Create a Sundial

Science Fair Project

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Since time immemorial, sundials have been used to give an indication of time, allowing people to function to a timetable. The ancient Babylonians, Egyptians, Greeks and Mayans were just some of the great civilizations who understood that the position of the sun in the sky, and the shadows it casts, could be used to make an estimate of the time of day.

[1]

Create a Sundial, Peter Whelerton

Of course, many of these, such as the Greeks and the Romans, believed that the earth was fixed in the center of the heavens and the sun orbited around it, making it move across the sky. We now know that the movement of the sun across the sky is caused by the rotation of the earth, although this makes little significant difference when it comes to sundials.

Ancient sundial from Marcianopolis, Museum of Mosaicas, Devnya, Bulgaria. (Creative Commons [2])

How Do Sundials Work?

In the morning, a shadow points to the west as the sun rises in the east, gradually getting shorter and moving towards the north. After noon, the shadow points eastwards, steadily lengthening as the sun moves towards sunset in the west. A sundial takes advantage of this by using a device called a gnomon to cast a shadow, with a dial and markings allowing you to gauge the time.

A sundial also depends upon your position on the earth and it can only be used at a certain longitude and latitude. You cannot move away from your latitude and, although you can move along it, you will need to add or subtract four minutes for each degree moved, depending upon the direction.

Making a Simple Sundial

This is the most basic sundial, and depends upon the ancient principle of placing a stick in the ground and using the shadow to tell the time.

You'll need:

- A flat wooden board or stout cardboard: Ideally, the surface should be painted white; if it isn’t, you can always stick a sheet of paper to it.
- A long nail
- A hammer
- A pencil
- A sunny day

Sundial in thyme garden at Minnesota Landscape Arboretum. (Creative Commons [3])

To Make Your Sundial

1. First thing in the morning, place the board on a flat surface in a spot that receives sun all day long.
2. Make sure that the board cannot move by placing a couple of rocks to weigh it down if the weather is windy.
3. Hammer the nail as close to the center of the board as you can. It doesn’t need to go too far in; just enough to make sure that it is sturdy.
4. Where the shadow of the nail head falls on the surface, make a mark. Ideally, you want to do this at the beginning of the hour: Six o’clock, seven o’clock and so on.
5. Every half hour or every hour, repeat the process and carry on until sundown.
6. Without moving the board, draw a line with the ruler connecting the marks to the nail at the center.
7. You can now tell the time at your longitude and latitude.

Problems When You Make a Sundial

If you monitor your sundial over the course of the year, you will notice that it does not exactly match the time. Why?

Many parts of the world use daylight saving time during the summer, so you will have to recalibrate your sundial twice per year.

For every degree you live away from your local meridian, the time will vary. For every degree east, add four minutes; for every degree west, subtract four minutes. A degree in latitude is about 69 miles or 100 kilometers, which will help you to take this variance into account.

For example, Penzance is approximately 5.5 degrees west of Greenwich. If it is noon at Greenwich, what time is it in Penzance?

To work this out:

- 5.5 x 4 = 22 minutes
- Penzance is west, meaning that noon arrives later.
- 12:00 – 22 minutes = 11:38am

If it is 6pm in Los Angeles (118.25 Degrees west), what time is it in New York (74 Degrees west).

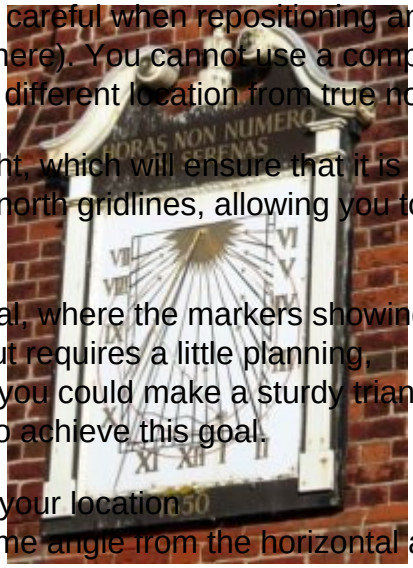
- 74-118.25 = 44.25.
- Multiply this by 4 and you get 177 minutes.

- 6pm + 177 minutes = 8:57pm
- According to timezones, NY is classed as 3 hours ahead of LA, so this is a good approximation.

Make a Sundial and Direction

If you want to move your sundial, you have to be extremely careful when repositioning and ensure that it points north (or south in the southern hemisphere). You cannot use a compass because this points to the magnetic pole, which is in a very different location from true north.

One way is to use the star Polaris to set your sundial at night, which will ensure that it is accurate during the day. Alternatively, buy a map with true north gridlines, allowing you to use landmarks to position your sundial.



Moot Hall Sundial (Public Domain)

Some people may want to make a sundial with a circular dial, where the markers showing the shadows fall are all of the same length. This is very easy but requires a little planning, because you have to set the gnomon at an angle. For this, you could make a sturdy triangle from a drinking straw or use wood – there are many ways to achieve this goal.

- Using a map or online resource, check the latitude of your location
- Using a protractor, set your gnomon to exactly the same angle from the horizontal and point it towards the celestial pole
- This will allow you to create a circular dial for your sundial in the same way as for the standard sundial

Hopefully, this has helped you to build your own sundial, or at least given you a few ideas about using the sun to tell the time. There is, of course, much more to learn, such as the Equation of Time and, because these devices have been around for thousands of years, there is a huge array of types. Some of the links below will help you to explore further:

Sundials at Wikipedia [4]

Sundials [5]

NASA

Related pages:

How to Tell Time Without a Watch - Learn how to make a sundial [6]

Source URL: https://explorable.com/sundials

Links:
[1] https://www.flickr.com/photos/8221805@N08/522276341, [2] http://commons.wikimedia.org/wiki/User:Edal, [3] http://commons.wikimedia.org/wiki/User:SEWilco, [4] http://en.wikipedia.org/wiki/Sundial, [5] http://www.sundials.co.uk//intro.htm, [6] http://www.watchshop.com/how-to-tell-time-without-a-watch-learn-to-make-a-sundial-a137, [7] https://explorable.com/users/martyn, [8] https://explorable.com/sundials