

# Circuit Putty

## Elementary Circuit Basics

### 1. MAKE CONDUCTIVE DOUGH.

#### Ingredients:

- 1 cup Water
- 1 1/2 cups Flour
- 1/4 cup Salt
- 3 Tbsp. Cream of Tartar\*
- 1 Tbsp. Vegetable Oil
- Food Coloring

\*9 Tbsp. of Lemon Juice may be Substituted

#### Directions:

- Mix water, 1 cup of flour, salt, cream of tartar, vegetable oil, and food coloring in a medium sized pot.
- Cook over medium heat and stir continuously.
- The mixture will begin to boil and start to get chunky.
- Keep stirring the mixture until it forms a ball in the center of the pot.
- Once a ball forms, place the ball on a lightly floured surface.
- Slowly knead the remaining flour into the ball until you've reached a desired consistency.

### 2. IDENTIFY YOUR DOUGH.

a. The conductive dough allows electricity to travel through it.

What color is your conductive dough? \_\_\_\_\_

b. The insulating dough does NOT allow electricity to travel through it. For this, use standard Play Doh or a generic equivalent.

What color is your insulating dough? \_\_\_\_\_

### 3. CIRCUITS BACKGROUND KNOWLEDGE.

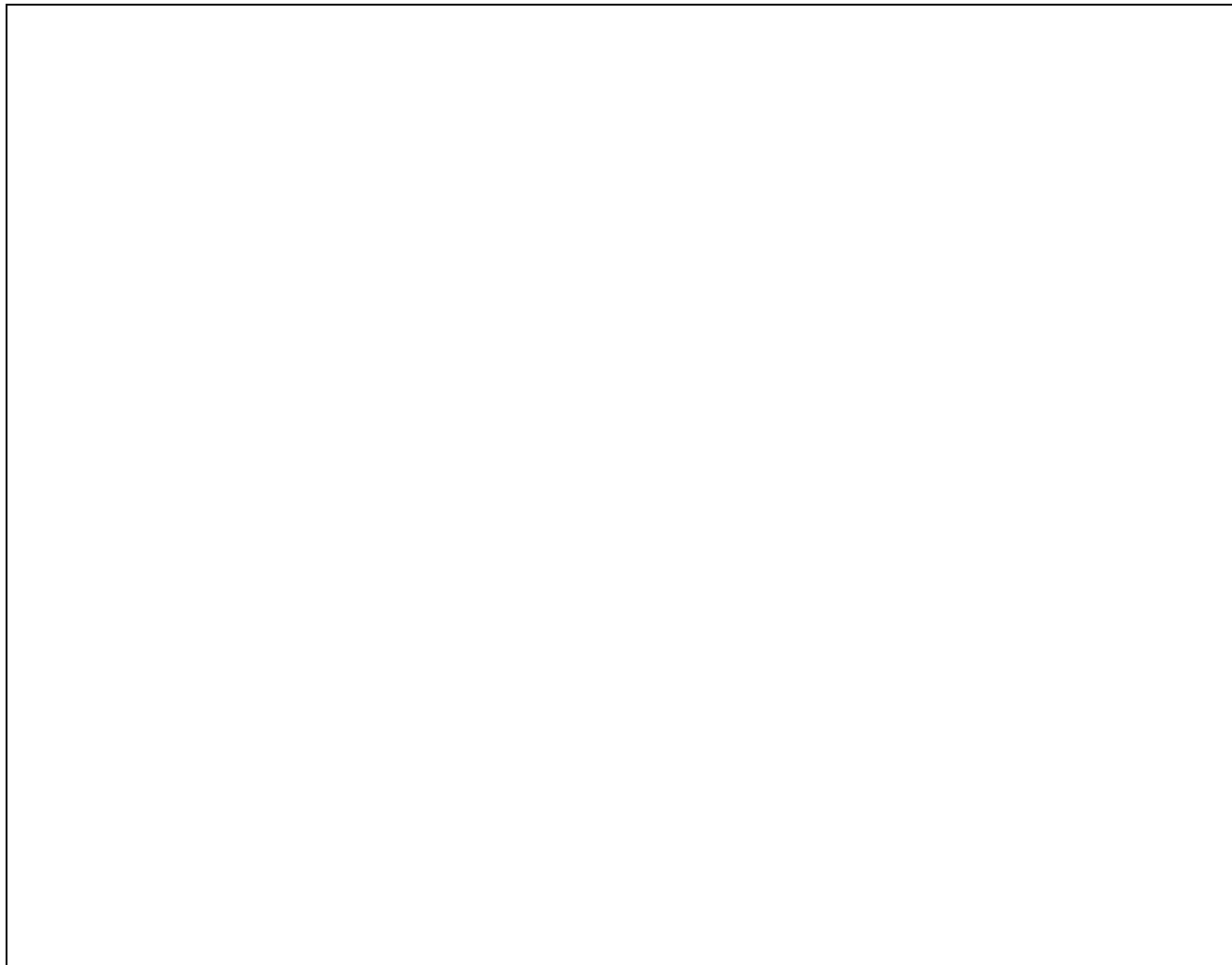
Electricity moves in a circle called a circuit. The energy starts and stops with the energy source. In this case, that is the battery pack. It flows through the wires and any other parts of the circuit.

It is harder for the electricity to move through the LED, so it wants to move through the dough if it can. If two sides of the dough are touching then the electricity will by-pass the LED and create a short circuit. Use the insulating dough between the conductive dough to prevent a short circuit from happening. You are forcing the electricity to travel through the LED bulb.

An LED bulb stands for Light Emitting Diode. It needs electricity in order to create light. The dough serves as a resistor, a part of the circuit that controls the flow of electricity. Always connect the battery and the LEDs through a piece of the dough. The LED "leg" with the longer stem will connect towards the red, or positive wires of the battery pack. An "alligator clip" is the wire with the metal clips at the ends.

### 3. SERIES CIRCUIT

- a. A series is one pathway for the electricity to travel.
  
- b. Sketch out your own series circuit in the following order: battery pack → red wire → alligator clip → conducting dough → insulating dough → conducting dough → alligator clip → black wire → battery pack. The LED should connect from one conducting dough to the next.



- c. Create your circuit with your materials.
  
- d. Now go ahead and add another pair of insulating and conducting layers to the circuit. Do the bulbs function as well as before? \_\_\_\_\_

- e. Now add another pair of insulating and conducting layers to the circuit. Does it change anything about the first or second bulbs? \_\_\_\_\_

#### 4. PARALLEL CIRCUIT

a. With a parallel circuit, the electricity has different ways that it can move through the circuit. Since all of the LEDs are receiving flows of electricity separately, they should continue to work if you connect an additional bulb, take one out, or it burns out.

b. Sketch out your own parallel circuit in the following order: battery pack → red wire → alligator clip → conducting dough → insulating dough → conducting dough → alligator clip → black wire → battery pack. The LED should connect one side of the conducting dough to the next.



c. Create your parallel circuit with your materials.

d. Now go ahead and add a second LED along side the first, connecting one piece of conducting dough to the other. Does it change anything about the first bulb? \_\_\_\_\_

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d. Now add another. Does it change anything about the first or second bulbs? \_\_\_\_\_

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## 5. ROTATING MOTOR

a. The motor also has two separate wires. You can hook up the red, positive end from the battery pack through the dough to either of the motor's wires. Note that changing which of the motor's wires you use also changes that direction that it spins.

b. Sketch out your own series circuit with a motor included in the following order:  
battery pack → red wire → alligator clip → conducting dough → motor wire → motor →  
motor wire → conducting dough → alligator clip → black wire → battery pack



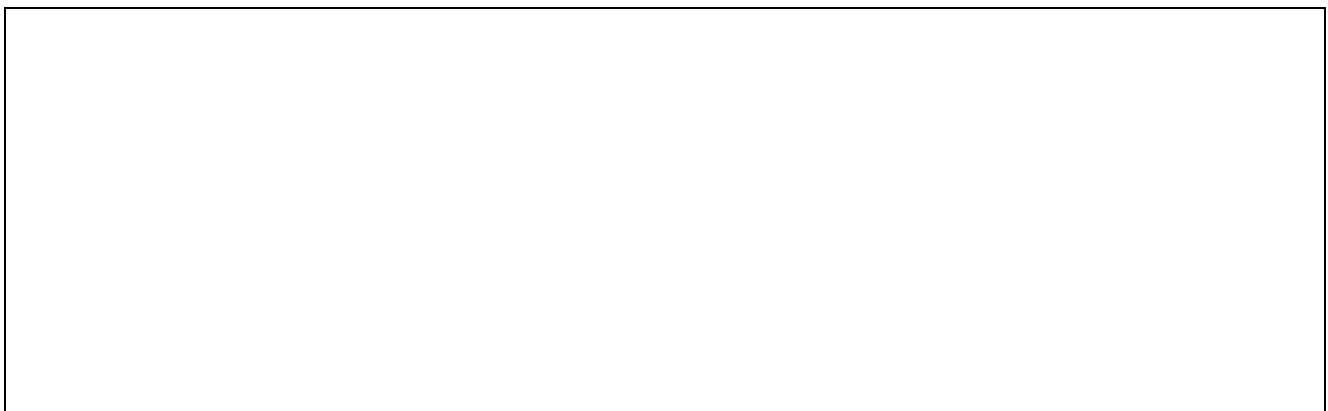
c. Create your parallel circuit with your materials.

d. Now try to change the direction of the motor by switching the red and black motor wires.

## 6. VIBRATING MOTOR

a. Similar to the instructions for the rotating motor in a series circuit..

b. Sketch out your own series circuit with a motor included in the following order:  
battery pack → red wire → alligator clip → conducting dough → motor wire → motor →  
motor wire → conducting dough → alligator clip → black wire → battery pack



c. Create your parallel circuit with your materials.