



**School District:**  
**Teacher's Name:**  
**Class Grade Level:**

**Lesson Name:** Batteries, Blubs, and Wires – Part 2

**Lesson:** Science/STEM

**Accommodations:**

**Material(s):**

- 8 AA Batteries
- 8 Battery holders (2 units)
- 2 Lightbulb
- 2 Lightbulb Holder
- 10 Wires
- Graphing paper (for ease of drawing)

**Time allotment (varies according to grade level):** 50 minutes for **higher** grade levels

**Alignment with CODERS module #(s):**

**MLS Standards:**

- 3-5.ETS1.A.1 – Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5.ETS1.B.1 - Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5.ETS1.C.1 - Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
- 6-8-ETS-3 - Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

**Learning Goal(s):**

- Define series and parallel connections and identify them within drawn circuits.
- Design operational circuit diagrams containing both parallel and series connection types.
- Interpret drawn circuit diagrams and create the real model.

**Objective(s):**

- Work in groups to design circuit diagrams that utilize both series and parallel connections.
- Work in groups to construct the working circuits drawn by another group.
- Compare and contrast the brightness of the involved bulbs of the various constructed circuits and the type of connections that they have.

### Background information and/or Activate Prior Knowledge:

- How electric charge flows (using the water tower analogy). From lesson plan 1 in circuitry.

### Introduction/Anticipatory Set/Engage:

- Have the students create their same simple circuits from the previous lesson (2 wires, 1 battery, 1 bulb) and ask them to match light bulb brightness's.
  - It is important for them, for the rest of the lesson, to have access to similar brightness bulbs in order to see the change in brightness with varying connections. We suggest obtaining 4 bulbs of the same brightness.

### Teaching (I do):

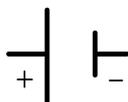
- Introduce the actual diagram symbols that will be used going forward.
  - Diagram wires all look like this, straight with no curving turns. Any turns in the wires are angular, typically right angles. Graph paper may be useful for students when drawing.



- Resistors, in our case, light bulbs, are drawn like this.



- Power sources are drawn like this. Convention says the longer vertical line represents the positive side and the smaller the negative. + and – symbols are also used for clarity.



- Explain, using circuit diagrams, the definitions, similarities, and differences between series and parallel connections.

### Guided Practice (We do):

- Work through several circuit diagrams (provided in attachments on planbook - “Circuitry Design”) and have students talk about and identify series and parallel connections.
  - Project diagrams on whiteboard and have students circle or point to the connections.

### Group/Independent Practice (You do):

- Ask the students to work in groups to draw diagrams that involve at least one of each type of connection.
- They will work as a team to ensure that, without constructing the circuit, it will work.



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- Once they have completed at least one diagram per group, they will swap with another group and that group will construct the circuit drawn to verify it can be read by others, and that it is in fact working.
- Back with their original papers, corrections being made if their circuit does not work, they will construct it themselves and write observations about varying light bulb brightness's and what connections those bulbs have.
  - This paper will be kept, and the students will be asked to use it again in lesson 3.

**Assessment (Formative or Summative)**

**Questions/questioning strategies:**

***Notes, Reflections, Attachments***