Science Fair Logbook

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My Timetable (I wish to follow)

Start finding a topic	November 20th, 2025
Form a question	December 1st, 2025
Clarify question	December 10th, 2025
Start researching background info	December 15, 2025
Finish researching	December 30th, 2025
Start collecting materials	December 31st, 2025
Gather materials	January 5th, 2026
Start doing experiment	January 10th, 2026
Finish experiment and start analyzing data	January 12, 2026
Finish analyzing data	January 15th, 2026
Start doing second experiment and analyze data	January 17 th, 2026
Finish analyzing data	January 20th, 2026
Start doing third experiment and analyze data	January 22nd, 2026
Finish analyzing data	January 23rd, 2026
Start working on trifold	January 25th, 2026
Finish Trifold	February 2nd, 2026
Make Flashcards	February 5th, 2026

FINISH AND PREPARE FOR SCHOOL SCIENCE FAIR

Entries:

Nov. 23rd, 2025 - Start planning what topic
Nov. 25, 2025 - Planned topic & question
Dec. 3rd, 2025 - Start researching about project
Dec. 14th, 2025 - Lemon research
Dec 16th, 2025 - Lemon research
Dec. 17th, 2025 - Finish lemon research and start orange research
Dec. 18th, 2025 - Orange research
Dec 19th. 2025 - Orange research
Dec. 20th, 2025 - Finish orange research and start potato research
Dec 21st, 2025 - Potato research
Dec 23rd, 2025 - Potato research
Dec 24th, 2025 - Potato research
Dec 25th, 2025 - Finish potato research and start banana research
Dec 26th, 2025- Banana research
Dec 28th, 2025 - Banana research
Dec 29th, 2025 - Wrap up researching
Dec 30th, 2025 - Finished researching and start collecting materials
Jan 2nd, 2026 - Make hypothesis
Jan 3rd, 2026 - Make variables
Jan 5th, 2026 - Finish gathering all materials needed
Jan 9th, 2026 - Do first experiments and write down information
Jan 13th, 2026 - Do second experiments and write down information
Jan 18th, 2026 - Do third experiments and write down information
Jan 23rd, 2026 - Finish experiments information and start working on Cysf platform
Jan 28th, 2026 - Trifold work
Jan 31st, 2026 - Finish typing up trifold papers
Feb 2nd, 2026 - Printed out trifold papers and taped them
Feb 4th, 2026 - Worked on videos and pictures
Feb 5th, 2026 - DONE

Feb 6th - bring trifold to school for school science fair

Hypothesis:

After researching, my hypothesis for my experiment is that the potato battery will act as the best battery. Potatoes have a high voltage, which will cause tiny electricity waves to light up the LED bulb. They are extremely rich in phosphoric acid, a special acid that when contacts with specific things, its reaction produces the light from the battery. Potatoes also have lots of fluid in them, which will help ions move around more freely in the potato.

Variables:

The variables in my experiment are the Independent Variable, the Dependent Variable, and the Controlled Variable.

Independent Variable: The Independent variable in my experiment is the change of the different fruits and vegetables I am testing.

Dependent Variable: The Dependent Variable in my experiment is the measurements of how bright and long the different batteries will light the LED bulbs.

Controlled Variable: The Controlled Variable in my experiment is how each set of batteries contains only four of each test subject, and that the equipment used to power the items is the same. All of the fruits and vegetables are all raw and have not been changed in some way that will allow it to be weaker or more powerful. All of the batteries will all be placed in the same setting and temperature.

Lemon Battery Research:

Lemons belong to a group of fruits called 'citruses'. This family of fruits includes limes and grapefruits. Citruses contain a sour acid called 'citric acid'. This acid acts as an electrolyte for the battery. An electrolyte is a special substance that produces charged particles, called ions, when caused by a chemical reaction with specific things. The citric acid in a lemon can dissolve into the lemon's juice. When citric acid is dissolved in a liquid, it turns into a substance with many ions in it. These ions carry electric waves that break into positive and negative waves. In order to turn the charged waves into electricity, there needs to be an electrode that contains two things - an anode and a cathode. An anode is the negative electrode, and the cathode is the positive electrode. In my experiment, the anode is zinc, while the cathode is copper. The zinc causes the citric acid to lose electrons (charged particles), and the copper attracts the electrons. The electrons continually flow through the two metals, which creates electricity! A lemon produces around 0.88 volts of electricity, so there needs to be multiple lemons in order to light up the LED bulb, which usually requires 2.0 volts in order to be lit. Usually, a lemon battery stops working if the anode has been corroded from the use of it, or the lemons have dried out.

Orange Battery Research

Oranges also belong to the same family of fruits as lemons called 'citrus fruits'. Oranges produce electricity the same way lemons do, with an anode and a cathode, zinc and copper. The electrolyte of the orange battery is also the citric acid an orange contains, although a lemon has more. Similarly, the ions of the citric acid flow through the zinc and copper in a cycle, creating an electric current, making the LED bulb light up, like all citric fruits. An orange produces around 0.8 volts, which is slightly weaker than a lemon, and

a lemon has more citric acid than an orange, meaning that most likely, the orange batteries will be weaker than the lemon batteries.

Potato Battery Research:

Potatoes have a special type of acid called 'Phosphoric acid'. This acid, along with several other salts and substances in the potato, acts similarly to citric acid. When plugged in with an anode and a cathode (zinc and copper), the moist interior of a potato works together with the phosphoric acid. When plugged in with the anode and cathode, the chemical reaction creates electrons. The electrons circle in a cycle around the connected system of the battery, and light up the LED bulb. The voltage of a potato is about 0.85 volts, but it may vary from potato to potato. A potato has lots of liquid in it, which helps ions move more freely around it.

Fact about potato batteries: If you boil a potato for around 8 minutes, it can break down the potato's internal structure, allowing the voltage to increase up to 5 volts, making the LED bulb last up to 40 days! But, all of the fruits and vegetables will be raw in my experiment.

Banana Battery Research

A banana is rich in a mineral called 'potassium', which is also found in citric fruits and potatoes, as well as a variety of other foods. Potassium conducts electricity when provided with an anode and a cathode (zinc and copper), similar to the rest of the fruits/vegetables, so it produces ions. A banana battery uses the banana's interior, along with the potassium in a banana, to also make a similar chemical reaction to the other batteries, and produces electrons. The electrons go in a cycle, lighting up the LED bulb. A banana has around 0.75 volts. An overripe banana will most likely work best due to how moist and soft the inside is.

Procedure:

Assembled materials:

For each of the batteries, I used four of each test subject, four zinc strips and four copper strips, clips that could attach onto each metal strip, and a red LED bulb.

Lemon Battery:

1. I rolled the lemons around to release some of the citric acid
2. I stuck one zinc strip into each lemon, and one copper strip into the lemon, about 2 or 3 cm into the fruit

   Observation: Could see lemon juice gathering where the metals were stuck into the fruit.

3. Did the same with 3 other lemons
4. Used a clip to clip onto a zinc strip on a lemon, then a copper strip on another lemon beside the lemon with the zinc strip
5. Repeat pattern
6. Finally, left with one zinc strip and one copper strip
7. Clip two wires - one end to each strip
8. Attach ends to LED bulb

   It should light up :)
9. Time how long it takes

   DO EXPERIMENT THREE TIMES

FOR THE ORANGE BATTERY, DID THE EXACT SAME THING.

1. Rolled the oranges
2. Stuck one zinc and copper strip into each orange
3. Clip the end of one clip to a zinc strip, then the other end to the copper strip on the orange besides the one with the zinc strip
4. Repeat for all oranges until there is a zinc strip and a copper strip left

5. Connect ends to LED bulb, should light up - time how long the light lasts for

DO EXPERIMENT THREE TIMES

Potato Battery:

1. Get four standard potatoes and stick a zinc and copper strip into each potato fairly distanced away from each other
2. Repeat pattern for the previous batteries - clip one end of a clip to a zinc strip, then the other end to a copper strip on the potato beside the zinc strip potato
3. Repeat for all potatoes
4. Connect two last zinc and copper strips to LED legs - should light up. Time for how long it lasts

DO EXPERIMENT THREE TIMES

Banana Battery:

1. Get four brown, overripe bananas
2. Stick a zinc and copper strip into each banana around an inch or two away from each other
3. Connect one end of a clip to a zinc strip on a banana, then connect the end of a copper strip to the banana beside it.
4. Attach last zinc and copper strips onto the two legs of an LED bulb - should light up - time how long it lasts

Graph of Findings:

Experiments:	Lemon	Orange	Potato	Banana
1st	46 min	32 min	33 min	25 min
2nd	54 min	30 min	42 min	22 min
3rd	41 min	25 min	42 min	31 min
Averages:	47 min	29 min	39 min	26 min

Lemon was first, then potato, then orange, then banana.

Why the lemon batteries overpowered the potato batteries:

My hypothesis did not support my findings, because lemons lasted the longest. It is most likely because of how rich lemons are in citric acid, a special acid that helps the lemon produce electricity.

Recommendations and Applications:

This way of creating electricity can be further researched to help create a new source of electricity one day. This can also be studied to help us develop our technology. This is a great hands-on activity to help people understand how chemical reactions can turn into electricity. If anybody has any about-to-spoil lemons, oranges, potatoes, or bananas, they can always turn their unwanted food into a science experiment that creates a tiny bit of electricity!