

Ideas with

# IMPACT

STEM/STEAM

## Homemade Battery for String Lights

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**Ideas with**

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**STEM  
Home Made Batteries  
for Christmas Lights**

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**Home Made Batteries for Christmas Lights**



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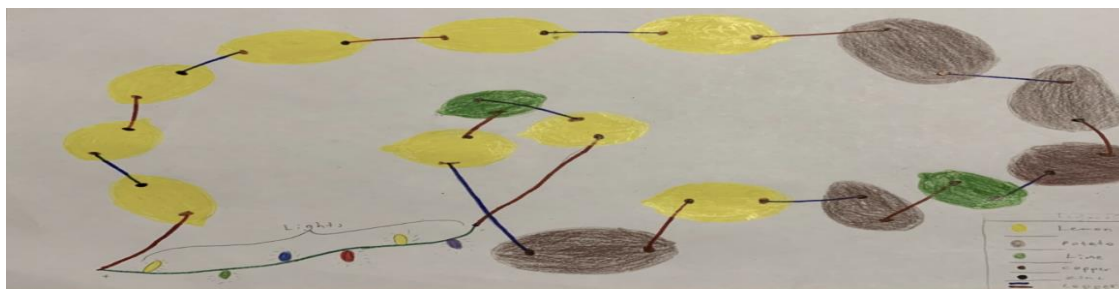
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## Goals and Objectives

This project is focused on teaching students how to make "homemade batteries" to power up Christmas lights. It can not only be for educational purposes but also for real life applications. It is expected to use the homemade batteries to light up Christmas lights on Christmas eve in case there is power shortage (due to a hurricane).

This project will use fruits or other available items at home such as lemons, apples, potatoes or juices as electrolytes and use copper and Zinc as electrodes to make Mini batteries.

The students will learn

- How the electricity works: explain the electrons and electrical current
- How the battery works: To use the fruits to explain the concept of electrolytes. To use the metal copper and zinc to explain the concept of electrodes
- How the current, voltage and resistance are quantitatively related to each other.

$$\text{Voltage} = IR$$

- Through this project, the students will learn Science, Technology, Engineering, Art and Math from this project (STEM/STEAM)
- The students will improve problem solving skills and critical thinking skills through the process of setting up the battery-light system, because there is always real-life challenge from theory to reality.
- Going through this project, the students will learn how to write experimental report and how to write a fiction (language art)
- How to enjoy the Christmas eve with the homemade battery powered up Christmas lights even if there is power shortage

### Florida Standards

Standards: <https://cpalms.org/public/search/Standard>

|                                                                                                             |                                                                                                                |                                                                                                                 |                                                                                                       |                                                                                                            |
|-------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| STEAM 1.0<br>Science<br> | STEAM 2.0<br>Technology<br> | STEAM 3.0<br>Engineering<br> | STEAM 4.0 Art<br> | STEAM 5.0<br>Math<br> |
|-------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|

|                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>SC.912.P.8.8:<br/>characterize types of chemical reactions, for example: redox, acid-base, synthesis, and single and double replacement reactions</p>                                                                                    | <p><b>TD.912.F.1.1</b><br/>Select the most appropriate tools and technology resources to solve problems and increase efficiency</p> <p>Name of the platform<br/>PowerPoint</p> <p>The students will make a PowerPoint to present their work<br/>Parameters<br/>The presentation must include<br/>title<br/>photos or videos<br/>graphs<br/>Conclusions</p> | <p><b>EG912.A.1.2.</b><br/>Apply the engineering design process to specify the criteria and constraints of a solution and to optimize the design solution based on the given criteria and constraints.<br/>Engineering design process<br/><b>Real world problem and measurable goal</b><br/>The students will design a setup for using homemade batteries to light up Christmas lights.<br/><b>Planning:</b> The students will create a blueprint for their prototype<br/><b>prototyping:</b><br/>The students will design how many fruits/or potatoes to make the battery and how many lights need to be lighted up by drawing the blueprint.<br/><b>testing:</b> the students will test the setup:<br/><b>Redesign/improving</b><br/>students will make modifications with their design based on their measurable goals<br/><b>Communicate Finding:</b><br/>students will summarize the process and findings in details in a presentation with a PowerPoint</p> | <p><b>VA.68.O.1</b><br/>Understanding the organizational structure of an art form provides a foundation for appreciation of artistic works and respect for the creative process.</p> <p><b>VA.912.F.1</b><br/>Creating, interpreting, and responding in the arts stimulates the imagination and encourages innovation and creative risk-taking.</p> | <p><b>MA.912.S.2.1</b><br/>Collect, organize, analyze and display data (including box plots and scatterplots) to solve problems.</p> <p><b>MA.912.NSO.1.7</b><br/>Generate equivalent expressions and perform operations with expressions involving exponents, radicals or logarithms.<br/>Given a numerical logarithmic expression, evaluate and generate equivalent numerical expressions using the properties of logarithms or exponents.</p> |
| <p>G.K.12.3.1.1b Cooperative Research-Understand: Demonstrate ethical leadership and/or teamwork within a research workgroup<br/>G.K12.5.3.3b-Technology-Understand: Demonstrate the ability to propose new uses for current technology</p> |                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

## Materials needed

- 1) *5 potatoes, or 5 apples, or 5 lemons or juice (lemon, or apple or orange et al)*
- 2) *5 Christmas lights*
- 3) *Multi-meter*

4) *Copper conductive wire*

5) *Homemade Battery kit (for convenient, for Cu and Zn electrodes)*

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### Course Outline and Overview

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This project is focused on teaching students how to make "homemade batteries" to power up Christmas lights. This project can not only be for educational purposes but also for real life application. It is expected to use the homemade batteries to light up Christmas lights on Christmas eve in case there is power shortage (for example due to a hurricane).

This project will use fruits or other available items at home such as lemon, apple, potato, juice as electrolytes and use copper and Zinc as electrodes to make Mini batteries.

This project will definitely be a fascinating project for students in different grade levels to be involved in.

- Firstly, making batteries is one of the cutting-edge topics in the education system
- Secondly, it is very important to learn how to survive and enjoy life during unexpected circumstances. For example, we can use homemade batteries to light up Christmas lights when there is no electricity after a hurricane.
- Thirdly, the teacher can easily apply this project to their classroom by teaching students to learn the followings:

1) How the electricity works: explain the electrons and electrical current

2) How the battery works: To use the fruits to explain the concept of electrolytes. To use the metal copper and zinc to explain the concept of electrodes

3) How the current, voltage and resistance are quantitatively related to each other.

$$\text{Voltage} = IR$$

4) Through this project, the students will learn Science, Technology, Engineering, Art and Math from this project (STEM/STEAM)

5) The students will improve problem solving skills and critical thinking skills through the process of setting up the battery-light system, because there is always real-life challenge from theory to reality.

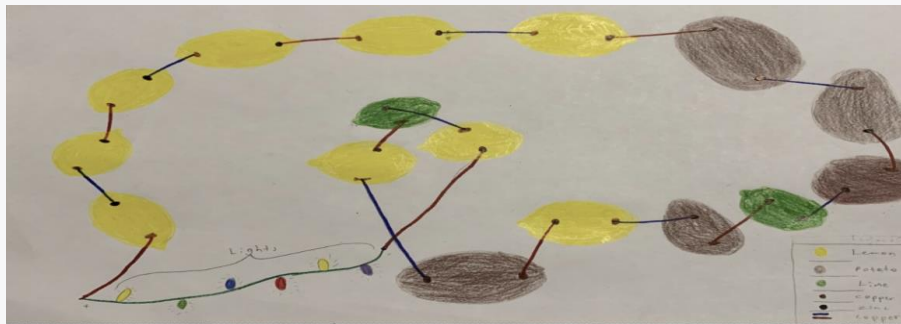
6) Going through this project, you can write experimental report, you can write a fiction (language art)

7) How to enjoy the Christmas eve with the homemade battery powered up Christmas lights even if there is power shortage

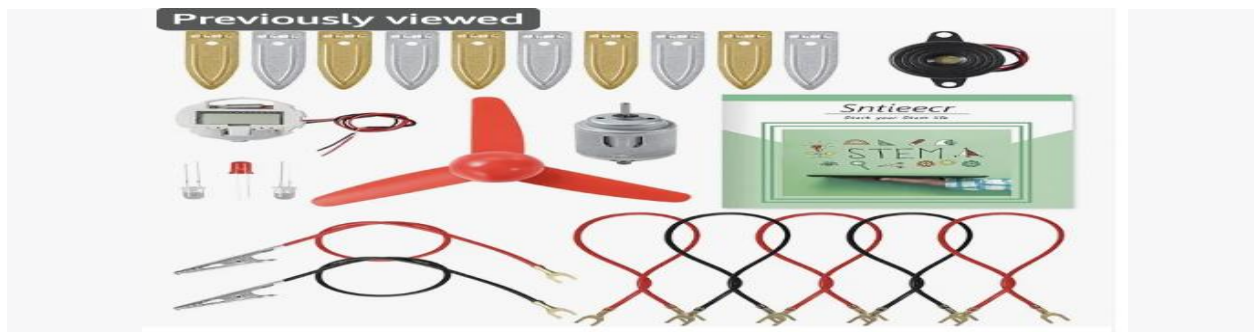
## Lesson Plan

### Title: Home Made Batteries for Christmas Lights

#### Step 1: Design the battery set up (Teacher and students cooperate)



- 1) **Collect the materials:** The students should be able to find all the materials from the kitchen or the storage room. For convenience, the teacher can purchase the homemade battery kit from amazon; the pictures below are an example.



2) The students can design their own batteries by using different types of fruits and different numbers of fruits.

3) Decide how many Christmas lights to be lit up

Step 2: Purchase the materials and set up circuit

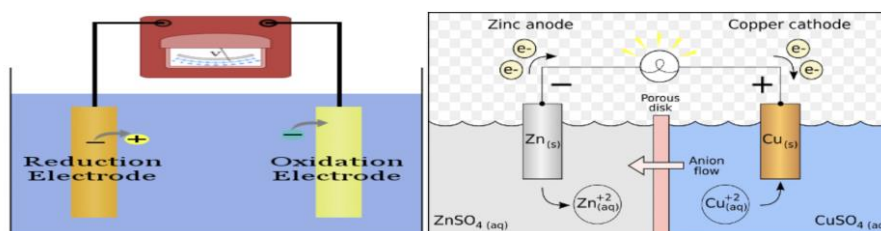
Step 3: Check if there is a “current” in the circuit by using multimeter or a tiny timer in the “homemade battery kit”

Step 4: Try to light up as many Christmas lights as possible

i) Make sure there are enough fruits to create enough current and voltage.



ii) To make sure the right connection between Christmas lights and the copper electrode and zinc electrode.



iii) Measure the voltages and the currents and calculate the resistance.

$$\text{Resistance} = \text{Voltage} / \text{Current}$$

iv) Try to light up as many as Christmas lights as possible

Step 5 After lighting up 1-5 Christmas lights, the students will have a discussion and draw conclusions. The teacher may give the students different assignments based on the grade levels:

a) For elementary/middle school students:

- what is electricity
- What is the function of copper and zinc from the “homemade battery kit”
- Write a report for their observations

b) For middle/high school students:

- what is electricity
- What is the function of copper and zinc from the “homemade battery kit”
- Understand the differences between copper and zinc electrodes
- Write the reduction/oxidation reaction
- Discuss why the Christmas lights must connect to the electrode with the right direction to light up the lights.
- Write a report and discuss their observations

Step 6 To make a PowerPoint Presentation for this project of Homemade battery for Christmas lights

### **Accommodations**

Ensure the students knows how to do the task

- Use computer assisted instruction
- Recruit and train a peer helper to repeat and explain directions and give assistance when they teacher is unavailable
- Group Project: group leader guides the group
- Extended time for assignment

Resources:

[1] <https://www.chemicool.com/definition/electrochemistry.htm>

[2] <https://www.youtube.com/shorts/X7A3UW5Y81E>

[3] <https://www.youtube.com/watch?v=dOGBMeVPeVI>

[4] <https://www.youtube.com/watch?v=9OVtk6G2TnQ>

[5] <https://www.youtube.com/watch?v=ru032Mfsfig&list=PLxPUNwEbydRN2yldvTWprBRxxpC3TRT7I>