

SNC1D/1P The Study of the Universe/Space Exploration

Student Activity: What Time Is It?

Topics	Timing
time constructing and using a sundial shadows	preparation: 5 min activity: 20 min

Specific Expectations

SNC1D

A1.5 conduct inquiries, controlling some variables, adapting or extending procedures as required, and using standard equipment and materials safely, accurately, and effectively, to collect observations and data

D3.6 describe various reasons that humankind has had for studying space (e.g., to develop calendars for agricultural purposes, to forecast weather, for celestial navigation, for religious inspiration) and the conceptions of the universe held by various cultures and civilizations (e.g., Aboriginal peoples; ancient Greek, Mayan civilizations)

SNC1P

A1.5 conduct inquiries, controlling some variables, adapting or extending procedures as required, and using standard equipment and materials safely, accurately, and effectively, to collect observations and data

D3.6 describe the role of celestial objects in the traditions and beliefs of selected cultures and civilizations (e.g., Aboriginal peoples; ancient Greek, Mayan civilizations)

Introduction

The sky has been mystifying civilizations for thousands of years. Many civilizations have performed religious ceremonies and timed agricultural activities based on celestial events such as eclipses and full moons.

Arguably the most important benefit of making observations of the sky was the ability to record and determine time. Earliest civilizations were able to count days (by observing as the Sun set and then rose the next morning) and months (the time between two new moons). The year is an important length of time because it divides time into complete cycles of seasons. The seasons dictated growing times for crops and the times when animals migrated. The ancient Egyptians knew, for example, that the appearance of the star Sirius over the horizon meant that the annual spring flooding of the Nile River was imminent. The Egyptians also determined that there were 365 days between each rise of Sirius.

Many cultures therefore divided up the year according to the appearance of the Sun, Moon, and stars. The day could also be divided into smaller units according to the passage of the Sun overhead. The first recorded use of sundials was in ancient Greece. Later civilizations used the sundial to create a work week. The construction of an accurate sundial, with the correct

orientation and spacing of the time markers, is challenging: its operation depends on the latitude and longitude in which it is being used.

In this activity students follow instructions to make and use a simple paper sundial. They evaluate its effectiveness and make suggestions for improvements.

Materials

copy of the template (see below)
scissors
glue

piece of cardboard or foam board
(approx. 25 cm square)
compass

Safety Considerations

None

Procedure

The following instructions are intended for students.

1. **Observe**
Cut the template (see template master: “I Only Tell Sunny Hours”) in half along line A. The top half is for the base and the bottom for the gnomon—the part that sticks up.
2. Cut away the corners of the gnomon along line B.
3. Fold the gnomon in half along the dotted line (line C). Cut along the curved line through both layers of paper and discard the curved part.
4. Fold along the other two lines opposite to the fold in the middle to produce a 90° angle. The gnomon should now be able to sit on the table with its flaps out to the sides.
5. Take the base sheet (top half) and cut along the “12” line from the apex (where the hour lines meet) up to the cross line. (Do not cut any further!)
6. Slide the gnomon into the cut you made with the horizontal parts under the base such that the gnomon sticks out of the top. Glue the gnomon’s flaps to the underside of the base.
7. Glue the sundial to a piece of cardboard or foam board.
8. Take the sundial outside—preferably on a sunny day. Use the compass to locate north. Align the gnomon so that is pointing north and the sundial is ready to use. The shadow from the tip of the gnomon now tells the time.
9. Compare “sundial time” to the actual time. Does your sundial indicate the time accurately?
10. **Explain**
Try to explain any differences between “sundial time” and actual time? Here are some hints:
 - a. The gnomon constructed is for latitude 38° N. How does this affect its accuracy? What needs to be altered for different latitudes?
 - b. You aligned the sundial to magnetic north. How does this affect its accuracy? What could you do to improve its accuracy? (See Fig.1.)

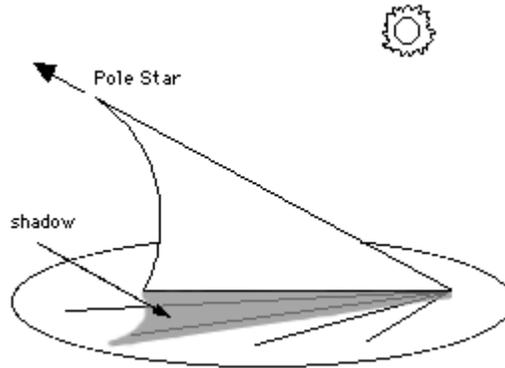


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Fig.1 A sundial aligned with the gnomon pointing north

Disposal

Students may take their sundials home to be used. Alternatively the sundials may be recycled (if the base is cardboard) or put in the garbage (if the base is foam board).

What happens?

The shadow of the gnomon moves as the Sun's position changes during the course of a day.

How does it work?

The shadow of the gnomon rotates in a clockwise manner around the sundial base as the Sun rises from the east, passes through its highest point (noon), and then sets in the west. A correctly positioned gnomon will indicate noon when the shadow points due north. (In the southern hemisphere the shadow will point south.) The markings on the sundial have been made to indicate the position of the gnomon's shadow each hour.

Teaching Suggestions/Hints

1. Ensure that students do not cut all of the way along the "12" line in Step 7.

Next Steps

Students may modify the design of a sundial for their appropriate latitude and make a second model. They can then evaluate its accuracy. See the NASA link in Additional Resources.

Additional Resources

1. NASA – The Sundial: <http://www-spod.gsfc.nasa.gov/stargaze/Sundial.htm>
2. Making a largescale Solar Calendar:
http://www.solarcalendar.org/01_solarcalendargallery2.html
3. A history of the development of calendars by various civilizations:
<http://www.historyworld.net/wrldhis/PlainTextHistories.asp?historyid=ac06>

Template Master

I Only Tell Sunny Hours

