



In this new series from PBS North Carolina, Ava and friends explore the world of science through hands-on experiments. In the episode “Lemon Power,” Ava and Brooke discover how different energy sources power our world by turning lemons into batteries.

To learn more, visit pbsnc.org/MiniFab.

Lemon Power Experiment

Materials

- 1 zinc strip (or a galvanized nail, which is coated with zinc)
- 2 copper wire leads (each about 20 cm long) with alligator clips on both ends
- LED bulb, 2 volts or less (the smaller the voltage, the better)
- 3–4 lemons
- 1 copper strip
- Knife
- Wire cutters & wire strippers

Instructions

1. Roll a lemon firmly on a surface to loosen its juice.
2. Insert copper strip and zinc strip vertically into the lemon, with one end sticking out.
3. Connect one wire lead to each metal strip (electrode).
4. Connect one of the free ends of the wire leads to one of the wires attached to the LED.
5. Connect the remaining free end of the wire lead to the remaining free wire on the bulb.
6. If the bulb doesn't light, try connecting up to 3 or 4 lemons. How many lemons does it take to light up the bulb?

Activity courtesy of Science World



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NC DEPARTMENT OF HEALTH AND HUMAN SERVICES
Division of Child Development and Early Education

Mini Fab Science Lab is made possible with support from the North Carolina Department of Health and Human Services (NC DHHS) Division of Child Development and Early Education.

Learning Goals

NC Foundations for Early Learning & Development (Pre-K)

Cognitive Development (CD)

- **CD-1:** Children use scientific inquiry and problem-solving skills.
This lesson supports observation, experimentation and asking questions about cause and effect.
- **CD-2:** Children demonstrate knowledge of physical science.
Children explore how materials conduct electricity (energy and matter).

Approaches to Learning (APL)

- **APL-2:** Children actively seek to understand the world.
The activity encourages curiosity, prediction and experimentation.
- **APL-4:** Children demonstrate creativity and problem-solving.
Teamwork and trial-and-error help them through technical challenges.

Language Development (LD)

- **LD-4:** Children communicate effectively.
Describing the steps, making predictions and reflecting on the outcome promote expressive language.

Emotional & Social Development (ESD)

- **ESD-6:** Children develop relationships and social skills.
Students collaborate to solve a problem and reflect on teamwork.

NC Standard Course of Study: K-3 Alignment—Science

Kindergarten: Physical Science

- **K.P.2.1:** Compare observable physical properties of different kinds of materials.
Copper and zinc are compared as materials with different functions.
- **K.P.2.2:** Classify objects by observable physical properties.
Students can group and describe different materials in the experiment.

Grade 1: Forces & Motion/Energy

- **1.P.3.1:** Predict the effect of moving objects and how energy is used to make things go.
Students observe how the lemon's chemical energy powers the LED bulb.

Grade 2: Energy

- **2.P.2.1:** Understand the properties of solids and liquids.
The role of lemon juice as an electrolyte introduces basic chemistry.
- **2.P.3.1:** Recognize that energy can be transferred from one object to another.
Students see energy transfer from lemon to wires to light.

Grade 3: Energy & Engineering

- **3.P.3.1:** Recognize how energy can be used in various forms (light, heat, sound).
Students observe electrical energy becoming light.
- **3.P.3.2:** Identify the ways in which energy is transferred (e.g., batteries to devices).
Directly relevant to the experiment and real-world electrical engineers.



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