

## LittleBits and Electronic Circuits

### What are littleBits?

littleBits are easy-to-use, color-coded, magnetic, electronic snap-and-lock circuits that can be linked together to invent and create a variety of projects. The blocks are already wired to perform different tasks. They can be used to teach basic circuitry and electromagnetism in a way that is active, engaging, and fun. They can also be integrated into lesson plans and used to teach research and design, the scientific method, and quantitative data analysis.

### Types of Bits



Blue bits are the **power** source bits. They usually include a battery connection, but there are also AC/DC adaptable bits and, recently, blue bits with USB ports have been created that can be run from the power in your computer.



Pink bits are used as **input**, or action, bits—they *do* something. Switches, levers, dimmers, knobs, and many other input devices are available.



Orange bits are used to **transmit signals**—they are the wires that carry electricity throughout the invention. Extensions, repeaters, splitters, and inverters are all available.



Green bits are used as **output**, or reaction, bits—they work when something is done to them. Buzzers, lights, fans, motors, and many other simple machines are available.

The power bits always come first, then input bits, transmit bits, and the output bits as shown below.



## Using littleBits

littleBits can be as simple or as challenging as the user wishes based on the combination of bits used and how they are used.

For an introductory lesson, simply experiment with the bits to see how the order of blue-pink-orange-green is necessary for a proper circuit to function. Switch out some of the pieces and see how different inputs, outputs, and wire configurations change the circuit.

**Activity - See how many of these beginner or intermediate activities you can complete. Check them off on this list, or choose a challenge card for a surprise task.**

### Beginner

- ┆ Make a blue light
- ┆ Make a buzzing noise
- ┆ Make a green light that flashes every second
- ┆ Make a blue light that you can adjust brighter or dimmer
- ┆ Make a red light that: turns on when a button is pressed and turns off when the button is released
- ┆ Make a motor that turns on when you clap your hands
- ┆ Make a personal fan that can change speeds
- ┆ Make a buzzing sound that turns on and off quickly
- ┆ Make a light that comes on when you clap
- ┆ Make a light change from green to red
- ┆ Make a motor tick like a clock

Intermediate challenges can be found within each box of littleBits, and they are also available online. There are dozens of pre-designed inventions for students to build using each littleBits set, and some of them ask users to integrate additional materials like copper tape, cardboard, aluminum foil, etc.

### Intermediate

- ┆ Make a robotic arm
- ┆ Make a neon sign
- ┆ Make a back massager
- ┆ Make a motor that turns on when you clap your hands and stays on until you clap your hands again (note at least a 3 second delay)
- ┆ Make a purple light that turns off after a short time
- ┆ Make a light that wraps around a pencil and turns off when a button is pressed
- ┆ Make a flashing red light and a buzzer that turns on and off quickly
- ┆ Make a security system with light, sound, and movement

Advanced users can use littleBits to design completely new products by utilizing the littleBits' compatibility features. Not only can littleBits be used with traditional LEDs, copper tape, copper wire, etc., but they also have the ability to work with other digital electronic toys like CircuitScribe, Circuit Stickers, Electronic Paint, Legos, Lego WeDo Kits, Arduinos, the MaKey MaKey, and many more. With a little creativity and access to various other materials, students can create just about anything. littleBits even have special Cloud Bits available that allow designers to connect their inventions to the internet, creating smart devices.

**Activity- See how many of these advanced activities you can complete**

**Advanced** (Requires extra materials and imagination)

- ┆ Make a pencil that draws an arc on paper controlled by a slide switch
- ┆ Make something that moves by itself
- ┆ Make something that claps when you clap your hands
- ┆ Make a hypnotizing wheel
- ┆ Make a hand wave
- ┆ Make a cooling campfire
- ┆ Make a windmill or lighthouse
- ┆ Make eyes that light up
- ┆ Make a new cat toy
- ┆ Make a paper card that lights up
- ┆ Make a superhero gadget
- ┆ Make something to wear
- ┆ Make a game that lights up and makes noise
- ┆ Make something that can draw
- ┆ Make a pet that moves
- ┆ Make a Rube Goldberg machine
- ┆ Make a robot that lights up
- ┆ Make a flashlight
- ┆ Make a vehicle that moves
- ┆ Make a tool for the future
- ┆ Design an inventor's house
- ┆ Make something that moves using Legos

## Light and littleBits – 4<sup>th</sup> Grade Activity

**What is light?** Light is electromagnetic radiation of any wavelength (as infrared, visible, ultraviolet, and X-rays) and travels in a vacuum with a speed of about 186,000 miles (300,000 kilometers) per second (Merriam Webster – Word Central). Humans see light in the visible light spectrum—red, orange, yellow, green, blue, indigo, and violet. Light waves can bend as they pass through different objects **refraction**, or can bounce off of other objects **reflection**.

### How to make a LittleBits flashlight

#### Materials

- Plastic cup (with bottom already removed)
- Toilet paper or paper towel tube
- Scissors
- Tape
- littleBits power module, battery, and cable
- littleBits input module (i6 dimmer, i3 button, i5 slide dimmer, i2 toggle switch, i1 slide switch)
- littleBits output module (o14 bright LED or o2 long LED)
- littleBits wire (w1)
- littleBits mounting board



**Procedure**

1. Put together your littleBits; connect the battery to the blue power module using the connector cable.



2. Put the remaining littleBits in the following order, power (blue) – input (pink) – wire (orange) – output (green).



3. Attach your littleBits modules to the mounting board.

4. Insert the tube into the bottom of the plastic cup.



5. Tape the tube to the plastic cup to keep it secure.



6. Insert the light through the tube and into the plastic cup. Tape the light to the side of the cup.



7. Insert the battery into the tube, as well, keeping the rest of the littleBits outside of the flashlight.



8. Tape the littleBits module to the outside of the tube. Be sure to not cover up your input module so you can turn your flashlight off and on.



9. Tape the battery to the inside of the tube. This will prevent the battery from sliding out of the tube when you move around with the flashlight.



10. Time to test it out! Once your littleBits and battery are secured to the flashlight, move into a dark room and see how it works. Write your observations on the littleBits Lights worksheet, Part A



11. After you have tested out how your flashlight works, trade with another team who may have used a different input module or output module. Write your observations on the worksheet.

### How to make a littleBits Light Spectrum

**Light Spectrum.** As mentioned earlier, the visible light spectrum contains all the light that humans can see with their own eyes—red, orange, yellow, green, blue, indigo, and violet. When humans see all of the lights at once, we see “white light.” In this activity, you will explore how the human eye responds to the varying combinations of red, green, and blue light to produce all of the colors of the visible light spectrum.

#### Materials

- littleBits power module, battery, and power cable
- littleBits RGB LED module
- littleBits screwdriver
- littleBits mounting board



#### Procedure

1. Each student pair will need one power module, one RGB LED module, one Screwdriver, and one mounting board.

2. Connect the power module to the battery, and then connect the RGB LED to the power module. This creates a circuit.



3. Attach the littleBits modules to a mounting board.

4. Using the screwdriver, adjust the red, green, and blue lights so that each RGB LED module is a different color.

- Group 1: Red
- Group 2: Orange
- Group 3: Yellow
- Group 4: Green
- Group 5: Blue
- Group 6: Violet (Purple)



5. Once each pair has adjusted their RGB LED to be a different color, connect all modules together in the order they appear in the visible light spectrum.

6. Have students write down their observations of visible light on the littleBits Lights worksheet Part B.

7. Return a differently colored RGB LED module to each group. Have students use the screwdriver to create “white” light on the RGB module.

8. Using a combination of the screwdriver and either the i5 slide dimmer or the i6 dimmer, have students explore how the intensity of the “white” light changes as the dimmer changes.

9. Have students write down their observations of “white” light on the worksheet.



### **South Carolina Academic Standards and Performance Indicators**

#### **Science**

**4.P.4A.1** Construct scientific arguments to support the claim that white light is made up of different colors.

**4.P.4A.2** Analyze and interpret data from observations and measurements to describe how the apparent brightness of light can vary as a result of the distance and intensity of the light source.

**4.P.4A.3** Obtain and communicate information to explain how the visibility of an object is related to light.

**4.P.4A.4** Develop and use models to describe how light travels and interacts when it strikes an object (including reflection, refraction, and absorption) using evidence from observations.

## littleBits Lights Worksheet

**Part A – After you have constructed your flashlight, answer the following questions.**

1. Does your flashlight function like a normal flashlight? What is different or similar between the two?
2. Trade your flashlight with another group. How is their flashlight different from yours? (i.e. input, output, etc.)
3. Trade your flashlight with a different group. How is their flashlight different from yours?
4. Trade your flashlight with the last group. How is their flashlight different from yours?
5. Which flashlight did you prefer? Why?

**Part B – After you have constructed your RGB LED circuit, answer the following questions.**

1. Were the RGB LEDs able to emit all of the colors of visible light? How?
2. Write down your observations of “white” light. How is “white” light created using the RGB LED modules?
3. Using one or more of the input modules, write down your observations of “white” light when it is turned on with a switch versus when it is turned on by the screwdriver.