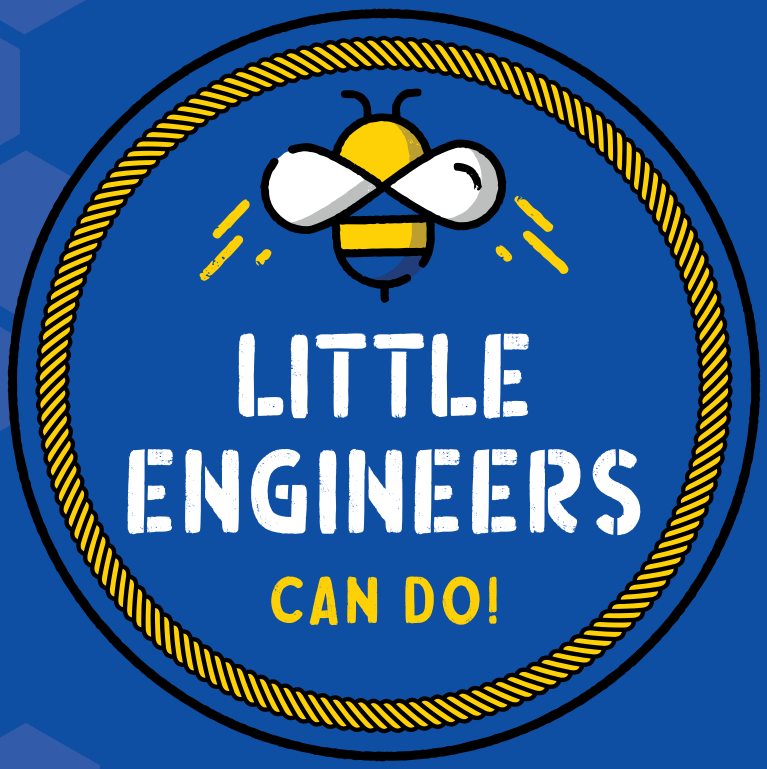

LITTLE
ENGINEERS
CAN DO!

LESSON PLANS, READINGS & ACTIVITIES

EARTH SCIENCE

EARTH SCIENCE

SUNDIALS

GRADE LEVEL: 1 | TIME REQUIREMENT: 1-2 HOURS

INTRODUCTION

The motions and patterns of the sun and the moon in the sky and the changing of shadows through the day and across the seasons are some of the first things young student scientists notice. Throughout elementary school, students will use their science practices to investigate and make sense of these patterns.

OBJECTIVE

In this lesson, students will use simple tools to notice the patterns of shadows that indicate the motion of the sun and will evaluate the regularity of this pattern. The motion of the sun, the patterns between the length of shadows, and the angles between objects are phenomena students should understand. In this engineering design project, they will apply their knowledge.

STANDARDS

NGSS DCI ESS1 A&B
The universe and its stars; Earth and the solar system.

NGSS SEP
Analyzing and interpreting data

NGSS CCC
Patterns.

CCSS W.1.7
Participating in shared research and writing projects.

CCSS MP.4
Modeling with mathematics.

PERFORMANCE EXPECTATIONS

1-ESS1-1
Using observations of the sun, moon, and stars to describe patterns that can be predicted.

HOW TO USE THIS RESOURCE

After reading the story about a real World War II situation with students and discussing it with them to ensure their understanding, lead them through an investigation of the patterns of shadows made by the movement of the sun throughout the day.

Materials (to be done as a whole class)

- Meter stick or other straight measuring stick of about the same size
- Eight stones (to mark shadow points) with the numbers 1, 2, 3, 8, 9, 10, 11, and 12 written on them in paint, chalk or marker
- Data table to record results

Instructions

1. Find a consistently sunny spot in the school yard, and bury the end of the meter stick so that the stick points straight up. You might need a small spade or trowel to help dig a hole to keep the measuring stick in place.

2. Place a stone at the spot where you see the tip of the stick's shadow. Check the time and use that stone with the number that corresponds to the appropriate hour.

3. Come back throughout the day, and the next day if necessary, to place the appropriate stone for the other hours until you have all 12 hours accounted for. Be sure to carefully place each stone right at the tip of the stick's shadow.

4. Check the shadows over the next few days or weeks. Ask your students, Are the shadows of the stick in the same place every day? Do you think the shadows will be in the same place forever or will they change throughout the year?

Further Discovery

If you have time, you could keep checking the pattern of the shadows throughout the year. You could also make a more permanent sundial, or alternately you could make smaller, more portable sundials using paper plates and a pencil or similar stick in place of the measuring stick.

To discuss with students

HOW DID PEOPLE TELL TIME BEFORE THERE WERE CLOCKS?

Have you noticed how the sun moves through the sky during the day? Is it always in the same position in the sky? Is there a pattern to how it moves? Have you looked and the shadows of trees and buildings in the morning, at noon, and in the evening? Is there a pattern to how long they are?

ADDITIONAL RESOURCES

To accompany this lesson, try these books:

+ *The Magic School Bus Lost in the Solar System*, by Joanna Cole
+ *The Next Time You See a Sunset*, by Emily Morgan

READING
SUNDIALS

In December 1941, Ned Nye was on Wake Island, a small island in the middle of the Pacific Ocean. Although Ned was not in the military, he worked for the Navy at a base there. Beginning December 8, 1941, Japanese forces began bombing and trying to take over Wake Island. Ned Nye and the other civilians on the island were quickly asked to join the Navy. Ned fought with the others on the island against the Japanese. On December 23, 1941, even though Ned and his friends fought hard and bravely, the Japanese captured the island. Ned Nye and the other survivors were taken prisoner and sent away to camps in China. Ned spent the war in very bad conditions at a camp near Shanghai, China.

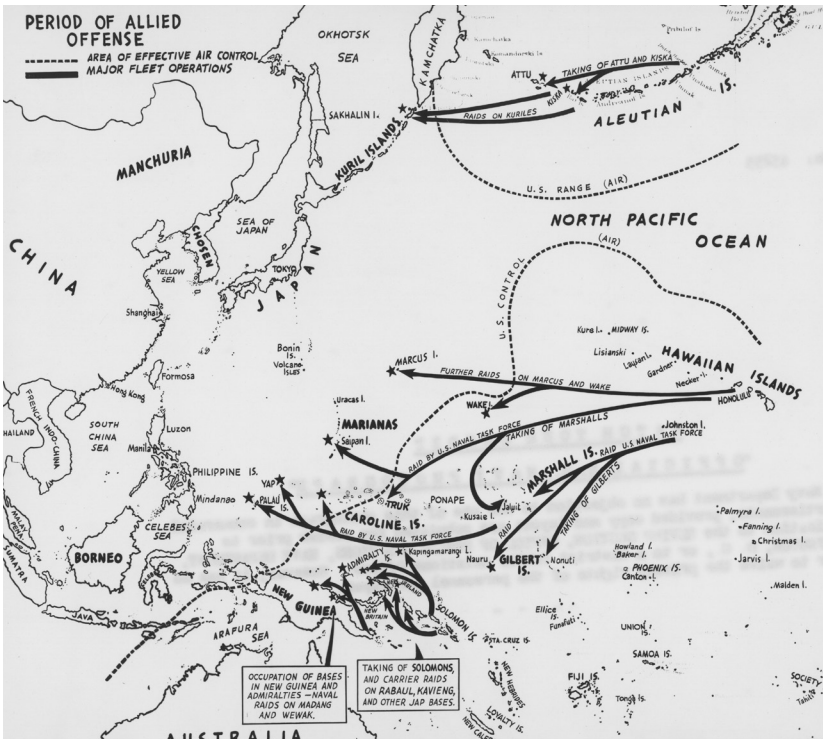
Ned Nye had a love for tinkering and for science. Using sticks and stones, Ned built sundials outside the building where he slept. With the sundials, he could tell the time of day and could figure out where he was in the world. Also, with the sundials, Ned could follow the seasons.

When World War II ended in August 1945, Ned Nye and the other prisoners were freed, and Ned was sent home to Baltimore, Maryland. In December 1945, he married Jacqueline Jenkins, whom he had known from before the war. Jacqueline had spent the war as a code breaker for the Navy. In 1955, the couple had a son, William Nye. William grew up influenced by his parents' love of math and science and became an engineer. William is better known today as "Bill Nye the Science Guy." Ned Nye died in 1997 and is buried in Arlington National Cemetery. His son William's interest in sundials continued through the years and even resulted in a sundial that was used on a mission to explore Mars.

A Coast Guardsman finding his ship's position with a sextant, which uses the position of the sun to navigate.
(Image: The National WWII Museum, 2015.063.091.)

NAME: **DATE:**

Ned Nye was able to use his knowledge of science in order to create a way to keep track of time while a prisoner during World War II. Using found objects in nature, Ned assembled a sundial to help him tell time and navigate the seasons. Try your hand at creating and using a sundial to see if you can track the time of the day and seasons like Ned Nye did!



Official U. S. Navy Map of Western Pacific, and troop travels.
(Image: The National WWII Museum, 2011.102.437.)

Your teacher will give you materials and directions. You will investigate the patterns of shadows the sun makes over a day.

Follow the instructions. Be careful with the materials. Before you make observations, say or write down what you think will happen. Draw pictures of what you see. After the activity, decide if your predictions were correct or incorrect. Discuss with your classmates what is happening and try to explain it out loud or written down.

EARTH SCIENCE

CONSTELLATION LANTERN

GRADE LEVEL: 1 | TIME REQUIREMENT: 1-2 HOURS

INTRODUCTION

Students are naturally curious about the stars and planets that can be seen in the night sky. These observations of night-time objects in the sky can help them understand the relative place of Earth in the solar system and the universe.

OBJECTIVE

In this activity, students will learn to identify constellations and make themselves a night light that imitates the night sky. Students will learn about how sextants were used for navigation during World War II and will then make models of constellations from the night sky. This activity will engage them in modeling and in noticing the patterns in nature.

STANDARDS

NGSS DCI ESS1 A&B
The universe and its stars; Earth and the solar system.

NGSS SEP
Constructing explanations (for science) and designing solutions (for engineering).

NGSS CCC
Patterns.

CCSS W.1.7
Participating in shared research and writing projects (for example, exploring a number of "how-to" books on a given topic and using them to write a sequence of instructions).

CCSS SL.1.1
Participating in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.

PERFORMANCE EXPECTATIONS

1-ESS1-1
Using observations of the sun, moon, and stars to describe patterns that can be predicted.

HOW TO USE THIS RESOURCE

After reading the story about a real WWII situation with students and discussing it with them to ensure their understanding, lead them through observations of the patterns of the stars in the sky.

A trip to a planetarium would be a really cool experience to plan along with this lesson. There are also many computer simulations and apps that can show the night sky and the movement of constellations as well.

Materials (per group or station)

- Glass or plastic jar, labels removed
- Electric tea light or headlamp
- Cardboard
- Tin Foil
- Toothpick or sharp pencil
- Constellation Guide (see additional materials)

Instructions

1. Cut a piece of tin foil that can wrap around the inside of your glass jar. You want a piece that will cover the glass completely so that very little extra light comes through.

2. Lay the tin foil flat on the table on top of a piece of cardboard.

3. See your constellation guide and choose 3-5 constellations you would like to copy onto your tin foil. Lay your constellation guide on top of your tin foil.

4. Using your sharp pencil or toothpick, make the holes in your tinfoil following along with your constellation guide. Try to keep your constellations away from the top or bottom of the tin foil so that they'll be easier to see.

5. Once you've added the constellations to your tinfoil, carefully roll up your tin foil and slide it into the jar. Put your hand into the jar and gently press the tin foil against the glass so the tin foil is as smooth as it can be.

6. Turn on your light source and carefully place it on the bottom of the jar then seal the lid.

7. Turn off the lights and enjoy your constellation lantern! Ask your students, can you identify the constellations you chose?

ADDITIONAL RESOURCES

To accompany this lesson, try these books:

+ *A Child's Introduction to the Night Sky (Revised and Updated): The Story of the Stars, Planets, and Constellations—and How You Can Find Them in the Sky,* by Michael Driscoll

+ *Find the Constellations*, by H. A. Rey.

  This is a charming older book. Rey and his wife were refugees from Germany during World War II before making the Curious George books.

READING

CONSTELLATION LANTERN

People have been watching the stars in the night sky for as long as there have been humans on Earth. There are thousands of stories and myths about the stars, about their locations and about their movements. Long ago, people noticed that they could use the stars to navigate or to find out in which direction they were going. Using stars for navigation was still important even during World War II. From smaller boats to large aircraft carriers, tools called sextants were used to find ways across the open waters of the ocean. A sextant measures the angles to and between different stars to find out exactly where you are on Earth.

Centuries of work went into making sextants and into observing stars and their patterns in the sky. At Harvard University before World War II, a team of women made important observations and discoveries about the stars. The scientists that ran the observatory there trained a group of women to take pictures of the night sky and to take notes on every detail of what they saw in their pictures. These women weren't paid as well as the men who were doing the same job and also weren't given official positions at Harvard, but their bosses gave them credit for their hard work and discoveries.

One of the first women to do this work was named Williamina Fleming. Williamina worked as a maid to the director of the observatory. When her boss noticed how careful and smart Williamina was, he taught her to take photographs using powerful telescopes. Starting in 1879, she classified more than 10,000 stars and discovered ten new stars. She even discovered other objects in space, like the Horsehead Nebula. Williamina also identified 300 stars as "variable," which means the light that they produce changes over short periods of time.

Another woman working at the observatory was named Cecelia Payne. She was a student at Harvard and became the first person to graduate with a PhD in astronomy. Using the kinds of light that came from the sun and other stars, she discovered that stars were made of mostly two gases called hydrogen and helium. Cecelia also discovered how to find out the temperature of different stars. Her ideas were not popular at first because they were very different from older ideas. Later, astronomers found out that Cecelia had been right all along.

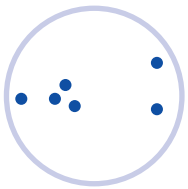
When you look up at the stars, think about all the information that light carries. The light that you see from stars has traveled many billions of miles to reach us. The light that you see in the sky today is actually the same light that the stars have been making for millions and millions of years.

NAME: **DATE:**

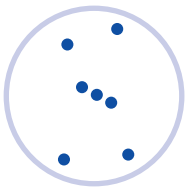
During World War II, navigators on aircraft and ships could use the constellations and their sextants so that they could stay on course and not get lost. Can you name and find some constellations in the sky? Let's try your hand as a navigator!

Your teacher will give you materials and directions. You will make a model of the night sky so that you can identify constellations and observe the patterns in the stars.

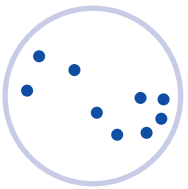
Follow the instructions. Be careful with the materials. Before you make observations, say or write down what you think will happen. Draw pictures of what you see. After the activity, decide if your predictions were correct or incorrect. Discuss with your classmates what is happening and try to explain it out loud or written down. When you are done, you will be ready to watch the sky and make observations like Williamina and Cecelia.



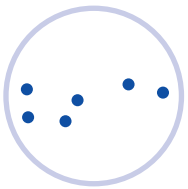
TAURUS
The Bull



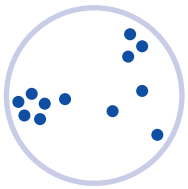
ORION
The Hunter



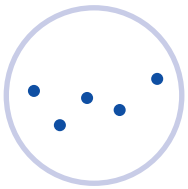
SCORPIUS
The Scorpion



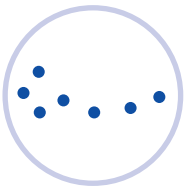
URSA MAJOR
The Great Bear



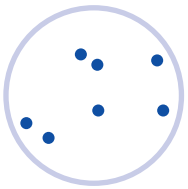
PISCES
The Fishes



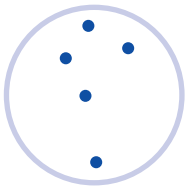
CASSIOPEIA
The Queen



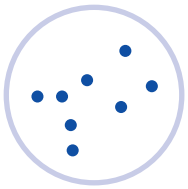
URSA MINOR
The Little Bear



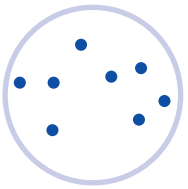
PEGASUS
The Flying Horse



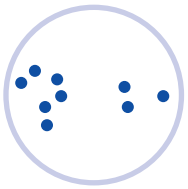
BOOTES
The Herdsman



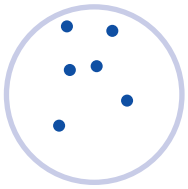
GEMINI
The Twins



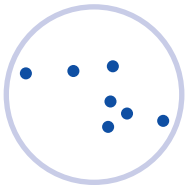
SAGITTARIUS
The Archer



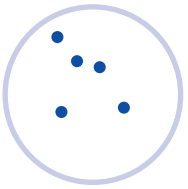
LEO
The Lion



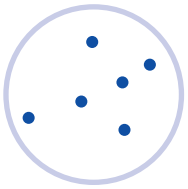
HERCULES



CANIS MAJOR
The Big Dog



PERSEUS



CYGNUS
The Swan