

Circuit Builders

Using **circuitry tools** to explore **Energy and Electricity**



Grade: 4th

Subject(s): Science

of students per group: 3-4

Time: 5 class periods

CHIEF LEARNING STANDARDS ADDRESSED

- 4-PS3-2 Energy. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
- 4-PS3-4 Energy. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
- CC.4.W.2.d Text Types and Purposes: Use precise language and domain-specific vocabulary to inform about or explain the topic.

LEARNING TARGETS

- I can observe energy transfer that results in heat, light, sound, and or motion.
- I can design an electric circuit that converts energy from one form to another.
- I can use scientific vocabulary to label and explain my circuit in my journal.
- I can create an audio/visual presentation to share my work with the class.
- I can identify an open and closed circuit.
- I can problem solve when something isn't working.

OVERVIEW

Essential Question: How do scientists build something to understand the world?

- **BEFORE MAKING** Students develop an operational understanding of circuits by completing Foss Energy and Electromagnetism Investigation 1 and 2.
- **DURING MAKING** Students create an electric circuit and keep a journal of their design process along the way.
- **AFTER MAKING** Making is the final step in the learning process.

EXAMPLE

- **Copper Circuit Lava Lamp**
 - [Journal](#)
 - [Final Reflection](#)
- **The Scribble Machine**
 - [Journal](#)
 - [Final Reflection](#)

MATERIALS

CONSUMABLE FOR PAPER CIRCUITS

Copper Tape
Surface mount LEDs
Coin Cell Batteries
Paper

CONSUMABLE FOR SCRIBBLE MACHINE

Small Plastic Containers
Styrofoam Cups
Markers
Tape

EQUIPMENT / TOOLS

D-cell Batteries (Foss)
Wires (Foss)
Motors (Foss)
Lightbulbs (Foss)
iPads (One per group)

Optional:

Makey Makey
Snap Circuits
Conductive Ink Set

VOCABULARY

Circuit
Conductor
Insulator
Electric Current
Contact Points
Energy
Transfer
Series Circuit
Parallel Circuit

WHY MAKING?

By building to learn, students will be able to experiment with their circuit using a variety of materials, redefine their circuit as they think of new ideas, and increase complexity of their circuit during the process.



LEARNING SEQUENCE

BEFORE MAKING

How are students building background knowledge to prepare for making?

CONTENT LESSONS / UNIT PLAN SEQUENCE

Foss Energy and Electromagnetism Investigation 1 and 2 will be completed first.

SELF REFLECTION

Pass out the [self reflection form](#) for each student. Have them fill it out before the making begins.

VOCAB BUILDING

Students build their vocabulary by drawing and labeling their circuits for Investigation 1 and 2. When answering the focus questions after each investigation, students use scientific vocabulary to explain.

JOURNALING

Students write their first journal entry brainstorming ideas they want to create. Students are encouraged to draw a picture of their design.

TEACHER/STUDENT CONFERENCE

Teacher meets with each group, listening to their ideas and asking questions before they get started.

DURING MAKING

How are students recording and processing what they learn?

Lesson Sequence

JOURNALING

Students take a photo every time they hear a bell (set at specific or random intervals). Later, students journal about what was happening in that moment- the successes & challenges using scientific vocabulary. Students can print their photos and glue them into their journal to enhance their writing. They can also create a journal on Adobe Spark Pages - [online website](#) or [iPad app](#).

**note- students under 13 can not sign on with their Google account, or any account they create. Teachers must create a class account and share the login information with students.*

Examples: [Student Journal #1 - Lava Lamp Copper Circuit](#) & [Student Journal #2 - The Scribble Machine](#)

WHOLE GROUP / SMALL GROUP DISCUSSION

Circuits are built at communal table that allows for students to see and hear what others are working on. Solutions to similar problems are shared from one builder to the next.

SELF REFLECTION

Pass out the self reflection form for each student. Have them fill it out during the making process and have them add skills they are able to do that may not be on the list.

TEACHER/STUDENT CONFERENCE

Teacher walks around the room asking questions and observing and assessing student progress.

CLASS MANAGEMENT TECHNIQUES

Plan for at least one volunteer or teacher to help in the classroom.



AFTER MAKING

How are students synthesizing and analyzing their learning? How are students being assessed on the learning target(s)? How will you and they measure what they know?

SELF REFLECTION

[Student Reflection- Lava Lamp Copper Circuit](#)

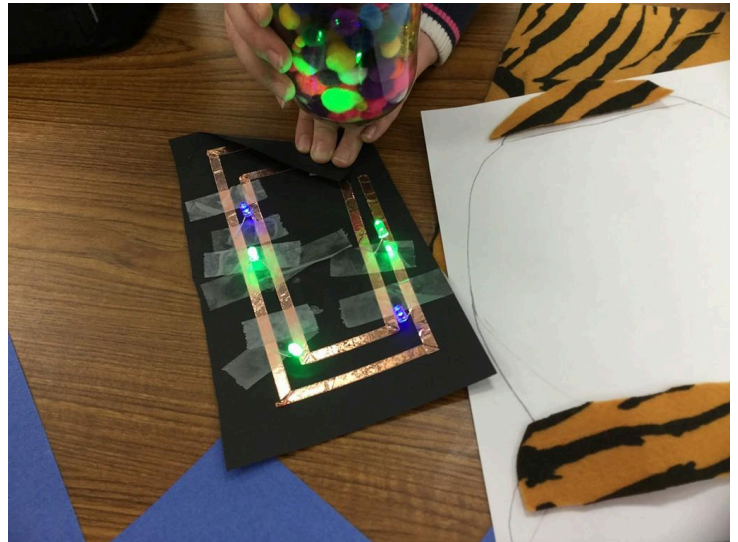
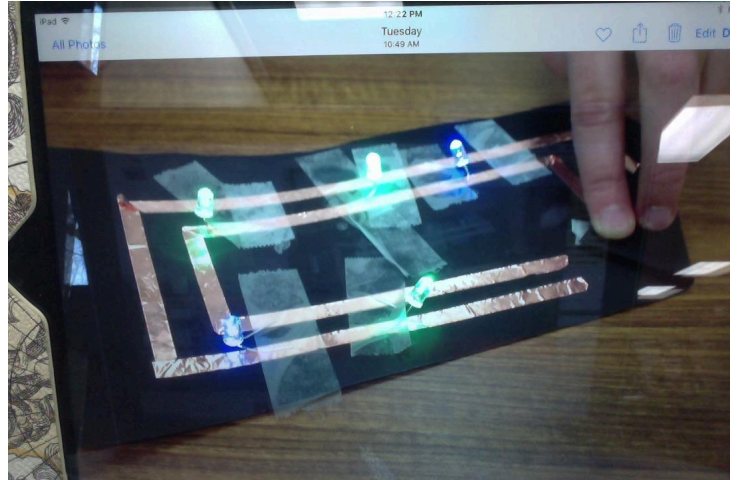
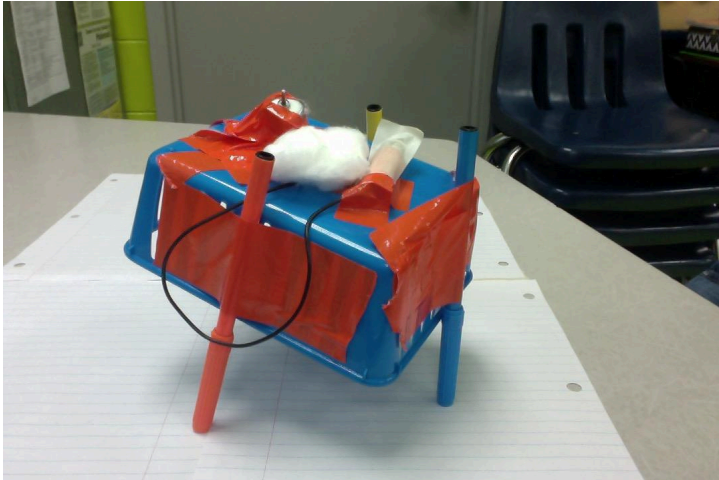
[Student Reflection- The Scribble Machine](#)

Pass out the self reflection form for each student. Have students add any additional skills they noticed in their learning. Students will also complete a self reflection form below.

[Form Example](#)

STUDENT CELEBRATION

Photos:



ASSESSMENT RUBRIC

I Can....

1. Observe energy transfer that results in heat, light, sound, and or motion.
2. Design an electric circuit that converts energy from one form to another
3. Use scientific vocabulary to label and explain my circuit in my journal.
4. Engage effectively in a range of collaborative discussions in order to complete tasks.

Name: _____

Date: _____




	4	3	2	1
Circuit Design	Students complete the 4th Grade Checklist and can complete a more complex project.	Students can complete the 4th Grade Student Checklist.	Students attempt to complete the 4th Grade Student Checklist.	Students cannot complete the 4th Grade Student Checklist.
Scientific Vocabulary	Students understand all 4th Grade Scientific Vocabulary and label drawings correctly. Students were able to complete more complex projects, learning new vocabulary words.	Students understand most 4th Grade Scientific Vocabulary and label drawings correctly.	Students understand some 4th Grade Scientific Vocabulary and label drawings correctly.	Students understand some 4th Grade Scientific Vocabulary and label drawings incorrectly.
Audio/Visual Journal Adobe Video, Adobe Pages, Journals, or Google Sites	Audio/Visual displays are focused and presents clearly. The steps taken in the making process are clear and shown through video clips, images, and or audio.	Audio/Visual displays, in presentation presents the steps taken in the making process through video clips, images, and or audio.	Audio/Visual displays are created, but may not clearly explain your steps in the making process.	Audio recordings and visual displays are present, but do not explain your steps in the making process.
Collaboration	Engages the entire time and able to problem solve and work well with others collaboratively in discussion without teacher direction.	Engages effectively in a range of collaborative discussions in order to complete tasks.	Engages effectively in a range of collaborative discussions some of the time and may need a couple reminders in order to complete tasks.	Reminders are needed and may not be collaborating effectively in a range of discussions in order to complete tasks.

4th Grade Checklist (made by class) _____ I can complete a circuit using a D-cell, wires, and a bulb. _____ I can complete a circuit that makes a motor run. _____ I can create a simple circuit. _____ I can use conductors to complete a circuit. _____ I understand the difference between a conductor and an insulator. _____ I can observe and explain energy transfer. _____ I can set a goal and problem solve to work through challenges.	4th Grade Vocabulary Circuit Conductor Energy source Electric current Electricity Insulator Series Parallel
Other Scientists _____ I can make a complex circuit using advanced components. _____ I can use additional science vocabulary. _____ I can make an object move using a motor. _____ I can create using makey makey. _____ I can add extra components such a switch to my circuit. _____ Add your own _____ Add your own	Other Scientists <i>(Add your own vocabulary)</i> 1. 2. 3.



Energy and Electricity

STUDENT SELF - REFLECTION

	Working on It  I need some help from an adult	Getting It  I need some extra practice/focus.	Got it  I'm ready for a bigger challenge.
I can observe energy transfer that results in heat, light, sound, and or motion.			
I can design an electric circuit that converts energy from one form to another.			
I can use scientific vocabulary to label and explain my circuit in my journal.			
I can create an audio/visual presentation to share my work with the class.			
I can identify an open and closed circuit.			
I can problem solve when something isn't working.			

What other learning do you think is happening while you work? Give some specific moments when you realize you were learning things by building that would be difficult or impossible without building for yourself.

