Pipe Cleaner Circuits

Teacher Guide

Objectives

This activity introduces students to several foundational concepts in electric circuits. Students learn that electricity flows in a closed circuit. Students also investigate different types of materials, including conductors and insulators. As they design and build simple circuits, they discover how electrical energy can be changed into light. By following the engineering design process, students plan, test, and redesign their circuits.

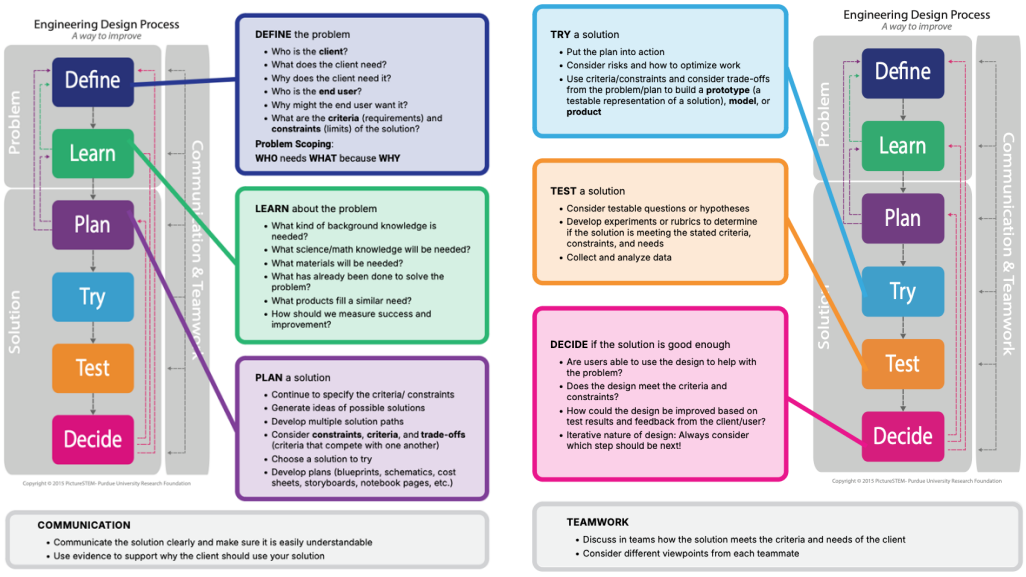
Materials

- LED light
- Pipe cleaners
- Battery (coin cell)
- Tape
- Rubber band
- Decorations (beads, shapes, googly eyes)
- Clothespin
- Popsicle sticks

Instructions

In this activity, students will complete an engineering design challenge.

Introduce the engineering design process: Begin by introducing the engineering design process. Outline each step of the engineering design process shown below.



Introduce the problem: Distribute the client letter and have students individually read through the letter. Have students start defining the client's problem. Allow students to discuss the following questions in their small groups: Who is the client? What is the client's problem that needs a solution? Who are the end-users? Have students write down their responses. Once students respond to the question, have them share their responses to the class.

Client Letter

To: Student Engineers

From: Brightwear Co., Design Team

Re: Challenge Response to New Accessory

Dear Student Engineers!

We need your help! Our company, Brightwear Co., wants to make a brand new accessory that lights up. People love items that glow because they're fun to wear and help keep them safe in the dark.

Your job is to create a light-up accessory using the materials you're given. It could be a bracelet, a badge, a backpack clip, a key chain, a light-up animal, or anything else you imagine. It doesn't have to be perfect — we just want to see your creative ideas and how you make the light turn on.

We know you'll do an amazing job, and we can't wait to see what you design.

Thank you for being part of our team.

Sincerely,

Alex Rivera

Introduce electric circuits: Tell students that they need to learn some basic ideas about electric circuits. Have students sketch how they connect a battery, bulb, and wire to light the bulb. Encourage students to share their sketches and ideas with the class. As they share their ideas with the class, ask questions such as: Why do you think your model works? How is your model different from the ones shared previously? What is similar among all these models? Next, ask students to light the two bulbs with a battery and a wire. Have them draw and share their ideas. Ask students to share their ideas to the class. Afterwards, introduce series and parallel circuits and explain how current flows in a closed circuit.

Introduce conductors and insulators: Show students a variety of materials (rubber band, pencil, paperclip etc.) and ask what materials they think are conductors or insulators. Explain the role of conductors and insulators in a circuit.

Application of new knowledge to the design challenge: Tell students that based on their new knowledge of how to build a circuit, they will determine what light-up accessory to design. Have students plan, try, test, and redesign.

Notes:

Preparing the pipe cleaners and LED and making the right wire connections are critical for a working prototype.

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Student Handout

Directions: Follow the steps to learn more about circuits and engineering design. With your group, complete the engineering design challenge.

STEP 1: DEFINE!

Directions: With your group, construct a response to each of the questions using information in the memo.

1. Who is the client?

2. What is the client's problem that needs a solution?

3. Who are the end-users?

STEP 2: LEARN!

You have a battery, bulb, and a wire. How do you light up a bulb with a battery and wire?

Sketch how you connect the battery, bulb, and wire below.

You have a battery, 2 bulbs, and 3 wires. How do you light the two bulbs? Draw your idea below.

STEP 3: PLAN!

Directions: You have learned about how electric current works, circuits, and circuit materials. It is time to design your light-up accessory! With your teammates, create plans for three different designs and pick one to build and test. Sketch your ideas below.

Design 1:

Design 2:

Design 3:

Which design did the team pick to move forward with? Explain the team's reasoning below.

STEP 4: TRY!

Collect the materials you need and build your design.

STEP 5: TEST!

After you build your light-up accessory, test it. When you connect the wires to the battery, does the LED light up?

STEP 6: DECIDE!

Does your design need any changes or improvements? If yes, explain what they are below.