NAME_____ DATE_____

Solar Observations
Essentials of Physics: PHYS 101

You will be making solar observations during the day for at least two days. You need to choose your first day some time in the first 2-3 weeks of the term, and your second day during weeks after that. You should bring your solar observations (marked dome, and this completed sheet) to Lab 6, May 10 or 14th.

Introduction:

Until the 1500's the common perception was that the sun revolved around the earth. Even in retrospect that seems like a reasonable perception. The sun certainly appears to rise on the eastern horizon every morning and disappear from the western horizon in the evening. We all say the sun rises—very few people say the earth turns to describe sunrise! Copernicus was one of the first astronomers to question the perception that the earth was the center of the universe; his ideas were not well accepted by other scientists. Tycho Brahe made naked-eye observations of planetary motions that fit Copernicus's model. It wasn't until the telescope was invented that Galileo was able to make other, key observations in the early-1600's that supported Copernicus' theory. Even with supporting observations Galileo's ideas were not popular, particularly with the Catholic Church, he was persecuted for his ideas throughout his lifetime. In this lab you will be making observations of the sun's shadows and using them to develop a physical model of the sun and earth system.

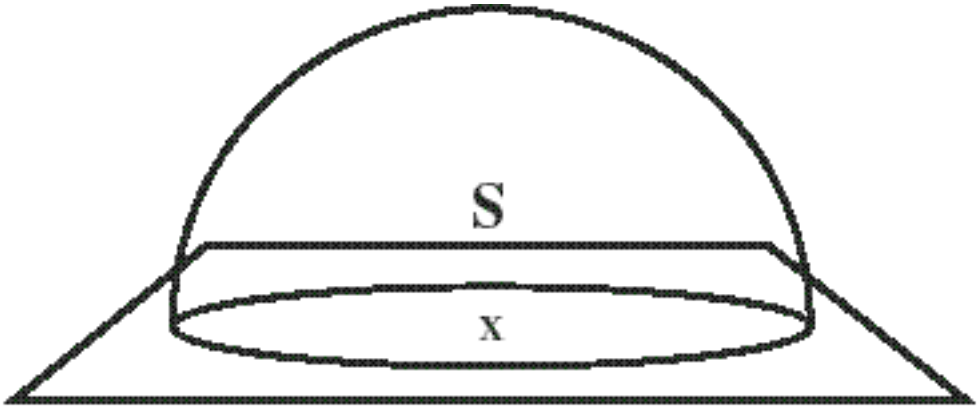

Figure 1: A clear hemispherical dome covers a sheet of paper. You are observing the Sun "move" across the sky by standing at the "X" mark and peering through the dome at different times of the day. "S" marks the direction of south.

Question: How does the sun's position appear to change throughout a day?

Hypothesis: (fill out on day of observation.)

For today, I predict the sun will rise in the _____ (be precise!), will be found at _____ (on the dome) at noon, and will set in the _____. There will be _____ hours of daylight today, which is _____ (enter date).

Mark your predictions for your first observation (from above) on the dome, following the instructions on and below Figure 2 (below). Label the location of sunrise on the dome using the letter "r," position at noon using "n," and the position of sunset using "s." Connect these points with a line that you think shows the path of the sun.

Use a different colored pen to record your observations!

Procedures:

You should begin making your observations early in the morning and continue them approximately hourly until sunset. If cloudy skies prevent one of your observations, just check back when the sun is out again. The idea is to adequately describe the (apparent) path of the sun through the sky, so you should try for several observations over the course of a day.

1. Tape or staple the base sheet to the piece of cardboard. Then tape or staple the base of the hemisphere to the base sheet-cardboard combination so that the ridge marked "N" lines up with North on the base sheet. See figure 2, below:

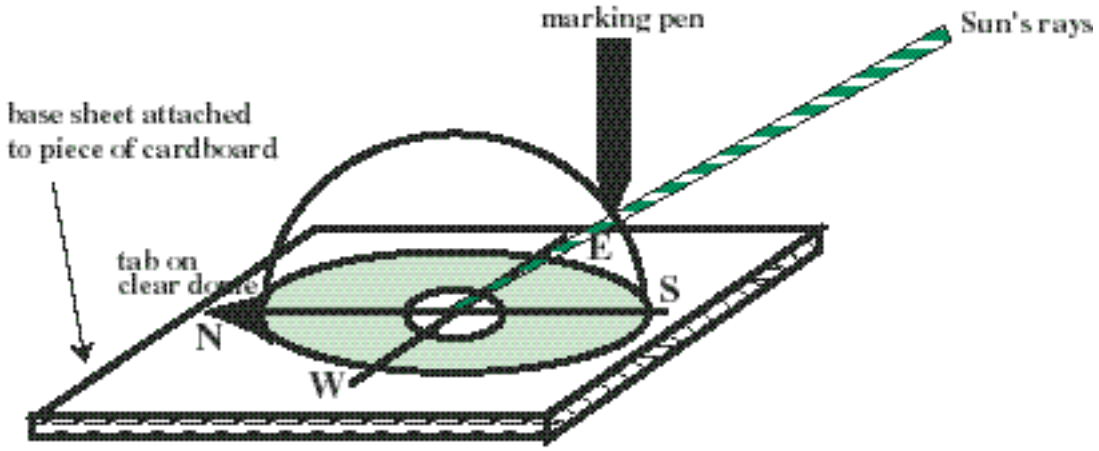

Figure 2. Mark the point on the dome where the shadow of the pen tip appears at the center of the circle on the base sheet.

2. Place the hemisphere on a flat, horizontal surface in direct sunlight. Turn the hemisphere so that the ridge marked "N" points North. One the dome is set in place DO NOT MOVE IT!
3. Plot the Sun's position in the following way (see Figure 2).
   a) Carefully move the tip of the pen close to the plastic hemisphere, but do not let the pen touch the plastic. Make sure that the pen is straight up and down.
   b) Move the pen around until the shadow cast by its tip falls directly on the + mark on the base sheet (which marks the center of the hemisphere).
   c) Touch the pen tip to the dome and make a dot. The dot's shadow should fall directly on the + mark on the base sheet.

d) Repeat steps a-c approximately once an hour until the pen no longer casts a shadow.

e) Connect the plotted points with a line ON THE INSIDE OF THE DOME. Label the line with the date and time range.

Figure 3: Base sheet for placing and orienting hemisphere dome for observations.