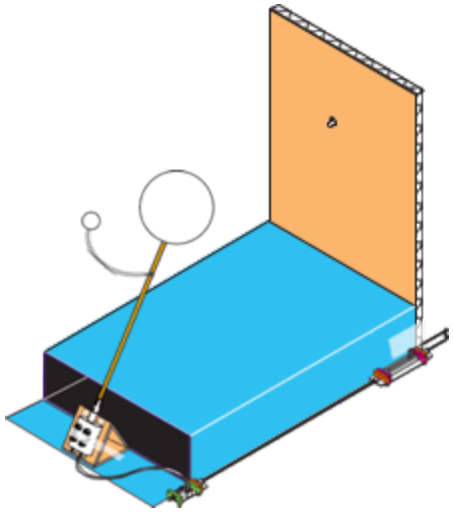
littleBits education

LESSON

Lunar Phases



Overview

In this lesson, students will:

- Model the phases of the moon to demonstrate waxing gibbous, full moon, and waning crescent.
- Explore the relationship between the rotation and position of the sun, Earth, and moon.

THE CHALLENGE

Create a theater to model the sun-moon-Earth relationship.

Lesson Tags

GRADE LEVEL:

Elementary (grade 5)

SUBJECTS:

Science, technology, engineering, art

DIFFICULTY:

Intermediate

DURATION:

60 minutes

PREREQUISITE KNOWLEDGE:

- littleBits basics
- Basic understanding of the phases of the moon

Supplies

Bits:

- STEAM Student Set (power, slide dimmer, DC motor, long LED, 2 wires, battery and cable and motor mate)

Tools Used:

- Pen/pencil
- Scissors
- Tape
- Ruler

Other Materials:

- Styrofoam balls (1” and 3” diameter)
- Wooden skewer
- Twist tie (included in your Kit)
- Cardboard cut to the size of a cereal box
- Cereal box (can ask students to bring in from home)
- Optional: Colored paper or paint

Description

LESSON OUTLINE:

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

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

PLAY: Students test their prototypes to make sure that it works, then apply their models.

REMIX: Use the model to explore what the moon will look like tonight.

SHARE: Discuss the pros and cons of using models.

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

5-ESS1-2 Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

Vocabulary

Waxing	Lunar
Waning	Eclipse

Resources

ATTACHMENTS

Lunar Phases Student Handout

SUPPORTING LINKS

Lunar phase infographic

Moon phases demonstration video

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 (60 mins)

Prep + Setup

Intro (5 mins)

Create (25 mins)

Play (10 mins)

Remix (10 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. Save time by pre-cutting the cardboard into the size of a cereal box.

Each group will need a power Bit, slide dimmer, DC motor, long LED, 2 wires, battery and cable and motor mate. 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.

For the demo in the introduction, fill a pitcher or large bowl with water and place it next to a dry sponge at the front of the class.

NOTES

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

Step 2: INTRODUCE

DURATION: 5 minutes

Discussion

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

1. Ask students to review why the moon appears to be full or a crescent at certain times. What kinds of patterns does the moon follow? Guide students to a discussion about the cycle of a month and how the moon's patterns established the idea of "months."
2. Ask students to describe the relationship between the sun and the moon during the month. Does everyone on Earth see the same moon? How could we design a model to show the cycle of moon?

Introduce the Challenge

Explain that they'll use littleBits and the littleBits Invention Cycle to create a theater to model the sun-Earth-moon relationship. The activity will be broken up into the following steps:

CREATE: Build your model following the directions given.

PLAY: Test your circuit to see how well it works, then apply your models.

REMIX: Use the model to explore what the moon will look like tonight.

SHARE: Discuss the pros and cons of using models.

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

Step 3: CREATE

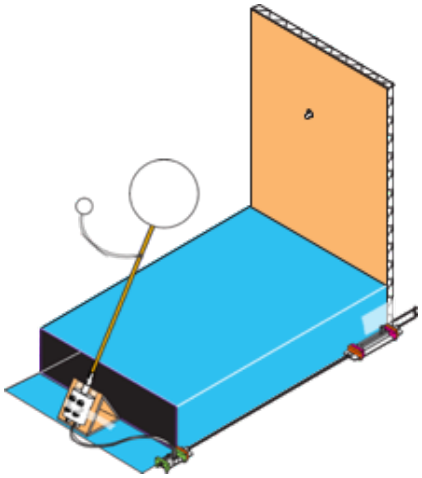
DURATION: 25 minutes

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

Once students have reached step #18, bring the class together and ask: " In front of you, you have an LED Bit, a smaller ball, and a larger ball. What do you think each material represents? Based on what you know about the position of the sun, Earth, and moon, where do you think each item should be placed?" Have students record their answers in **Writing Box #1** in their handouts before completing the build.

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 up your circuit and explore the phases of the moon! Turn off the lights or travel to a darker location to view the full effect. Use your slide dimmer to control how fast or slow the moon revolves around the earth.

Ask students, “How can we demonstrate the slowness of which the moon orbits the Earth?” Students can use the slide dimmer to speed up and slow down the rotation.

Writing Box #2: Challenge students to use their lunar model to demonstrate an eclipse. What happens during a lunar eclipse? What about a solar eclipse? Draw a diagram of both.

Step 5: REMIX

DURATION: 10 mins

Writing Box #3: Ask students to draw what the moon will look like tonight.

Give students the moon’s position with relationship to the Earth and sun, either by drawing an aerial view on the board or using a group’s model to manipulate. After adjusting their models to the correct position, ask them to draw their prediction of the moon’s appearance tonight. If needed, use Moongiant for a quick teacher-only reference of tonight’s moon.

Step 6: SHARE

DURATION: 5 mins

Writing Box #4: Ask students, “In what way is our model imperfect?”

Answers include: the proportions in size and distance between the sun, Earth, and moon are incorrect; the speed of rotation is inaccurate; the moon’s rotation and the Earth’s rotation aren’t thesame speed as with our model; the tilt of the axes isn’t exact; the sun provides more light; the moon is more reflective than the model shows.

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:

- How might we use the Bits to engineer a star system that gets brighter as the Sun goes down? The students will discover that the light sensor Bit and inverter can power the circuit when it detects darkness!
- Have students decorate their model to more accurately represent the Earth, moon, and sun.
- How would our model change if we lived on Jupiter? Allow students to build a model of another planet!