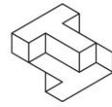


Squishy Circuits

Lab Related Activity: *Simplicity of Electricity*



The Tech
Museum of Innovation

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This activity is meant to extend your students' knowledge of the topics covered in our Simplicity of Electricity lab. In this activity, students will explore and play with an unconventional conductive material to make circuits.

Grade Levels: 4-8

Estimated Time: 1 hour to make conductive and insulating dough; 30-45 minutes exploration time

Student Outcomes:

1. Students will be able to create simple circuits using conductive Play-Doh

Next Generation Science Standards

Physical Sciences:

Grade 4: 4-PS3-2, 4-PS3-4; **Grade 5:** 5-PS1-3

California State Science Standards

Physical Sciences: **Grade 4:** 4.1.a, g; **Grade 5:** 5.1.i;

Investigation and Experimentation: **Grade 4:** 4.6.c, d;

Grade 5: 5.6.a-c

Common Core ELA Standards

Grades 4-5: *Writing* W.7; W.8

Grade 4: *Speaking and Listening* 4.SL.1b-d

Grade 5: *Speaking and Listening* 5.SL.1b-d

Grades 6-8: *Writing* W.7; *Speaking and Listening* SL.1b-e

Vocabulary

Familiarity with these terms and concepts will enhance students' experience in the activity.

- Circuit: a path which electrons from a voltage or current source flow.
- Conductor: a material that allows electricity to flow through it easily.
- Insulator: a material that does not allow electricity to flow through it easily
- Electricity: (from Greek, meaning "amber") phenomena resulting from the presence and flow of electric charge; includes: lightning, static electricity, electromagnetic field, and electromagnetic induction.
- Electron: subatomic particle possessing a negative (-) electric charge.

Materials (one set per team of 4 students)

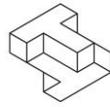
- Conductive dough (recipe on next page) – you can try using Play-doh brand, which does have some conductivity, but it will not be as conductive as the recipe provided. Dough should be made ahead of time by an adult
- LEDs
- Double (AA) battery pack with wire leads
<https://www.sparkfun.com/products/9547?gclid=Clei2om4kscCFUNhfgodt58I6g>
- 2 AA batteries
- Paper towels or plastic place mats

Procedure

1. Begin by letting students explore the materials. Ask students if they can figure out how to light an LED using the conductive dough, so that the LED is not in direct contact with the battery pack. Let students play with the materials and try different ways of lighting the LED(s).
2. After some exploration time, start a discussion with students on what arrangements worked and which didn't. Why did some arrangements work and some not?
 - If two sections of conductive dough are touching each other and both are receiving electricity from the battery pack, a short circuit will be created.
3. Move the discussion towards why they think the conductive dough worked to light the LED. What type of material must the Play-doh be (conductor or insulator)? What do you think makes it a conductor?
 - This conductive dough is primarily made of salt, water, and flour. Salt is the magic ingredient that makes it highly conductive.

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- *More advanced explanation:* When making the conductive dough, the salt and water are mixed together. When this happens, the sodium and chlorine dissociate (split up) freeing up the sodium and chlorine ions, which is what allows the electricity to flow through it.

The following recipes are from the Playful Learning Lab at the University of St. Thomas.

Recipe for Conductive Play-doh

Materials

- 1 ½ cups flour
- ¼ cup salt
- 4 Tbsp. cream of tartar
- 1 Tbsp. vegetable oil
- 1 cup water
- Food coloring if desired

Procedure

1. Mix water, 1 cup of flour, salt, cream of tartar, vegetable oil, and food coloring in a medium sized pot.
2. Cook over medium heat and stir continuously
3. The mixture will begin to boil and become chunky
4. Keep stirring mixture until it forms a ball in center of pot
5. Once ball forms, place ball on lightly floured heat resistant surface
6. Allow to cool for a few minutes before handling
7. Knead remaining flour into ball until desired consistency is met
8. Store in an airtight container for up to three weeks.

Recipe for Insulating Play-doh

Materials

- 1 ½ cup flour
- ½ cup sugar
- 3 Tbsp. vegetable oil
- ½ cup distilled water

Procedure

1. Mix 1 cup of the flour, sugar, and oil in a large bowl.
2. Add in water 1 tablespoon at a time, stirring after each addition. Repeat until majority of water is absorbed by dry mixture
3. Mixture will look lumpy and dry.
4. Knead mixture into one large ball or lump.
5. Knead in more water until it has a sticky texture
6. Knead in remaining flour until desired texture is reached.
7. Store in an airtight container for up to three weeks.