

Activity 4

High Tech Fashion

MAKE A FASHION TECH ACCESSORY!

What do you get when you combine fashion and electronics? Fun and functional clothing and accessories! Soft circuits are electronic circuits that use conductive thread instead of wire. With these circuits, you can make wearable designs that light up the runway.

SMART START: If girls are unfamiliar with LEDs (light emitting diodes), start with a brief introduction. LEDs are a bright, energy-efficient, long-lasting, and generally unbreakable light source made from semiconductors. Point out

that each LED has two legs, or leads, one slightly longer than the other.

The longer lead is the positive side, the shorter lead is the negative side. Ask girls if they can think of any places they have seen LEDs. (bike lights, camping flashlights, light-up sneakers) ²



Part 1 Build Simple Circuits

Here's how:

- 1. Introduce fashion technology.** Ask girls if they have seen any clothing or fashion accessories that incorporate technology. ² After a brief discussion, present the **SciGirls Challenge:** Make a fashion accessory with LEDs that lights up when you wear it.
- 2. Prepare the battery and holder.** Divide girls into small groups ¹ and pass out the coin cell batteries, holders and LEDs. Point out that

You'll Need:

per girl

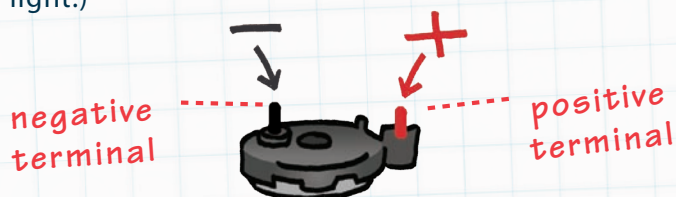
- ◆ paper and pencil
- ◆ 1 piece of felt
- ◆ 1 sewing needle
- ◆ conductive thread (sparkfun.com)
- ◆ 2 or 3 LEDs, 1.9 V - 2.4 V / 20 mA - 40 mA (RadioShack or evilmadscience.com)
- ◆ 1 metal snap or magnetic purse snap (craft store)
- ◆ 1 CR2032 (coin cell) battery (e.g., 3 V watch battery) (sparkfun.com, budgetbattery.com or drugstore)
- ◆ 1 CR2032 battery holder (RadioShack or sparkfun.com)



per small group

- ◆ ruler
- ◆ scissors
- ◆ fabric pen or chalk (to sketch circuit on fabric)
- ◆ needle-nose pliers
- ◆ wire with alligator clips or wire stripper (RadioShack or sciencekit.com)
- ◆ permanent black and red markers or nail polish
- ◆ optional: needle threader, regular thread, decorative fabric, lace, and beads

one side of the battery is positive and the other negative. Now, place the battery in the holder and use black and red markers or nail polish to mark the positive and negative terminals. To determine which is which, test it with an LED. (The long lead of the LED must be attached to the positive terminal of the battery for it to light.)



Visit pbskidsgo.org/scigirls for videos and projects.

SciGirls

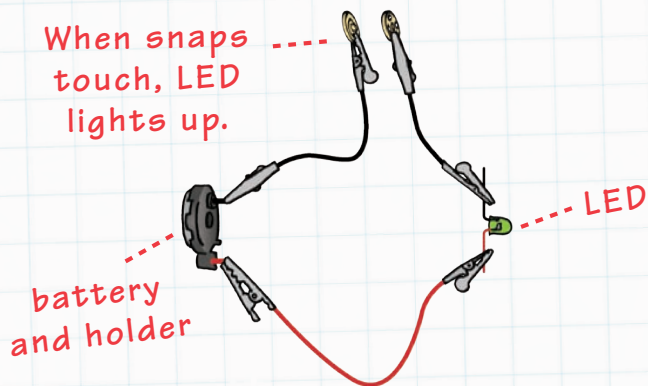


High Tech Fashion continued



3. Make a simple circuit. Pass out the LEDs and wires with alligator clips and have girls make a simple circuit. Why did the LED light up? (For their LED to light, electricity must travel from one terminal of the battery, through the wire to the LED, and back through another wire to the other terminal of the battery.)

4. Add a switch. Pass out the metal snaps and have girls think of a way to add them as a switch to turn the LEDs on and off. (A switch is used to open and close the circuit. When the switch is open, no current flows, and when the switch is closed, current flows.)

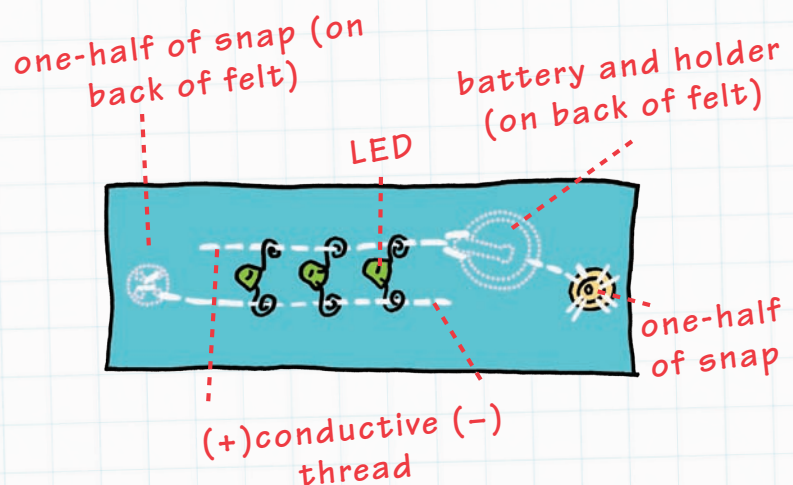


5. Introduce conductive thread. Explain to the girls they will be creating a fashion accessory that lights up by sewing a circuit made of conductive thread. The thread will replace the wire from the simple circuit because it is coated with metals, such as silver, copper, tin, and nickel, which are conductive. Have girls try adding the conductive thread to the simple circuit from Steps 3 and 4 to see if the LED lights up.

Part 2 Prototype a Soft Circuit

6. Brainstorm. Explain to the girls they will be creating a circuit for an accessory that will only light up when a person snaps the two metal snaps together. (The snap will act as a switch that turns the LEDs on when it's closed and off when it's open.) Have girls brainstorm and sketch some ideas.³

7. Plan circuit design. Let each girl choose an accessory she wants to make (bracelet, choker, belt, headband).⁴ Have girls decide where they want to place the LEDs on the accessory. Explain that the LEDs should span the two lines of conductive thread (one positive and one negative—see final design below). In this design, the LEDs are necessary for completing the circuit. When the snap is closed, current flows from the battery, through the conductive thread to the LEDs, and back to the battery.



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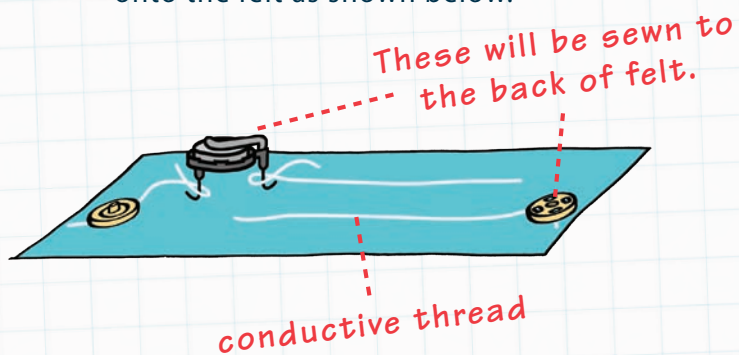
POINTER: The LEDs in this circuit are connected in parallel, meaning the electrical current splits and flows through all LEDs simultaneously.

To see girls use parallel circuits in their fashion design, watch the *SciGirls Get Tech DVD*. (Select High Tech Fashion: Design.)⁷

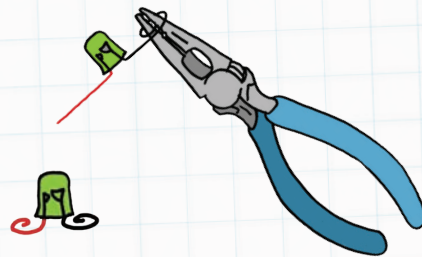
8. Prepare battery holder. Have girls bend the two terminals so the battery holder sits flat. Attach the conductive thread to the negative terminal of the battery holder (without the battery inside). Next, have them use another piece of conductive thread and attach it to the positive terminal of the battery holder.

9. Prepare snap. Have girls attach the conductive thread from the negative terminal of the battery to one half of the metal snap. Next, have them take a *separate* piece of conductive thread and attach it to the other half of the metal snap.

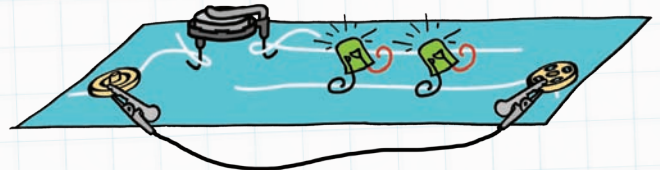
10. Lay out the design. Have each girl measure and cut a piece of felt of the appropriate size for her accessory. Lay each part of the circuit onto the felt as shown below.



11. Prepare LEDs. Girls should mark the long lead (positive side) of the LED with a red marker (or nail polish). Then have girls bend up the leads so the LED will lie flat, using needle-nose pliers to curve the leads into a loop.



12. Test circuit design. Have girls add a battery to the battery holder and place the LEDs on the conductive thread. Then, have them use a wire with alligator clips to make a connection between the two snaps to see if the LEDs will light up.



Visit pbs.org/teachers/scigirls for more activities!

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Part 3 Sew a Switch-Activated Circuit

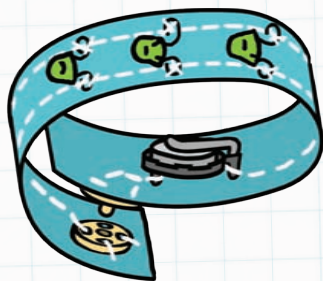
13. Transfer design to the felt. After they have shown their circuits work, have girls transfer the circuit pattern and placement of each piece onto the felt using a fabric pen or chalk. This is the “road map” they will follow as they sew. (Make sure to mark whether the piece is being sewn onto the front or back of the felt.)

14. Stitch battery and snaps in place. Use a new piece of conductive thread for each item.

15. Stitch the circuit. Now girls should stitch the conductive thread along their pattern using a simple stitch, such as a running stitch. Make sure the stitching shows on both sides of the felt. Have girls use a needle threader to make threading the needle less frustrating.

16. Sew the LEDs. Have girls stitch both looped leads of each LED to the conductive thread. Make sure the orientation is correct and the connections are good. Girls should trim the thread ends as close to the knots as possible. Warn them not to let any thread cross between the two LED loops—this could create a short circuit!

17. Test. Have girls test their design by connecting the snaps.



POINTER: If girls have problems, suggest they check all their connections. Then, have them test if the battery and individual LEDs are working. They should also check that the battery is properly inserted into the holder and the LED ends are oriented correctly. Girls may have to cut some stitches and redo a section, but in technology, that’s just fixing a bug! Don’t let girls get discouraged.⁵

18. Get Creative. Once the LEDs are working, have the girls sew lace, beads, and felt onto their accessories, using regular thread.⁴

19. Debrief. Let girls model their finished accessories for the group. Discuss which parts of the project were most challenging. Why? If they were going to do the project again, what would they do differently?⁶

See Diana mentor girls as they prototype LEDs on a breadboard on the *SciGirls Get Tech DVD*. (Select High Tech Fashion: Mentor Moment.)⁷



Mentor Moment Diana Eng is a fashion designer who displayed her love of technology on Season 2 of *Project Runway*. She is also the author of *Fashion Geek*, a how-to book for designing tech-savvy fashion projects. Since the age of 12, Diana has loved computer programming and showed off her skills each year at her school’s science fair!