Conducting Insulating Squishy Circuits Lab

Description:

In this activity, you will explore and play with unconventional conductive material and non-conductive material to make circuits.

Materials (one set per team of 4 students)

- Conductive dough and insulating dough
- LEDs
- Double (AA) battery pack with wire leads
- 2 AA batteries
- Paper towels or plastic placemats

Next Generation Science Standard:

HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.

Grade Levels: (5-10)

Materials (one set per team of 4 students)

- Conductive dough and insulating dough (Recipes provided below.)
    - Play-Doh brand has some conductivity, but will not be as conducive as the recipe provided.
    - Dough Should be made ahead of time (by an adult or with adult supervision).
- LEDs
- Double (AA) battery pack with wire leads: Link
- 2 AA batteries
- Paper towels or plastic placemats

Recipe for Conductive Dough

Materials	Procedure
• 1 ½ cups flour • ¼ cup salt • 4 Tbsp. cream of tartar • 1 Tbsp. vegetable oil • 1 cup water • Food coloring if desired	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 the mixture until it forms a ball in the center of the pot. 5. Once the ball forms, place the ball on a lightly floured heat resistant surface. 6. Allow to cool for a few minutes before handling. 7. Knead remaining flour into the ball until desired consistency is met. 8. Store in an airtight container for up to three weeks.

Recipe for Insulating Dough

Materials	Procedure
• 1 ½ cup flour • ½ cup sugar • 3 Tbsp. vegetable oil • ½ cup distilled water	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 the water is absorbed by the dry mixture. 3. Mixture will look lumpy and dry. 4. Knead the 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.

Student Outcomes/Objectives:

- Create simple circuits using conductive and insulating dough material.
- Compare and contrast both qualitatively and quantitatively the conductive material using the open-ended question:
  How does diameter or length affect conductivity?

Teacher Prep Time:

- 1 hour to make conductive and insulating dough

Student Time:

15-30 exploration time up to 60 minutes if also doing data collection

Procedure/Discussion:

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?
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?

Apply:

1. <u>Data collection for diameter:</u>
    a. Roll the conductive playdough into different diameter snake-sized pieces making sure the length of each remains the same and only the diameter is different.
    b. Measure and record the diameter of each in the data table below.
    c. Attach the LED lights to the different diameter pieces of conductive dough and record what you observe.
    d. Measure the voltage across each side of the circuit and record your amount of voltage.
2. <u>Data collection for length:</u>
    a. Roll the conductive playdough into snake-sized pieces making sure the diameter of each remains the same and only the lengths are different.
    b. Measure and record the length of each in the data table below.
    c. Attach the LED lights to the different diameter pieces of conductive dough and record what you observe.

d. Measure the voltage across each side of the circuit and record your amount of voltage.

Diameter Data Table:

Diameter	Observations	Voltage

Length Data Table:

Length	Observations	Voltage

Results and Questions:

Did changing the diameter make a difference in the voltage across the LED light? What pattern or trend did you notice?

_____

_____

_____

_____

Did changing the length of the dough affect the voltage across the LED light? How?

_____

_____

_____

_____