Penny Battery

From phones to lights to toys, batteries power many things we use everyday! Create an electrochemical reaction between metals and use an electrolyte solution to make your own battery and power an LED.

TEKS:

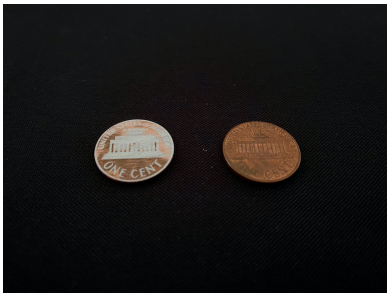
SCI 4.6 C: The student is expected to demonstrate that electricity travels in a closed path, creating an electrical circuit.
SCI 5.5 C: The student is expected to identify changes that can occur in the physical properties of the ingredients of solutions such as dissolving salt in water or adding lemon juice to water.
SCI 5.6 B: The student is expected to demonstrate that the flow of electricity in closed circuits can produce light, heat, or sound.
SCI 6.9 C: The student is expected to demonstrate energy transformations such as energy in a flashlight battery changes from chemical energy to electrical energy to light energy.

Materials:

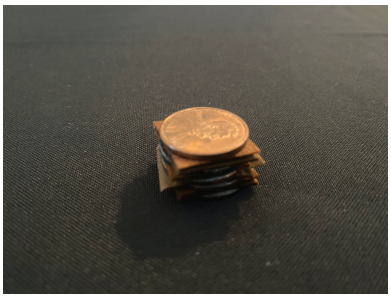
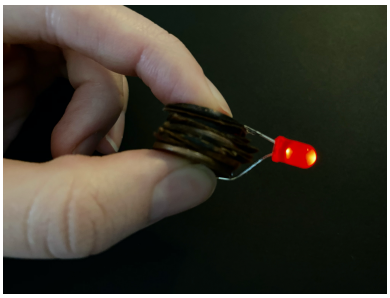
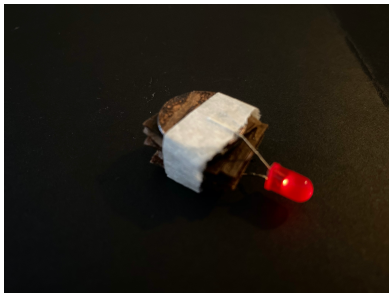
- Cardboard
- Cup
- Electrical or masking tape
- 5mm LED (red works best)
- Paper towels
- Salt (1/8 cup)
- Sandpaper
- Scissors
- Spoon
- 5 U.S. pennies (dated after 1982)
- Vinegar (1 tablespoon)
- Voltmeter (optional)
- Warm water (1/2 cup)

How To:

1. Pour the warm water into your cup.
2. Create a salt solution by using a spoon to stir the salt into the warm water.
3. Add the vinegar to the salt solution and use the spoon to stir it in.
4. Use your scissors to cut the cardboard into four squares, each about the size of one penny.
5. Soak the cardboard squares in the salt and vinegar solution for five minutes. When they are completely soaked, remove the squares from the solution and place them on a paper towel.
6. Use sandpaper to remove the copper from the "tails" side of four of the pennies, leaving the fifth penny as it is. Sand until you remove almost all of the copper (brown color) and see the zinc (silver color) coming through. Note: A helpful strategy for sanding the pennies is to place the sandpaper on a flat surface and then rub the penny across the top of it.



7. Place one sanded penny on a flat surface with the copper side down and the zinc side facing up. Place a damp piece of cardboard on top of it.
8. Continue stacking, alternating between the sanded pennies (copper side down and zinc side facing up) and cardboard pieces. Be sure that the pennies do not touch each other and that the cardboard pieces do not touch each other.
9. Place the fifth (un-sanded) penny on the top of the stack.
10. Optional: Use a voltmeter to check the voltage of your penny battery by placing the leads on the top and bottom of your battery.
11. Use electrical tape to connect the LED to your battery. The slightly longer leg is the positive side and should be connected to the top (fully copper) penny. The shorter leg is the negative side and should be connected to the bottom (sanded copper) penny.
12. Wrap your penny battery with electrical tape to hold the LED in place.
13. Use your penny battery flashlight for up to 24 hours! To recharge your battery, take the battery apart, re-soak your cardboard pieces in the salt and vinegar solution, then re-assemble.

STEM Explanation:

Batteries are containers of cells in which chemical energy is converted into electricity to use as a power source. When two different metals are connected by an electrolyte, a chemical reaction occurs that releases electrons and creates an electric current. In the case of your penny battery, the sanded pennies provided two different metals, copper and zinc. The salt and vinegar solution on the cardboard pieces was the electrolyte that conducted the electricity released from the reaction between the copper and zinc. This combination of materials and the reaction between them created a battery; the chemical energy from the metal and electrolyte reaction converted into the electricity needed to light the LED. Then, you created a closed circuit by connecting the penny battery to the LED. A closed circuit is a complete connection that allows electric current to flow from the power source (penny battery), to the LED, and back to the power source. This closed circuit caused your LED to illuminate!

Career Connection:

Electrical engineers work with electricity in many forms from designing small-scale circuits to building large electrical systems. They develop wireless communication systems, make the latest media displays like HDTV, design computer processors and other hardware, and work in robotics.

Resources:

https://www.exploratorium.edu/snacks/penny-battery
https://www.explainthatstuff.com/batteries.html