

SQUISHY CIRCUITS

Explore the basics of electrical circuits with conductive dough

MATERIALS NEEDED

FOR DOUGH

- 1 ½ cups flour
- ¼ cup salt
- 3 tablespoons Cream of Tartar
- 1 tablespoon vegetable oil
- Food coloring
- 1 cup water
- Sauce pan
- Spatula



FOR EXPLORATION

- Battery Pack (recommended: 4 AA holder with wires)
- Alligator Test Leads or insulated wire fitted with spade or probe ends
- Motor
- Light Emitting Diodes (LEDs) (recommended 10mm, any voltage under ~3.5V)
- Optional: additional components (buzzers, switches, etc.)

PRE-ACTIVITY PREPARATION

Making Conductive Dough

- Set ½ cup of the flour aside.
- Mix the remaining flour, salt, cream of tartar together in a medium sized sauce pan.
- In a separate container combine the water, vegetable oil and food coloring.
- Pour the liquid mixture into the dry ingredients and stir until thoroughly combined.
- Cook over medium heat stirring continuously until the mixture starts to thicken and solidify into a ball.
- Flip the mixture over in the pan and flatten the ball like a pancake. Wait a few seconds, fold the pancake in half, flip and repeat the process until the dough firms and darkens slightly.
- Lightly flour a cookie sheet or a clean flat surface with the reserve flour. Transfer the dough to the floured surface and let it cool slightly.
- Slowly knead the remaining flour into the ball until you've reached a desired consistency.
- Store in an airtight container or plastic bag. While in the bag, water from the dough will create condensation. This is normal. Just knead the dough after removing it from the bag, and it will be as good as new. If stored properly, the dough should keep for several weeks.

WHAT TO DO:

The Foundation – Making Circuits:

- Place the batteries into the battery holder. **IMPORTANT - Never connect the battery pack's terminals directly to each other; this is called a short circuit and can make the batteries and wires get very hot**
- Divide the dough into two pieces and roll each piece into long cylinders about an inch in diameter Lay the two piece side by side, but not touching.
- Connect the power supply to your dough by pushing one of the battery contacts into each of the rolls of dough.
- Try completing the circuit with an LED (Light Emitting Diode). An LED produces light from electrical power, but in order to get it to work, it has to be oriented properly . Usually the two leads are different lengths. The longer lead goes to the positive, or red, side of the battery pack. The shorter goes to the negative, or black, side of the battery pack. **IMPORTANT Do not connect the LED directly to the battery pack. Make sure that there is dough between the LED and battery terminals or the LED will burn out.**

Open Explorations:

- Explore different configurations to get multiple lights to light up. Draw a diagram to show the connections.
- Explore connections with the motor and see how you can get it to spin. The motor has two leads like the LED, does the way they are connected affect the direction the motor spins?
- What happens to the LED when the two stands of conductive dough touch? Explain what you believe is happening.
- Does the length or thickness of the dough affect how well the components work?
- Experiment with the distance from the battery pack in the dough. How does distance affect the way components work?
- Does the number or type of components on the circuit affect how well they function?

When you are finished exploring Squishy Circuits, clean off all of the metal parts on the components and battery connectors with a damp paper towel. This prevents the salt in the dough from corroding the contacts.

Squishy Circuits were developed by Anne Marie Thomas of the St. Thomas Lab at the University of St. Thomas.

The official Squishy Circuits website:

<http://courseweb.stthomas.edu/apthomas/SquishyCircuits/buildingCircuits.htm>

