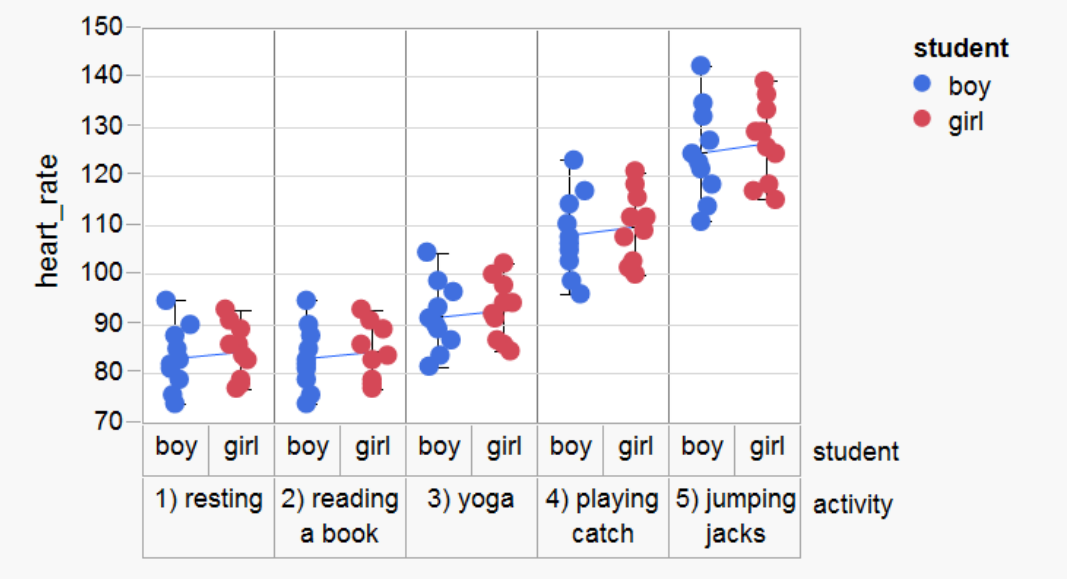
activities:
-laying down
-reading a book
-playing catch
-squats
-jumping jacks

4) Plot heart rate on graph paper for each activity, using different color dots for girls vs boys.

Step 5. Data and Analysis

The heart rate results show that laying down and reading a book did not change the resting heart rate.
Since our bodies are not moving during reading or laying down, we did not expect the heart rate to increase.

When we play catch, our arm and leg muscles are moving to throw and catch. Our heart rate increased. Doing squats works your leg muscles and this requires more oxygen. Squats increased heart rate even more than playing catch. The most demanding activity was jumping jacks since our entire body is moving quickly. This caused our heart beat to be fastest, increasing from 84 beats per minute to 123 beats per minute!



Step 6. Conclusion

Our hypothesis was correct. Heart rate did not speed-up when we were doing relaxing activities, laying down and reading a book. Heart rates sped-up as we started moving like playing catch, squats to work our leg muscles and jumping jacks. Our conclusion is to keep our heart healthy and strong, we need to move our bodies, work our muscles and increase our heart rate everyday.

Other project ideas that are easy data collection……

RISE OF THE MUFFINS

Step 1: Problem

What is the difference between using baking soda and baking powder in a muffin recipe?

Step 2: Research

Baking soda and baking powder are often used in baking recipes. Both are leavening agents that produce carbon dioxide gas (CO_2) when activated. The CO_2 bubbles make baked goods rise and become fluffy.

Baking soda is sodium bicarbonate, and is naturally alkaline or basic. So, it needs an acid and liquid to be activated. When baking soda is combined with an acid it reacts immediately. Sometimes a recipe needs a longer reaction. Once the baking soda reacts with the acid, the recipe will begin to rise.

Baking powder is unlike baking soda because it is a complete leavening agent. This means it has both the acid and the base needed to help the product rise. The baking powder in grocery store is double acting and has different ingredients that produce CO_2 gas at different phases of baking.

Table 1: Duration of and size of bubbles observed in different water and vinegar solutions

Solution	1 tsp Baking Soda	1 tsp Baking Powder
50:50 Water:vinegar	1min 40s Large bubbles	48s Small bubbles
Water	No bubbles	9s Small bubbles

Step 3: Hypothesis

Greater amounts of leavening agent used will produce a larger muffin. The greater the baking powder amount, the larger the muffin, because it is double-acting.

Step 4: Experiment

Materials for 24 muffins: 2 muffin tins, 8 different sets of muffin liners, measuring cups and spoons, 4 cups flour, 1 cup sugar, varying of baking powder, 1 tbsp salt, varying baking soda, 1 cup butter, 1.5 cups milk, 4 eggs, phone for photos, ruler, mixing bowls, mixing spoons, oven.

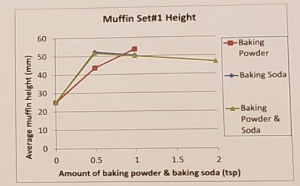
1. Preheat oven to 350°F
2. Line muffin tins with 8 rows of 3 identical muffin liners for 24 total muffins
3. In small bowl, whisk flour, sugar and salt together
4. In medium bowl whisk milk, butter and eggs together
5. Add flour mixture to the butter mixture until combined
6. Divide batter evenly into 8 separate bowls. Add varying amounts of baking soda and baking powder into each bowl, according to table 2
7. Divide each bowl of muffin batter into the corresponding three muffin liners
8. Insert muffin tins into preheated oven
9. Open oven door every 4 minutes to take photos and note observations
10. Remove muffin tins at 20 minutes
11. Place muffins onto cooling racks after 10 minutes
12. Measure of heights of muffins with ruler

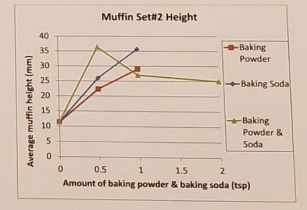
After the first 24 muffins, it was observed that muffin batter rose above the muffin tin level on some sets within 4 minutes, and it was determined that a more specific batter measurement would give more precise data. So, a second set of muffins was made with the same steps for 1-12, but instead of Step 7 dividing each bowl of muffin batter into 3, only 1 tbsp of batter was used in each muffin.

Step 5: Data & Analysis

In experiment set #1, too much batter was placed in the tins which made the muffin height measurements difficult. In experiment set #2, only 1 tablespoon of batter was used in each muffin tin. The result was shorter muffins but the data was clear to show increasing baking soda produced taller muffins than increasing baking powder. When adding too much of both baking soda and baking powder, the muffins rose but soon spread out and collapsed into lumps to become shorter.

During baking, it was also observed that the muffins with more baking soda were more brown. According to research, baking soda also helps brown baked goods.





Step 6: Conclusion

The hypothesis was correct that adding more leavening agents will produce a bigger muffin. However, baking soda rose taller than baking powder which was unexpected since the hypothesis said the baking powder muffins would rise more than the baking soda. Adding too much leavening agent resulted in shorter muffins due to the muffins collapsing.

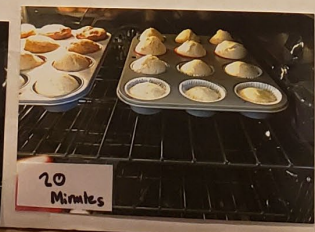
In conclusion, adding the correct amount of baking soda (1 tsp) worked best for producing the tallest muffin and nicely browning the muffins. The recommendation is to measure the amount of leavening agent used in recipes to produce the best results and avoid sad, flattened muffins.

References

https://www.healthline.com/nutrition/baking-soda-vs-baking-powder

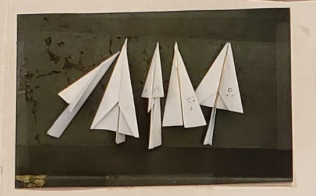
https://www.thoughtco.com/how-baking-soda-works-for-baking-607383

Myla Zawadzki
4A: Mr. Lams



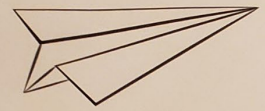
Wings of Flight

Oscar Hoffelt & Kazmer Zawadzki



Step 1: Question

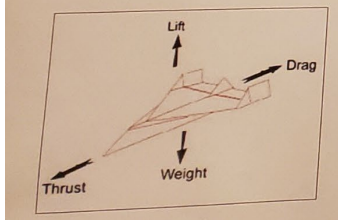
How will changing wing size affect the flight distance of paper airplanes?



Step 2: Research

4 forces acting on airplane:

- Thrust: the force with which the paper airplane is thrown
- Weight: the force of the airplane being pulled back to Earth caused by gravity
- Lift: the force that holds an aircraft in the air
- Drag: the aerodynamic force that opposes an aircraft's motion



Step 3: Hypothesis

The larger the wing, the greater the lift, thus the further the flight distance is expected.

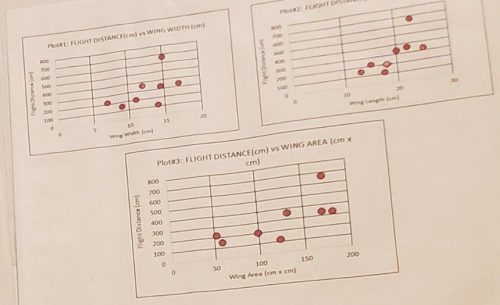
Step 4: Experiment

1. We created 8 paper airplanes
   - A popsicle stick was inserted into each airplane to maintain similar weight
   - The surface area of the wings were varied by cutting them with scissors
   - Each plane was labeled with a letter
2. Each plane was thrown 3 times with the approximate same force by Kazmer
3. Each flight distance was measured by using Oscar's feet

Step 5: Data & Analysis

- Three charts were created using an average of each plane's three flight distances:
  1. Plot #1: Flight distance (cm) VS wing width (cm)
  2. Plot #2: Flight distance (cm) VS wing length (cm)
  3. Plot #3: Flight distance (cm) VS wing area (cm x cm), calculated by multiplying wing length by wing width
- There is a correlation between greater wing surface area and flight distance.

plane	wing width (cm)	wing length (cm)	wing area (cm x cm)	FLIGHT DISTANCE (cm)				
				trial 1	trial 2	trial 3	AVERAGE	notes
A	17	20	170	299	357.5	364	340.2	
B	11	18	99	208	273	130	203.7	
C	15	23	172.5	676	624	702	667.3	
D	14	17.5	122.5	149.5	130	78	119.2	
E	12	22	132	416	253.5	403	357.5	
F	7	15	52.5	208	208	247	221.0	
G	14.5	25	181.25	208	260	520	329.3	lots of loops
H	9	13	58.5	156	130	169	151.7	



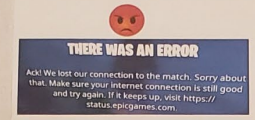
Step 6: Conclusion

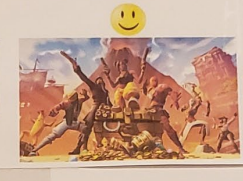
The experiment supported our hypothesis. Our data showed that the larger the wing, the further the flight distance is observed. This can be further explained by the direct correlation between greater lift, and increased flight distance.

WI-FI ZERO OR HERO?

Kazmer Zawadzki (5A)

Oscar Hoffelt (5C)





Step 1: Problem

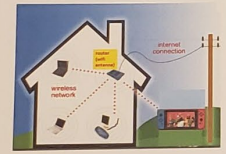
How does distance from router affect WiFi internet speed?

Step 2: Research

Why Wifi: Wifi is important in daily life. It can be very frustrating when a work assignment, movie, or game starts lagging and crashing. In this project, Wifi internet speed is tested over varying distances from the router.

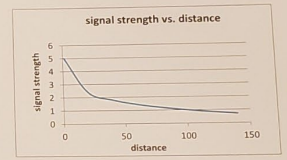
How it works: Internet signal is sent through wires down streets and into homes. A Wifi router sends the internet signal through the air as radio waves that devices can connect to. This is shown in picture #1.

Picture 1: How WiFi works



Effect of distance: Wifi signal strength degrades by the factor of $\frac{1}{distance^2}$.
Picture #2 shows how much the signal strength degrades with distance. It's like talking. When you're close, you can talk fast and the other person can understand. But the further away you go, the slower you have to talk to be understood. It's the same with Wifi signal strength impacting internet speed.

Picture 2: How radio signal strength is expected to degrade by distance



Step 3: Hypothesis

It is expected that the greater the distance from the router, the weaker the Wifi signal as shown in picture 2. Therefore, we expect slower internet speed as distance from router increases. Furthermore, the greater the number of devices using a particular Wifi router, the slower the internet speed.

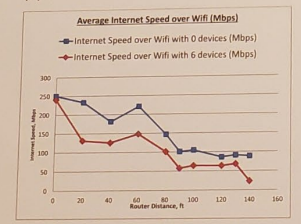
Step 4: Experiment

1. Internet speed data was measured with an Xfinity speed test website at 10 varying distances from the router.
2. The distances varied between 0 and 140 ft from the router.
3. Data was taken with 0 devices connected to the router
4. Steps 1-3 were repeated with 6 devices streaming movies.

Step 5: Data & Analysis

Plot 1 shows the internet speed at 0 devices and 6 devices. It also shows the distance from the router. It is clear that the internet speed decreases as distance from the router increases, and that the increase in device activity also decreases internet speed. Based on our research, the internet speed decreased because the Wifi signal strength gets weaker with distance from the router.

- Plot 1: Average Internet Speed (Mbps) vs. Router Distance (ft)



Step 6: Conclusion

The experiment data supported the hypothesis. The data showed that the greater the distance from the router, the slower the Wifi internet speed. Furthermore, the data showed that with an increase of devices connected to the router, the slower the internet speed. It is recommended that for optimal device performance, being close to the router is key.

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Brain, M., Wilson, T., Johnson, B. How Wifi works: What is Wifi? Retrieved from http://computer.howstuffworks.com

Xfinity Speed Test, Retrieved from http://speedtest.xfinity.com

Keep it Hot!

Keep it Cold!

Harper Brinkley (3B) and Myla Zawadzki (3B)

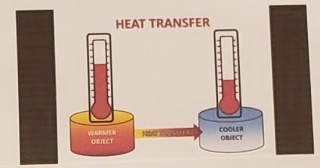
Step 1: Problem

What materials are best for keeping beverages hot or cold?

Step 2: Research

Every material has the physical property thermal conductivity, *k*. Thermal conductivity is how well a material can transfer heat. People drink liquids out of containers made of different materials. Depending on their choice, their hot drink may not stay hot, or their cold drink may not stay cold. The chart lists *k* values for common beverage containers.

Material	*k* (W/mK)
Stainless Steel	16.3
Ceramic	3.8
Glass	1.35
Paper	0.05



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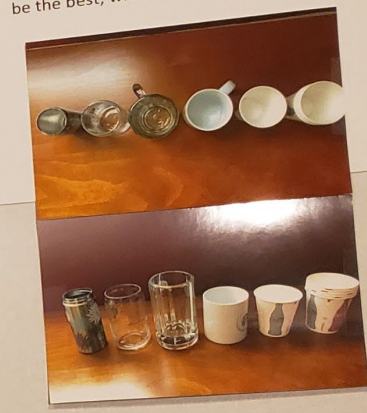
Thermal conductivity values – Retrieved from https://www.engineeringtoolbox.com

Specific heat and heat transfer: What is thermal conduction? – Retrieved from https://khanacademy.org/science/physics/thermodynamics/specific-heat-and-heat-transfer/a/what-is-thermal-conductivity

Munoz, E. *Heat transfer image: Heat transfer science.* Retrieved from https://tinycards.duolingo.com/decks/41qWbt4a/heat-transfer-science

Step 3: Hypothesis

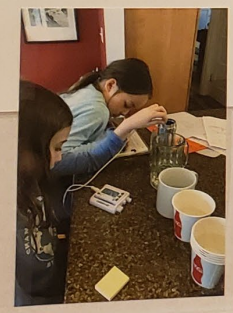
The larger the value of *k*, the greater the temperature change of the liquid over time in that material. The smaller the value of *k*, the smaller the temperature change of the liquid. It is expected that stainless steel, with its higher *k* will be the worst at keeping the liquid at its original temperature and the paper will be the best, with its lower *k* value.



Step 4: Experiment

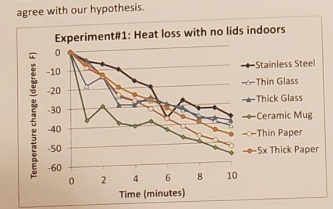
Materials: 6 beverage containers (stainless steel, thin glass, thick glass, ceramic, thin paper, thick paper), boiling water at 220°F, lids made of cardboard covered with saran wrap, measuring cup, digital kitchen thermometer

1. Boil water to 220°F
2. Pour 1 cup of boiling water in each container
3. At 1 minute intervals, measure the temperature of each liquid with room temperature of 70°F
4. Repeat steps 1-3 with a cardboard lid outdoors with air temperature 40°F



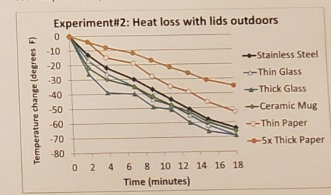
Step 5: Data & Analysis

Indoors with No Lid: The first experiment indoors with no lid had very unexpected results. We expected the stainless steel to be the worst at keeping the heat in but it turned out to be the best. We suspected that the stainless steel was best because it had the smallest diameter opening, meaning it had less heat loss with the air. We decided that our first experiment was affected by the extra heat loss through the top opening because we had no lids and that is why the results did not agree with our hypothesis.



Outdoors with Lid: For experiment number two, we decided to put a lid on the cups to minimize the heat through the top opening to hopefully see the expected results from our hypothesis.

The experiment number two results showed the paper was the best as expected because it has the lowest thermal conductivity. It also showed that the thicker the paper, the less the heat can go through. All of the other materials were terrible compared to paper and there was not a big difference between them. We were still surprised the stainless steel was not the worst and think that happened because the stainless steel cup was shaped different.



Step 6: Conclusion

Our hypothesis was half correct because we were right about the paper [thick] performing the best because it had the lowest *k*. We were half wrong because the steel was not the worst, possibly because the opening was so small. So, a container with a low *k* could still keep a beverage hot or cold, depending on if it had a lid or not, and if it's diameter were large or small.

"People used to say that information is power but that is no longer the case. It's the analysis of the data, use of the data, digging into it — ***that is the power****"*

Choose project with a quantitative dependent variable…
easy to measure with #s!

- distance in inches
- time (seconds)
- heart rate = beats per minutes
- speed = distance travelled per second

Conclusion

science is awesome!

- Goal is to get as many grade 2-5 students involved as possible!
- Teams of 2 OK!
- Register before April 1st (in-school office hour)

GRADE	platform	2017	2018	2019	2020	2021	April 2022
PreK	classroom	classroom	classroom	classroom	Hermann	cancelled	~~too late~~
K	classroom	classroom	classroom	classroom	Hermann	cancelled	~~too late~~
1st	classroom	classroom	classroom	classroom	Hermann	cancelled	~~too late~~
2nd	voluntary at home	12	13	7	cancelled	cancelled	tbd
3rd	voluntary at home	25	14	20	cancelled	cancelled	tbd
4th	voluntary at home	14	11	15	cancelled	cancelled	tbd
5th	voluntary at home	6	1	18	cancelled	cancelled	tbd
6th	classroom in 2020+	2	0	4	Shufelt	cancelled	Shufelt
7th	classroom	Shufelt	Shufelt	Shufelt	Shufelt	cancelled	Shufelt
8th	classroom	Shufelt	Shufelt	Shufelt	Orr	cancelled	~~too late~~
	voluntary students	59	39	64	cancelled	cancelled	tbd

Upcoming key dates and help needed (parent volunteers!)

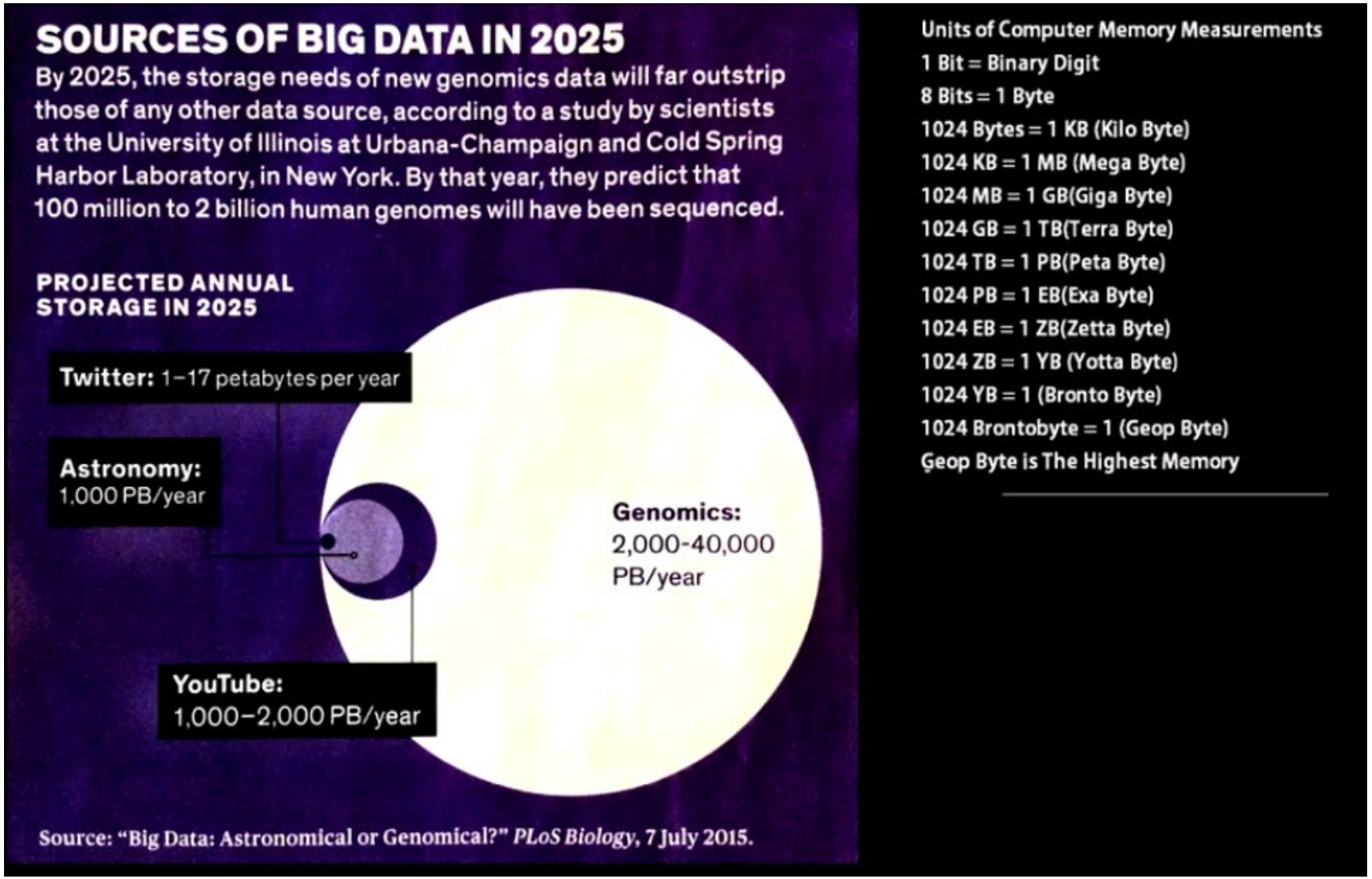
Friday, April 1st	8am-9:30am - Science Fair help session available in the library for grade 2-5 registered participants.
Wednesday, April 20th	8am-10am – Judge projects! (> 125 trifolds)
	6:30pm-7:30pm – Open House in gym, friends & family welcome)

Contacts keith.e.zawadzki@intel.com
reniera.eddy@gmail.com

Online documents www.allsaintsportland.com/sciencefairpacket

BACKUP

BIG DATA!!!
->Artificial Intelligence
-> Autonomous Driving
-> Gene therapy



Units of Computer Memory Measurements
1 Bit = Binary Digit
8 Bits = 1 Byte
1024 Bytes = 1 KB (Kilo Byte)
1024 KB = 1 MB (Mega Byte)
1024 MB = 1 GB(Giga Byte)
1024 GB = 1 TB(Terra Byte)
1024 TB = 1 PB(Peta Byte)
1024 PB = 1 EB(Exa Byte)
1024 EB = 1 ZB(Zetta Byte)
1024 ZB = 1 YB (Yotta Byte)
1024 YB = 1 (Bronto Byte)
1024 Brontobyte = 1 (Geop Byte)
Geop Byte is The Highest Memory

MARBLE ROLLER COASTER PROJECT:

2018 preK & 1st grade classroom project

Step 1: Question

Tower height

Does the tower height of the roller coaster impact the speed and design of the ride?

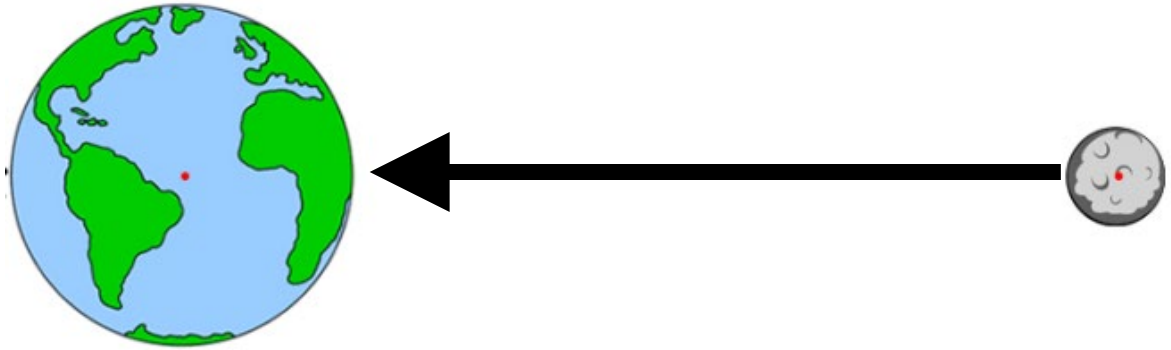
Step 2: Research

What are the scientific principals that engineers and scientists use to build a super, awesome roller coaster?

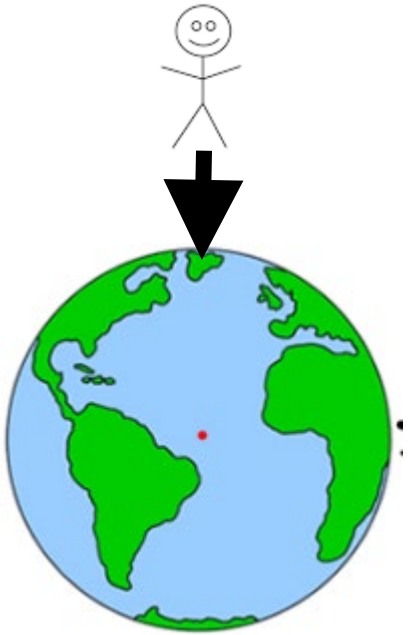
1) GRAVITY
2) POTENTIAL ENERGY
3) KINETIC ENERGY

http://www.physicsclassroom.com/mmedia/energy/ce.cfm

Step 2: Research: GRAVITY



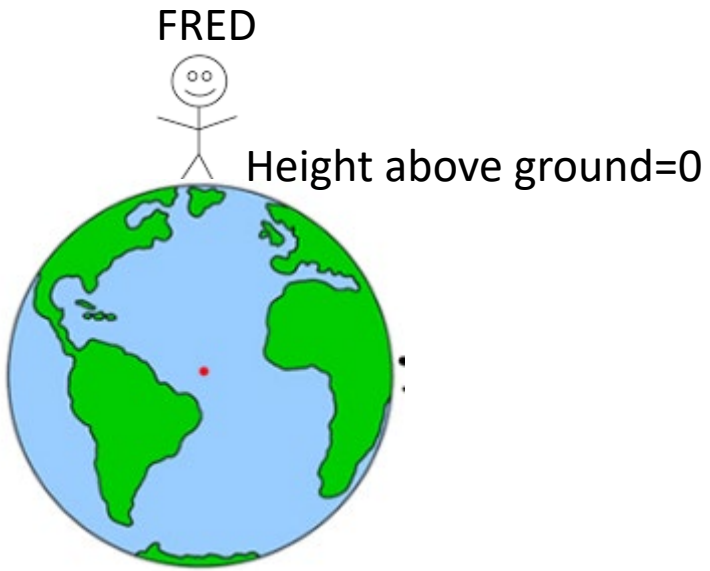
The earth pulls on the moon.
We call this pull force = gravity.



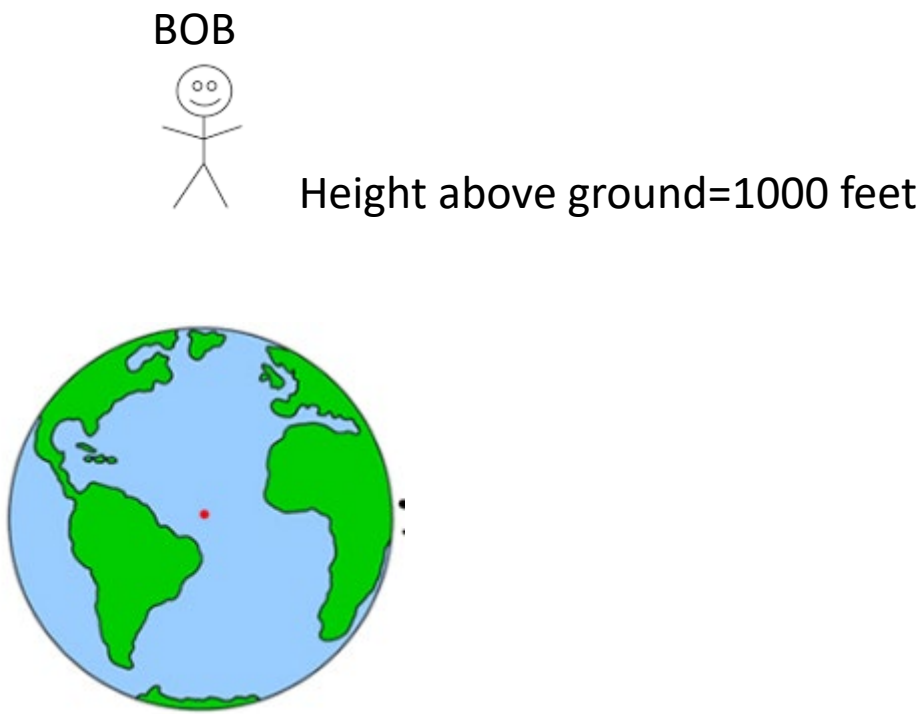
The earth's gravity pulls on every object, including every person.
What happens when you jump in the air?
Gravity pulls you back down.

KEY CONCEPT: Gravity is a force that pulls all objects towards the earth.
Earth's gravitational acceleration = g = 9.8 meters/second^2
Force = mass * g

Step 2: Research: POTENTIAL ENERGY



Fred has 0 potential energy.



Bob has LOTS of potential energy.

KEY CONCEPT: As you increase object's height above ground, the POTENTIAL ENERGY increases because of GRAVITY.

Potential Energy = mass * g * height

Step 2: Research: KINETIC vs POTENTIAL ENERGY

BOB

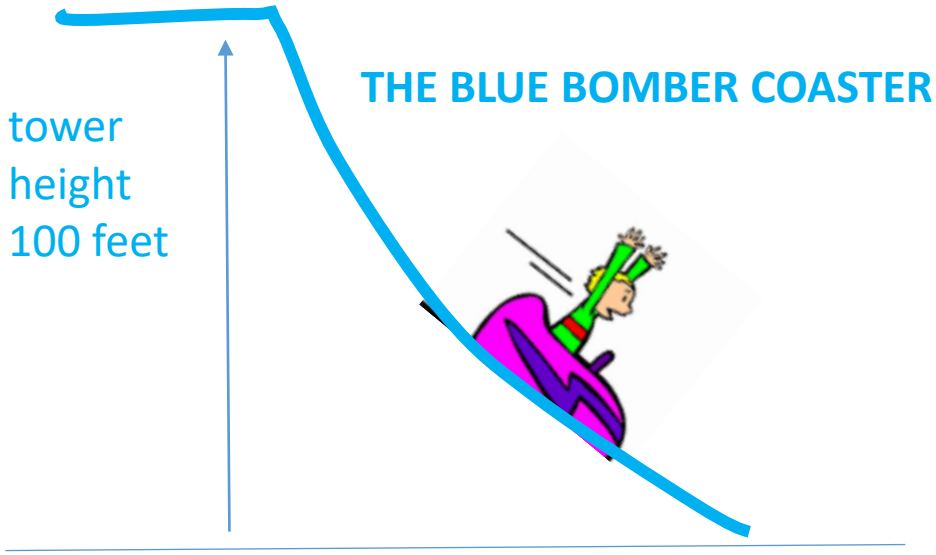
Height above ground=1000 feet

Bob has LOTS of potential energy.
What will happen to Bob's potential energy?

Bob's potential energy will convert into kinetic(motion) energy.

KEY CONCEPT: Kinetic energy is movement.
Kinetic Energy = ½ * mass * velocity^2

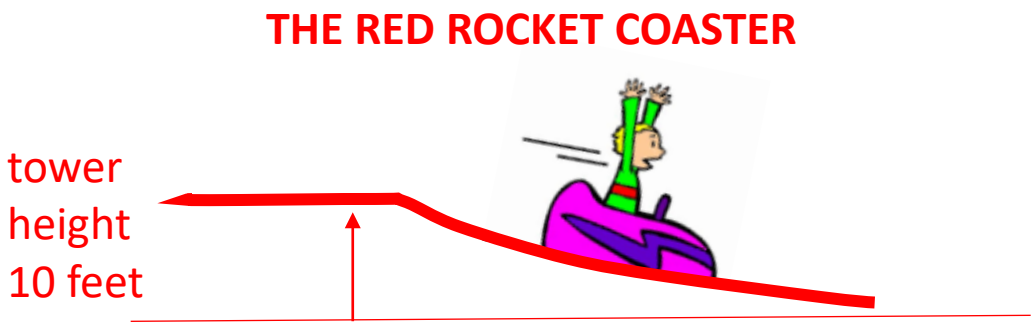
Step 3: Hypothesis (educated guess)

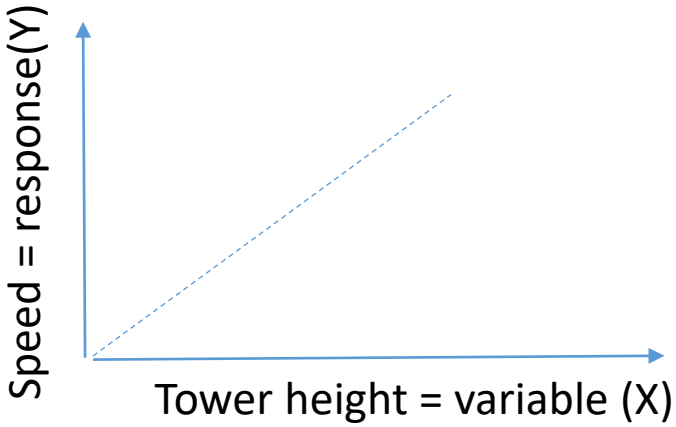


Which roller coaster tower has more potential energy?

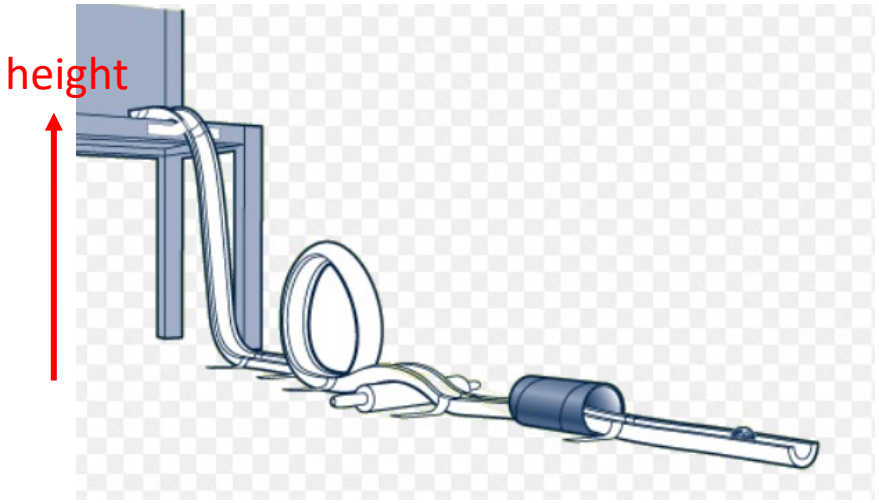
When all of the potential energy is converted into kinetic energy, which roller coaster will be FASTER?

What is our hypothesis about how the tower height impacts the roller coaster? Make a plot of expectation/hypothesis.





Step 4: Experiment



Supplies:

- Marble
- Roller coaster track (foam track = 24 feet long)
- Measuring tape to measure height
- Stop watch to measure time to complete the roller coaster

Procedure:

1) Setup 24 feet of roller coaster track.

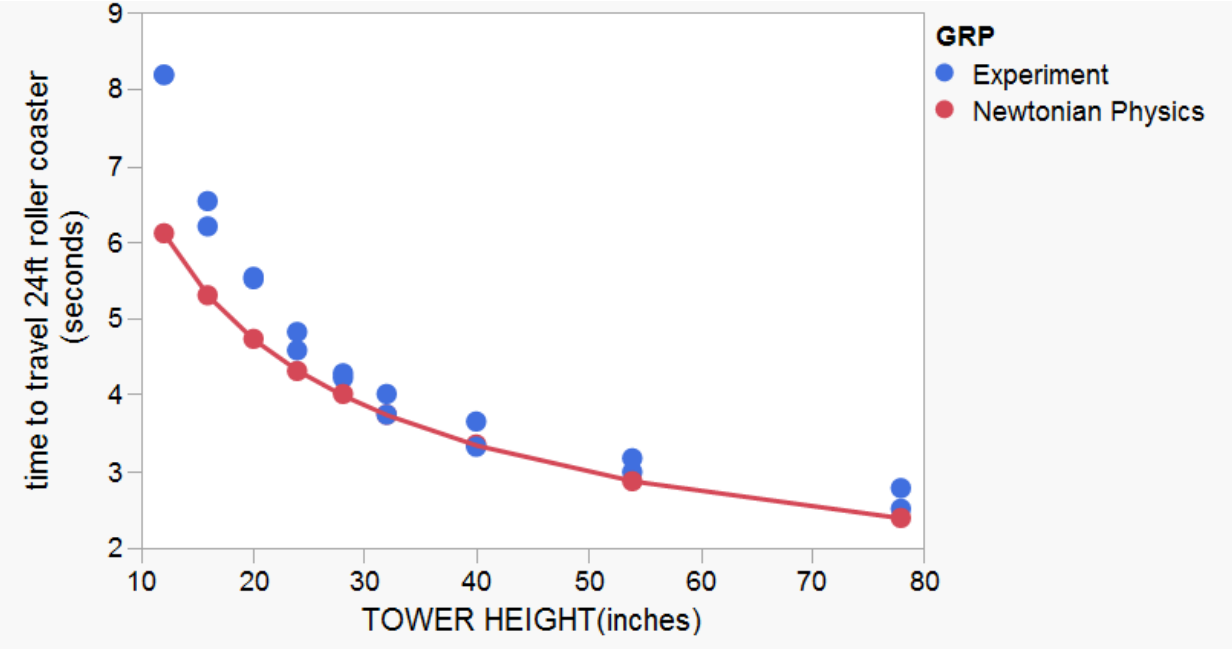
2) Variable = tower height

10 inches
14 inches
18 inches
24 inches
48 inches
72 inches

3) Send marble down the track and record time to complete for different tower heights. Be sure to measure multiple times to reduce experimental error.

4) Option to experiment with success for completing a loop vs tower height. Does tower need to be taller than the loop?

Step 5: Data & Analysis



A scientist used math and science to predict our experiment result (red-line).
Did our experiment (blue data) match their result?

What does the data and plot tell us?

Taller tower height = MORE potential energy

MORE potential energy = faster roller coaster
(less time to finish the track)