Ancient Sun Observations

How did ancient civilizations study the Sun?

Description

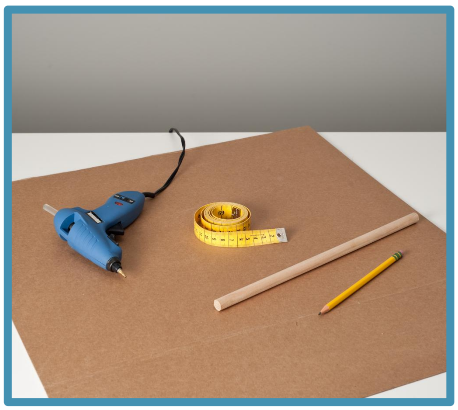
Make your own Sun tracker to explore how ancient civilizations around the world studied the Sun. You'll need a bright sunny day.

Age Level: 7 and up

Materials

- Cardboard square, roughly 60 cm x 60 cm
- Wooden stick, roughly 25-30 cm long and 6-12 mm in diameter
- Hot glue
- Pencil
- Tape measure (optional)

Don't have a wooden stick? Just use a wooden pencil.



Time

Preparation: 15 minutes
Activity: 20 minutes + data collection
Cleanup: 5 minutes

Safety

Never look directly at the Sun!

Step 1

Glue the wooden stick near the center of an edge of the cardboard square, so that the stick stands upright. If necessary, you can also poke a hole in the cardboard and glue the stick in the hole.

Step 2

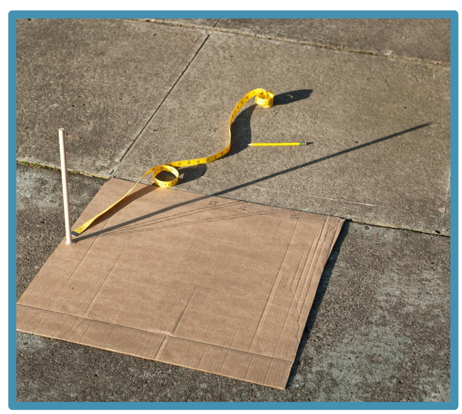
Place the cardboard square on a flat surface in the Sun. Mark the point on the cardboard where the tip of the stick’s shadow falls, and write the time and date. Orient the board in the same direction each time you lay it on the ground to record the position of the shadow. (Take a picture so you can position it the same way every time.)

Tip

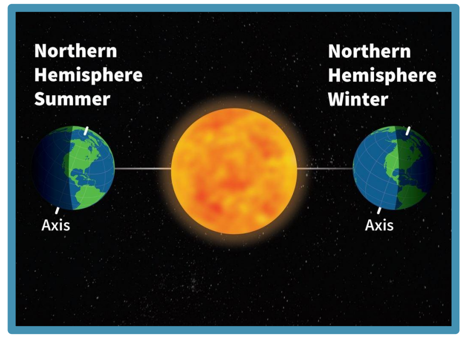
If the shadow extends beyond the cardboard, mark the edge of the cardboard where the shadow falls. Measure the entire shadow's length with a tape measure, and record the length.

Step 3

Repeat these observations daily or weekly at the exact same time each day. Does the Sun’s position stay constant in the sky over days or weeks?

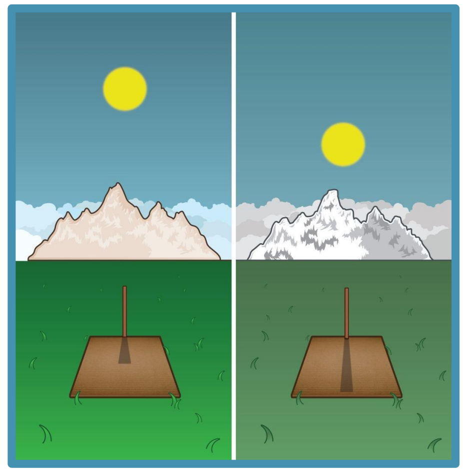


What's Going On?



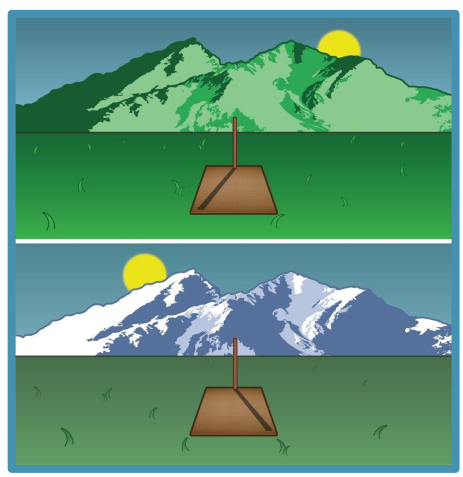
Why does the Sun's path in the sky appear to change over the course of a year? Earth spins on its axis once every 24 hours, and orbits around the Sun once every year. Earth's spin axis is tilted by 23.5 degrees relative to its path around the Sun. This tilt causes the Sun's position in the sky to change, from our perspective, over the course of a year. Depending on where Earth is in its orbit around the Sun, Earth's northern and southern hemispheres can either be pointed toward or away from the Sun.

Long and short shadows



As a result, the Sun's location in the sky appears in a different place in the sky over the course of a year. Therefore, the lengths of the shadows you measured change from day to day and month to month with a cycle of one year. In the northern hemisphere, the Sun appears much higher in the sky at noon in summer because the north end of Earth's axis is pointing toward the Sun.

Sunsets in different places



The Sun's position next to the horizon where it rises and sets also changes over the course of the year. In the northern hemisphere, the Sun will set more north in the summer and in the winter, the Sun sets more toward the south.

Many ancient cultures built elaborate structures to track the Sun's movement, and studied the Sun's movement over the course of a day to track time, and over the course of a year to track seasons.

The following show a few examples of the structures these ancient civilizations built.

Temple of the Sun

Machu Picchu, Peru
Date built: 15th century

The curved portion of this building in Peru may have served as a solar observatory. A rock inside the temple could have been used as an altar. During the summer solstice, the rising Sun shines directly into one of the temple's eastern windows and the Sun's rays fall upon the rock.

Stonehenge

Wiltshire, England
Date built: 3000-2000 BCE

This circular arrangement of huge, standing rocks in England may have been aligned with important solar events like midsummer sunrises and solstices. In particular, the summer solstice Sun rises over one particular rock, called the Heelstone, and the Sun's light strikes another stone called the Altar Stone.

Sun Dagger

Chaco Canyon, New Mexico, USA
Date built: 500-1300 AD

At an outcropping of rock in New Mexico, a Native American cultural group called the Anasazi people carved "petroglyphs" (stone carvings) into sandstone. Two spiral petroglyphs are found at the Sun Dagger, one large and one small. On the summer solstice, a single sliver of sunlight—the "Sun Dagger"—is projected near the top of the larger spiral and "slices" its way down through the very center of the spiral, visually cutting it in half before leaving it in shadow once again. On the winter solstice, two daggers of sunlight appear and frame the large spiral.

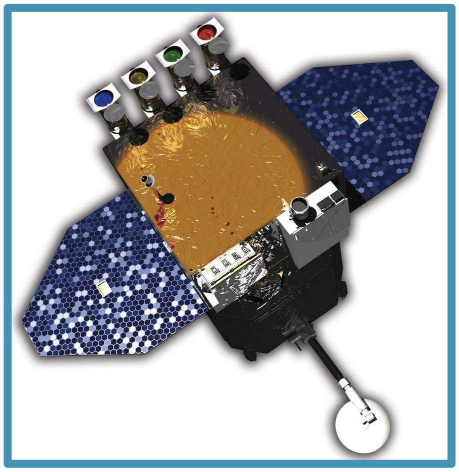
Chichén Itzá

Yucatan, Mexico
Occupied by the Maya from 600-1200 AD

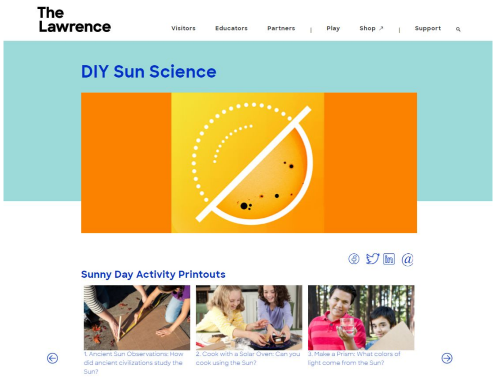
The Mayan people built the city of Chichén Itzá in Mexico, including a pyramid called El Castillo ("the castle"). As the equinox Sun sets, a play of light and shadow creates the appearance of a snake that gradually moves down the pyramid's stairway. This snake is composed of approximately seven triangular shadows, cast by the angles of the pyramid's walls. The image may represent the Mayan snake deity K'uk'ulkan, the feathered serpent.

Studying the Sun Today

Today, scientists study the Sun using solar telescopes on mountains, on satellites or on probes in space. NASA supports many of the space-based solar telescopes. The Solar Dynamics Observatory and the Interstellar Boundary Explorer are uncovering mysteries of the Sun's physics, from its fairly steady output of visible light to its dynamic, ever-changing storms of electrically-charged particles that get thrown into space and can affect Earth-based technology.



Learn More



For more info and other activities, visit:

LawrenceHallofScience.org/do_science_now/diy_sun_science

Credits

Partner

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The DIY Sun Science app allows families and educators to investigate and learn about the Sun at home, at school, or anywhere you go! The app provides thirteen hands-on investigations, images, and videos.

Activity inspired by “Where is the Sun?” Space Science Lab, University of California, Berkeley. Slide 9, Fabricio Guzmán. Slide 10, Kristian H. Resset. Slide 11, David Cortner. Slide 12 CyArk and Partners 2013. Slide 13, NASA/Goddard.