Lesson: Electricity and Energy	Name:
Teacher:	Date:

Lemon Battery Experiment Guide

www.innovatewithmrbarbado.com | https://www.youtube.com/@STEMClub-z7l

Lesson Focus:

Exploring chemical energy conversion and electricity by creating a simple battery using a lemon.

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
- Plate or small tray
- Knife (teacher use only)

Safety Rules:

1. Only the teacher uses the knife to make small holes in the lemons.
2. Do not eat or drink any of the materials.
3. Handle wires carefully to avoid short circuits.
4. Keep the workspace clean and dry.

Procedure:

Step 1: Prepare the Lemon Battery

1. Roll the lemon gently to soften it and release the juice inside.
2. Insert a zinc-coated nail into one side of the lemon.
3. Insert a copper coin or strip into the other side of the lemon, making sure it does not touch the zinc nail.

Step 2: Connect the Circuit

1. Attach one wire from the zinc nail to the negative terminal of the LED.
2. Attach another wire from the copper coin to the positive terminal of the LED.
3. Observe whether the LED lights up.

Step 3: Measure the Voltage (Optional)

1. Connect a digital multimeter to the zinc and copper electrodes.
2. Record the voltage reading.

Step 4: Create a Series Battery (Optional)

1. Connect multiple lemons in series: zinc of the first lemon to the copper of the second lemon, and so on.
2. Connect the free zinc and copper terminals to the LED or multimeter.
3. Observe changes in LED brightness or voltage readings.

Step 5: Record Observations

- Note which setup made the LED light brighter or produced a higher voltage.
- Record any differences when changing the number of lemons or electrode positions.

Step 6: Analyze and Conclude

- Explain why the LED lights up: chemical energy in the lemon juice is converted into electrical energy.
- Identify which metal acts as the anode (zinc) and which as the cathode (copper).
- Discuss how adding more lemons increases the voltage and why.

Optional Challenge:

- Try using other fruits (like oranges or potatoes) and compare the voltage produced.

Discussion Questions:

1. What type of energy is stored in the lemon?

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2. Which metal is the anode and which is the cathode?

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3. How does connecting lemons in series affect the voltage?

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4. How does this activity demonstrate energy conversion in real life?

Clean Up:

- Disconnect wires and remove electrodes from the lemons.
- Dispose of lemons properly.
- Wipe the workspace and wash hands.