

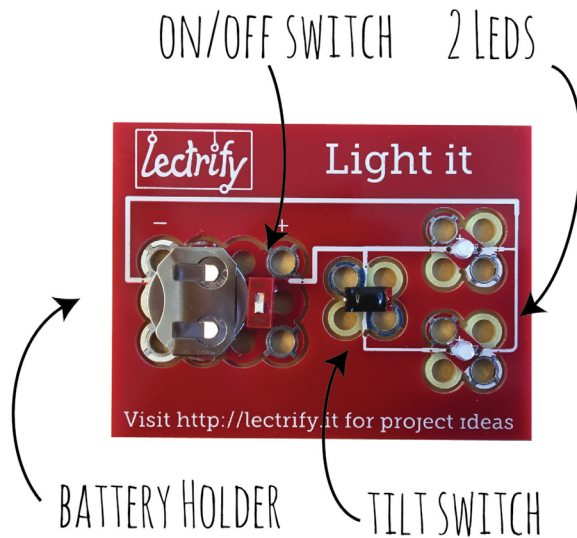
Teacher Guide Light it Crafts

Light it Kit:

The kit includes a battery, an on/off switch, a tilt switch and 2 LEDs.

The board has a functioning circuit that allows beginners to easily explore and gain self-confidence with basic electronics.

Once students have explored the desired concepts using the board, they can then remove the components from the board and embed them into their own projects. Note, once the components are removed from the board, they cannot be placed back on.



Grade Level:

Elementary (Grade 3-5)

Materials:

1 Battery
1 On/off Switch
1 Tilt Switch
2 LEDs

LEGO Bricks
Copper Tape
Pipe cleaners

The kit allows students to learn **simple circuits**, circuits in **series** and **parallel**, and/or **logic gates**, and when removed from the board, **conductivity** and **insulation**.

Lesson Scope & Concepts:

The kits allow learners to explore concepts in electricity. By the end of the lesson, we hope that students feel more comfortable working with electronics and feel more confident to participate in STEM projects in the future.

The scope and complexity can scale to the age, grade, and skill level of the learners. What follows is a sample lesson for 4th grade. This lesson will cover circuit basics & conductivity, identification and understanding of basic components, testing ideas and prototyping.

Project Sequence:

Here is a sample project for a 4th grade class:

1. Review the basics of circuits using the Quickstart Guide
2. Explore logic gates on the board
3. Explore components off the board (conductivity, series & parallel)
4. Embed circuits into creative projects

Duration:

1-2 hours

1. Review the Quickstart guide

A couple things you'll want to reinforce to students:

- LEDs and batteries have a positive and negative side. The positive is marked in red and negative in white on lectrifly components.
- Some components don't have a positive or negative side. These are marked in blue.
- Finally, you'll notice some holes without any color. Since these holes are not tinned and therefore not conductive, they won't allow you to create a functioning circuit. You can use them if you need to attach a circuit in place

**2. Logic gates on the board**

Trace the white line on the board. This is a complete circuit!

Logic gates are the building blocks of circuitry and you can see examples of these daily life. In an AND statement, both conditions must be true. In an OR statement, only one of the conditions must be true. It's likely that you and your students use logic gates often. For example, in your classroom you might have conditions a student completes their classwork and sits quietly they are rewarded to be let out for recess.

Ask students to observe and explore the circuit. What do they notice? Do they identify any patterns?

You'll notice two different switches and two LEDs. We've included these for students to get familiar with AND/OR logic. Ask students to observe and document what happens when they turn the switches on and off.

What happens if you can turn the tilt switch horizontal or vertical?
 What happens if the on/off is on and you tilt the board to one side?
 Remind students they can use this logic to create complex circuits later in their projects.

3. Explore components off the board (conductivity, series & parallel)

You can remove the components off the board by gently rocking it back and

Next Generation Science Standards**2-PS1-1**

Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

2-PS1-2

Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

K-2-ETS1-2

Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

forth. Be careful not to pull on the component itself. You may find it useful to use the tip of a pencil to get the circuits off.

Students can get started by exploring conductivity and insulation with a sample set of materials - paper clips, pipe cleaners, alligator clips, etc...

Next ask them to go around the room and see if they can find other conductors. Ask students to document their findings on the worksheet.

Students should start with one LED and the battery holder to create a simple circuit using what they learned about conductivity. If students have trouble, it may be due to one of these reasons.

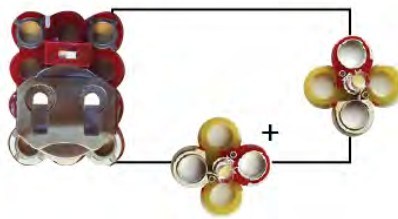
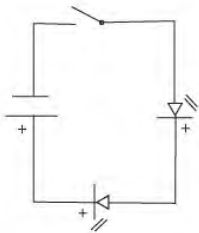
Is it wired up correctly - red to red and white to white?

Is the connector conductive?

Is the circuit a complete loop?

Once they figure out how to light up the LED, ask them what they might be able to do enhance the circuit. If they keep it as is, what will happen?

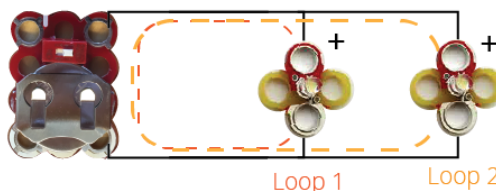
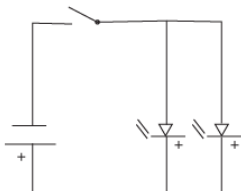
Students can create more complex circuits by adding a switch or more LEDs. Circuits with multiple components can be wired up in a couple of ways, each with a different outcome. Ask students to add another LED. They will probably add the component so that they are connected in a single path. This is called a **series circuit**.



Students will quickly realize that the LEDs don't light up when connected in series. In order to get the LEDs to work, students must wire them in **parallel**. Each component is wired back to the battery in its own loop.

Ask students to complete different challenges:

- What happens when they wire up both LEDs?
- Does it work?
- What does the circuit look like when it works?
- Add a switch to their circuit
- How many LEDs can they get to light up?



4-PS3-2

Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

4-PS3-4

Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

3-5-ETS1-2

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-ETS1-3

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.

4. Embed circuits into creative projects

There are lots of different ways to incorporate Light it kits. You may be able to include it in an upcoming lesson. Some of the educators we've worked with have used it for a 'morse code-like" project where students created signals with LEDs and switches to communicate.

Or tag it onto a lesson about animals or the environment. In the example below, students created animal critters out of the circuits.

The circuits are sized to fit on LEGO bricks. With a few strips of copper tape, students can create an easy to use breadboard with LEGOS. In addition to writing a report, you can ask students to create a scene from a book using LEGO bricks and circuits.

During the holidays, Light it kits make for a creative craft project. You can have students create a holiday ornament using pipe cleaners, paper or



LEGOS.

Finally, we suggest using the circuits in open-ended exploration. In the classrooms we've worked with, we found students to be motivated and curious about circuitry even without a prompt! We found some of the best ways to work with the components is to just start tinkering.





Student Worksheet

Name: _____

1. Describe what will happen in this circuit. Why?



2. List 10 materials you think might be conductive. Then, test your hypothesis and document your findings.

1. _____

6. _____

2. _____

7. _____

3. _____

8. _____

4. _____

9. _____

5. _____

10. _____

3. You learned a little about logic gates, determine if the following statements meet AND logic. Remember both statements need to be TRUE to meet the criteria.

Amy is a girl, Peter is a girl _____

Amy is a girl, Peter is a boy _____

Amy is a boy, Peter is a boy _____

4. Draw a sketch of a project you'd like to make. Make sure to include how you'd wire up your circuit and which connectors you will use.

