



Solar Lesson: What Time is it?

Lesson: Human Gnomon Lesson- What Time Is It?

Grades: 1-2

Subjects: Science, Math

Time: 40-50 minutes divided into short observation sessions throughout the day

***Standards:** Students will...



Science Standard 3: Understand the composition and structure of the universe and Earth's place in it.

Benchmark # 1: Know the basic patterns on the Sun (e.g., the Sun's position in the sky changes throughout the day and the seasons).

Science Standard 9: Understand the sources and properties of energy.

Benchmark # 1: Know that the Sun supplies heat and light to the Earth.

Benchmark # 5: Know that light travels in a straight line until it strikes an object.



Science Standard 12: Understand the nature of scientific inquiry.

Benchmark # 1: Know learning can come from careful observation and simple experiments.

Benchmark # 2: Know that tools (e.g., rulers) can be used to gather information and extend the senses.

Mathematics Standard 4: Understand and apply the basic and advanced properties of the concepts of measurement.

Benchmark # 1: Understand the basic measure of length.

Benchmark #2: Understand the concept of time and how it is measured

Benchmark # 3: Know the process for measuring length and for telling time using basic standard and non-standard units.

Objectives: Students will be able to...

- Identify natural phenomena that demonstrate repeating patterns (seasons, day and night).
- Identify and explain why the Sun's position changes (in relation to a fixed object) throughout the day.
- Recognize that tools (rulers,...) have specific functions (to assist in measuring, ...) to makes tasks easier.
- Demonstrate how shadows change using grade appropriate tools (shadow stick, sundial,...)

Materials:

- Sidewalk Chalk
- Measuring utensil
- Writing utensil
- Included table for data recording



Overview: The Sun releases heat and light that reaches us here on Earth and provides us with an abundance of energy. This solar energy is what makes life on Earth possible. It is a renewable resource, available in inexhaustible amounts, and it has many applications. One of the first applications was to use sunlight to tell time.

No one knows who invented the first sundial, but one thing is clear, ancient man recognized the heat and light from the Sun could help him survive and thrive. A sundial is one example of how the energy of the Sun was first used. It is perhaps the oldest scientific instrument found to date. Archaeological evidence indicates the earliest sundial is of Egyptian origin and places its appearance around 1,500 BC. Similar evidence suggests that the Greek civilization further developed the Egyptian's design and improved its accuracy, while the Romans made great public displays of the sundials they brought back from Egypt. Though much of the sundial technology was lost during the "Dark Ages" it was rediscovered in the Middle East during the "Middle Ages" and brought back to the Europe.

A sundial in a very practical sense is an instrument for telling time in an exact location, although many are beautifully crafted and used as ornamentation as well. A sundial has a pointer, called a gnomon that casts a shadow on the surface surrounding it when struck by sunlight. This shadow moves in a predictable path throughout the day. This path can be divided into equal segments, marking the hours to indicate the time. However, because the Earth follows an elliptical orbit around the sun and is tilted on its axis, the shadow's path changes causing the shadow to move at different speeds and locations during different times of the year. As a result a sundial keeps what is known as solar time, which varies somewhat from clock time kept by mechanical timepieces.

Kid's Speak: The Sun is a source of energy and gives off both heat and light. Sunlight can help us tell time. The time of day can be found from the position and length of a shadow that is created by sunlight. A shadow is cast when energy from the Sun, in the form of sunlight, strikes a pointer called a gnomon. This part of the sundial casts a shadow onto a flat base that is divided into equal segments. Where the shadow falls indicates the time of day. At noon, when the sun is directly overhead and highest in the sky no shadow can be seen.

Eco-Fact: Nationwide, schools spend more than \$180 per student each school year on energy.

Procedures:

Before Measuring and Recording Data:

- Discuss how long ago the sun was used to tell time but today the sun is used for other purposes such as producing heat or electricity.
- Explain to the class how the sun and a gnomon indicate time of day.

Measuring and Recording Data:

1. Pair students and go outside to a sunny, paved area.
2. One student in each pair will stand on the pavement and draw circle around their own feet with sidewalk chalk.
3. The 2nd partner will trace the 1st partner's shadow and write the time of day inside the shadow.
4. Students will measure the length of their shadows with a tape measure and record the measurement in the table provided below.
5. Have Students switch positions and repeat the experiment.



6. Periodically, throughout the day, go outside and trace and measure shadows. Have students stand inside the same circle they created during the first shadow recording. Continue to record the length of the shadow cast by each partner.

After Measuring and Recording Data:

Students can answer these questions at the bottom of the attached worksheet. Class can together discuss the data results and their conclusions.

- How did length of shadow change?
- Did position of shadow change?
- Did the position of sun in the sky change ?
- Why do students think the shadow length and position changed during the day?

Adaptations:

- Students can make a bar or line graph showing the length of their shadow throughout the day.
- For older students two additional columns could be added to table to record the position of sun in sky and the position of shadow relative to the first circle drawn around student. See the second worksheet provided below.

Extensions: Older students can see how to make a sundial on our **GEF** site in the Grades 3-5 section of Curriculum.

GEF Community: Join the **GEF Community!** First, add your school, class or group as a **GEF** member. It just takes a minute and your students will learn about technology and social networking all in one. Use your class or group page to keep a record of your students' projects, ideas, and photos. You can share them with other schools across the nation. Simply, complete the basic information and then join the **Green Energy Challenge** where you can share your diagrams, pictures, or graphs from this experiment.

Click on the second icon from the print button to save your lesson to your computer.

For technical assistance with printing any of the GEF lessons, please contact:

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* All lessons listed on the GEF website have been aligned with the McREL Compendium of Standards and Benchmarks for K-12 Education. GEF curriculum has been developed in accordance with the McREL standards in order to reflect nationwide guidelines for learning, teaching, and assessment, and to provide continuity in the integrity of GEF curricular content from state to state. The decision to utilize McRel's standards was based upon their rigorous and extensive research, as well as their review of standards documents from a variety of professional subject matter organizations in fourteen content areas. Their result is a comprehensive database that represents what many educational institutions and departments believe to be the best standards research accomplished to date. To access the McREL standards database, or for additional information regarding the supporting documentation used in its development, please visit <http://www.mcrel.org>.

