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 youth are unfamiliar with LEDs (light emitting diodes), start with a brief introduction. LEDs are a bright, energy-efficient, and long-lasting 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 youth if they can think of any places they have seen LEDs. (bike lights, camping flashlights, light-up sneakers).

You'll Need

2+ Hours

per person
• 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
• 1 metal snap or magnetic purse snap (craft store)
• 1 CR2032 (coin cell) battery (e.g., 3 V watch battery)
• 1 CR2032 battery holder

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

Challenge Stereotypes

Introduce youth to diverse role models to help counter stereotypes. 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!

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Part 1
Build Simple Circuits

1. Introduce fashion technology. Ask youth if they have seen any clothing or fashion accessories that incorporate technology. 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 youth into small groups and pass out the coin cell batteries, holders and LEDs. Point out that 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.)

3. Make a simple circuit. Pass out the LEDs and wires with alligator clips and have youth 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 youth 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 youth 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 youth 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 youth 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 youth brainstorm and sketch some ideas.

7. Plan circuit design. Let each youth choose an accessory she wants to make (bracelet, choker, belt, headband). Have youth 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.

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

To see SciGirls use parallel circuits in their fashion design, watch High Tech Fashion (Design).

8. Prepare battery holder. Have youth 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 youth 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 youth 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. Youth should mark the long lead (positive side) of the LED with a red marker (or nail polish). Then have youth 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 youth 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.

**Part 3**  
**Sew a Switch-Activated Circuit**

13. **Transfer design to the felt.** After they have shown their circuits work, have youth 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 youth 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 youth use a needle threader to make threading the needle less frustrating.

16. **Sew the LEDs.** Have youth stitch both looped leads of each LED to the conductive thread. Make sure the orientation is correct and the connections are good. Youth 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 youth test their design by connecting the snaps.

**POINTER:** If youth 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. They may have to cut some stitches and redo a section, but in technology, that’s just fixing a bug! Don’t let youth get discouraged.

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

19. **Debrief.** Let youth 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?