2024 All Saints science fair grade 2-7 parent info night

2024 key dates

ALL SAINTS SCHOOL
SCIENCE FAIR

Friday , January 26th	preK-grade 7 school assemblies with science performer to kickstart science fair season and rally student interest (performance included physics- gravity, juggling)
Wednesday, Jan 31	7-8pm Science Fair Info Night for grade 2-7 parents in the library, students welcome also. -> goal tonight is: 1) give overview of project expectations 2) explain student in-school help session (office hour) opportunity as jump start 3) register grade 2-7 students for the science fair 4) recruit parent volunteers for help sessions & judging
Friday, February 23rd	8:30-9:30am Science Fair help session available in the library for grade 2-7 registered participants, parents welcome also.
Tuesday, March 19th	All Saints Science Fair in the gym! Project drop off in morning and open house and awards from 6:30 - 7:30pm.

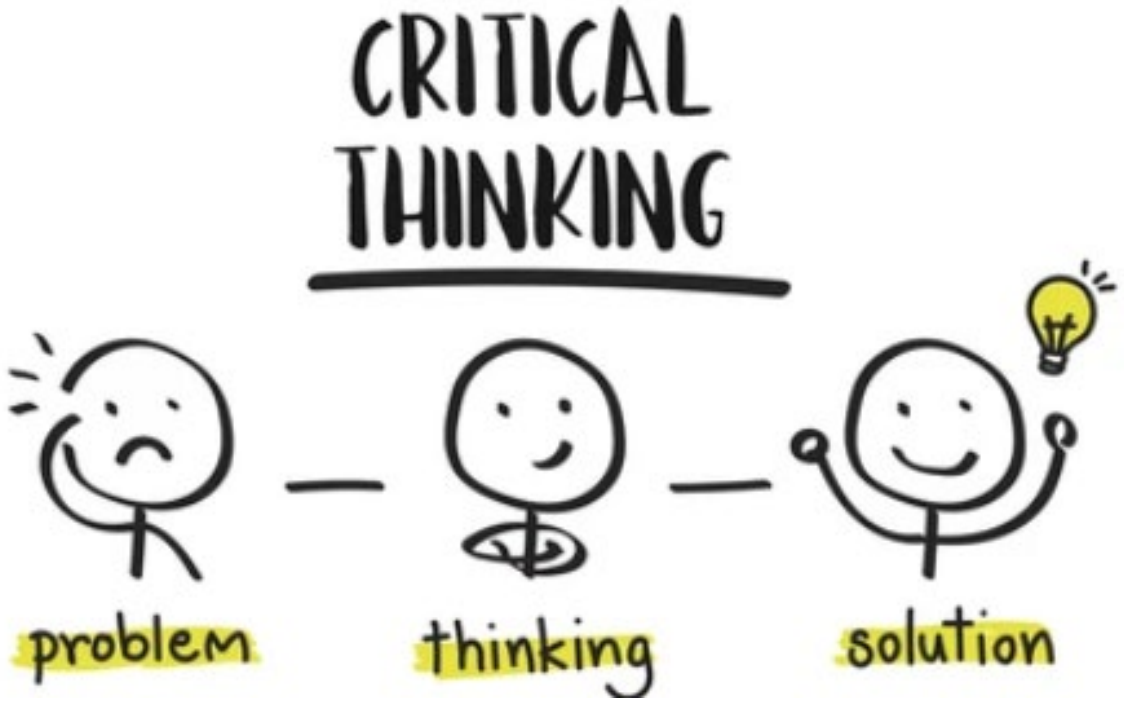
URL = www.allsaintsportland.com/sciencefairpacket
Email = sciencefair@allsaintsportland.com

All Saints 1st science fair, March 2017 open house

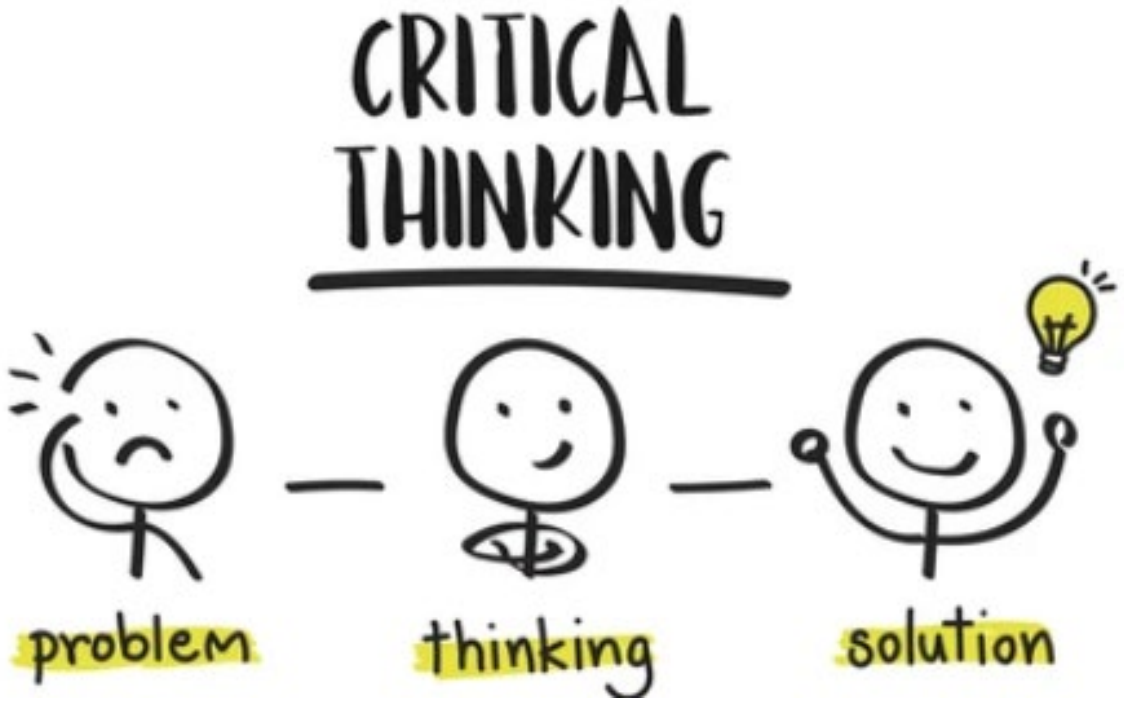
ALL SAINTS SCHOOL
SCIENCE FAIR
2017

2024 Science Fair coordinator:
Keith Zawadzki
8th grader Myla
10th grader Kazmer

All Saints science fair: WHY?



All Saints science fair: WHY?

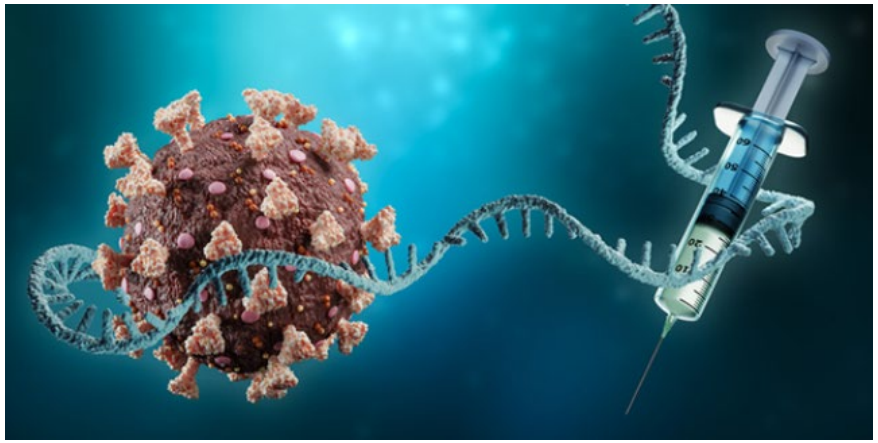


Presentation Skills

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

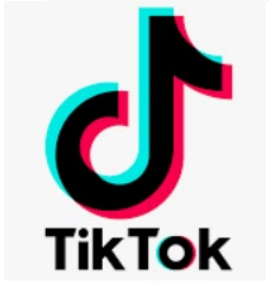
SpaceX – satellites, Mars?

Healthcare, vaccines

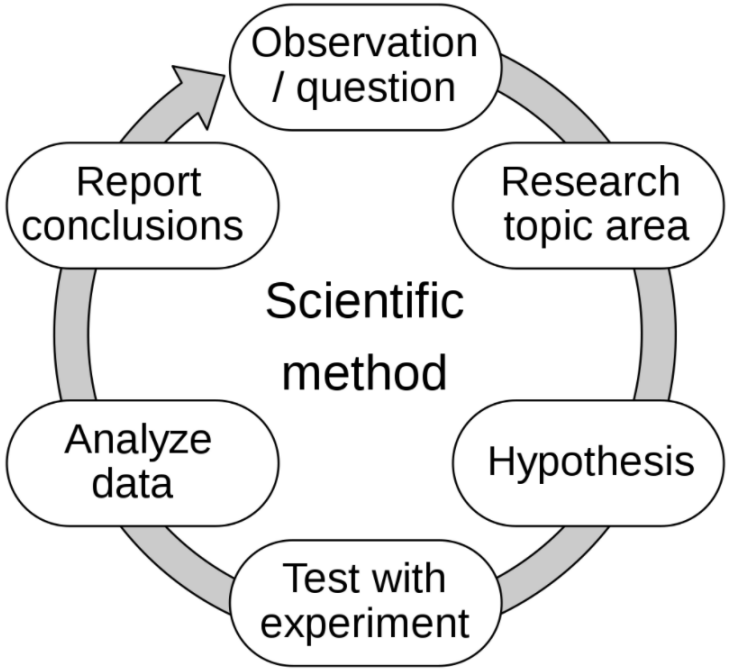


Autonomous driving

Metaverse, social media, entertainment



The Scientific Method



This is the same scientific method we use for the All Saints science fair!

student participation by grade

GRADE	platform	2017	2018	2019	2020	2021	2022	2023
PreK	classroom	classroom	classroom	classroom	classroom	cancelled	not included	not included
K	classroom	classroom	classroom	classroom	classroom	cancelled	not included	not included
1st	classroom	classroom	classroom	classroom	classroom	cancelled	not included	not included
2nd	voluntary at home	12	13	7	13	cancelled	14	**16**
3rd	voluntary at home	25	14	20	11	cancelled	22	**16**
4th	voluntary at home	14	11	15	16	cancelled	10	**28**
5th	voluntary at home	6	1	18	13	cancelled	8	**13**
6th	classroom in 2020+	2	0	4	Shufelt	cancelled	Shufelt	**2**
7th	classroom	Shufelt	Shufelt	Shufelt	Shufelt	cancelled	Shufelt	**1**
8th	classroom	Shufelt	Shufelt	Shufelt	Orr	cancelled	~~too late~~	Shufelt
	voluntary students	59	39	64	53	cancelled	54	**76**

SCIENCE FAIR

1) Grade 8 are mandatory part of curriculum

2) Grades 2-7th are voluntary participation.

-MAX GROUP allowed = 2 students.

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

oral presentation option:

2nd-7th graders have 3-5 min oral presentation option.

Present project to 1-2 judges during school hours on day of Science Fair (March 22nd).

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.

2023: 80 grade 2-7 students participated in science fair
70 presenters!

2nd grade presenters (2022)

Merit Awards

Merit awards for best trifold project - fred meyer gift card.

Merit awards for best oral presentations - fred meyer gift card.

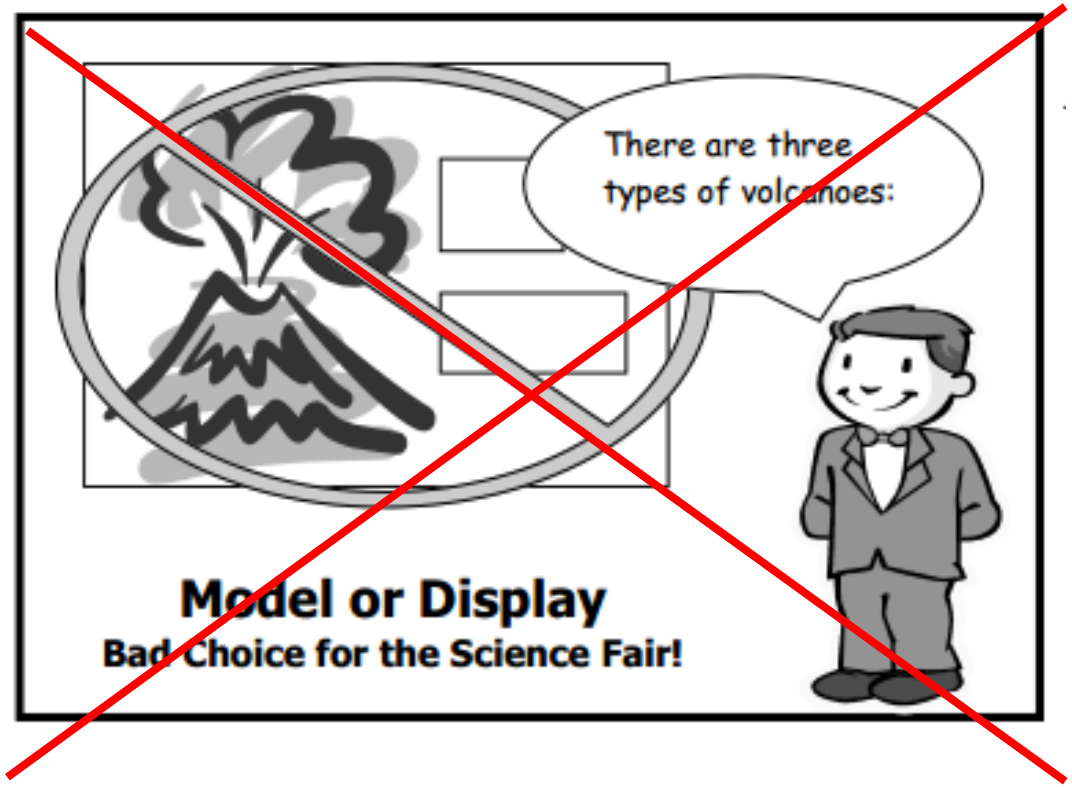
All oral presentations received BASKIN ROBBINS gift card.

What does the student need to do for the science fair?

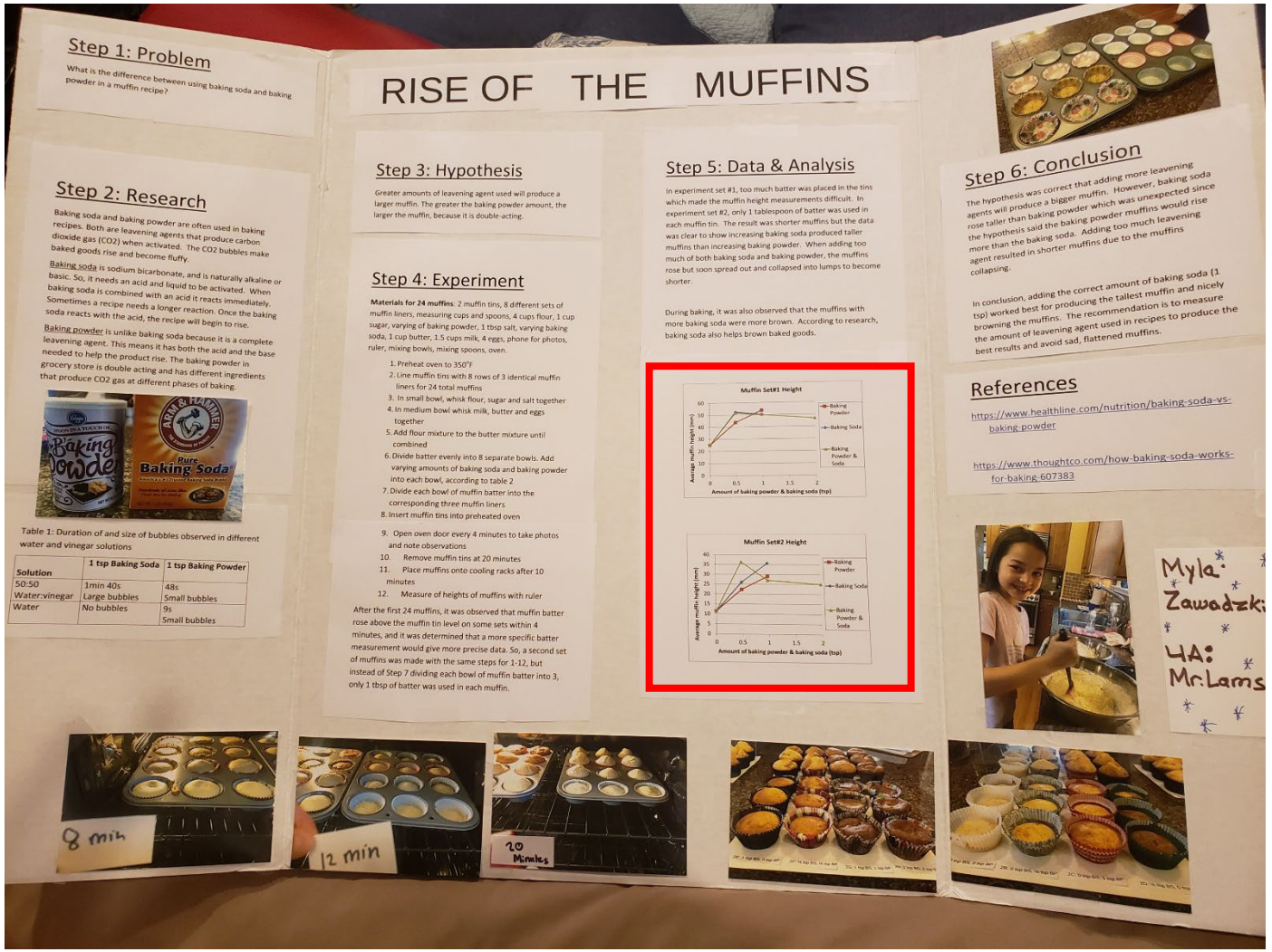
Part 1: overview of final result -> the trifold!

2 TYPES OF SCIENCE PROJECTS

(1) display or report



(2) Experiment with quantitative variables:
Results you can measure with numbers!



final result -> the trifold! (school supplies trifold boards)

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

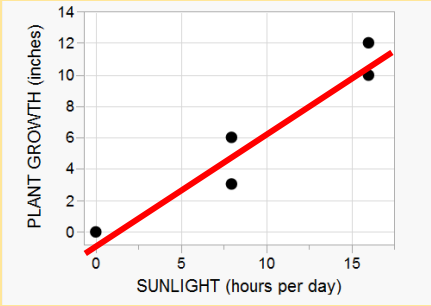
Propose a hypothesis. This is an educated guess about what you expect based on your research.

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

Student name:_____

JUDGING RUBRIC

Scientific Method	key content & checklist	Judge Feedback
1) Question	○ clearly stated ○ has scientific relevance or application ○ Bonus: unique or creative	
2) Research	○ Cites reference ○ Includes scientific history, principles or laws that relate to the problem. ○ Bonus: Includes a picture or plot to help explain the scientific principle	
3) Hypothesis	○ Clearly states what may happen based on scientific learning from research section ○ Bonus: Includes a picture or plot to help explain expected result	
4) Experiment Plan	○ Document step by step plan. ○ Bonus: Includes materials list ○ Clear definition of variables and use of controls ○ Bonus: picture or drawing of setup	
5) Data and Analysis	○ Chart or table of results that shows how the independent variable impacts the response ○ Clearly labels axis and units on the plot or table ○ Appropriate number of replicates done ○ Understanding of the meaning of the data ○ Analysis states how the scientific research helped or did not help predict the result	
6) Conclusion	○ States if hypothesis is right or wrong ○ How did this project potentially solve the problem? ○ Recommends how to improve result or experiment	

All positive encouragement!!

What does the student need to do for the science fair?

Part 2: What can the student complete at school during “office hour” (help session) vs at home?

(1) Goal of help session: student completes scientific method steps 1,2,3,4 on worksheet.

Note: parents can join help session and volunteer to help lead group of 5-7 students with chromebooks for research.

NAME_____ My Scientific Method April 1st, 2022

Step 1: QUESTION

Example = Does more water make plants grow faster?

Does more water make plants grow faster?

Step 2: RESEARCH (what is scientific principle or law to help answer your question?)

Website source https://www.science-sparks.com/what-is-photosynthesis/

Scientific principle

(example = Photosynthesis is process that plants use sunlight, carbon diode and water to create food to grow)

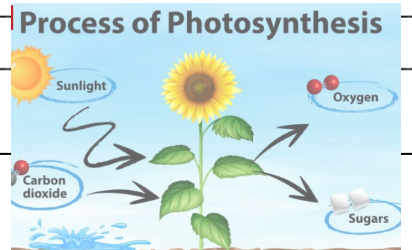
Green plants make sugar for growth by a process called **photosynthesis**, which means **making things with light**. Plants use sunlight, water, and carbon dioxide to create oxygen and energy in the form of sugar.

Description how principle relates to question

(example = Providing more water will help the plant create more food to grow because of photosynthesis

If plants use sunlight, water, and carbon dioxide to create oxygen and energy in the form of sugar, then giving a plant more water will make it grow faster.

Picture or diagram to help explain



NAME_____ My Scientific Method April 1st, 2022

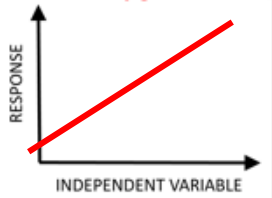
Step 3: HYPOTHESIS (educated guess what you expect to happen based on research, include plot)

independent variable (amount of water)= Amount of water

response (height of plant)= Height of plant after 14 days

My hypothesis is

Giving a plant more water will make it grow faster because of photosynthesis.



Step 4: EXPERIMENT PLAN (step-by-step instructions)

1) Buy 8 small bean plants in separate containers
2) Daily watering schedule:
   - 2 plants = no water
   - 2 plant = 2 mL of water
   - 2 plants = 4 mL of water
   - 2 plants = 6 mL of water
3) Measure the height of each plant every day

Experiment setup picture

(2) Student brings home worksheet and works with parent to perform experiment and complete steps 5 (data & analysis) and 6 (conclusion).

NAME_____ My Scientific Method April 1st, 2022

Step 5. DATA AND ANALYSIS (record data and make a plot/graph)

At home with parent

Step 6. CONCLUSION (Was hypothesis correct or incorrect? What is recommendation for future experiment?)

At home with parent

(3) Use completed worksheet (scientific method steps 1-6) to present on tri-fold.

At home with parent

Project Title

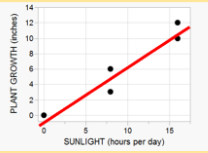
Step 1: Question
Ask a question.

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.



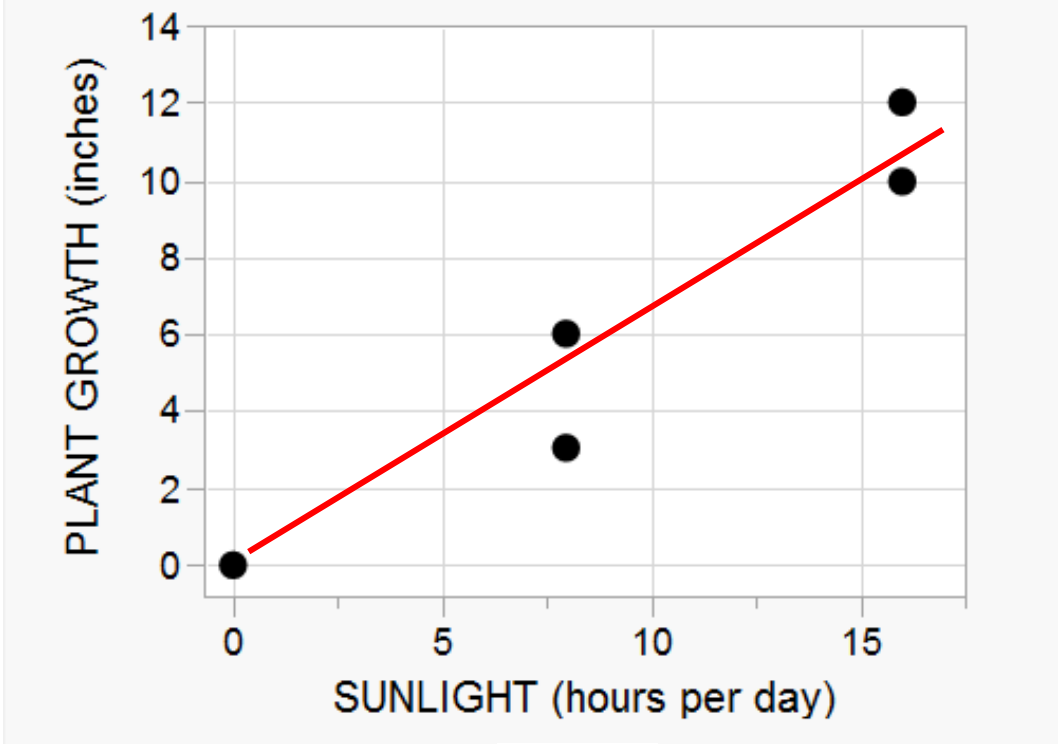
Step 6: Conclusion
Conclude whether to accept or reject your hypothesis. Make recommendations on what you would do for future or repeat experiments.

NAME
GRADE
TEACHER

How can I help my student brainstorm idea BEFORE the 1st office hour?

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.



FIRST: Choose a question & experiment that is easy to measure with NUMBERS (#)

	Independent Variable	Response (# of something)	Scientific Principle
1) Healthy hearts :	physical activity (reading, jumping)	# heart beats per minute	biology: human cardiovascular system
2) Internet speed	distance computer from router (# feet)	# Mb per second internet speed	physics: radio wave strength
3) Hot beverages	material of cup (glass/ metal/ paper)	# degrees Fahrenheit temperature change	heat transfer: thermal conductivity
4) Electricity	material of object (metal, non-metal, ionized)	# mAmps electrical current	physics: electrical conduction
5) Magnets	# of electrical coils around magnet	# of nails picked up	physics: magnetomotive force
6) Paper Airplanes:	size of wing (# inches x # inches)	# feet distance plane traveled	physics: forces of thrust, lift, drag, gravity
7) Muffins:	baking soda & powder (# teaspoon)	# millimeters height of muffins	chemical reaction to create bubbles

RULES:

1) Talk quietly and be respectful to adult helper.
2) Review your project plan with adult helper before starting any work on paper or chromebook.
3) Chromebook is only to work on science project. Adult helper will take away chromebook if not being used for science.
4) Fill out worksheet #1 Question, #2 Research, #3 Hypothesis, #4 Experiment Plan and review with adult helper.
5) Take 1 trifold with you back to classroom and home (only need 1 per team)

PROJECT IDEAS- page1

#	Theme	Question	Data to measure	Reference
1	chemistry: reaction rates	Can you slow down or speed up a chemical reaction?	reaction speed vs reactant size/temperature (alka-seltzer bubbling and dissolving in hot vs cold water)	https://www.education.com/science-fair/article/reaction-speed-particle-size/
2	chemistry: reaction rates	How to change baking soda bubbling reaction with vinegar concentration?	ratio of vinegar in water solution (& temperature) vs height of bubble reaction in a cup (inches) while stirring	
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
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/
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.	

PROJECT IDEAS- page2

#	Theme	Question	Data to measure	Reference
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://easysciencefforkids.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://easysciencefforkids.com/all-about-sink-and-float/
18	physics: properties of matter=density	How do dissolved substances change the density 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
21	life sciences & physics	What is the best sports drink for electrolytes?	electrical current(Amps) vs sports drink or amount of salt added to water [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
23	Physics: mechanical advantage	Can an adult teeter-totter(see-saw) with a child?	weight of children, adults and distance from fulcrum/pivot to find equilibrium	
24	physics: pressure	how does pressure and or temperature inside a basketball impact the bounce?	pressure (psi) and/or temperature of bball vs bounce height when dropped from height	
25	chemistry: reactions	Amount of baking soda vs baking power impact muffins rising?	amount of baking soda or baking powder added to muffin recipe (grams or teaspoons) vs height (inches) of muffins after cooking	

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

Can choose from project list or be creative with student's interests: (keep in mind something easy to measure with numbers!)

	Independent Variable	Response (# of something)	Scientific Principle
1) Healthy hearts :	physical activity (reading, jumping)	# heart beats per minute	biology: human cardiovascular system
2) Internet speed	distance computer from router (# feet)	# Mb per second internet speed	physics: radio wave strength
3) Hot beverages	material of cup (glass/ metal/ paper)	# degrees Fahrenheit temperature change	heat transfer: thermal conductivity
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5) Magnets	# of electrical coils around magnet	# of nails picked up	physics: magnetomotive force
6) Paper Airplanes:	size of wing (# inches x # inches)	# feet distance plane traveled	physics: forces of thrust, lift, drag, gravity
7) Muffins:	baking soda & powder (# teaspoon)	# millimeters height of muffins	chemical reaction to create bubbles

How to incorporate Baking, Video Games, Sports?
Note: learning opportunity in crunching data.

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

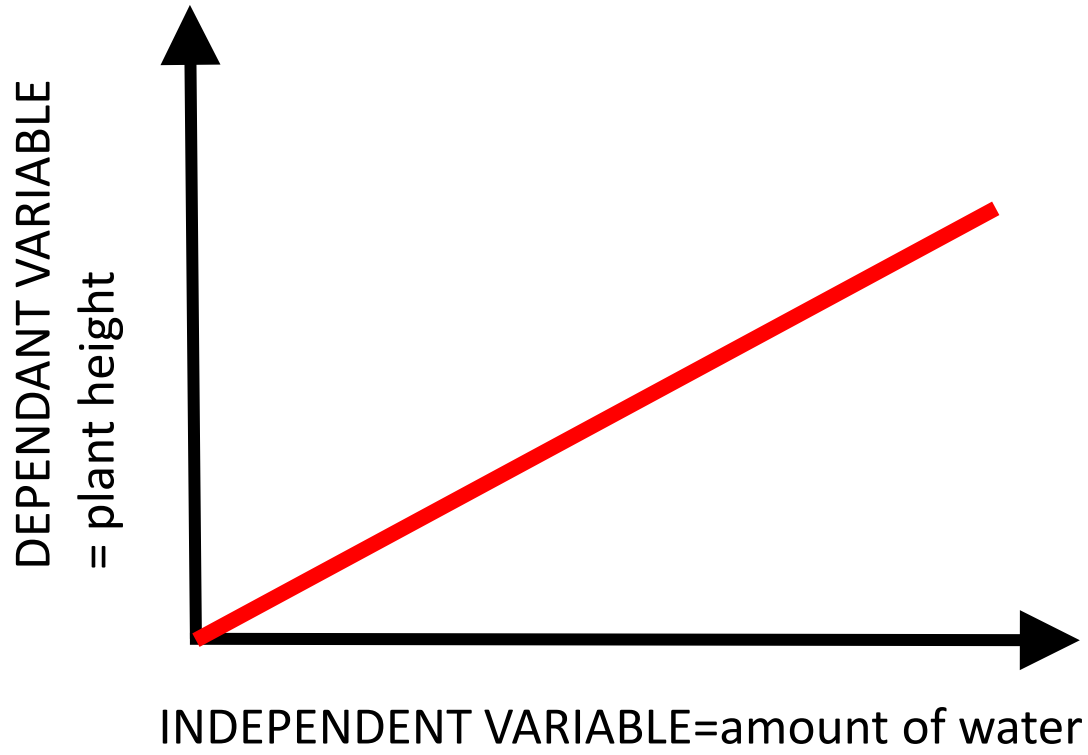
INDEPENDENT VARIABLE=amount of water

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

INDEPENDENT VARIABLE=amount of water

DEPENDANT VARIABLE= plant height

Step 4: Experiment Procedure

1) Bought packet of bean seeds, starter soil and 30 individual pots
2) Planted 3 seeds per pot, placed pots under fluorescent lights (12 hours light per day) and watered seeds every day:

    Group A = 10mL water
    Group B = 20mL water
    Group C = 30ml water
    Group D = 40mL water
    Group E = 50mL water
    Group F = 60mL water
    Group G = 70mL water
    Group H = 80mL water
    Group I = 90mL water
    Group J = 100mL water

3) Measured plants every day for 30 days

PLANT GROWTH EXPERIMENT

INDEPENDENT VARIABLE=amount of water

DEPENDANT VARIABLE= plant height

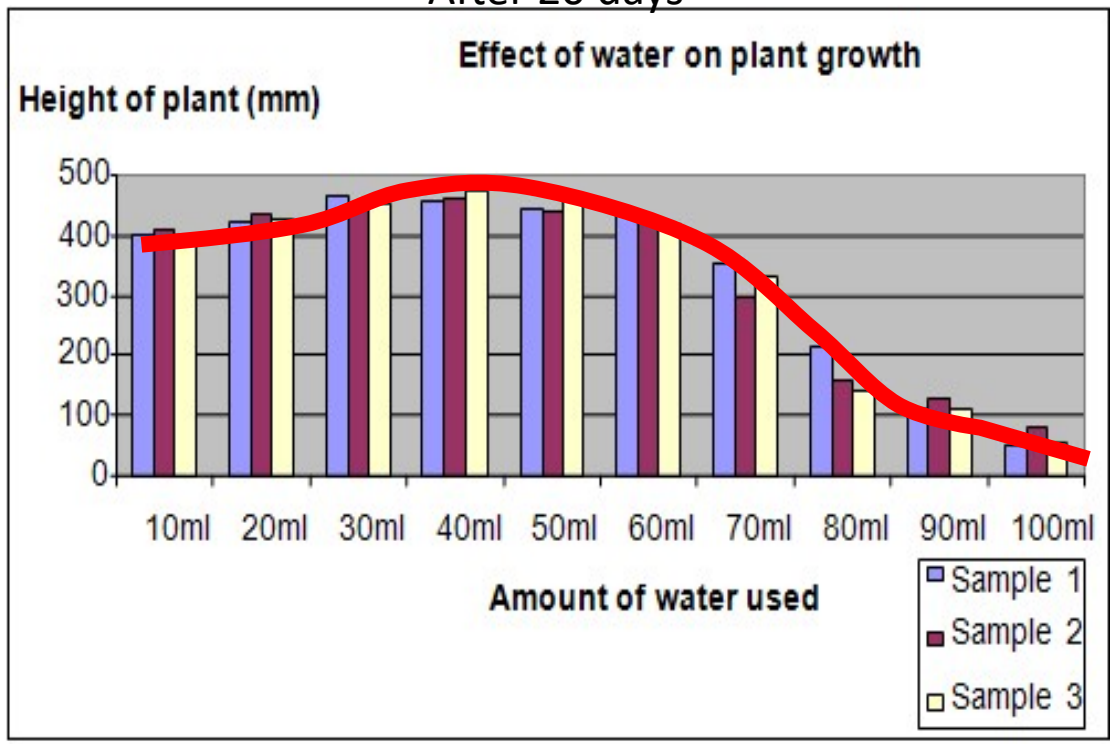
Step 5: Data & Analysis

(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 20 days



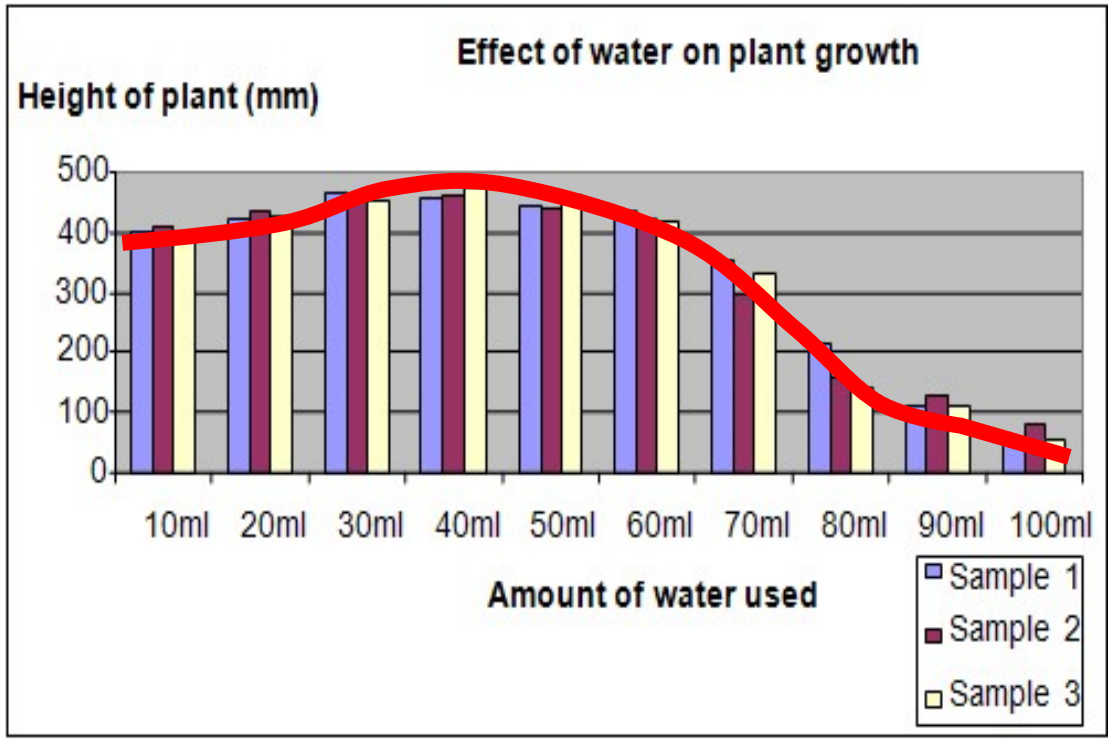
PLANT GROWTH EXPERIMENT

INDEPENDENT VARIABLE=amount of water

DEPENDANT VARIABLE= plant height

Step 6: Conclusion

My hypothesis that more water would increase plant growth due to photosynthesis was partially correct.
I would recommend next experiment with less water (0mL, 2mL, 4mL) and watering every other day.



Conclusion

science is awesome!

WHAT'S NEXT!

1) register grade 2-7 students for the science fair -> sign-up sheet here!
2) Brainstorm ideas (quantitative variables!) before help sessions. May need to purchase measuring equipment now.
3) Check PRC updates and remind your student to go to help session on Friday Feb 23rd.
4) sign-up to volunteer for help sessions & judging

Email/questions/register	sciencefair@allsaintsportland.com
Online documents	www.allsaintsportland.com/sciencefairpacket

BACKUP

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.

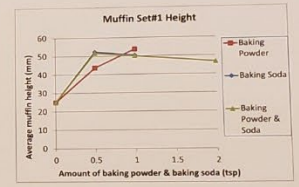
1. Preheat oven to 350°F
2. Line muffin tins with 8 rows of 3 identical muffin liners for 24 total muffins
3. In small bowl, whisk flour, sugar and salt together
4. In medium bowl whisk milk, butter and eggs together
5. Add flour mixture to the butter mixture until combined
6. Divide batter evenly into 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

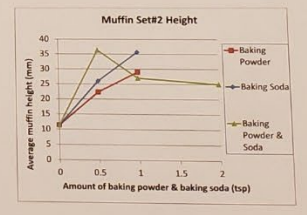
After the first 24 muffins, it was observed that muffin batter rose above the muffin tin level on some sets within 4 minutes, and it was determined that a more specific batter measurement would give more precise data. So, a second set of muffins was made with the same steps for 1-12, but instead of Step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

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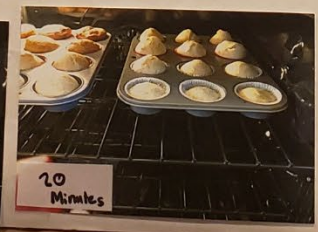
https://www.thoughtco.com/how-baking-soda-works-for-baking-607383

Myla Zawadzki
4A: Mr. Lams



Wings of Flight

Oscar Hoffelt & Kazmer Zawadzki

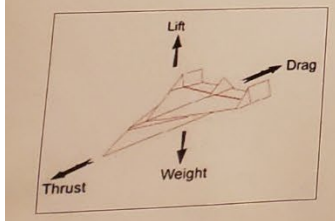
Step 1: Question

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.

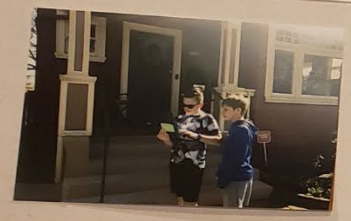
WI-FI ZERO OR HERO?

Kazmer Zawadzki (5A)

Oscar Hoffelt (5C)

Step 1: Problem

How does distance from router affect WiFi internet speed?



Step 2: Research

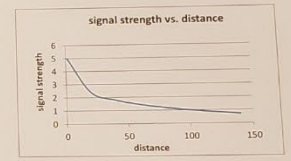
Why Wifi: Wifi is important in daily life. It can be very frustrating when a work assignment, movie, or game starts lagging and crashing. In this project, Wifi internet speed is tested over varying distances from the router.

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.

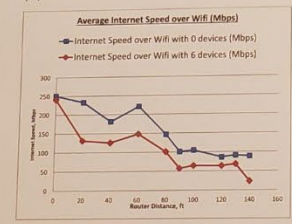
Step 4: Experiment

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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Keep it Hot!

Keep it Cold!

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

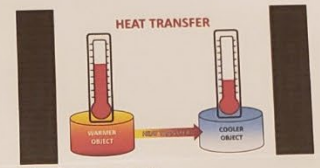
Step 1: Problem

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

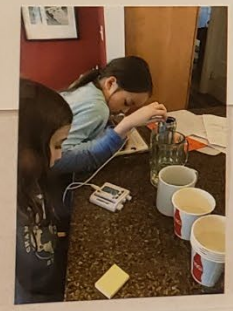
Step 3: Hypothesis

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

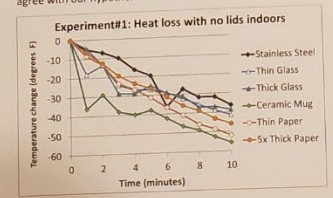
Materials: 6 beverage containers (stainless steel, thin glass, thick glass, ceramic, thin paper, thick paper), boiling water at 220°F, lids made of cardboard covered with saran wrap, measuring cup, digital kitchen thermometer

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



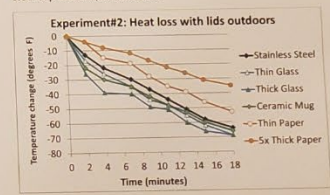
Step 5: Data & Analysis

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.

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?

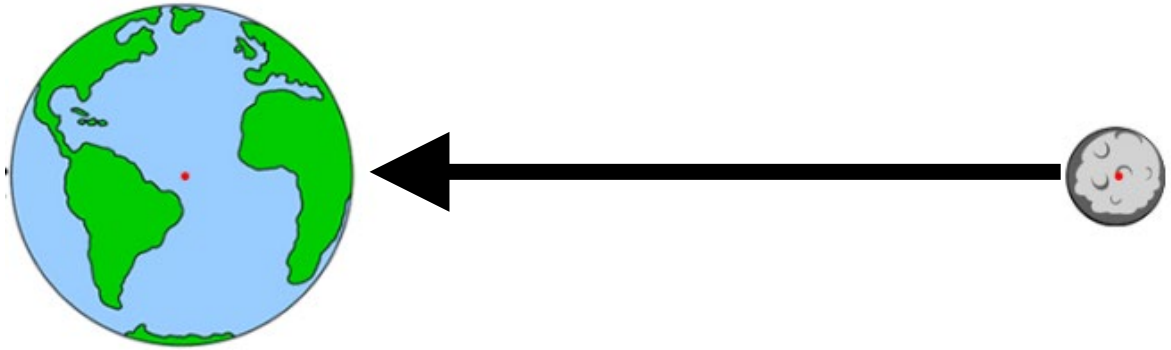
Step 2: Research

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

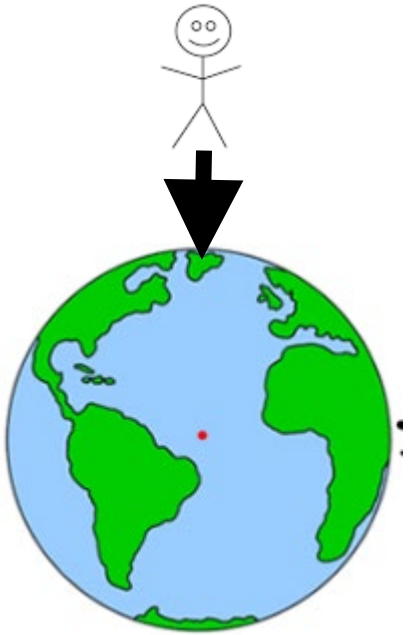
1) GRAVITY
2) POTENTIAL ENERGY
3) KINETIC ENERGY

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

Step 2: Research: GRAVITY



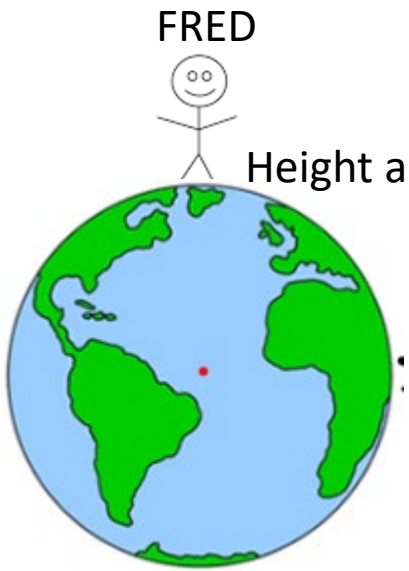
The earth pulls on the moon.
We call this pull force = gravity.



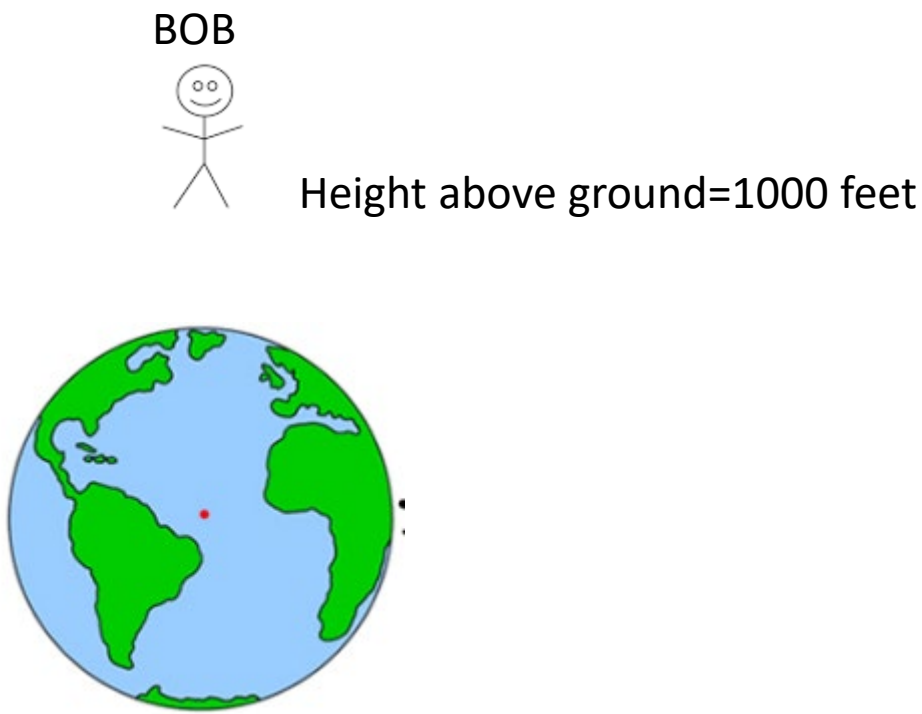
The earth's gravity pulls on every object, including every person.
What happens when you jump in the air?
Gravity pulls you back down.

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

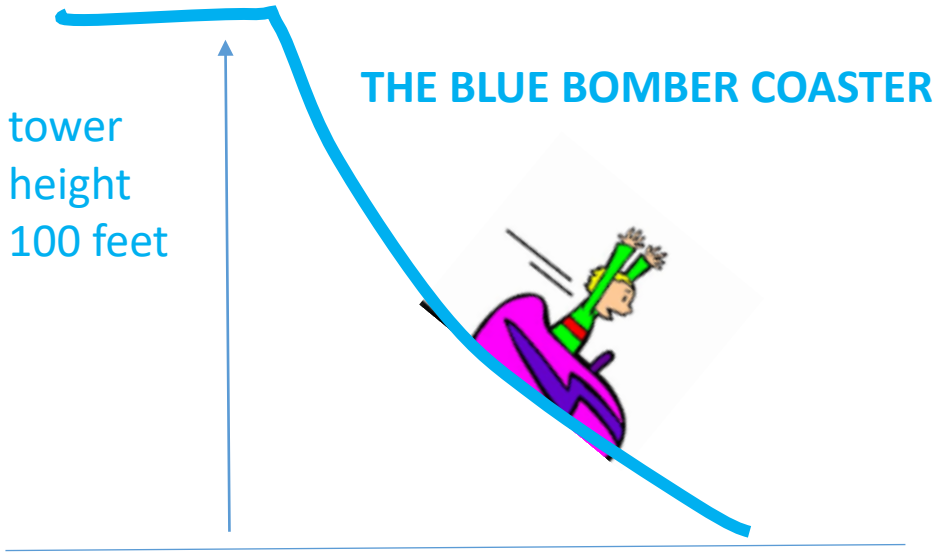
Height above ground=1000 feet

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

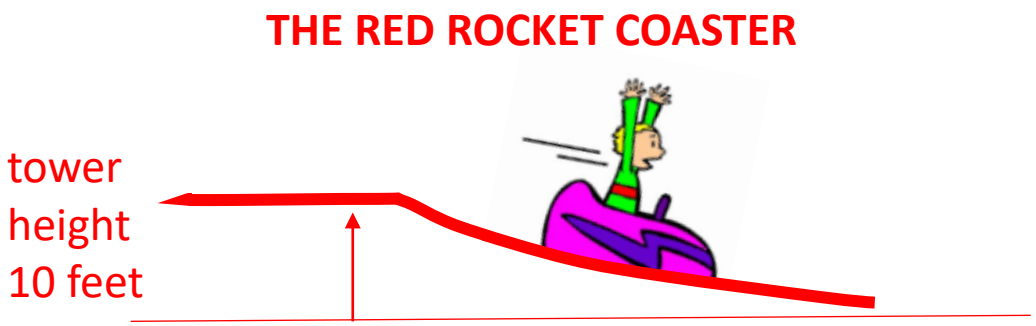
Step 3: Hypothesis (educated guess)

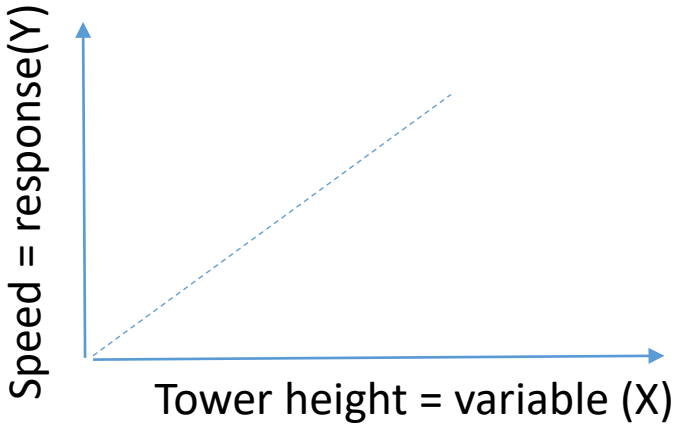


Which roller coaster tower has more potential energy?

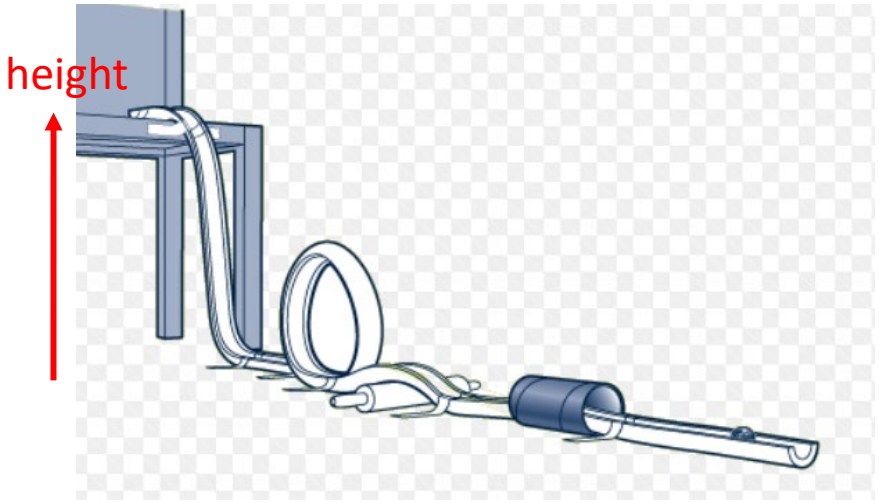
When all of the potential energy is converted into kinetic energy, which roller coaster will be FASTER?

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.

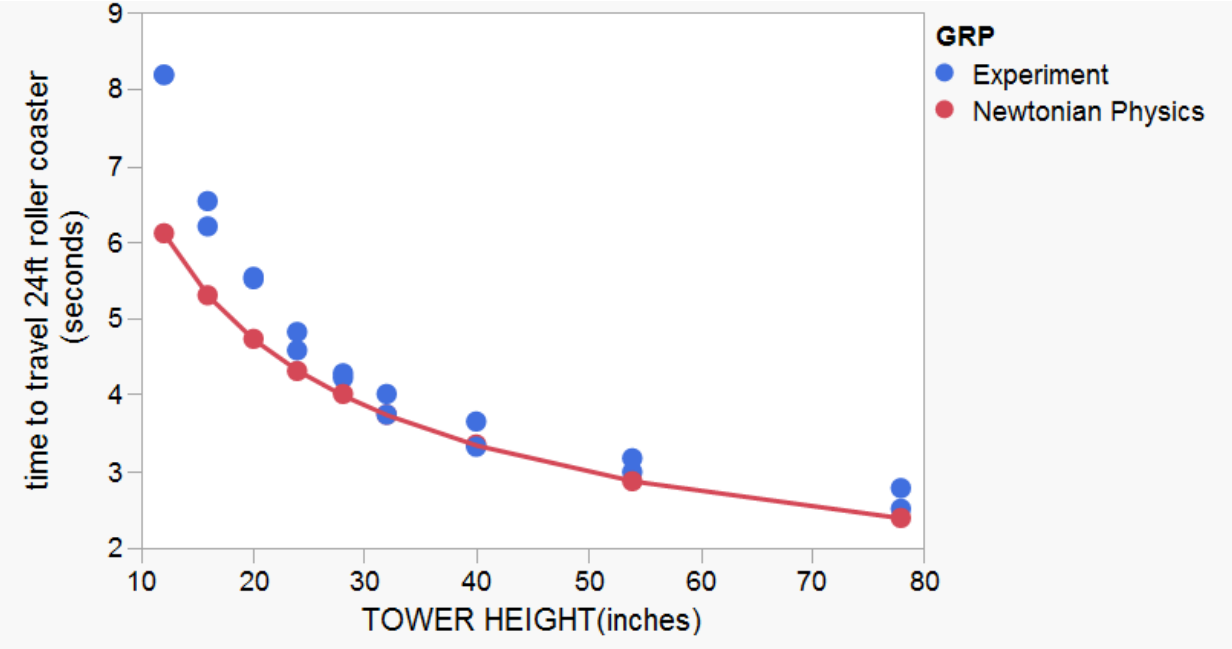
2) Variable = tower height

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)