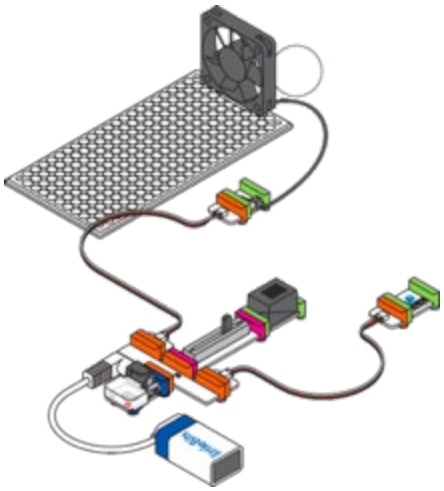
littleBits education

LESSON

Energy Transfer



Overview

In this lesson, students will:

- Investigate different forms of energy
- Build a circuit that demonstrates a change in energy and produces motion.
- Explain energy transfer in a circuit using scientific vocabulary

THE CHALLENGE

Design a littleBits circuit to demonstrate different forms of energy.

Lesson Tags

GRADE LEVEL:

Elementary (grade 3-4)

SUBJECTS:

Science, technology, engineering

DIFFICULTY:

Beginner

DURATION:

45 minutes

PREREQUISITE KNOWLEDGE:

- littleBits basics
- Basic understanding of changes in energy

Supplies

Bits:

- STEAM Student Set (power, slide dimmer, RGB LED, fork, buzzer, fan, 2 wires, battery and cable, and mounting board)
- Optional: tissue paper

Other Materials:

- 1.5 inch styrofoam or ping pong ball

Tools Used:

- Pen/pencil
- Paper

Description

LESSON OUTLINE:

INTRO: Introduce the lesson prompt and assess students' current knowledge.

CREATE: Groups of 2-3 students start to build their circuit.

PLAY: Students test their prototypes to make sure that it works and identify the forms of energy in the circuit.

REMIX: Consider how the circuit or energy transfers would change under given scenarios.

SHARE: Share out ideas.

ASSESSMENT STRATEGIES:

FORMATIVE ASSESSMENT: Circulate the classroom as students work, assessing their use of the Bits, teamwork, and any other relevant skills you wish to focus on. Depending on students' level of experience, you might look for students putting Bits together backwards (e.g. trying to force them together and not aligning the right sides and getting a magnetic snap), students not adding a power source etc.

SUMMATIVE ASSESSMENT: Students should complete the student handout. You may choose whether this is an individual or group submission.

Standards

NGSS

4-PS3-4 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

CPALMS

SC.3.P.10.1 Identify some basic forms of energy such as light, heat, sound, electrical, and mechanical.

SC.3.P.10.2 Recognize that energy has the ability to cause motion or create change.

SC.3.N.3.1 Recognize that words in science can have different or more specific meanings than their use in everyday language; for example, energy, cell, heat/cold, and evidence.

Vocabulary

Source	Kinetic Energy
Potential Energy	Electrical Energy

Resources

ATTACHMENTS

Energy Transfer: Student Handout

SUPPORTING LINKS

Exploring Kinetic and Potential Energy in Cleveland, Ohio's Indoor Theme Park

TIPS & TRICKS

#1:Keep an eye on the clock, and where students are at. Some students will want to spend too much time in the Create stage, and some students will try to speed through it.

#2: We occasionally update our Bits and accessories, so some of the names and images included in the student handout may look different from those in your STEAM Student Set. Use your Invention Guide from within your Kit to support students with the parts that they have accessible to them. Use a rubber band or glue dots if you don't have a battery clip in your Kit. The invention will function the same!

PACING (45 mins)

Prep + Setup

Intro (10 mins)

Create (10 mins)

Play (10 mins)

Remix (5 mins)

Share (5 mins)

Close (5 mins)

Instructional Steps

Step 1: SETUP

DURATION: 10 minutes (prior to class)

This lesson can be done individually or in small groups (2-3 students). Each group will need one STEAM Student Set and a lesson handout. Set up a central location in the classroom for assorted materials and tools. Each group will need a large amount of floor space to test their robots, preferably without carpet and free from obstacles. Consider making arrangements for students to complete this challenge in a hallway, gym, or similar space.

Each group will need a power, button, slide dimmer, 2 DC motors, 2 wires, battery and cable, battery clip, mechanical arm, 2 wheels, 2 magnet shoes and mounting board. If you don't have a battery clip in your kit, use tape, glue dots or elastic bands to secure the battery to the board. Younger students can start out with just these materials, so they aren't overwhelmed and don't try to add unnecessary Bits. Older/more confident students can have access to any Bits in their Kits.

NOTES

- You should use a classroom timer or digital timer to help keep students on track.

Step 2: INTRODUCE

DURATION: 10 minutes

Discussion

Elicit student responses to gauge understanding and warm-up for the activity.

1. Ask students to imagine a stretched rubber band. What do they think would happen if you let go? How do they know that it will travel? Explain using the terms potential energy and kinetic energy how that energy changes when your friend lets go of the ball.
2. **Writing Box #1**: Draw a picture of your friend holding a ball in their outstretched hand. What type of energy does the ball in the hand represent? How will that convert once your friend lets go? Explain, in your own words, what is kinetic energy and what ispotential energy.
3. Ask students to share their definitions of kinetic and potential energy.

Introduce the Challenge

Explain that they'll use littleBits and the littleBits Invention Cycle to create a circuit that demonstrates several different forms of energy, including electrical, light, sound and motion. The activity will be broken up into the following steps:

CREATE: Build your circuit following the directions given.

PLAY: Test your circuit to see how well it works and identify the forms of energy in the circuit.

REMIX: Consider how the circuit or energy transfers would change under given scenarios.

SHARE: Share out your ideas.

Divide the class into groups of 2-3 and have them set up their workstations.

Step 3: CREATE

DURATION: 10 minutes

Students will follow the instructions and diagrams in the student handout to build their circuits.

NOTES

- If students need a little extra help getting started, reference the Bit Index in their STEAM Student Set Invention Guide or the littleBits website to learn how specific Bits work.
- The Create phase may take more or less time, depending on the group and students' familiarity with littleBits. You may want to give students guidance on what they should do after assembling their circuit (e.g. move on to the Play phase to test their circuit), so they can self-pace.

Step 4: PLAY

DURATION: 10 minutes

Test your invention!

Power on your circuit. The fan Bit should spin; the slide dimmer can be used to control the volume of the buzzer; the RGB light should shine. Place the ball on the table in front of the fan better "see" the air that the fan is moving (optional: tape pieces of tissue paper to the middle of the fan).

Discussion

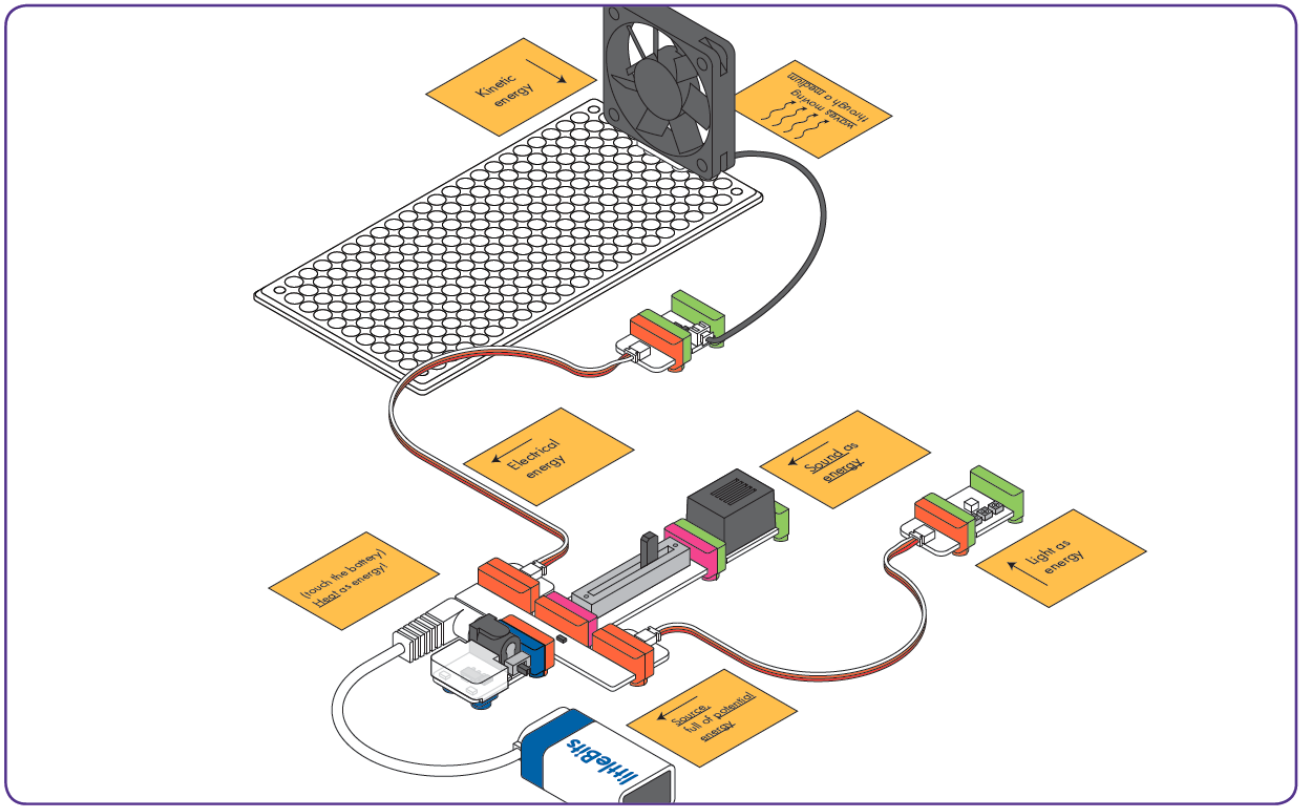
Ask students to offer suggestions of where they see different forms of energy in the circuit. Where do we see light as energy? Sound as energy? Motion as energy?

Ask students to turn off their circuit. All of the energy that we just experienced is now gone. What kind of energy remains? Students may answer that potential energy remains in the battery to start the circuit all over again!

Writing Box #2: Have students draw a model of their circuit, labeling it with the following vocabulary words: Source, Potential Energy, Electrical Energy, Energy as Heat, Energy as Light, Energy as Sound, Energy as Motion, Waves moving through a Medium.

Possible examples include (seesample diagram below):

- The battery is a source of potential energy
- The wire demonstrates electrical energy
- The fan demonstrates kinetic energy
- The fan creates waves moving through a medium (visualized by attaching tissue paper to the fan)
- The buzzer demonstrates sound as energy
- The RGB LED demonstrates light as energy



Step 5: REMIX

DURATION: 5 mins

Ask students to discuss in their groups, the following questions:

1. How could we design our circuit to produce waves in the medium of water instead of air?
    a. Possible solution: We could perhaps create something that stirred a cup of water!
2. What new Bits could you invent to harness the sun as a source of energy?
    a. Possible solution: We could design a solar panel Bit that converts sunlight into energy instead of using a battery!
3. Imagine that we had a 'Stove Bit' that, when attached to the power Bit, became very hot and could even cook a pancake! What kind of energy transfer would be working here?
    a. Answer: This is conduction, which is heat energy transfer between substances that are touching!

Step 6: SHARE

DURATION: 5 mins

Call on groups to share out ideas from their discussion.

Step 7: CLOSE

DURATION: 5 mins

Students should take apart their inventions and put away the Bits according to the diagram on theback of the Invention Guide. Students should clean up their workspace and return any usable materials/tools.

Step 8: EXTENSIONS

Consider the following invention or discussion prompts:

- Have students design a solution to the question above: "How could we design our circuit to produce waves in the medium of water instead of air?" Be sure to remind students of best practices for handling Bits around water!
- How could we generate more kinetic energy from this circuit? Students might discover that they can use the DC motor and/or servo to "hit" an object, like a small bat, to begin motion. This ball could fall off the table, demonstrating kinetic energy from gravitational potential energy.
- How could our circuit exhibit an example of gravitational energy? Students may suggest that the circuit could have some motion, such as the DC motor or the servo, that would knock something off the table.