Battery Power

Adult Note: This activity revolves around problem-solving and experimenting. To join in on the fun with your child, you may want to read this background information after your family has successfully completed the activity. Or, you may use this background as a head start to prepare for a fun activity with your family. Either way, it is recommended that you do not share the background information below with your child until after the activity is complete. Your child will get the most of this experience if you allow him/her to experiment first!

Background

Batteries have been around for a LONG time! The first battery was created in 1800 by Italian physicist Alessandro Volta. While his invention was not the first device to ever create electricity, it was the first to create a lasting and constant current.[2] Today, batteries are used everywhere to provide electric power to remote controls, cell phones, flashlights, and many other items that are used every day.

While batteries are all around us, have you ever thought about how a battery actually works? A battery is an energy-storing container that holds onto energy until it is needed. Energy is stored inside a battery as chemical energy, which then changes into electric energy when the battery is used.[3]

Batteries are made up of three main parts: a cathode, an anode, and an electrolyte. If you have ever placed a battery into a device, you know that it has two terminals: a positive end and a negative end. The positive side is called the cathode, and the negative side is called the anode. When an electrolyte (which contains electrically charged particles called ions) exists between the anode and the cathode, the ions produce a chemical reaction that gives the battery its electric current. This current runs from the anode to the cathode, where it leaves the battery as power.

When Alessandro Volta invented the battery, he used copper as the cathode, zinc as the anode, and cardboard saturated in salt water as the electrolyte. In this activity, your family will experiment with new materials (aluminum wire, galvanized nails, and lemons) to create an aluminum battery that lights an LED. The aluminum wire will serve as the positive cathode, and the nail will serve as the negative anode. The lemon acts as the electrolyte! To increase the voltage and make the current stronger, several lemon batteries can be connected together as long as the positive wire from one lemon connects to the negative nail in another lemon. Every time an additional lemon is added, the voltage increases. To light an LED, you and your child will use alligator clips to connect the nail from one end of the circuit to the short leg of the LED, and the aluminum wire from the other end of the circuit to the long leg of the LED. It may be helpful to turn off your lights to see the true glow of the LED when it is powered by your battery![1]

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Get Started

Part 1

Battery Scavenger Hunt

Some items in your home need to be plugged into an outlet to get power. Others use batteries! A battery is an energy-storing container that holds onto energy until it is needed. What devices in your home use batteries? Take a walk around and keep a list of what you find:

_____

_____

_____

_____

Part 2

Can you build your own battery?

1. As you just discovered, batteries are used to power many different devices, from big to small! Does your family have what it takes to light an LED with a battery that YOU build?
   Get out the following materials before you begin:
   a. Aluminum wire, 5 six-inch pieces
   b. 5 galvanized nails (Note: most nails for outdoor projects are galvanized)
   c. LED
   d. 2 alligator clips
   e. Optional: Multimeter

2. Think about it: How might you use these materials to create a battery?

3. If you're not sure how to use these materials to create your own battery, then you're onto something... because you are missing one important part! Use the puzzle on the next page to figure out what you still need.

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Can you figure out what's missing?

Directions: Perform the steps below to uncover your battery's missing part!

1. Match the battery clues with the correct response. (If you need help, work with an adult in your family to research your answers.)

____ 1. The world's first battery was created by this man.	A. Anode
____ 2. This is what the positive side of a battery is called.	B. Electrolyte
____ 3. This is what the negative side of a battery is called.	C. Rechargeable
____ 4. In addition to a cathode and an anode, batteries also need this.	D. Alessandro Volta
____ 5. Batteries produce an _____ current.	E. Cathode
____ 6. Some batteries are disposable (thrown out) and some batteries are _____.	F. Electrical

2. Rewrite the letter answers for each number below:

_____	_____	_____	_____	_____	_____
# 2	**# 4**	**# 5**	**# 1**	**# 6**	**# 3**

3. Use this secret alphabet code to decode your answer in #2 and uncover the missing part to your battery!

C=N	B=E	A=S	E = L	D=O	F=M
_____	_____	_____	_____	_____	_____
# 2	**# 4**	**# 5**	**# 1**	**# 6**	**# 3**

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Part 3
Time to REALLY build your battery

Revised Material List

a. Up to 5 ***lemons***
b. Aluminum wire, 5 six-inch pieces
c. 5 galvanized nails (Note: most nails for outdoor projects are galvanized)
d. LED
e. 2 alligator clips
f. Optional: Multimeter

Hypothesis

How many lemon batteries does your family think it will take to light one LED? _____

Experiment

Now you have everything you need to really build your own battery! Before following the steps below, experiment with the different battery parts and try to build the battery on your own. Remember: a big part of being a scientist is experimenting again and again. Don't get discouraged if your first, second, or third trial doesn't work!

If you really get stuck, follow these directions:

1. Examine the aluminum wire. If it is insulated, strip the ends of insulation. If it is not insulated, move on to step #2.
2. Roll and squeeze a lemon to get its juices flowing.
3. Push the wire about one inch into the side of the lemon.
4. Push the nail into a section of the lemon that is next to the wire. The nail should be close to the wire but not touching the wire.
   Nice work! You've just created your first lemon battery… but you're not done yet!
5. See if one lemon battery is enough to power the LED. Use the alligator clips to connect the LED legs to the nail and the aluminum wire. (If the LED doesn't light, rearrange how you connect the legs, wire, and nail.)
6. If the LED still doesn't light up, continue adding lemon batteries to your chain. You can connect the batteries by wrapping the wire from one lemon around the nail in the next lemon. Be sure to continue testing how to best connect the LED, too!
   Hint: It may also be helpful to bring the batteries and LED into a dimly-lit room!
7. If you have a multimeter, you can use it at any time to measure the voltage between the two electrodes (the nail and the wire.) Every time you add a lemon, you should see an increased voltage!

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Making Conclusions

1. Was your hypothesis correct?

   _____
   _____
   _____

2. Do lemons, aluminum wires, and nails seem to make a good battery? Why or why not?

   _____
   _____
   _____

3. How were these lemons, aluminum wires, and nails able to light the LED? It may be helpful to look at another household battery and observe how they are similar and different. After you write your family's thoughts below, go back and read the Background section to double-check your response!

   _____
   _____
   _____
   _____

Continue Experimenting

Put other fruits (and even vegetables!) to the test. Will any other food work successfully as your electrolyte?

Works Cited

[1]BN Editors. "Lemon Power: A Make & Collaborate Project." Electronics for Kids: Play with Simple Circuits and Experiment with Electricity.
https://www.barnesandnoble.com/blog/lemon-power-make-collaborate-project.

[2]Brain, Marshal; Bryant, Charles; and Pumphrey, Clint. "Battery History." HowStuffWorks.
https://electronics.howstuffworks.com/everyday-tech/battery1.htm.

[3]Kids Britannica. "Battery."
https://kids.britannica.com/kids/article/battery/390651.

[4]Palermo, Elizabeth. "How Do Batteries Work?" Live Science.
https://www.livescience.com/50657-how-batteries-work.html.