PRESENTED BY: girlstart

deSTEMber

SCIENCE ★ TECHNOLOGY ★ ENGINEERING ★ MATH

Tic Tac Flashlight

Reduce, reuse, and recycle with this fun electronics project. Convert a Tic Tac candy container into a handy LED flashlight and never get caught in the dark again!

TEKS:

4.6A Differentiate among forms of energy, including mechanical, sound, electrical, light, and heat/thermal.

5.6B(rs) Demonstrate that the flow of electricity in circuits requires a complete path through which an electric current can pass and can produce light, heat, and sound.

6.9C(ss) Demonstrate energy transformations, such as when energy in a flashlight battery changes from chemical energy to electrical energy to light energy.

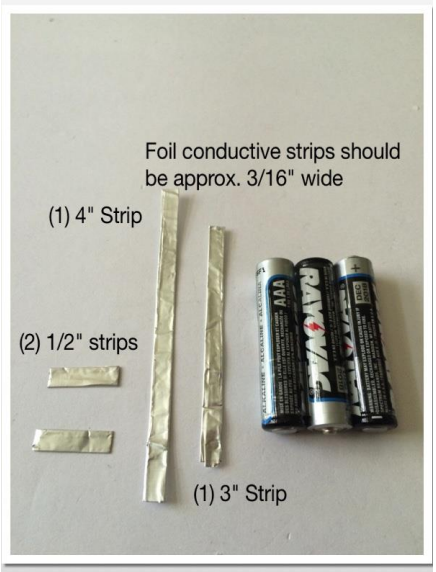
Materials (per flashlight):

- (1) Empty Tic Tac container
- (3) AA or (3) AAA batteries (both types are 1.5v)
- (1) 5mm LED light - example here: 25.000 mcd - 3.8 volt and 20 mA
- (1) Switch - example here: tact switch or slide switch
- (1) 27 ohm serial resistor - example here: resistor
- Aluminum foil (about 6 sq. inches per flashlight)
- Clear (scotch) tape or electrical tape (1 roll will cover at least 20 projects)
- Scissors
- Needle nose pliers and/or hemostats
- Drill with 3/16” diameter bit (ask for help from an adult when using this tool)
- Hot glue gun and glue sticks (only a dab is needed per project)
- **Note**: a multimeter is helpful to troubleshoot circuit problems, but it is not required.

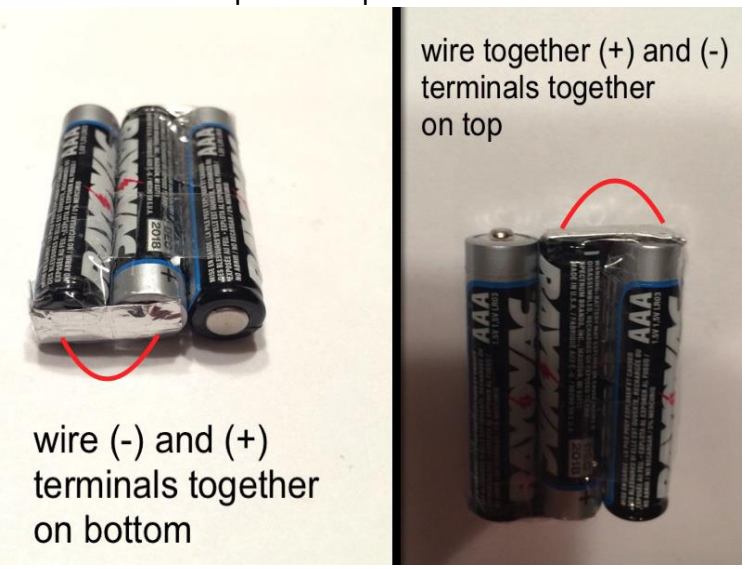
How To:

1. Orient 3 batteries as shown and use tape to secure the batteries into a single "pack" as shown.

2. Fold the foil (edge over edge) to create foil conductive strips approximately 3/16" wide. You will create 4 strips of the lengths shown below: (2) ½" strips, (1) 4" strip, and (1) 3" strip. The foil should be folded about 10 times so that each strip has the thickness of 10 pieces of foil. If using heavier weight foil, 5 folds will suffice.



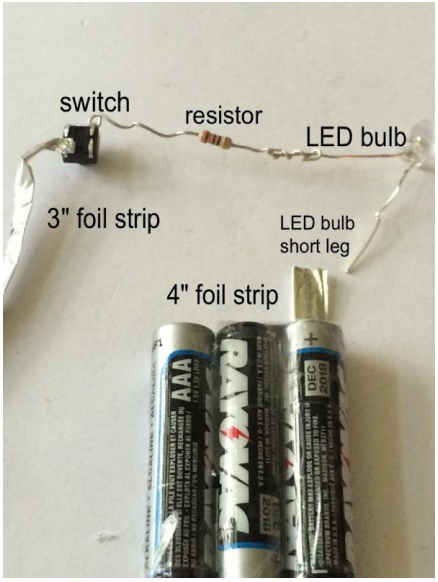
3. Attach the ½" conductive strips to "wire" the batteries in series. Place the foil over the terminals and secure the foil strips with tape.



4. Connect the 4" conductive foil strip to the bottom negative terminal and use tape to secure position.

5. Prepare the flashlight top by drilling two 3/16” holes in the cap. Note: you should adjust the size of this hole according to the size of the switch and bulb you are using.

6. Connect the LED bulb, resistor and switch as shown. Note that the short leg of the LED bulb should be connected to the 4” foil strip and the long leg of the bulb to the resistor. At this point, you may want to temporarily connect the 3” and the 4” foil strips to the battery pack to ensure that the LED bulb illuminates. If there are no issues with the circuit, move to step 7.



7. Temporarily disconnect the 3” and 4” foil strips from the battery pack if you would like to maximize flexibility in connecting the components into the flashlight cap. Fit the bulb and switch into their corresponding holes in the flashlight top and use a small amount of hot glue to secure them into place. This task may be best performed by an adult.
8. Once the glue has cooled in the flashlight top, connect (or reconnect) the LED bulb short leg to the 4” foil strip. Use a bit of tape to ensure the connection does not come loose.
9. Connect (or reconnect) the 3” foil strip to the top positive battery terminal of the battery pack. This will complete the electrical circuit once again and you should be able to use the switch to operate the flashlight.
10. Place all components in the plastic case and snap the top to the case.
11. You can embellish the outer case with your favorite decorative tape, decals, etc. or leave it unadorned to show off the science inside the flashlight.

Why Does It Work?

The 3 batteries are wired together in series to provide power to the LED bulb. Because aluminum is a conductive metal, the folded aluminum foil makes a great conductive material to carry electricity in the circuit. The 27-ohm resistor is required to step the power down in the circuit so the LED bulb is not burned out by excessive power. The switch completes the circuit when pressed, allowing electricity to flow through the circuit without interruption.

Career Connection:

Electrical Engineer: “As an electrical engineer you’ve got the power - and you’ll efficiently and safely channel it from turbines, fuel cells, or hydroelectric and solar plants to homes, factories, and businesses. Electrical engineers also develop wireless communication systems, develop the latest media displays like HDTV, design computer processors and other hardware, and work in robotics.” Read more at egfi-k12.org...

Additional Resources:

- LED calculator: http://led.linear1.org/1led.wiz
- Flashlight wiring schematic: