



## Making a Sun Clock

**Objective:** (grades 1- 3) Objects in the sky move in regular and predictable patterns. The sun “travels” across the sky in a predictable pattern, and this pattern can be used to tell time. The earth rotates on its axis every 24 hours, producing the night- and- day cycle.

- Students will practice using a compass and making measurements.
- For older students, the teacher can discuss magnetism, the Earth’s magnetosphere, and the reason why the compass points to the north.

### **Materials:**

A sunny day  
A pencil  
A compass  
A printout of the Sun Clock Diagram

### **Instructions:**

- 1) Ask a grown- up to help you with this experiment. On a sunny day, go outside with a compass, pencil, and print- out of the Sun Clock Diagram. Put your compass on the ground and turn it so that the arrow and the "N" (for "North") line up.
- 2) Follow the directions on the Sun Clock Diagram to find out how to line up the Sun Clock with your compass. Once you have the Sun Clock pointed in the right direction, you can figure out what time it is.

### **Explanations:**

- 1) **Why doesn't the time on my Sun Clock exactly match the time on my watch?**  
The time you get from your Sun Clock is solar time, not standard time. The two aren't exactly the same.

According to *solar time*, it's noon when the sun reaches its highest point in the sky. But the sun is always moving across the sky- - which means that noon where you are is at a slightly different time than noon at a place a few miles to the east or west.

Back before 1883, people used solar time. Each community kept its own time, basing that time on the sun's position in the sky. Back then, noon in one town would be four minutes later than noon in a town fifty miles to the east.

In 1883, to regulate time for the sake of railroad schedules, the United States adopted what is called *standard time*, designating time zones and requiring all communities within a time zone to keep the same time- - even though that standard time didn't quite match solar time.

If you are in the middle of your time zone, your Sun Clock will be fairly accurate. If you are at one edge of your time zone, the time on your Sun Clock (solar time) may differ from the time on your watch (standard time) by as much as forty minutes.

**2) Why do I have to put the pencil on different spots for different times of the year?**

The position and length of a shadow depends on the time of day - - but it also depends on the season of the year. That's because the sun's position at a certain time of day is different in different seasons.

**3) How does a shadow tell time?**

Shadows change direction, depending upon the time of day. A Sun Clock like this one uses a shadow's position to tell the time.

**4) Why does it matter what city I'm in?**

What time it is depends upon where you are on the planet. That's why you use a compass to orient yourself in this activity.

A compass needle (which is attracted to the magnetic field of the earth) points in a direction called *magnetic north*. That isn't exactly the same as *true north*, or *geographic north*, which is the direction of the earth's North Pole. We've set up our Sun Clock so that it uses geographic north as a reference point. If you don't line up the diagram print- out with geographic north, the Sun Clock won't give you the right time of day.

The difference between magnetic north and geographic north is called *magnetic declination*, and it's different in different locations. When you position the Sun Clock according to the directions on the diagram, you are compensating for the magnetic declination of where you live. After you do this, the "Geographic North" arrow at the top of the diagram will be pointing to geographic north and your Sun clock will work just fine.

**5) What if my city is not on the list? Can I still use my Sun Clock?**

If you aren't near any of the cities on the list, you can still use the Sun Clock. Go out at night and look for the North Star. (You may need a book of constellations to help you find it.) Mark an arrow on the ground that points toward the North Star. That's geographic north. The next day, position your print- out of the Sun Clock diagram with the Geographic North arrow (in the top right- hand corner of the diagram) pointing in the same direction that you marked on the ground (toward geographic north). Now follow the rest of the instructions on the diagram.

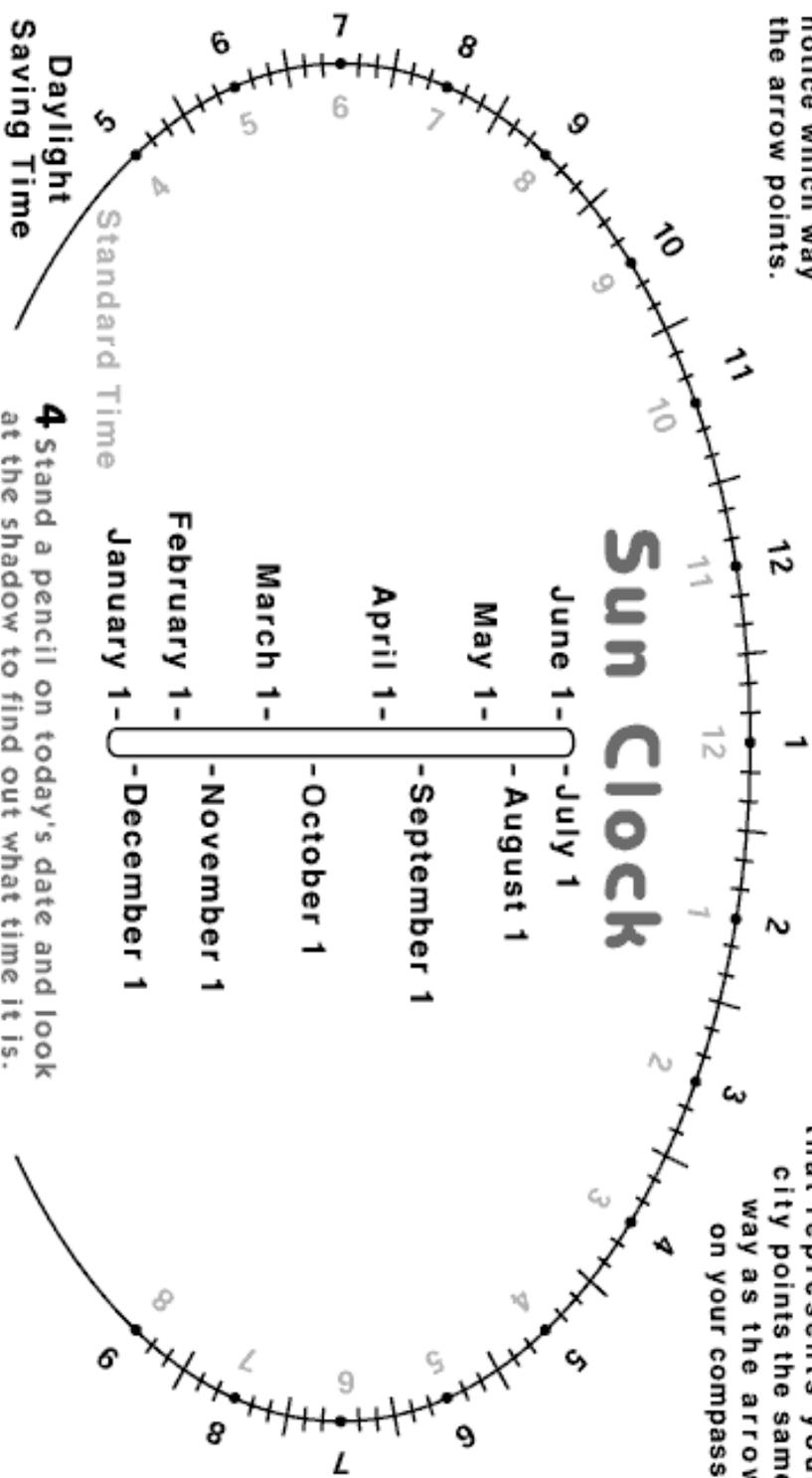
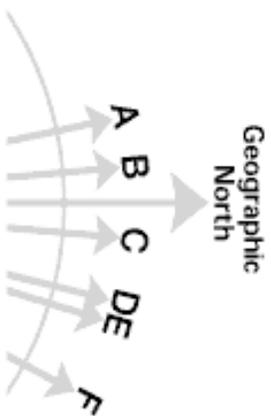
## Start Here!



**1** Put a compass on the ground and notice which way the arrow points.

<b>A</b> Washington DC New York, NY	<b>B</b> Atlanta, GA Miami, FL Chicago, IL Louisville, KY Detroit, MI	<b>C</b> Minneapolis, MN Kansas City, KS Dallas, TX New Orleans, LA
<b>D</b> Denver, CO	<b>E</b> San Francisco, CA Salt Lake City, UT Rapid City, SD	<b>F</b> Seattle, WA Boise, ID

**3** Put this page on the ground and move it around until the arrow that represents your city points the same way as the arrow on your compass.



**4** Stand a pencil on today's date and look at the shadow to find out what time it is.