

2018 Winter Docent Tour Project

Simple Paper Circuit Greeting Cards

Overview:

As part of the Hand in Hand: Craft & New Technology Exhibit, our docents will teach students to incorporate technology into their artwork. Students will create a functional circuit using copper tape and colored LED lights to light-up their designs.

Building a paper circuit is a playful platform for students to investigate concepts at the intersection of art, science and technology.

An electrical circuit is a path or line through which an electrical current flows. We need three things to create a circuit:

- A source of voltage (our coin cell battery)
- A conductive path (our copper tape)
- A resistor (our LED light bulbs)

The path may be closed (joined at both ends) making it a loop. A closed circuit makes electrical current flow possible.

In a parallel circuit, electricity can travel from one end of the cell (battery) through many branches to the other end of the cell (battery). We can light up more than one bulb using a parallel circuit. When making a parallel circuit, think of it as creating two copper tape pathways that come very close together but don't touch. The LEDs will bridge the gap between the two pathways. Students will create a parallel circuit in this project.

Electronic circuits are at the core of nearly every new technology. Circuits power cell phones, computers and televisions, and are essential in cars, houses and kitchens. Circuits are everywhere and modern innovations would not be possible without them. Circuits enable electricity to flow between speakers, bulbs, buzzers, sensors, buttons and batteries. When

engineers design new technologies, they often design and build companion electronic circuits so the technology functions as intended. In this activity, students are reminded about how electronic circuits work and then build their own circuits using simple, easy-to-use materials and provided templates.

Student Introduction:

A very important aspect of engineering is **creativity**. Engineers often need to think creatively in order to dream up the amazing new technologies that have never existed before. It is not possible until you dream it, so today is your chance to think like an engineer and create something special and all your own!

Have you ever wanted to give someone a Valentine's card or a greeting card of some kind, and wanted to *really* impress them?

Do you feel limited or bored with making the same old drawings with pencil, pen or marker?

What if you could use technology to light up your own card? What would you light up?

Well today is your chance to make the best Valentine's Day (or birthday, Arbor Day, holiday, etc.) card ever! In this activity, you will get to design, customize and create your own light-up card that is powered with a mini battery, LEDs (light emitting diodes), and a circuit made of copper tape. Your design is totally up to you, but we'll give you a template for where the light bulbs will go.

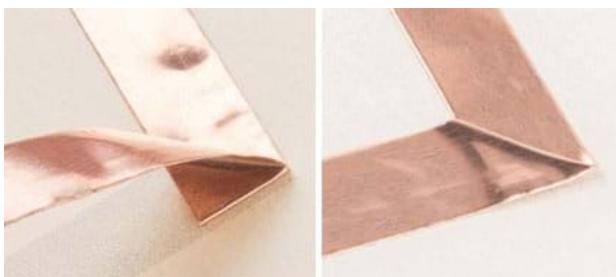
Materials:

- Card template
- Pre-cut copper tape (1 short, 1 long per student)
- LED light bulbs (2 per student)
- Paper clip (1 per student)

- 3 V coin cell battery (1 per student)
- Scotch tape
- Pencils
- Erasers
- Crayons or markers

Activity:

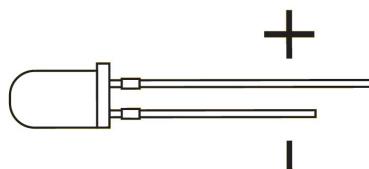
1. Demonstrate how a circuit works with the premade card.
2. Distribute parallel circuit paper.
3. Ask the students to fold their piece of paper, with the circuit on the inside.
 - a. Can they see the two dots through the paper? This is where the light bulbs will shine through their artwork. Students may choose to design their card horizontally or vertically, but the light bulb placement will remain the same.
 - b. Ask the students to make a light dot where the light bulbs will shine through.
4. Show students examples of card ideas. Ask students to use pencils, crayons and markers to design their cards.
5. Review the parallel circuit pathway. Notice the positive (+) and negative (-) path, just like the two sides of the battery.
6. Distribute copper tape.
7. Demonstrate how to apply copper tape. Fold the corners back, then up, to create an angle.



8. Ask students to carefully peel the backing off the copper tape and place over the black lines.

9. Distribute LED's.

- a. Show students that the bulbs have a long and short end. The long end is the positive (+) side and the short end is the negative (-). When placing the LED's onto the copper tape, students need to make sure that they have the long side (+) facing up and the short side (-) facing down.



10. Use scotch tape to tape down both LED bulbs.
11. Fold down the upper corner of the paper.
12. Put 3V coin cell battery between fold. Remember to place the positive side (+) of the battery to the positive side of the copper tape, and negative (-) to the negative side of the copper tape.
13. The LED bulbs should light up! Use the paper clip to secure the battery.
14. Ask students to put finishing touches on their artwork now that they can see where the light shines through.

Review / Closing:

- What is the minimum number of parts you needed to make your finished product? Name them.
- What was one problem you encountered and how did you overcome it?
- What is your most favorite aspect of your design?
- What makes your design unique?
- What improvements or new ideas would you implement in designing another light-up greeting card?
- What other artwork could you design using paper circuits?