



Lesson: Electricity and Energy

Name:

Teacher:

Date:

Lemon Battery Lesson Plan

www.innovatewithmrbarbado.com | <https://www.youtube.com/@STEMClub-z71>

Florida State Benchmark:

SC.6.P.13.3 – Explore energy transformations and how chemical energy can be converted into electrical energy.

NGSS Alignment:

- **MS-PS1-6:** Construct and test a device that releases or absorbs energy via chemical processes.
- **MS-PS3-3:** Design a device that converts chemical energy to electrical energy.
- **Crosscutting Concepts:** Energy and matter, structure and function, cause and effect.
- **Science & Engineering Practices:** Planning and carrying out investigations, analyzing data, constructing explanations.

Lesson Focus:

Exploring chemical energy conversion and electricity through a hands-on lemon battery experiment.

Materials:

- 2–3 lemons
- Zinc-coated nails or galvanized nails
- Copper coins or copper strips
- Wires with alligator clips
- Small LED light or digital multimeter
- Knife (for teacher use only)
- Plate or small tray

Lesson Objectives:

By the end of this lesson, students will be able to:

1. Explain how chemical energy in a lemon can be converted into electrical energy.
2. Construct a simple lemon battery using zinc and copper electrodes.
3. Measure the voltage produced by the lemon battery.
4. Observe the flow of electrons and understand the oxidation-reduction reaction.
5. Apply scientific reasoning to predict how changing variables (number of lemons, electrode types) affects battery output.



Procedures:

1. Introduction

- Discuss: “Where does electricity come from?” and “Can food produce electricity?”
- Introduce Alessandro Volta and the concept of a simple battery.
- Present objectives and key vocabulary: chemical energy, electrical energy, electrode, electrolyte, oxidation, reduction.

2. Experiment

- Step 1: Insert a zinc-coated nail and a copper coin into one lemon, keeping them separate.
- Step 2: Connect wires with alligator clips from zinc and copper to the LED.
- Step 3: Observe if the LED lights up. If using a multimeter, measure voltage.
- Step 4: Test multiple lemons in series to see how voltage changes.
- Step 5: Record observations, noting LED brightness or voltage readings.

3. Observation & Analysis

- Compare voltage readings or LED brightness when changing the number of lemons or electrodes.
- Discuss chemical reaction: zinc loses electrons (oxidation), copper gains electrons (reduction).
- Relate to energy conversion from chemical to electrical.

4. Generalization

- Summarize key concepts: energy conversion, oxidation-reduction, flow of electrons, practical applications.
- Real-life applications: household batteries, renewable energy storage, portable electronics.

5. Assessment

- Ask students:
 1. What type of energy is stored in the lemon?
 2. Which metal acts as the anode and which as the cathode?
 3. How does adding more lemons in series affect voltage?
 4. Explain how a chemical reaction produces electricity.
- Evaluate understanding via group discussion or short worksheet.



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Safety Notes:

- Handle knives only by teachers.
- Do not ingest any materials.
- Supervise wires and electrodes to avoid short circuits.

Differentiation & Supports for ELL/ESE Students:

- Provide diagrams showing lemon battery setup.
- Use sentence starters: “The lemon battery produces _____ because _____.”
- Pair students for collaborative observation and recording.