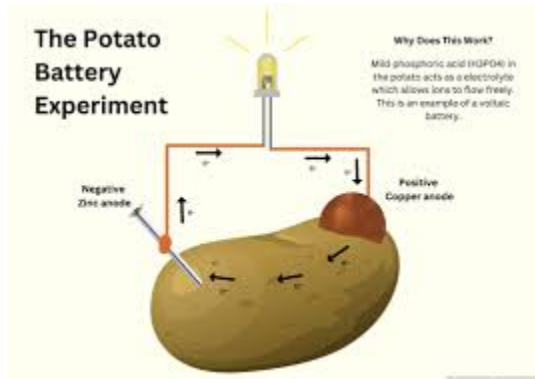


# Sci Fair Doc: Potato energy ( and other fruits and vegetables)



Electricity. What is voltage, what is current.

How does potato electricity work? What's the chemical process?

Manipulated controlled: What are you changing on purpose

Responding controlled: What are you measuring?

Controlled variables: need at least 5. Stuff that needs to be the same to keep it fair.

## Hypothesis

We have a hypothesis, one for what we think will produce the highest voltage, and one for the lowest voltage.

for the highest voltage we think that the lemon will produce the most.

and we think the mini potato will produce the least voltage.

We think that because lemons have lots of citric acid compared to a mini potato which is small and might not create enough voltage to power a light bulb.

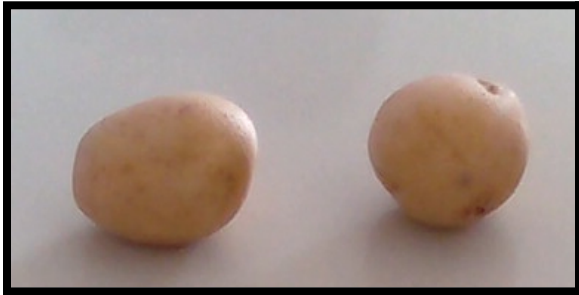
# Materials

## Fruits:

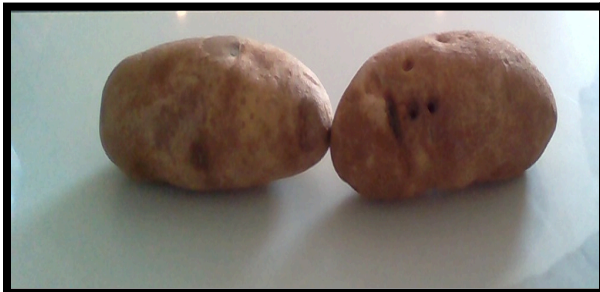
- Potato
- Mini potato
- Apple
- Lemon
- orange

## Tech:

- 2 zinc nails
- 2 pennys ( copper)
- Voltage meter
- wire



mini potato



normal potato



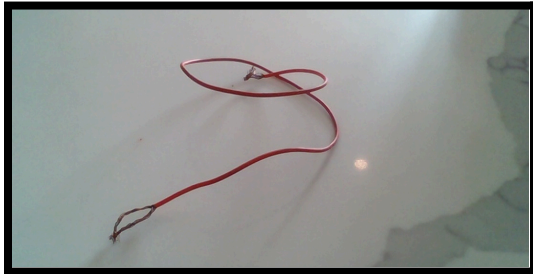
lemon



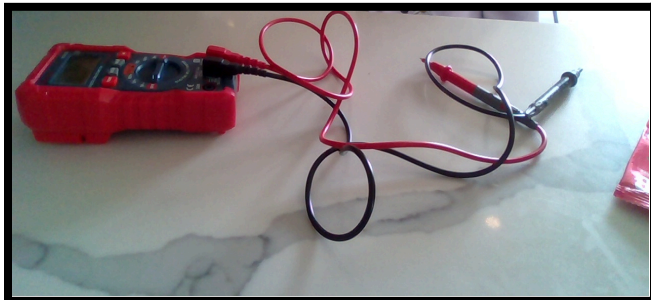
tomato



pennys



wire



volt meter



zinc nails

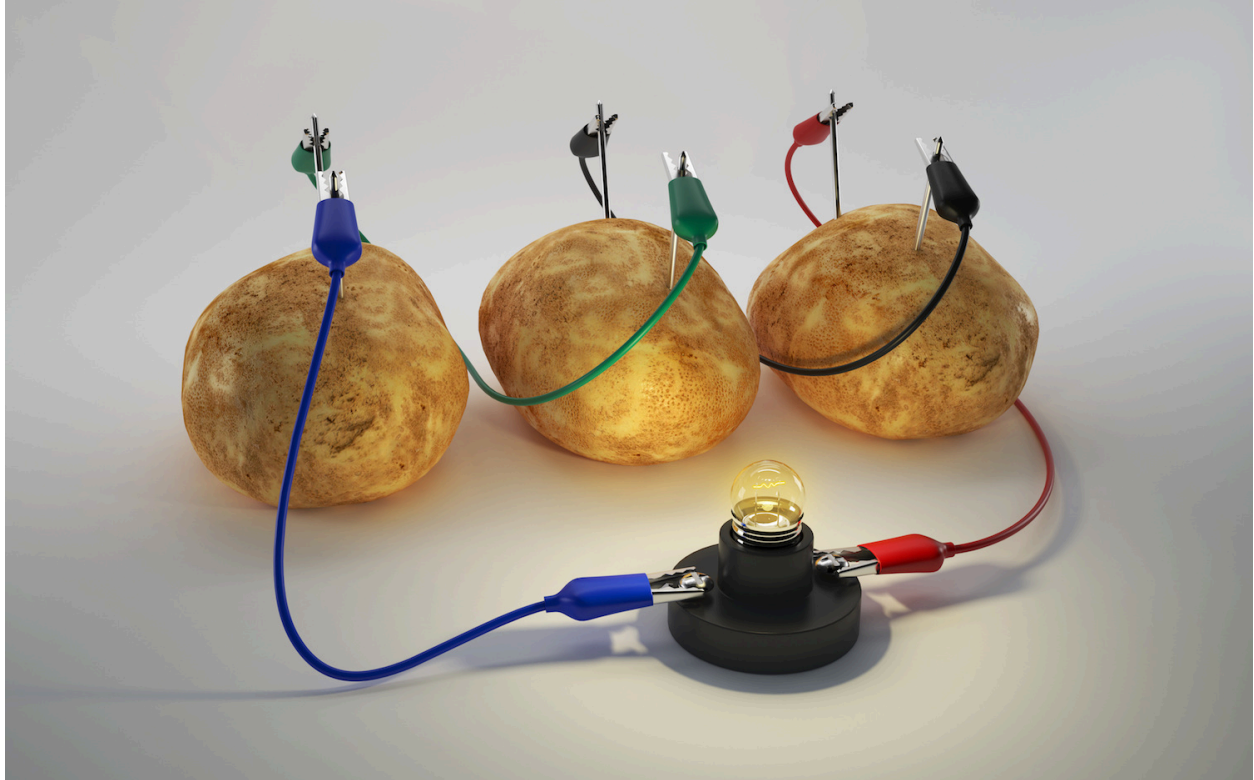
# What is the chemical process?(how it works)

The reaction happens by inserting a zinc nail and a copper coin or wire in a fruit or vegetable but not letting them touch. The zinc is reactive, acting like a negative electron when the zinc oxidizes its digs into the acidic juice of a fruit or vegetable. Copper is less reactive so it acts as the positive electron. The electrons from the zinc travel through the connected wires to the copper. The potatoes acid and water acts as an electrode letting the ions to move completing the circuit.

Our hypothesis was based on two main things: citric acid and size. The more citric acid the fruit has, the more voltage is produced. Size is also a big factor, because the bigger fruits are more likely to have more voltage stored in them. This is why it was surprising to have the lemon only produce 1.3 volts, when it has the most citric acid. Also surprising was that the mini potato only had 0.1 volts less than the normal potato, despite the big size difference.

The potato itself doesn't actually produce the voltage, it just helps the metal create the voltage because it has chemicals inside it that allow the electricity to move between the two metals ( galvanized nail, penny). Inside of the potato there are little particles called ions, and ions help move the electricity between the metals like a bridge. The zinc, ( galvanized nail ) creates electrons, and the copper moves the electrons around, and the moving electrons create electricity! The potato juice or citric acid helps move the electrons around, and the bigger the fruit, the more electrons there are. So if we added more potatoes, there would be more voltage! Basically, all the potatoes are like batteries, and the more batteries we have, the more electricity we have!

Think of it like a hill, the zinc is at the top of this hill and the copper (penny) is at the bottom, and the electrons want to go down the hill. Then the voltage would be how steep the hill is. The potato ( or whatever fruit we're using ) is like a slide that makes it easier for the electrons to travel down the hill. It would be very hard without the potato. Also, just know that the potato doesn't get used, because it just helps the elect



Picture from: [Why Do Some Fruits and Vegetables Conduct Electricity? | Live Science](#)

## Manipulated controlled: What are we changing on purpose

We controlled our variables by using the same materials each time and only changing the type of fruit.

Responding variable:

The amount of voltage each pair of vegetables make

Controlled variables:

- Number of vegetables/fruits used in each electricity generation

- same wiring
- Same volt meter
- same amount of zinc and copper
- 

## How does electricity work?

Electricity works by the flow of electrons moving through a circuit then when pushed by voltage powering devices, lightbulbs ect.

## What is voltage?

Voltage is the measure of electric potential energy per unit charge between 2 points in an electric field (the force that pushes electrons to a circuit). Voltage is basically the thing that pushes the electricity forward. If a wire is a hose and the electricity is the water, the voltage is what pushes the water out of the hose, so if our hypothesis is correct and the lime produces the most electricity, it has the most voltage pushing the electricity out. There could be a bunch of electricity there, but with no voltage it will not come.

## What is current?

Movement of an electric charge (the rate of the flow of electrons). Current is the flow of electricity through the wires. If the voltage is the water pressure, then current would be the flow of water. It's basically just like if the water from the hose only flowed a little every second, it would have low current.

## Responding control. What are we measuring

We are measuring the amount of electricity a simple fruit or vegetable can conduct using a simple circuit. We will be measuring the electricity and voltage that each fruit produces during our tests and experiments, and then will be ranking them from most voltage to least. We are

measuring the electricity using a simple gadget called a voltage meter, that will tell us how much electricity each fruit produces.

## Errors

During our first experiment we accidentally pushed one of our pennies too deep into the fruit, causing the experiment to not work. Also, during our early stages of the experiment, we had some troubles knowing what to do, and how it works! ( but now we understand).