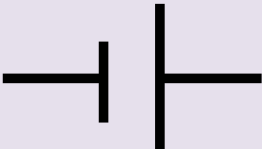
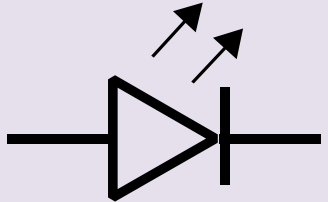
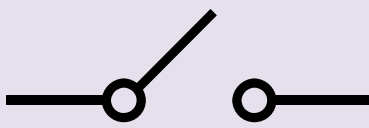
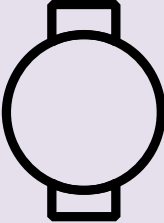
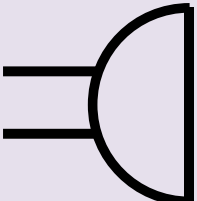


Lesson 3: Challenge Time!

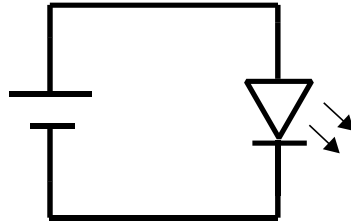
Summary and Background Knowledge:

In this lesson, students will use their previously gained knowledge to construct more advanced circuits that utilize both series and parallel circuits. Then, they will transfer their circuits to paper using schematics.

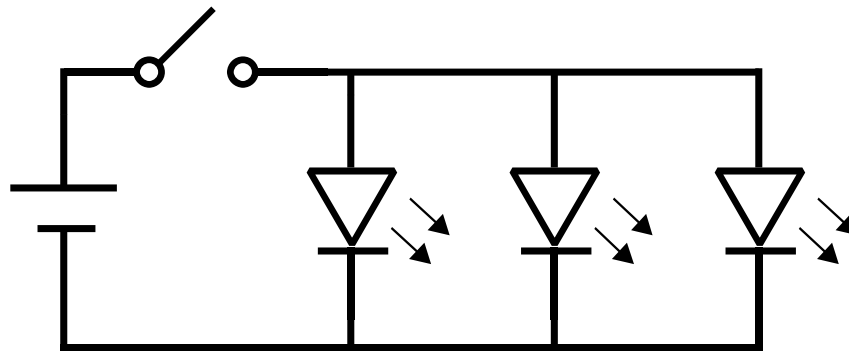
Schematics are a way to easily draw electrical circuits so that they can be analyzed, rebuilt, and shared. Every component has its own symbol, and they are joined together by lines (which represent wires, or with Squishy Circuits, play dough!)

Battery Pack	
LED	
Switch	
Motor	
Buzzer	

When we built the simple circuit in Lesson 1 with a battery pack and LED, the schematic looked like this:

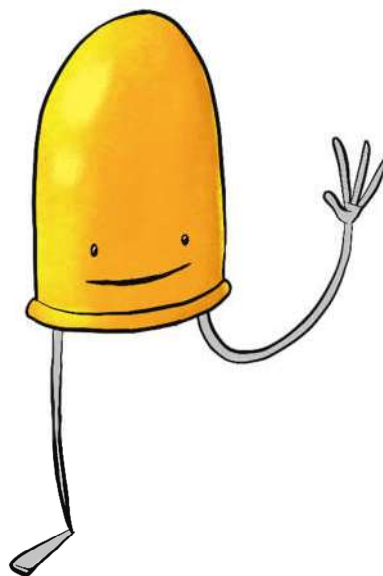


Challenge students to build a circuit that uses both a series and parallel circuit. This circuit has a switch in series with three different LEDs in parallel. If the switch is turned off, it breaks the circuit and all three lights turn off. But, if one of the LEDs is removed, the others will continue to shine brightly because there are separate paths for the electrons to take to complete the circuit.

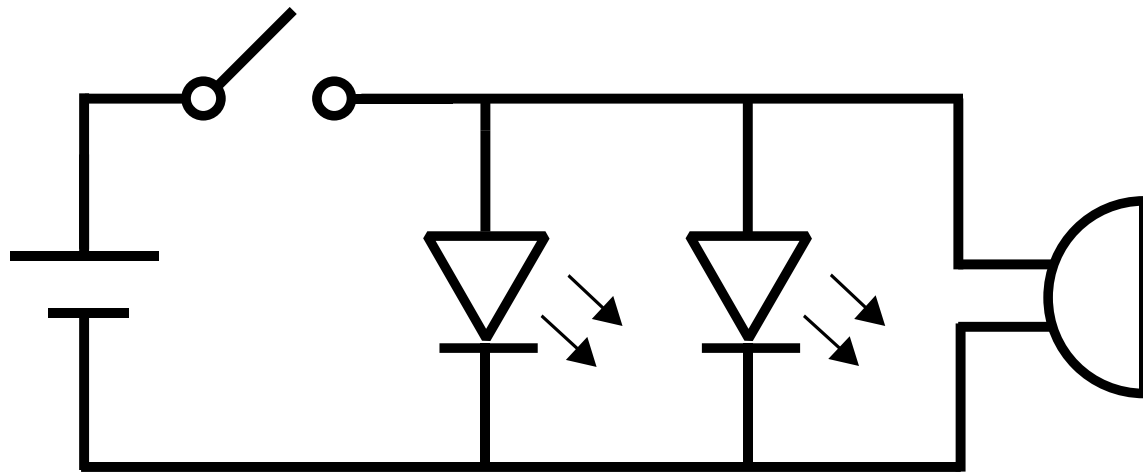


Often, it can be fun to think of a scene that the entire class can build and have each student or group build an object from that scene. For example, you could create a neighborhood – so groups could create a car, house, light pole, etc.

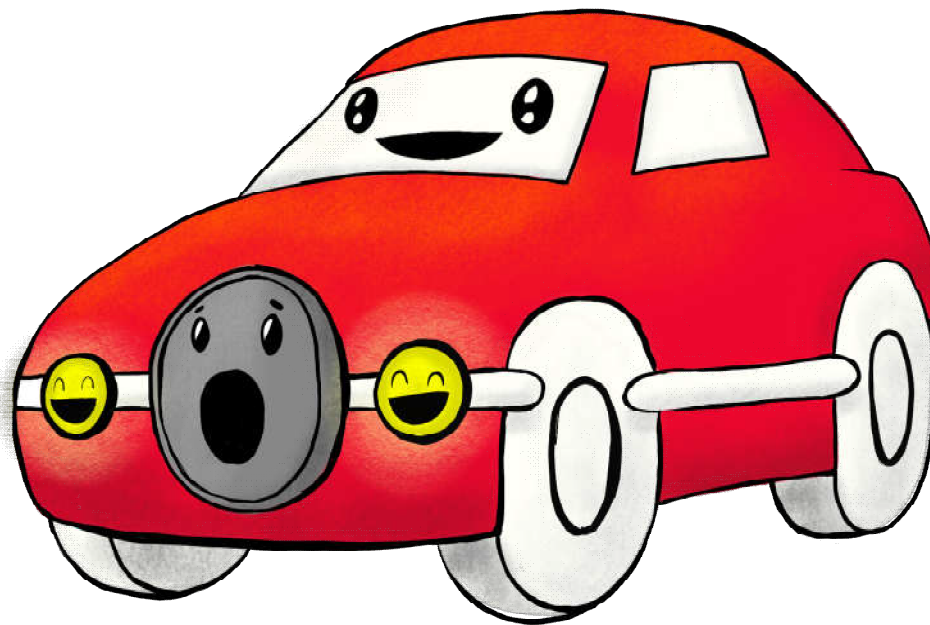
As you get more creative with your Squishy Circuits, it's important to remember to avoid short circuits!



What if you made a car with two LED headlights in parallel, and a horn buzzer – all controlled by the switch? Its schematic could look like this:



And could be made to look like this:



Remember, the schematic only illustrates what electrical components are used in the circuit, and in what configuration. It does not indicate the shape or distance between them and the dough (or wires) used.

Applicable Vocabulary:

- Schematic

Main Objective:

Upon completion of this lesson, students will be able to

1. Combine a series and a parallel circuit using a single battery pack
2. Create a schematic using component symbols that represent their circuits.

Materials:

- Insulating dough (roughly 1 cup per pair of students)
- Conductive dough (roughly 2 cups per pair of students)
- 1 battery pack with four (4) AA batteries
- At least three light emitting diodes
- Optional: motors, switches, fans, and buzzers
- Student science journal or provided handout

Time:

- Pair students and hand out materials: 5 minutes
- Instruction: 10 minutes
- Design: 15 minutes
- Data recording: 5 minutes

Total Time: 35 minutes

Instructor Procedure:

1. After students have been divided into pairs or trios, provide each student with the materials listed above
2. Encourage students to participate in a class-wide conversation:
 - a. *How could you write down your circuit to share with a classmate who hasn't seen it before?*
 - b. *What if we used symbols for each component?*
 - c. Explain each schematic symbol by drawing on the board.
3. Challenge students to create a circuit that uses a series and parallel circuit
4. Spend time wandering the classroom to identify student misunderstandings, comprehension, and answer questions as well as ask questions. *Provide guidance as you see fit.*
5. Bring the class together. Invite a few groups to share.
6. Instruct class to create a scene where each student is given an object to create. The objects can be assigned or open-ended. Challenge students to use multiple components arranged in both series and parallel. Have them capture the schematic in their journals.
7. Share with the class!