

WITH THIS ACTIVITY

- Handout
- At-a-Glance



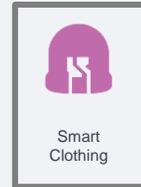
We are Engineers!



Movement Improvement



Marvelous Materials



Smart Clothing



Patternmaking Tools n' Tech

MODULE

Big Picture

Young designers will make a light-up skirt by applying wearable electronics to a garment.

What's the goal?

By the end of this activity, young designers will learn how to create a working parallel circuit and incorporate electronics into fashion design.

Prerequisite Activities

- DIY Wrap Skirts
- Introductory & Advanced SpaceDough

Grouping

Each young designer completes the activity individually; one leader per five designers.

Materials

What they need: (per person)

- Handout
- Completed skirts from DIY Skirts Activity – or other skirt
- Sewing machines (pre-thread the sewing machines with regular thread on top and conductive thread in the bobbin. Stitch length should be 6 to 8 stitches per inch)
- Ordinary sewing thread
- Conductive Thread (200 Yard spool wound onto bobbins)
- Hand sewing needles (EMB needles size 5 recommended to fit through battery holders)
- 3mm LEDs, white or colored, up to 6 per designer
- 1-2 Battery holder (s)
- 1-2 3V Coin-cell battery (CR2032)
- Marking chalk/disappearing ink pens

...Materials continued on next page

**Preparation Time: 30
Minutes**

Activity Time: 2 Hours

Difficulty: Level 3

Preparation

Prepare bobbins with conductive thread. Thread the upper part of the machine with regular thread.

Tips

- Extra adult helpers are essential for this activity if you have more than 5 young designers.
- Long stitching lines (over 36") may cause LED's to be dim or not light at all. Using no more than 6 LEDs per battery is recommended for brightness.
- Make sure positive and negative lines are about 1/2" apart at points where LEDs are to be attached. Remember, the positive and negative lines cannot cross! Straight lines are easiest to sew.
- Loose components (LEDs, battery pack) may be secured with regular thread.
- Remember **polarity!** Having the young designers keep the positive line always on top and the negative always towards the bottom as they sew can help keep this straight.
- Don't squeeze the LED metal tails too hard or bend them back and forth too many times or they will break.

Materials (Continued)

Supplies to Share

- Needle nose pliers
- Decoration materials (ribbons, felt, glitter, sequins, fake flowers, fabric paint)
- Fabric glue
- Small scissor/ thread snips

What you need: (per leader)

- Extra supplies
- Hand sewing needle/thread
- Hot Glue (optional)
- Hole punch
- Needle threaders
- Small thread snips

VOCABULARY

Polarity: Batteries have a positive and negative terminal. Electricity flows from the positive terminal to the negative terminal. Some components, like LEDs, also have positive and negative sides. You can identify the polarity of an LED easily, as the positive leg is longer than the negative leg.

Let's get started!

1. Introduce the activity, the electrical components, and the tools. Refresh designers about the features of a **parallel circuit**.

VOCABULARY

Parallel Circuit: A parallel circuit is one in which all components are connected directly to positive and negative battery lead. Electricity flows through all the components in parallel.

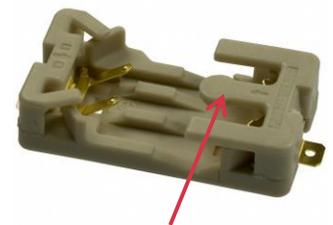
2. Have the young designers use the handout to plan their design placement on the skirt, the location of **LED's** and battery, the **circuit** paths, and mark the polarity. The circuit itself can be part of the design. Check the circuit plans.

VOCABULARY

Circuit: A path for an electrical current to flow.

LED: Light-emitting diode

3. On the backside (inside) of the skirt, have designers draw their plan using chalk, including location of LED's and battery pack and the positive and negative sewing lines.
4. Instruct designers to place their skirt into the sewing machine with the back side facing up. The conductive thread should be on the right side (outside) of the skirt. Stitch along the positive chalk line leaving 8" tails at start and finish. Do not backtack. Stitch along the negative chalk line, leaving tails, and not backtacking.
5. With a needle, poke the conductive thread tails to the back side of the skirt. Line up the positive side of the battery holder with the positive sew line. The positive side has the three prongs (see picture). Next, they should insert the trailing ends of the thread through the battery holder and tie a knot at each end to hold it in place (no need for needles). Get the knot as close to the skirt fabric as possible so that the components are secure. Trim



Positive side

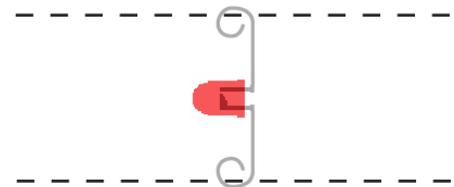
the ends of thread from the knots, so the tails do not cross and cause a **short circuit**. A drop of glue can help keep knots in place.

- **Instructor Extra:** If the battery holder is not secure after tying it on with the conductive thread, use a regular needle and thread to secure. Be sure the head of the needle fits through the hole on the battery holder.

VOCABULARY

Short Circuit: A high-conductivity connection between positive and negative is a “short circuit”. Usually caused by a positive and negative line of conductive thread touching.

On the front side of the skirt, young designers should insert the LED legs under the conductive thread, but not through the fabric. The longer leg connects to the positive trail and the shorter leg connects to the negative trail. Curl each leg using needle nosed pliers to secure it.



6. Insert the coin cell battery and check LED function. Troubleshoot non-functioning LEDs by using the At-a-Glance document.
7. Decorate skirts with ribbon, sequins, or whatever. Artificial flower petals will just fit over LED's if taken off their stem.

Take it further

- Try adding other simple components like switches and color changing LEDs!
- Use multiple batteries to make designs that are very long or that require more than 6 lights.
- Check out these cool sites for more inspiration :
 - AdaFruit: www.adafruit.com/category/65
 - Makers Shed: www.makershed.com/Intro_Electronics_s/49.htm
 - Spark Fun: <https://learn.sparkfun.com/tutorials/ldk-experiment-1-lighting-up-a-basic-circuit>

Supply Specifics

Component	Description	Picture	Suggested Sources
Coin Cell Battery Holder	<ul style="list-style-type: none"> Battery holder for 3V, CR2032, 20mm coin cell battery, for sew-on use. 		www.digikey.com www.sparkfun.com
Coin Cell Battery	<ul style="list-style-type: none"> CR2032 3V 20mm 		www.digikey.com www.Amazon.com
LEDs	<ul style="list-style-type: none"> 3mm or 5 mm, 2,2 volts or less, round (note that different colors may have different voltages) 		www.digikey.com www.Amazon.com www.sparkfun.com
Conductive Thread	<ul style="list-style-type: none"> 2 ply for sewing. May be stainless steel or silver coated nylon. Lame Lifesaver sells a large spool, so is most economical. Other suppliers sell it by the bobbin. 		www.adafruit.com www.sparkfun.com Lame Lifesaver, members.shaw.ca (allow extra time for Canadian shipping)