

LET'S DO CHEMISTRY

Build a Battery Facilitator Guide

ACTIVITY LEARNING GOALS

Learners will develop positive attitudes toward learning about chemistry:

- Learners will increase their feelings of **interest** in chemistry through hands-on exploration.
- Learners will increase their sense of **self-efficacy** related to chemistry through hands-on interaction with scientific tools and by experimenting with variables.

Learners will explore chemistry concepts, tools, and practices:

- Chemists study how different materials behave and change, and how materials interact with each other.
- Chemists use tools to discover and make new things.

FACILITATION STRATEGIES

- Encourage **interest** and **self-efficacy** through hands-on interaction and by encouraging participants to experiment with their battery to control the reaction.
- Encourage **relevance** by asking participants questions about when and how they use batteries in their everyday lives. Do they have a story about when a device didn't work because of a dead battery or when they needed a longer lasting one?

MATERIALS

- Permanent marker and labels
- 2 LED flashlights (one with working batteries inside, one without)
- Acrylic stand
- Felt disks
- $\frac{3}{4}$ -inch standard zinc washers (8, save extras)
- $\frac{3}{4}$ -inch copper washers (8, 1 with a length of copper wire attached, save extras)
- Bowl
- Vinegar
- Tray
- Small, grippy tongs to hold felt washers
- Paper towels
- Microfiber cloth or sponge
- 2 wires with alligator clips on each end
- Large LED diodes (Squishy Circuit style)
- Buzzer
- Marker and labels
- Safety data sheets

ADVANCE PREPARATION

Pour about a cup of vinegar into the plastic bowl and label the bowl “vinegar.” Place 8 felt washers in the bowl so they soak up the vinegar. They should sit in the liquid for at least a few minutes before being used with participants.

Place the acrylic stand on the tray alongside a pile of 8 zinc washers and a pile of 7 copper washers.

Put the LED flashlights out front, so that they are immediately available to participants. The LED bulbs, buzzer, and coated wires with alligator clips can be kept back until later on in the activity so they’re not too distracting.

SAFETY

Always follow and model prudent practices when doing chemistry activities.

Think about:

- What **hazards** exist and what associated risks may arise from these hazards?
- How to **minimize** risks through protocols we have designed into the activities and training materials.
- How **safe practices and protocols** should best be communicated with facilitators, participants, and others

Label all containers with their correct chemical names and concentrations. Vinegar is a dilute, mild acid. Choose a location with good ventilation. Use of gloves is recommended if facilitators or participants directly handle the felt washers rather than using the provided tongs.

Your institution may have special rules or protocols for chemistry related activities, so check with your facilities staff, safety committee, and/or others. Learn more about safe practices in the *Let's Do Chemistry: Safety Guide* included in the physical kit and with the online digital kit resources.

CLEANUP

Rinse the zinc and copper washers with water at the end of the activity and dry them off using the paper towels (this will prevent some corrosion).

Remove the felt washers from the vinegar, squeeze the vinegar out as much as possible, and dump any remaining vinegar down a drain. The felt disks can be left in the rinsed bowl to dry. Don't store the materials in a bin or container with a sealed lid—you want the vinegar to evaporate away.

The washers will corrode over time, especially the zinc, so you may need to replace them by swapping them out for new ones.

FACILITATION NOTES

To quickly reset the activity between visitor groups, sort and pat dry all the washers and return the felt disks to the vinegar.

It takes at least three "voltaic stacks" to light the LED or sound the buzzer. Once the circuit is connected, the LED should light up or the buzzer should sound. If it doesn't, try troubleshooting with visitors: "What should we try to make it work?" For example, try flipping the LED or buzzer around (they both have polarity), or you can add more stacks, check the saturation of

the felt disks to make them more or less wet, or try switching or reattaching the alligator clips.
Hint: Even just pressing down on the "pile" a little may produce better contact.

Some younger visitors may need to be taught how to open and close the alligator clips around the exposed wire leads. Suggest they pinch the ends to open the alligator's mouth! If there are multiple visitors or a larger group, participants can take turns and work together layering each material, one on top of the other.

If visitors want to handle the vinegar disks, make sure to offer them a glove. The vinegar is a mild acid and skin irritant and it's smelly.

An activity training video is available at vimeo.com/channels/nisenet.

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This is a common activity that exists in many variations. The Let's Do Chemistry version was adapted from Frogs, Volts, and Vinegar by The Bakken Museum, and the Penny Battery activity from the Exploratorium by the Museum of Science, Boston, and further adapted by Sciencenter for the NISE Network. Copyright 2018, Sciencenter, Ithaca, NY. Published under a Creative Commons Attribution-Noncommercial-ShareAlike license: <http://creativecommons.org/licenses/by-nc-sa/3.0/us/>



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