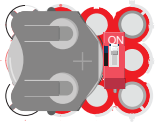
Teaching notes

The switch is an important building block

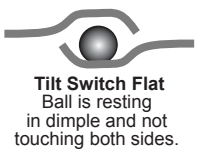
In a circuit diagram, a switch is drawn as a "door" that opens and closes the circuit. Switches come in many different shapes and forms and can be found in every device with electricity.

BATTERY WITH ON/OF SWITCH



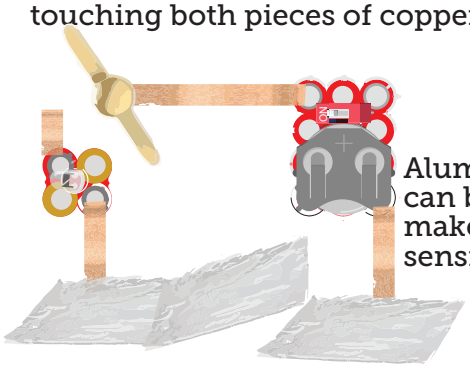
The lectrify kits come with two switches. The battery has an On/Off switch. The tilt switch has a metal ball bearing in it that closes the circuit when the switch is tilted.

TILT SWITCH

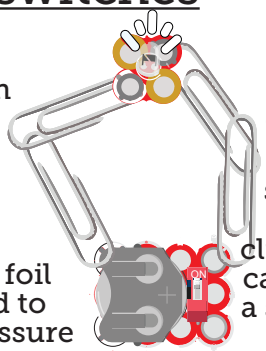


Get creative with your switches

In this circuit, the brad can function as the switch closing the circuit when touching both pieces of copper tape.



Aluminum foil can be used to make a pressure sensitive switch

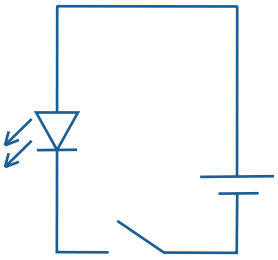


This paperclip bracelet does not look like it has a switch but the air gap between the clips when it is loose can be thought of as a switch. Tight= On, Loose=Off

Prompt

Ask students to look around the room and see how many switches they can see from their seats

Advanced: Explore how switches enable logic



In a simple circuit, the switch is the part of the circuit we control and is our INPUT, and the light is the OUTPUT, (what the circuit does). Even a simple circuit allows us to collect data as in the following table.

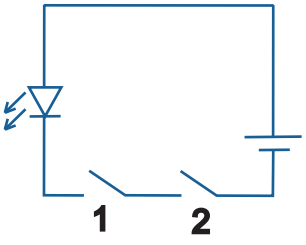
INPUT (Switch)	OUTPUT (Light)
OFF	OFF
ON	ON

We shorten ON/OFF to I/O

INPUT (Switch)	OUTPUT (Light)
O	O
I	I

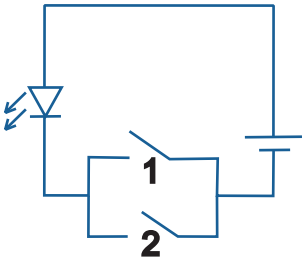
When we use two switches, we now have two inputs and this allows us to explore the most common logic circuits in computers: AND and OR. An AND circuit is done when we put two switches in series and the OR when they are done in parallel.

2 Switches in series



INPUT		OUTPUT
Switch 1	Switch 2	Light
O	O	O
I	O	O
O	I	O
I	I	I

2 Switches in parallel



INPUT		OUTPUT
Switch 1	Switch 2	Light
O	O	O
I	O	I
O	I	I
I	I	I

When the switches are in series, both switches must be on for the light to turn on. We call this an AND circuit because both Switch 1 AND Switch 2 need to be on for the light to turn on.

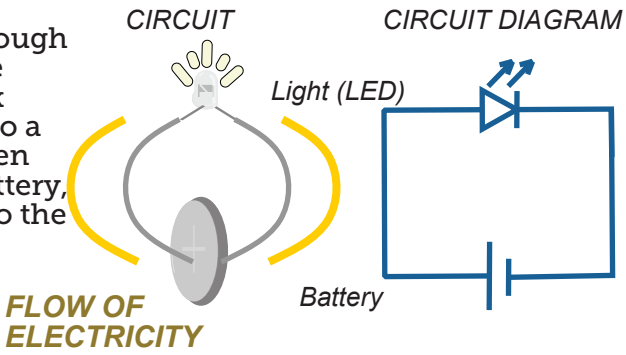
When the switches are in parallel, we observe that the light turns on when Switch 1 OR Switch 2 or both switches are on. This is called an OR circuit.

AND and OR are building blocks for many programming ideas and important circuits to learn.

Project Design Ideas

Start by exploring: what is a circuit?

A circuit is a closed path through which electricity flows. The simplest circuit we can work with is a battery connected to a light. The light turns on when electricity flows from the battery, through the light and back to the battery.

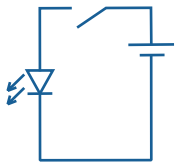


In a circuit diagram, a battery is shown as two parallel lines and an LED as a triangle and line with arrows representing the light. NOTE: An LED has polarity, a negative and positive side. Always make sure the positive side of the battery is connected to the positive side of the LED. On Lectrify circuits red is positive and white is negative.

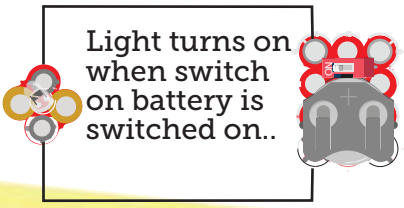
Once students have been introduced to a basic circuit, provide them components and craft materials to build their own. The scope and complexity of a student's project can be calibrated to fit ability and time. Below is a sample rubric with project examples.

	Foundational	Proficient	Extending
Description	Students build a simple circuit to light an LED within their creation. Students explore conductivity and electricity.	Simple AND/OR logic is added to circuit to enable user to control outcome through simple actions.	Through the use of switches, students demonstrate conditional logic through circuit.
Components	Single LED Battery	2 LEDs 2 or more switches Battery	Multiple LEDs Novel switches Battery
Craft Materials	Single material (e.g. Paperclip, pipe cleaner, etc.)	Multiple materials (e.g. Paperclip, pipe cleaner, etc.)	Novel materials discovered by students.

Example



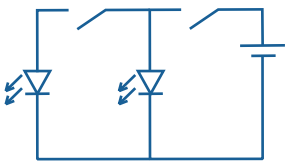
Simple Circuit with 1 Switch

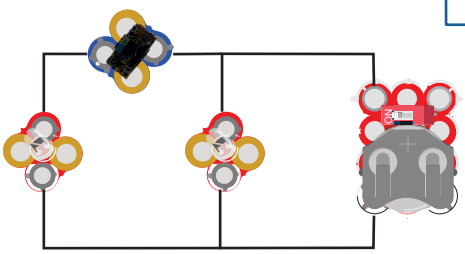


Light turns on when switch on battery is switched on..

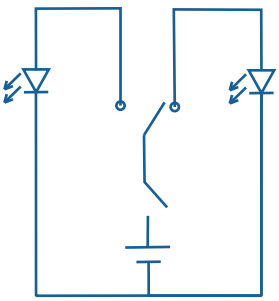
Troubleshooting Tips:
Always make sure circuit is a closed path.
Check LED polarity (red to red, white to white)

2 Switches in series
2 LEDs in parallel





First light turns on when switch on battery is switched on. Second light turns on when tilt switch is tilted AND the battery switch is on.



This circuit uses a Single Pole Double Throw switch where a single switch controls two lights.