

Safety Shake Light

Did you know you can create a light without batteries or power? A shake light relies on mechanical power to turn on the light bulb. Use your muscles to make your shake light glow!

TEKS:

SCI 4.6 A: The student is expected to differentiate among forms of energy, including mechanical, sound, electrical, light, and thermal.

SCI 4.6 C: The student is expected to demonstrate that electricity travels in a closed path, creating an electrical circuit.

SCI 5.6 B: The student is expected to demonstrate that the flow of electricity in closed circuits can produce light, heat, or sound.

SCI 6.9 C: The student is expected to demonstrate energy transformations such as energy in a flashlight battery changes from chemical energy to electrical energy to light energy.

Materials:

- 2 8.5 x 11-inch A4 transparency sheets
- 5 ceramic "donut" disk magnets, 1-inch outer diameter
- Clear tape
- 200 feet (~60 meters) of #30 magnet wire (very thin copper wire with lacquer insulation)
- 5mm LED light
- Masking tape
- 2 mini alligator clips
- 2 plastic film canisters with lids
- 3 rubber bands (size #33)
- Scissors
- Sheet of fine sandpaper

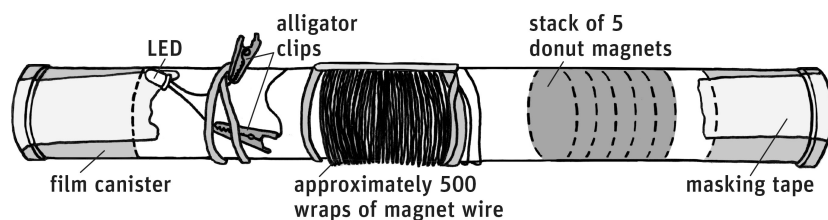
31 Days of STEM FUN!

www.destember.org | [#deSTEMber](https://twitter.com/deSTEMber) | © 2019 by Girlstart www.girlstart.org

DeSTEMber is a trademark of Girlstart

How To:

1. Take the two transparency sheets together and, holding them in a stack, roll them lengthwise, making a long tube.
2. Next, insert a film canister into each open end of the tube until only the lids are sticking out. Tighten the rolled tube until it is tight on the sides of the canisters.
3. Use a few pieces of clear scotch tape to secure the transparency sheets in a tube shape while still being able to remove and re-insert the film canisters. Tape around both ends, a spot or two around the middle to hold the diameter securely, and lengthwise along the seam of the tube.
4. Take two of the rubber bands and wrap them both around the tube so they are tight, but not creasing/bending the tube. These should be placed near the middle of the tube with about 1 inch of space between them. These will help keep the wire coil tightly in place.
5. Wrap the magnet wire around the tube in the space between the two rubber bands. Continue to wrap all of the wire as tightly as possible without squishing the tube (about 500 times around) until there are about 12 inches of wire loose at each end. If needed, use a piece of tape to hold the coiled wire in place.
6. Once the large wire coil is securely in place on the tube with the two 12-inch ends hanging loose, use a pair of scissors to trim the loose ends down to just 3-4 inches each.
7. Starting with one loose end of the wire, use the sandpaper to remove about 1.5 inches of the insulation around it so only the pure wire is showing. Then, thread this stripped end of wire through the hole at the end of one alligator clip and wind the wire tightly around the hole.
8. Repeat step #7 with the other loose end of wire and the second alligator clip.
9. Next, clip each alligator clip to one of the legs of the LED light.
10. Lay the alligator clips flat against the tube, making sure they do not touch each other (this would short the circuit).
11. Use the third rubber band to hold the alligator clips in place against the tube.
12. Now, stack the five donut magnets together.
13. Remove one of the film canisters from an end of the tube, place the magnet stack inside the tube, and re-insert the film canister back in its place.
14. The magnet stack should be able to easily slide back and forth between the two film canisters inside the tube.
15. Apply two pieces of masking tape across the lids of the film canisters to hold them in place inside each end of the tube.
16. The assembled shake light should look like the picture below.



<https://www.exploratorium.edu/sites/default/files/snacks/SDGdiagram.jpg>

31 Days of STEM FUN!

www.destember.org | #deSTEMber | © 2019 by Girlstart www.girlstart.org

DeSTEMber is a trademark of Girlstart

17. Hold your shake light at both ends and shake the tube as fast as you can back and forth so the stack of magnets moves quickly between the two film canisters. Each time the magnets pass through the wire coil, the LED light should light up!

STEM Explanation:

When a wire and magnetic field move across each other, a voltage is introduced in the wire. If that wire is part of a circuit, the voltage will cause an electric current to flow through it. Every time the magnet stack in the shake light moves past the wires, the field around them sends a voltage into the wire. Since there are a lot of wire coils, that voltage is multiplied throughout each turn of the wire. This voltage creates enough electrical current to light up the LED light!

The shake light is a unique circuit because it is an open and closed circuit at different times. When the magnet stack is located at an end of the tube, it is open, but when the magnets pass through the wire coil and cause the current to flow, it is a closed circuit. The point at which the circuit changes from open to closed is the same as when the energy transfer in the shake light changes from the mechanical motion of the magnets to the electrical voltage sparked in the coil.

Career Connection:

Health and safety engineers develop procedures and design systems to protect people from injury and property from damage. They combine their knowledge of engineering and of health and safety to make sure that chemicals, machines, software, and other products will not cause harm to people or damage to property. These engineers also recommend safety equipment and plans in case of the event of injury or malfunction.

Resource:

<https://www.exploratorium.edu/snacks/stripped-down-generator>

31 Days of STEM FUN!

www.destember.org | [#deSTEMber](https://twitter.com/deSTEMber) | © 2019 by Girlstart www.girlstart.org

DeSTEMber is a trademark of Girlstart