



FACILITATOR GUIDE

Make a Lighthouse

Learning Objectives

1. Make a paper circuit and use it to send messages with light.
2. Learn that a lighthouse is a communication system of light, lenses, and people used to transmit and receive messages.

Materials

Prepare the following for each learner

- 1 LED
- 1 coin cell battery (CRC2023)
- Adhesive copper tape (about 12” per lighthouse circuit)
- Scissors
- Regular tape
- Optional: Aluminum foil and glue sticks if copper tape is not available.
- Cardstock for printing the lighthouse template (two projects per sheet)
- Morse code printable



Safety

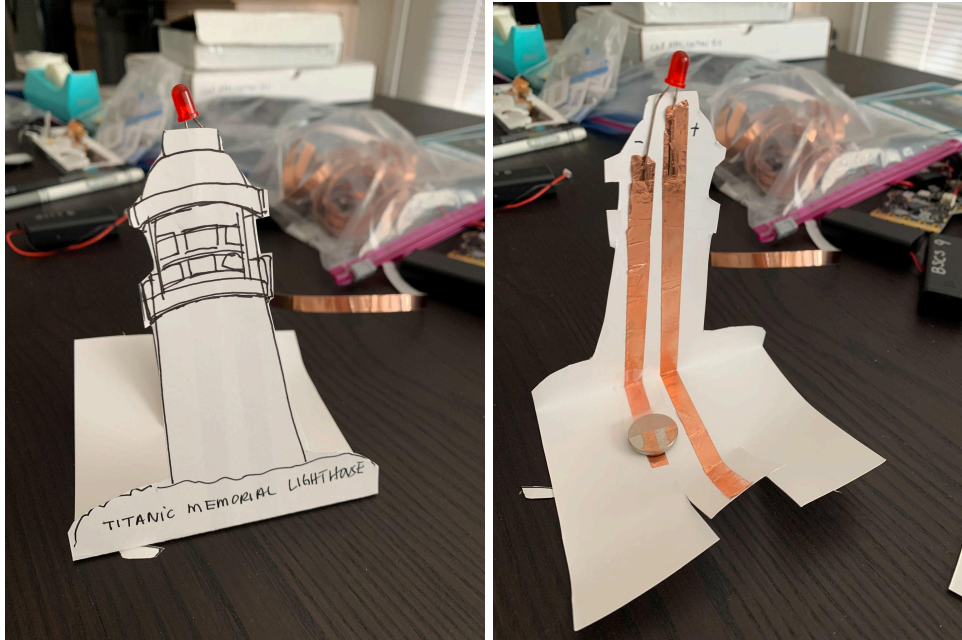
- Please ensure that any batteries used during our activities remain at the designated location and do not go home with the learners.
- We encourage the use of bitter-coated batteries to deter accidental ingestion. These batteries have a bitter taste to discourage children from putting them in their mouths.

Advance Preparation

- Print lighthouse template onto cardstock and cut sheets in half lengthwise
- Pre-cut 12” strips of copper tape, one per learner.

Activity Procedure

1. Ask learners if they have ever heard of what a lighthouse is. Encourage learners to develop ideas about what purpose a lighthouse serves.
2. Introduce a lighthouse as a communication system by saying: “Lighthouses are a tower at a land’s end. They are an important system designed to shine light using a system of lamps and glass lenses. This light serves as a beacon for navigational aid for sailors or on inland waterways.”
3. Use a pre-assembled paper lighthouse circuit to show how simple lighthouses are and what they could look like
4. Pass out one coin cell battery and an LED to each learner. Notice the LED has one long and one short leg. Let learners explore how to make the LED light up. Ask learners to check that the long leg of the LED is touching the ‘+’ side of the battery. LEDs have polarity and allow electricity to flow in one direction.
5. Hand out the rest of the materials (scissors, adhesive copper tape, regular tape, printed lighthouse template). Ask learners to make a circuit by extending the LED legs with copper tape to connect to the battery. NOTE: Learners may invent different kinds of folding switches to close the circuit.
6. After learners make their lighthouse, hand out the Morse code sheets. Model how the Morse code works by using the lighthouse to send a letter that includes dots and dashes, like “R”. Have learners use the code to identify the letter you sent.
7. Introduce the term **decode** by telling learners that they had to decode your message using the Morse code in order to identify the actual letter you were sending.
8. Have learners use the Morse code to compose a simple secret message, such as “I like cats”. Once they finish, introduce the idea of **coding** by telling them that they transformed an actual message into a different form.
9. After dimming the lights in the classroom, play a game by taking turns to transmit a message using their lighthouse and Morse code while others try to guess or decode the message.
10. Discuss the advantages and disadvantages of using this code for communication using the following prompts:
 - a. What are the benefits or drawbacks of sending messages by light?
 - b. What are the benefits or drawbacks of sending messages by Morse code?
 - c. Can you guess which letters of the alphabet were used the most and what code was assigned to it in Morse code?
 - d. How could lighthouses help with communication?



Notes to the Presenter

This activity can be used to introduce a basic circuit and the four basic components of a circuit: A source of electricity (battery), connecting wires (copper tape that acts as a conductor to flow electric current), a light (LED) that acts as a load to the circuit, and a switch to turn the circuit on/off.

Consider sharing information about the importance of lighthouses for ship navigation and maritime communication. Lighthouses are a communication system that include a light, a large Fresnel lens, and an operator who knows a convention of codes for sending and receiving communications by flashing light. Depending on age level, consider sharing the story of the RMS Titanic.

Note: There are lighthouse templates [PDFs](#) for the Cape Race Lighthouse, the Titanic Memorial Lighthouse, a traditional lantern, and a city stoplight.

Working with large/class groups: Organized materials into baggies or a kit of parts to save time when passing out materials. To maximize participation in larger groups. Organize the class in pairs, and have learners send a message to each other and decode it.

Extensions:

- This can be paired with the **Titanic Problems & Solutions** activities.
- Challenge learners to add a second LED to their project using only one battery and some additional copper tape.

Conversational Prompts

- How do lighthouses help with communication?
- What are the benefits or drawbacks of sending messages by light?
- What are the benefits or drawbacks of sending messages by Morse code?
- Can you guess which letters of the alphabet were used the most and what code was assigned to it in Morse code?

Content Background

A lighthouse, a tower at a land's end, is an important system designed to shine light using a system of lamps and glass lenses. This light serves as a beacon for navigational aid for sailors or on inland waterways. Lighthouses also housed early Marconi Company wireless radio stations which were used to send and receive Morse code messages.

The Titanic Memorial Lighthouse in Lower Manhattan was erected to remember the people who died on the RMS Titanic on April 15, 1912. The Cape Race Lighthouse in Newfoundland is noteworthy because it was a radio station that received the distress calls from the Titanic on April 14, 1912, and kept [a log of the communications](#).

Morse code is an example of a convention used for a radio communication system.

List of Terms Related to this Activity

Encode: When a piece of information is transformed into a different form using a specific code or set of rules, we call this encoding. This transformation is done to make the message more secure, private, or understandable for those who have the key to decipher it. In electronics, voltage patterns or bursts of electrical currents are encoded into 1s and 0s.

Decode: When a piece of information is converted from a coded or encoded message back into its original, understandable form, we call this decoding. It is the reverse of coding and involves using a specific method or key to interpret the coded message correctly.

Circuit: An electric circuit is a path where electrical current flows. A circuit is powered by an energy source such as a battery and that energy is used by loads (e.g., lightbulbs, motors) on the circuit.

Morse Code: Invented by Samuel Morse, this is a communication method designed to map dots and dashes to letters of the alphabet. The most used letters in words were assigned to the easiest and fewest dots and dashes. For example, the letter "E" is just one

dot. In the past, a spark gap transmitter would be used to create electrical pulses and radio waves to send the short and long clicks across seas with Morse code. Morse code was also used during World War II to send secret messages.



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