



Science Experiments and Demonstrations

Batteries

Science Experiments: Batteries

- *Batteries* provide the energy and force that causes *electrons* to flow through wires and devices.
- A *circuit* is the path along which electricity can flow.

Key Vocabulary

- battery
- electron
- circuit

Lesson Options: Select from these lesson elements to create a single-day or multiday lesson.

Lesson Elements

Digital Playlist: For this topic, the playlist consists of one video: *Science Fair: Penny Battery*. It is recommended that you and your child watch that video together as part of the Explore Activity, and review as you consider appropriate at the beginning of the other two activities.

Explore Activity: This activity is designed to guide your child in thinking about the ideas presented in

the video and how those ideas relate to other things that they have experienced or understand.

Dig Deeper Activity: This offline activity develops a deeper understanding of some aspects of the topic.

Extend Activity: This offline activity extends the child's understanding and application of the topic.

Explore Activity

1. Have your child get a toy that runs on *batteries* and open the *battery* compartment to see them. Ask: *How do batteries make things work?*

Sample answers: "They must have some kind of power in them. I'm not sure how it works, but lots of fun things run on *batteries*. They make electricity." Explain to your child that they will watch a video about how they could make their own small *battery*.

2. With your child, watch *Science Fair: Penny Battery*.
3. Engage your child in a discussion by asking, *What did you learn from the video?*

Sample answers: "I found out that it takes two different kinds of metal to make a *battery*. I didn't know that pennies are made from two types of metal. I saw that the wires had to be touching the pennies for the light to turn on. The *battery* made the *electrons* move so the light could turn on. The metal in the pennies and the wires must make enough energy to turn on the light."

4. Explain to your child that the electricity the *battery* made is just a very large number of very, very tiny particles called *electrons* that move through the wires and the light bulb. The *electrons* are already in the wires and light bulb, but the *battery* pushes them so that they move around the path that is made by the *battery*, wires, and light bulb. Tell them that a path the *electrons* move on is called a *circuit*.

IMPORTANT SAFETY NOTE: Explain to your child that the small *battery* is not strong enough to push *electrons* very hard, but the force that pushes *electrons* through the outlets in your wall is very strong



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and is dangerous. Be sure they understand that they should keep hands or other objects away from wall sockets and stay away from exposed wires in or around the house. Tell children to only perform electrical experiments when an adult is present.

Dig Deeper Activity

Set Up

1. Gather the materials on the list.
2. Review the video *Science Fair: Penny Battery* (optional).
3. Tell your child that together you are going to make the kind of *battery* they saw in the video and see if you can make the light bulb shine brighter.

Procedure

1. Follow the procedure described in the video *Science Fair: Penny Battery*.
2. Ask your child to explain what's happening with *electrons* when the LED bulb lights up.
Sample answer: "The penny *battery* pushes *electrons* through the wires so that they go into and out of the bulb and back to the *battery*."
3. Ask your child to predict what will happen if you add more pennies to the *battery* stack. Then, try it (always keeping the penny with copper on both sides on top). Did the LED get brighter? If so, ask your child what the reason for that might be.

Sample answer: "The more pennies there are, the more *electrons* are pushed through the wire and the bulb."

Materials

- See the materials used in the video *Science Fair: Penny Battery*.

Extend Activity

Set Up

1. Gather the materials on the list.
2. Review the video *Science Fair: Penny Battery* (optional).
3. Tell your child that together you are going to make another kind of *battery* using potatoes, and do an experiment to investigate how to make a potato *battery* more powerful.

Procedure

1. Hold the potato and help your child carefully push the zinc nail into it, leaving some of the nail sticking out. Have them push in the copper nail, the pieces of solid wire (bent double), or the penny (you may need to cut a small slice in the potato first) an inch or so away from the zinc nail, but not touching that nail inside or outside the potato. For younger children, have your child help hold the potato while you push in the metal objects.

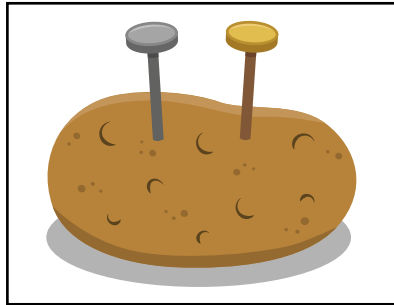
Materials

- Three potatoes
- Eight zinc (galvanized) nails
- Eight copper nails or six-inch lengths of solid copper wire or copper pennies
- Six-inch lengths of insulated stranded wire with alligator clips on each end
- Small LED light (the type used in the *Science Fair: Penny Battery* video)
- Printout of Potato *Battery* Experimental Data Chart (last page of this lesson plan)



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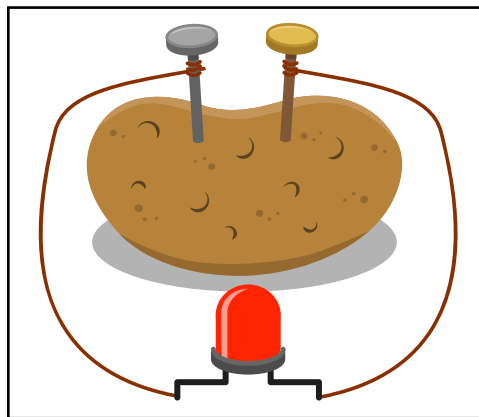
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2. Ask your child to tell you how this potato *battery* is similar and different from the penny *battery* they saw in the video.

Sample answer: “It doesn’t use pennies, and there’s no vinegar in it.” Help them observe that there are two kinds of metal in the potato, just as there were two kinds of metal in the penny *battery*.

3. Use the wire to connect the LED light to the nails. It may or may not light up. Either way, record what you observed in the Potato *Battery* Experimental Data Chart. In the Set Up column, describe your potato *battery* in detail, including what you used for metals and how far apart they were. In the Observation column, describe whether or not the LED light lit up and if so, whether it was dim or bright. (You may need to darken the room to see if the LED is lit up.)



4. Tell your child that together you’re going to do an experiment where you change some things with your potato *battery* and see how those changes affect the amount of electricity the potato produces. Ask your child to think of something to change, prompting them as needed with ideas from the list below.

For each modification, describe what you did in the Potato *Battery* Experimental Data Chart and what the effect was on the LED bulb.

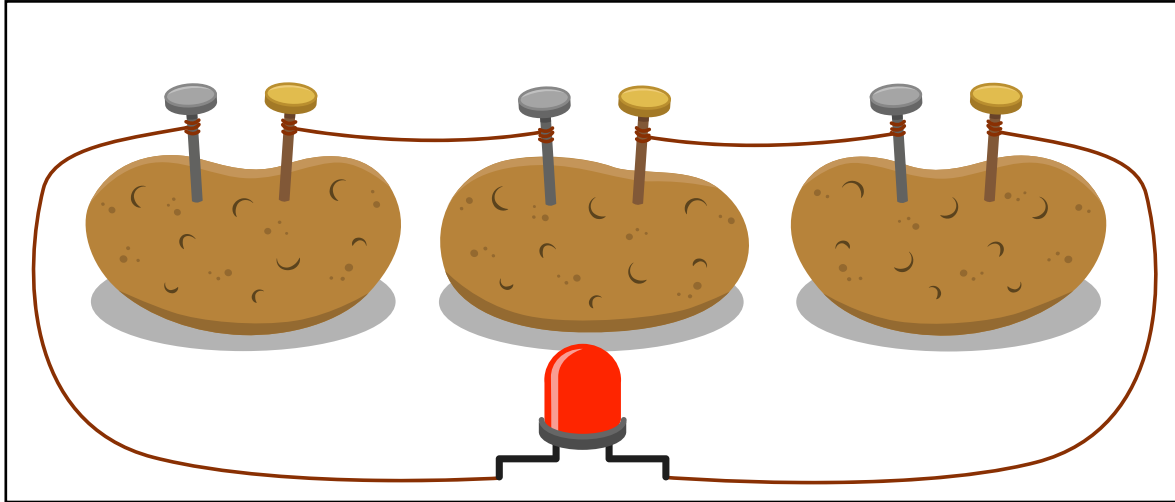
- Move the metal pieces closer together or farther apart.
- Make both metal pieces the same kind of metal (for example, use two galvanized nails instead of one galvanized nail and one copper piece).
- Try a non-galvanized iron nail in place of the galvanized, zinc-coated nail.



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- Put in more metal pieces. Be sure to connect them to each other (for example, put in a second galvanized nail next to the first one and connect those two with a wire as well as connecting one of the LED wires to one of them).
- Make additional potato *batteries*. Use the wire to connect the galvanized nail of one potato to the copper piece of the next.



- Once you have enough potatoes to light up the LED, find out what happens if you remove one of the wires connecting the metal pieces in two of the potatoes. Discuss this with your child to reinforce understanding that there must be a complete pathway for *electrons* to move on or they will not move at all, and that such a pathway is called a *circuit*.
5. Engage your child in a discussion after completing the experiment. What did they learn about *batteries*, *electricity*, and *circuits*?



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MODIFICATIONS

Beginning Learner	Advanced Learner
<p>Watch the video twice. The second time, stop at 0:50 and 1:47, and discuss with your child what has happened so far. At the end, ask your child to explain what they think the video is teaching them.</p>	<p>Your child might wish to find out more about household electricity. They can start by observing as you plug in a lamp, then turn it on and off. Have them try to explain what happens in terms of whether or not there is a complete pathway for <i>electrons</i> to travel on. (When the switch is on, the wires and light bulb in the lamp complete the pathway from one of the slots of the outlet to the other slot. That allows <i>electrons</i> to move on the wire.)</p> <p>You may wish to explain that for electricity that comes out of a wall outlet, instead of going in only one direction, the <i>electrons</i> first go one way, then the other. They <i>alternate</i> their direction of travel back and forth, which is why that kind of electricity is called “alternating current.”</p> <p>Your child might also want to do research to find out more about what it is that pushes the <i>electrons</i> through a household <i>circuit</i> once it is complete, using sources in the library or on the internet. You can show your child the electrical meter and explain that it keeps track of how much electrical power is used in your house.</p>

Signs of Success and Needs

You can feel confident of your child’s understanding of electricity if they can explain what is happening with *electrons* when the LED lights up.

Sample answer: “The *battery* is pushing *electrons* through the wire and through the light bulb.”

Children may have the misconception that a *battery* makes all the *electrons* that travel through a wire in a *circuit*. You can correct or avoid this misconception by explaining that *batteries* work by pushing *electrons* that are already in wires and light bulbs.

Our activities are designed to be safe with adult supervision. Please follow directions carefully.



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Potato Battery Experimental Data Chart

Set Up	Observation