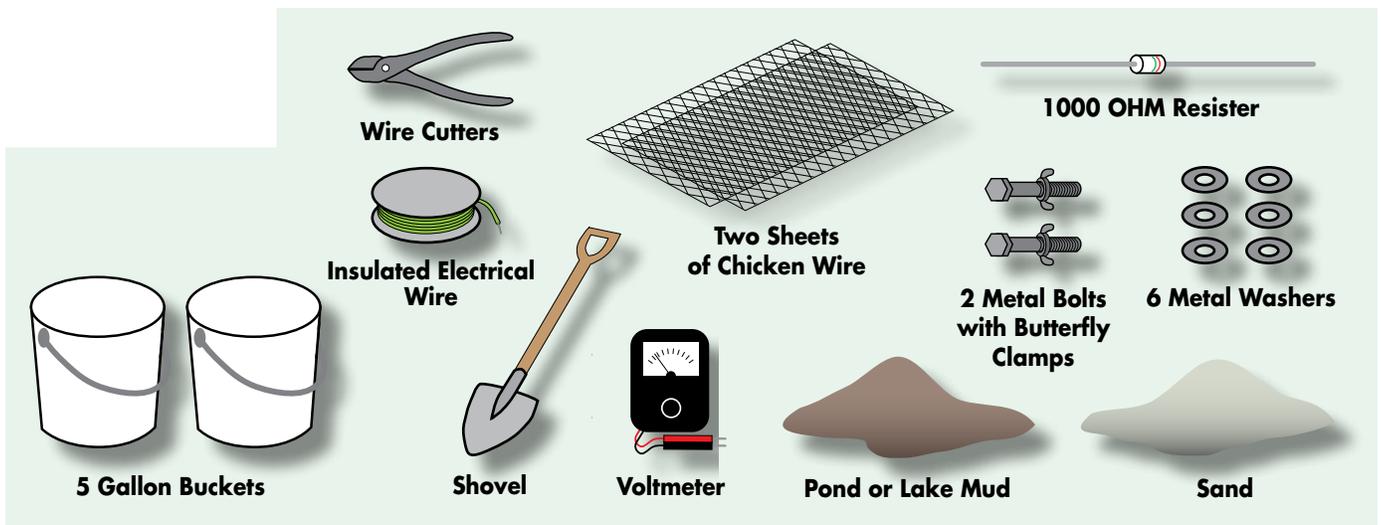


# Mud Battery

Check out the video for this activity at [kidsciencechallenge.com](http://kidsciencechallenge.com).

## Find What You Need...

- 2 five-gallon buckets
- Mud from the bottom of a pond, lake, or other outdoor water source
- Shovel
- Two sheets of chicken wire measuring 16" x 24" each
- 2 metal bolts with butterfly clamps
- 6 metal washers
- Insulated electrical wire – about 3 ft. (available at Radio Shack)
- 1000 OHM Resistor (available at Radio Shack)
- Voltmeter (available at Radio Shack)
- Sand (enough to create about a 3-inch layer in a 5-gallon bucket)
- Wire cutters



## What makes a battery?

A battery changes chemical energy to electric energy. Chemical energy consists of a flow of negatively charged particles called electrons. A battery needs two electrodes, or conductors. These are called the cathode and the anode. Electrons flow into the battery at the cathode and leave through the anode.

Electrons can flow from all kinds of atoms – including atoms in living things. In this activity, you will make use of some bacteria that live in mud. As bacteria eat, they release electrons. The more they eat – and grow, and multiply – the more electrons they release.

When you build a mud battery, bacteria from the mud will collect on your electrode and begin releasing electrons. You'll use a voltmeter to see what kind of charge these electrons will create. Ready to make some bacteria work for you? Follow the instructions on page 2!

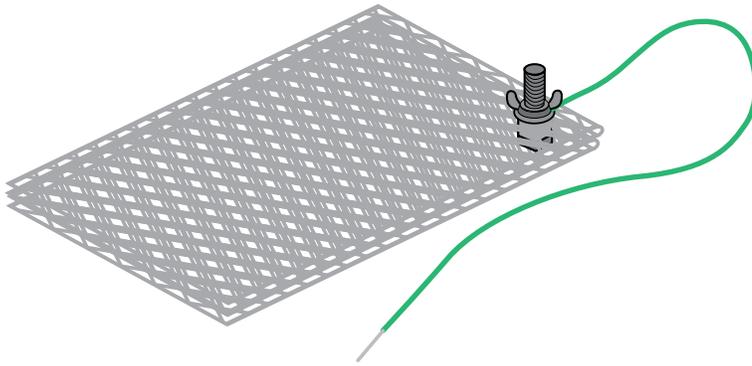
### Fact:

You could also make a battery from a potato, or a lemon.

## Activity Instructions:

### To make the anode and cathode electrodes:

1. Fold one sheet of chicken wire over itself six times so that you have one square measuring about 8 inches by 8 inches. Do the same with the second sheet of chicken wire.



2. Place one washer onto the bolt, then push the bolt through the chicken wire. Place two more washers onto the bolt, then screw the butterfly clip onto the bolt. Repeat for the second chicken wire.
3. With the help of an adult, cut the insulated electrical wire into two pieces so that you have one 2ft. piece and one 1 ft. piece.

4. Also with the help of an adult, strip back the plastic covering on the ends of the insulated electrical wire so that the actual wire is exposed.
5. Take the long piece of electrical wire and one piece of chicken wire. Wrap one end of the electrical wire around the bolt between the two washers. Take the shorter piece of electrical wire and the second piece of chicken wire. Wrap the electrical wire around the bolt as you did before. On both bolts: Make sure the butterfly clip is screwed on tight so that the wire doesn't fall out.
6. **Remember this:** The chicken wire with the longer insulated electrical wire connected to it will be your anode. The chicken wire with the shorter electrical wire will be your cathode.

### Building your mud battery:

7. Use your shovel to collect mud from an outdoor water source (like a pond or a lake). Fill one 5-gallon bucket about half to three-quarters of the way full. This is bucket number 1. Completely cover the bottom of your second bucket with at least 3 – 4" of mud. This is bucket number 2.
8. Take bucket number 2. Place the anode electrode (the electrode with the longer electrical wire) on top of the mud, leaving the electrical wire hanging out of the bucket. Cover the electrode with more mud – it's important that the electrode be entirely buried in the mud.



9. Pour a layer of sand over the mud layer in bucket 2. The sand should be about 3 inches deep. Place your cathode electrode on this mud, leaving the electrical wire hanging out of the bucket. Be sure to take note of which wire belongs to which electrode – this will be important later on.
10. Cover the cathode electrode with water.
11. Connect the ends of both wires to the resistor. Be sure to keep the resistor out of the water, otherwise your battery will short circuit.
12. Take your voltmeter and clip the red connector to the side of the resistor that the anode electrode is connected to. Clip the black connector to the side of the resistor that the cathode electrode is connected to.
13. Watch your voltmeter for the next few days. Bacteria in the mud will realize that that electrode is there, and they will attach themselves to it and begin to produce electrons. As they're producing electrons, they're gaining energy, so they'll keep growing and multiplying – and making more electricity over time. Your voltmeter won't immediately register electricity because the bacteria need some time to find the electrode and start multiplying.

