

## Q405: Saturday Science

### Session 2, Lesson 2

**Lesson Topic:** Designing Various Circuits

**Grade level(s):** 3rd-4th

**Instructor Names:**

Desired Results	
<b>Overarching Focus Question for the Session</b> How can science help us to design art that lights up?	
<b>Central Focus/Topic for today:</b> <ul style="list-style-type: none"><li>• Students will understand:<ul style="list-style-type: none"><li>○ How to build different types of circuits (series and parallel) in order to make a light-up artistic creation.</li></ul></li></ul>	<b>Relationship that this central focus has to the overarching big idea/question for the unit</b> <ul style="list-style-type: none"><li>• Students will be utilizing different types of circuits to understand complex forms of electricity transfer. So, within this lesson, the students will be deepening their understanding of circuits and how electricity flows which will help them understand the science concepts behind <i>how</i> their microbits are lighting up.</li></ul>
<b>Student objectives (outcomes):</b> Students will be able to: <ul style="list-style-type: none"><li>• Build a simple, series and parallel circuit in order to create their own artistic LED light creation.</li></ul>	
Timeline of Activities for the Day	
<i>*Provide a breakdown of how long each activity will take, who will lead the segments of the activities, when breaks will occur or other transition points, etc.</i> <i>*Identify by <b>highlighting in blue</b> the portion of the lesson you team wants video-recorded each week. This should be ~45 mins</i>	
9:30-9:40→ Review norms and expectations	
9:40-10:00→ Drawing circuits, discussion, creation of circuits and revision of drawings	

10:00-10:15 → Bathroom and snack break

10:15-11:00 → 4 challenges (series circuit, parallel circuit, series circuit with a switch, parallel circuit with a switch) building and discussion at tables

11:00-11:20 → introduce the light up card

11:20-11:40 → students will create their own individual light up card

### **Learning Plan (First three E's of the 5E model)**

*Any of these phases can be repeated should you have more than one activity to describe OR a complex activity with multiple iterations of some phases.*

#### **ENGAGE**

- Students will be given a sheet of paper and a pencil. Students will be asked to think about what their circuits looked like from last week, and then they will be instructed to draw them on their paper. (If students complete this task very quickly, they will be asked to put labels on each of their parts to reiterate their understanding.) The teacher will circulate to each group and discuss their drawings.
  - What does this represent?
  - Why did you put this here?
  - How do you know that this is where \_\_\_\_\_ goes?
  - How do you know this works?
- The same materials from last week will then be passed out again; wires, batteries, battery holders, lightbulb holders, and lightbulbs. With their shoulder partner, the students will be asked to build their circuits that they just drew to double-check and make sure their memories were correct.
  - Here, students will be able to revise their drawings if necessary.
  - But, instead of having students erase their ideas, they will create a new drawing that depicts the correct way to complete the circuit.

#### **EXPLORE**

- Since the students' memories are refreshed from last week's work, they will be ready for this week's challenges! The teacher will present four challenges written on the board. For each challenge written on the board, underneath it there will be a picture. There will be a picture of a series circuit, a parallel circuit, a series with a switch, and a parallel with a switch.
  - During each challenge, the teacher will circulate to each group and do some explaining/questioning.
    - Why did this not work?
    - How do you know this will work?
    - What things could you change in order to make this work?

- Can you show me how this is a complete circuit? Where is the circle?  
Are there more than one circle in this circuit?
  - Etc.
- Challenge 1: Series Circuit (With a partner)
  - Students will be given a sheet of paper and they will fold it into four parts (fold one way hot dog style and one way hamburger style to make four quadrants).
  - While they are folding papers, the teacher will hand out the materials needed to each group.
  - Students will then attempt to build a series circuit based upon the drawing on the board. With each attempt, they will draw their circuits in order to keep track of their tries. This will allow them to revise their ideas in order to track if their circuits are in fact closed circuits.
  - Having their final models drawn out will help them when they get to the third challenge when they will have to add a switch into the circuit.
- Challenge 2: Parallel Circuit (With a partner)
  - If students complete the first challenge, they raise their hands for the teacher to come inspect their circuits. If they have in fact successfully built a series circuit, they will be allowed to move on to the next challenge and will be given more materials. (Note: there are tons of ways to make series circuits, so if there is time, the teacher will probe students to try multiple ways to make this type of circuit.)
  - If students still have room on their first sheet of paper they will continue to keep track of their trials/revisions on there. If not they will get a new piece of paper.
  - Students will then attempt to build a parallel circuit based upon the drawing on the board. With each attempt, they will draw their circuits in order to keep track of their tries. This will allow them to revise their ideas in order to track if their circuits are in fact closed circuits.
  - Having their final models drawn out will help them when they get to the fourth challenge when they will have to add a switch into the circuit.
- Challenge 3: Series Circuit with Switch (With a partner)
  - If students complete the second challenge, they raise their hands for the teacher to come inspect their circuits. If they have in fact successfully built a series circuit, they will be allowed to move on to the next challenge and will be given a switch to add into their series circuit.
  - Students will look back at their drawing of their series circuit and rebuild it, but this time, they will be incorporating a switch within the circuit in order to turn the lightbulb on and off.

- If students are easily able to do this, they will be asked to incorporate multiple light bulbs and find ways to make one turn on and one turn off when the switch is being used.
- Students will record their tries/revisions and their final version drawn on their papers.
- Challenge 4: Parallel Circuit with Switch (With a partner)
  - If students complete the third challenge, they raise their hands for the teacher to come inspect their circuits. If they have in fact successfully built a series circuit with a switch, they will be allowed to move on to the next challenge and will be given a switch to add into their parallel circuit.
  - Students will look back at their drawing of their parallel circuit and rebuild it, but this time, they will be incorporating a switch within the circuit in order to turn the lightbulb on and off.
  - If students are easily able to do this, they will be asked to incorporate multiple light bulbs and find ways to make one turn on and one turn off when the switch is being used.

#### **EXPLAIN**

- While the teachers are circulating to all of the table groups during the challenges, they will explain what is happening and why it is happening.
- The teachers will make it evidently clear that the electricity in the battery has to flow from the negative end to the positive end without interruptions in order to make the circuit complete.
- The teacher will model for students *how* their various circuits are still in a complete “circle” even when they begin to get more complex.
- During this time teachers may ask:
  - Based on what I said about how the series circuit makes a complete circle, how do you know the parallel circuit makes a complete circle?
  - What will happen if we add more switches? Will the lightbulb burn brighter or dimmer?
  - How does the electricity know where to travel within the circuit?
  - Why does the lightbulb turn off when you open the switch?

#### **ELABORATING/EXTENDING Understanding**

- Paper Light Up Circuit (Individual)
  - Students will be creating a greeting card for any occasion/person they want using copper tape to create a circuit with an LED light
    - They can create either a parallel or series circuit and either way it will have a switch to turn it on and off

■ How to create the circuit:

1. Lay the copper tape down in a complete circuit (all pieces need to be touching, most likely in a square-shape)
  2. Each one of the legs of the LED must be touching one end of the circuit, to make it complete
  3. Create some sort of flap in which the watch battery will be connected to. When the flap is open, the circuit is not closed and the light is off. When the flap is closed (and the battery is connected to the circuit) the circuit is closed and the light is on.
    - a. As shown on the picture
- Discussion during the creation of their cards:
    - Have you seen any cards (maybe a birthday card) that when you open it, a light turns on or music starts? This is how!
    - Why does the switch turn on the light? Why is it not on when the switch is not connected to the circuit?
    - Can you see a connection to this activity and what we did last week?
  - Make sure that the watch batteries are collected at the end and tell the students that they can have their parents or someone at home buy a watch battery to connect to their card and use at home
    - They can keep everything else, including the LED
  - Example of how the tape and switch look for teacher reference:



**Assessment Evidence (\*This is the Evaluation Phase of the 5E approach)**

**Performance Task(s):**

- Students will complete four different types of challenges. Consisting of making a series circuit, parallel circuit, series circuit with switch, and parallel circuit with switch. Also, students will make their own light-up circuit out of paper, a watch battery and an LED bulb.

**Other Evidence:**

- Oral questions during classroom discussions, and listening in on table/partner group discussions.
- Revision/Final Product papers

**Materials + Quantity:**

- Approximately 50 sheets of printer paper
- Colored paper (any various colors will work, at least 5 sheets of each)
- 20 pencils
- 1 whiteboard marker (any color)
- One bucket of markers (any colors)
- Wires (the ones without the clamps, as many as possible!)
- Mini light bulbs (as many as you can get)
- Light bulb holders (as many as you can get)
- Battery holders (as many as you can get)
- 20 Switches
- Copper tape
- 20 Watch batteries
- Any conductors (washers, paperclips, etc. anything made of metal)

**Required Accommodations/Modifications:**

- Discuss with students what we expect out of them. There were problems last week with being respectful towards us and others. Have students share more within in their table groups instead of asking the whole class. When we asked students to share in front of the whole class, some students wouldn't share with us their ideas/thoughts. They felt more comfortable sharing with their table group or partner. Also, the class was a lot more disruptive and off task when asking in a whole group setting.
- **Gear Up:** Students who have completed all of the challenges and demonstrate a great understanding of the scientific content will be allowed to use different conductor materials to add on to their circuits. First, they will be asked to plan out their ideas on paper with knowledge of the conductors they will have available to them (washers,

paper clips, metal sheets, etc). Then they will try out their ideas while still recording drawings of their circuits.

- **Gear Down:** Instead of having students complete four different circuit challenges they can complete one or two with the teacher's assistance if they cannot figure it out on their own. Students could also work as a whole group instead of just in groups of two. Hopefully, this will help the students work together on the challenges and hear each other's ideas.

**Additional Modifications for Individual Students:**