

# POTATO BATTERY

## Getting a Charge Out of Spuds

FIELD: **ELECTRONICS**  
CONCEPT: **ELECTROCHEMISTRY**

### MATERIALS



2 copper electrodes  
(included in kit)



2 zinc electrodes  
(included in kit)



2 potatoes  
(the bigger, the better)



Clock  
(included in kit)



Wire connector  
(included in kit)



Sound chip  
(included in kit)

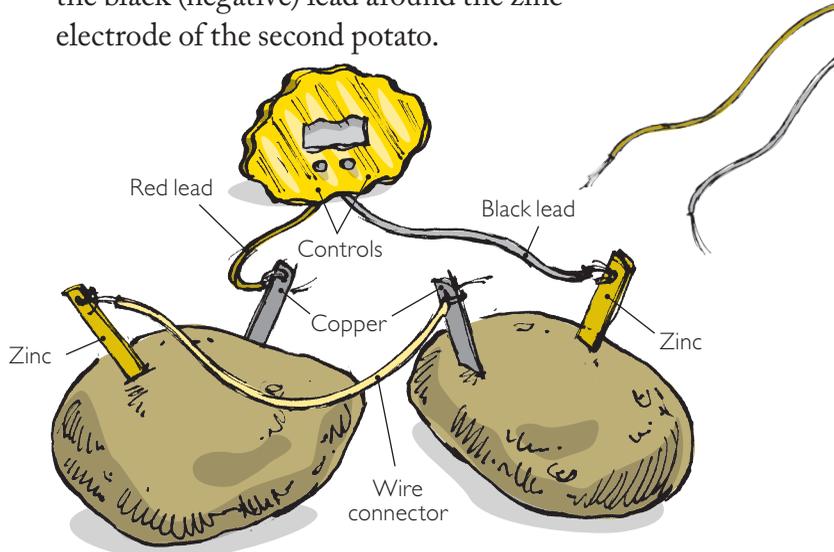


Chip tube

### METHOD

#### To Make a TATER CLOCK

- 1 Jab one copper electrode and one zinc electrode into each potato. Keep the copper and zinc far away from each other.
- 2 Attach the clock leads (wires) to the electrodes in the following manner: Twist the red (positive) lead around the copper electrode of the first potato, and twist the black (negative) lead around the zinc electrode of the second potato.



- 3 Complete the electrical circuit by twisting the exposed ends of the wire connector around the two unconnected electrodes.

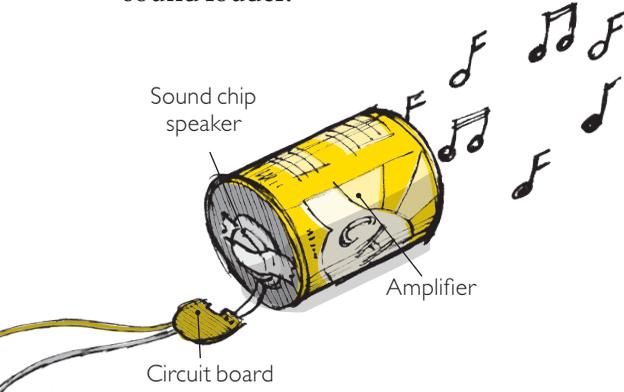
- 4 Set the time using the two clock controls.

### CHIP CHALLENGE

Try powering a clock off a couple of lemons. Can you find other fruits that will keep your clock ticking?

## To Make a Potato-Powered Sound System

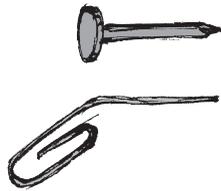
To run a sound system off a pair of potatoes, follow the method on the opposite page but swap the sound chip for the clock. To amplify the sound, stick the sound chip speaker to a metal-bottomed chip tube. Fiddle with the speaker to make the sound louder.



### MATERIAL MODIFICATIONS

Spud clocks can be built out of all sorts of stuff. Here are some substitute substances:

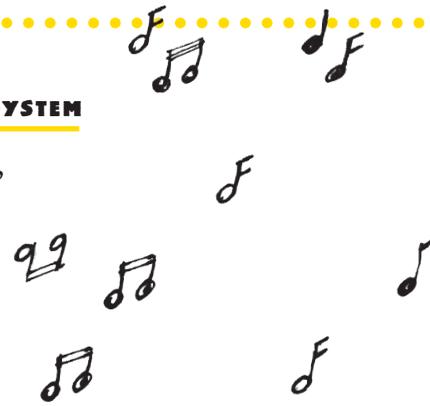
- Zinc electrodes can be made from galvanized nails or shiny paper clips.



- Copper electrodes can be made from certain keys and coins. (Pennies minted before 1969, when the copper content was still very high, work especially well.)

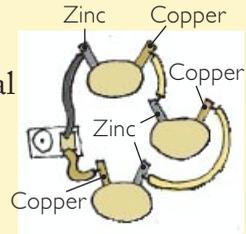


- Wire connectors can be made from a rolled-up piece of aluminum foil.



### TROUBLESHOOTING YOUR TATER: A CHECKLIST

If your sound chip sounds weak you can wire more potatoes together for extra power. (Need additional electrodes? See Material Modifications to the left.)



Still think you've got a dud spud? Not to worry. A few simple checks can often remedy the problem. Before you replace your batteries, make sure:

- ✓ Wires and electrodes are making contact (touching).



- ✓ Zinc and copper electrodes are spaced far apart.

- ✓ Each potato has one zinc and one copper electrode.

- ✓ Electrodes are clean. (Rust and oxidation can be removed with a little sandpaper or steel wool.)

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## MEANING

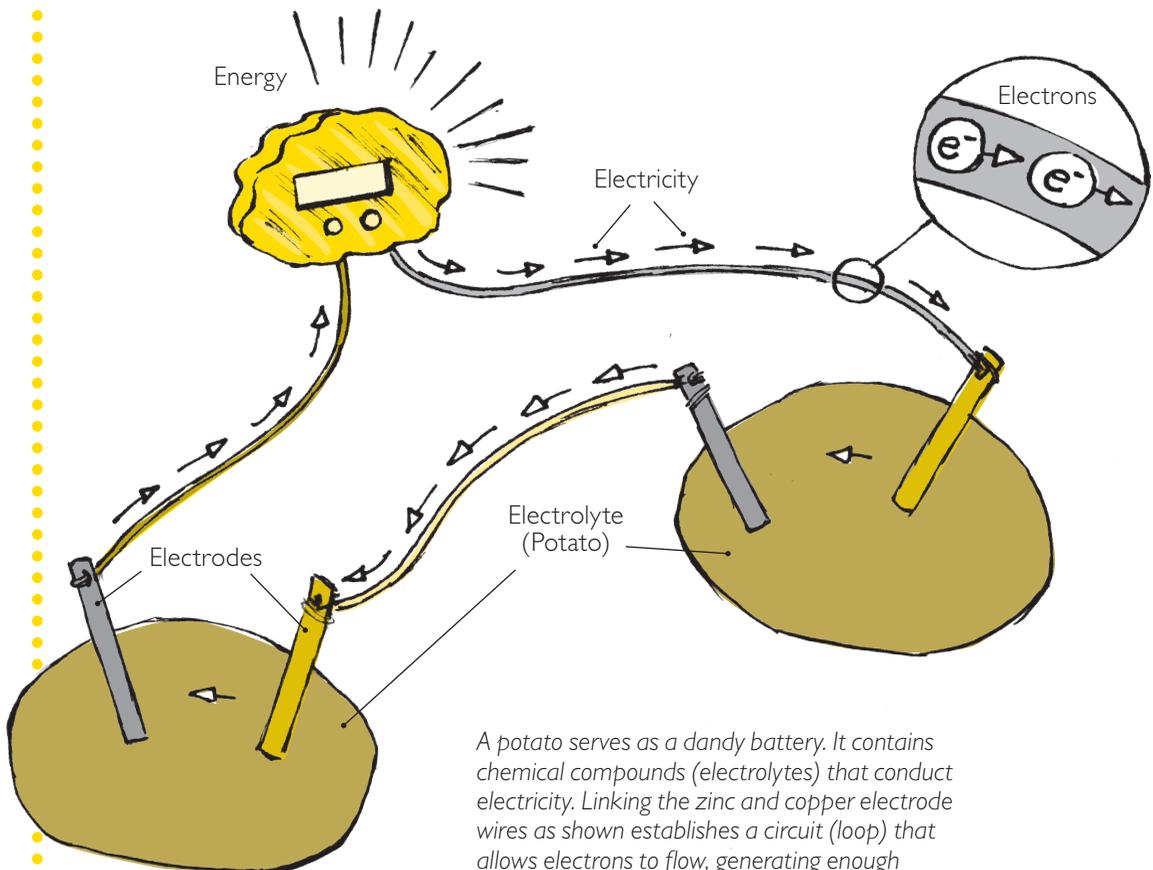
Potatoes do not contain electricity. They are, however, full of electrolytes—chemicals that can be *turned into* electricity. With a few bits of metal, potatoes can be used as batteries—storehouses of energy that allow us to run digital clocks, tiny sound modules, and low-voltage LED lightbulbs.

Here's how a spud battery works: Poking copper and zinc strips of metal (electrodes) into a potato produces a series of chemical reactions that release electrons—subatomic particles that are the basic component of electricity.

Zinc sheds electrons more quickly than

copper does. This imbalance triggers a steady movement of the electrons between the copper and zinc electrodes. When electrodes are looped in an alternating pattern (copper-zinc-copper-zinc) they create an electrical circuit. In effect, the metal probes and wire allow us to turn a chemical reaction into electrical energy. This is why a potato can be considered an electrochemical battery.

The more spuds you line up in a series—using wire connectors—the more electricity you can produce. Two potatoes provide just enough energy to power low-voltage electronic devices. Twenty can power a simple computer server.



*A potato serves as a dandy battery. It contains chemical compounds (electrolytes) that conduct electricity. Linking the zinc and copper electrode wires as shown establishes a circuit (loop) that allows electrons to flow, generating enough electricity to power the clock.*

**Explaining Electricity (with the Greatest of EEEEEEs)**

<b>Electricity</b>	A form of energy characterized by the flow of electrons. This flow can be generated in many ways, including (as in the case of the potato battery) chemical change.
<b>Electrochemistry</b>	The branch of science that deals with the production of electricity by chemical change.
<b>Electrode</b>	A terminal that conducts an electrical current into or out of potatoes and other fuel cells.
<b>Electrolyte</b>	A chemical compound that can conduct electrical current.
<b>Electron</b>	A negatively charged particle that spins around an atom. The flow of electrons produces electricity.
<b>Energy</b>	Usually defined as the ability to do work. Energy comes in many forms, including light, heat, sound, and motion. All energy is either kinetic or potential (page 36).



**MUNCH ON THIS**

The average baking potato stores about 1 volt of potential energy, which is why electrical devices that require no more than 2 volts of power can be run off a pair of large potatoes.

**... AND THIS**



Benjamin Franklin coined the word *battery* after a series of jars he used during electrochemical tests reminded him of a battery, or grouping, of cannons.

**... AND THIS**



You can connect potatoes in a series to increase voltage. One scientist built a spud battery to power a portable sound system. He needed 500 pounds of potatoes and a U-Haul truck to move the stereo around town. Talk about Eye-Tunes!

**... AND THIS**

Electrochemical batteries can also be made out of lemons, jars of vinegar, pots of wet dirt, soda pop, sports drinks, fruit juice, and other substances rich in electrolytes.