

Sundial Activity

Welcome to the Workshop for Physics Teachers! It so happens that the workshop is being held on dates very close to the [Winter Solstice](#). So, it's only appropriate that we think about the position of the Sun in the sky, the seasons, and of course about time. It would be wonderful if you can try out the following activities before the workshop. We will discuss your findings during our session together.

Measuring Time

You can use several simple methods to measure the time of day. While doing this, make as many careful observations as you can. We will discuss how some of these observations can lead to several interesting and surprising discoveries, such as the tilt of the earth's axis, the existence of seasons, the shape and size of the earth, and even the shape of the earth's orbit around the sun!

Simple Sundial

1. Place a stick vertically in an outdoor place, as shown in Figure 1, which gets continuous sunlight from at least 10 am and 2 pm.
2. You can use the edge of a nearby building or wall to make sure that the stick is vertical.
3. Observe and record the position of the shadow of the tip of the stick at noon using an accurate watch. A photo can be a good way to record this position.
4. Do the above every day.
5. If you think it may be cloudy at noon, you can also record positions of the shadow of the tip of the stick every hour between 10 am and 2 pm. You can then interpolate the position of the tip at noon.
6. You can also observe the following:
 - a. Any change in the length of the shadow at noon from one day to the next.
 - b. The position of the shadow of the stick at different times during the day, and how this compares with the time on your watch.
 - c. The length of the shadow of the stick at different times during the day.

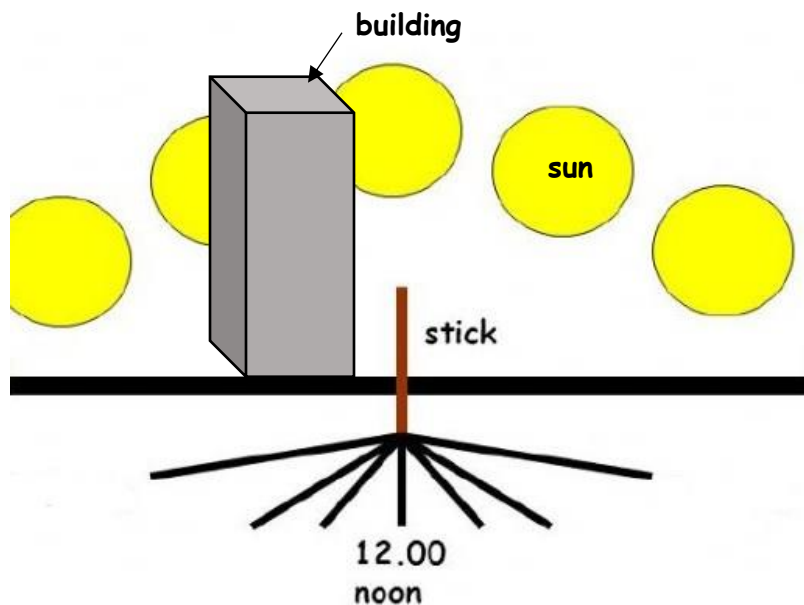


Figure 1: Shadow of a vertically placed stick. © nagwa.com

Equatorial sundial

You may notice that without some kind of calibration the previous method does not yield very accurate measurements of time. Use the template provided at the end of this instruction sheet to build a more accurate sundial known as the equatorial sundial as shown in Figure 2. This [video](#) from ThinkTac gives detailed instructions.



Figure 2: Equatorial sundial model. © Wikimedia commons

Please think about the following:

1. Is there a difference between the time shown on the sundial vs what is shown in your accurate watch? Why?
2. Is this sundial more accurate over the course of a whole year than the previous one? Why?

For the Workshop

Please fill out the following tables and bring to the workshop to share with everyone.

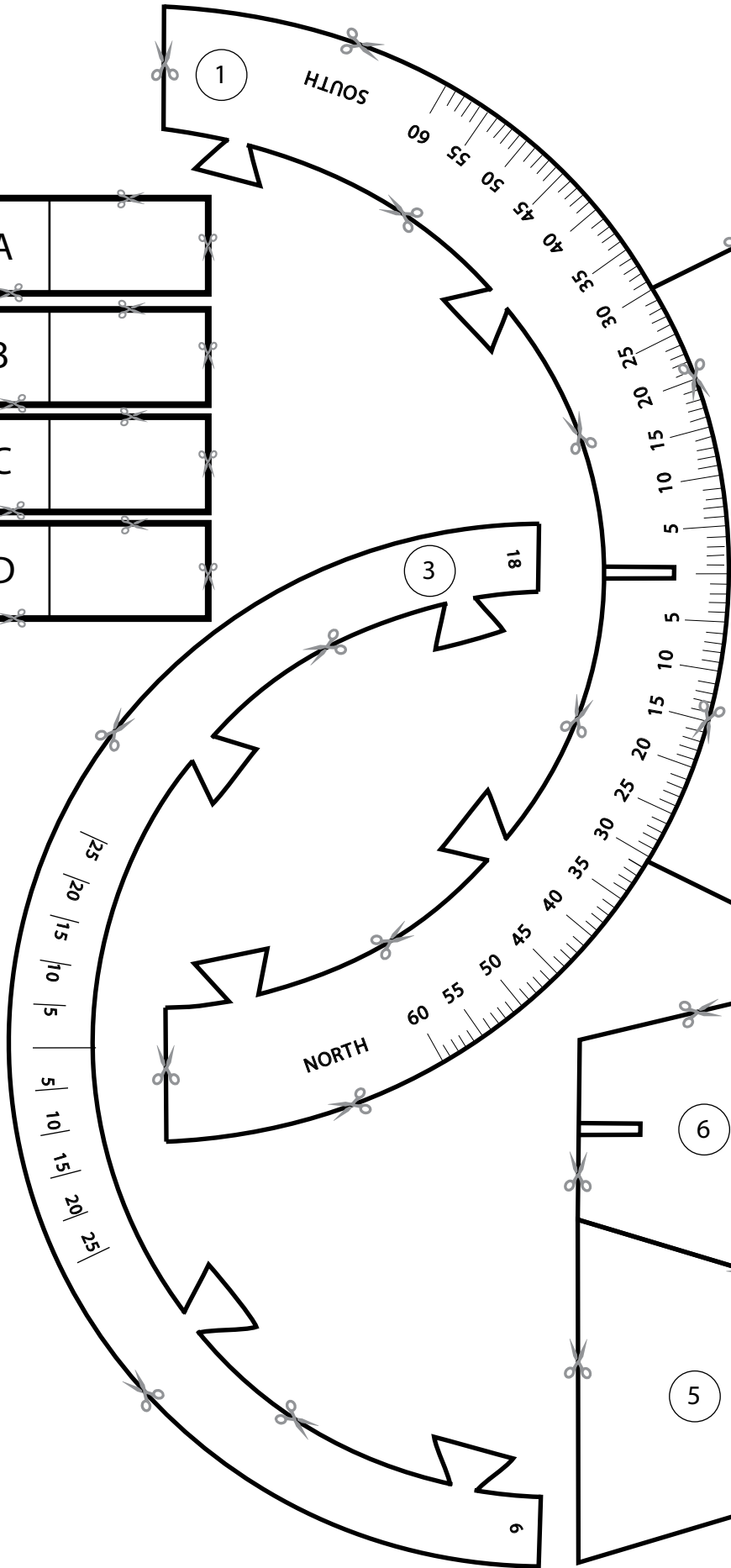
Simple sundial	
Length of stick (cm) =	
Day	Length of shadow at noon
Dec 14	
Dec 15	
Dec 16	
Dec 17	
Dec 18	
Dec 19	
Dec 20	
Dec 21	

Table 1: Daily data for simple sundial

Equatorial sundial	
Your latitude and longitude (deg) =	
Sundial time	Watch time

Table 2: Comparison of sundial time and watch time at several times during the day (need NOT be done all on same day)

A	
B	
C	
D	



ThinkTac

