

## 2 - Plotting the Daily Motion of the Sun

Purpose: To investigate the Sun's apparent daily motion across the sky.

Materials:

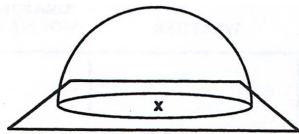
plastic hemisphere  
 hemisphere base (hemisphere base sheet, cardboard, tape)  
 dry erase pen (do not use permanent marker)  
 smartphone with compass app or magnetic compass  
 piece of chalk

Instructions:

At the end of the class, you should have answered Q1-Q6 and have a clear understanding of how to proceed at home in order to answer Q7-Q10. At home you will also need to work on problems H1 - H3. Total of 13 points. Due in one week at start of class.

### Preparation

1. Place the hemisphere base flat on your desk and the square rim of the plastic hemisphere flat on the hemisphere base.



2. Imagine that the sky is the inside surface of the dome created by the hemisphere. As an observer, you would be standing at the center of the circles where the lines intersect.

3. Using the dry erase pen, label with the letter "N" the ridge on the dome that is closest to the arrow head labeled "North" on the base. Looking down on the dome and going clock-wise from north, mark the other three ridges with "E", "S", and "W."

### What Do You Think?

*As a team, write the answers to questions Q1-Q6 on a separate sheet of paper. Where appropriate, you will mark your answers on the dome.*

Q1: Predict the positions of the Sun for today and draw these on the dome using the dry erase pen. Please do not use a permanent marker. Mark the dome with the letter r to show the position of the Sun at sunrise; the letter n to indicate its position at noon, and the letter s to indicate its position at sunset.

Q2: Connect these points on the dome with a curved line to show how you think the Sun will move across the sky today.

Q3: From what direction did the Sun rise this morning?

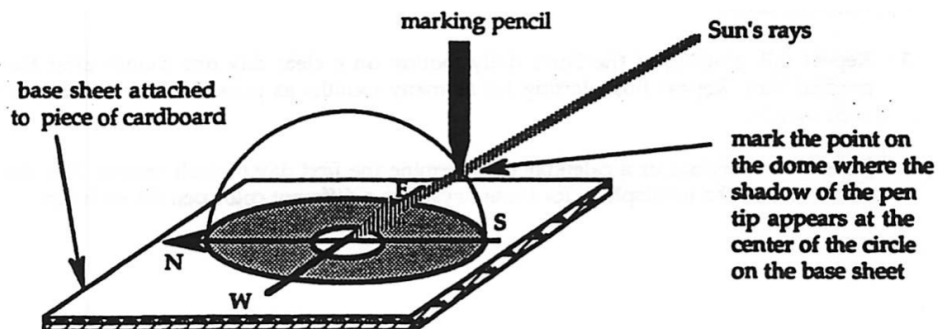
Q4: In what direction will the Sun set this evening?

Q5: Where in the sky is the Sun at noon?

Q6: How many hours of daylight will there be today?

## Observations - at home

1. Before taking the dome home assemble the dome/base: Tape the dome to the base. Make sure to align the circular base of the dome with the circle on the base. Tape only one edge. This will allow you to draw on the inside and look through the dome from the inside.
2. Place the dome on a flat horizontal surface in direct sunlight. With the aid of a compass, turn the dome so the ridge marked N points north. Be careful not to place your dome near iron or steel objects since these metals will attract your compass needle and produce an inaccurate reading. Once the dome is set in place **DO NOT MOVE IT**. Draw an outline around the base with chalk in case the dome is accidentally moved.
3. Plot the Sun's position in the following way:
  - I. Carefully move the tip of the dry erase pen close to the dome, but do not let it touch it.
  - II. Move the pen around until the shadow cast by its tip falls directly on the center of the base sheet where the lines intersect.
  - III. Touch the tip of the pen to the dome and make a dot. The dot's shadow should fall directly on the intersection of the lines on the base.
  - IV. Repeat steps (a) - (c) as often as you can so you can have a good set of data that describes the motion of the Sun across the sky. At a minimum take two hours of data in intervals of 20-30 minutes. Ideally take data from sunrise to sunset in intervals of one hour.
  - V. On the inside of the dome, draw a line connecting the points. Label the line with the date and time range.



## Discussion Questions

- Q7: Discuss how the points and line you drew for question Q1 compare with the points and line plotted from your actual observations of the sun. (about 100 words)
- Q8: From what direction did the Sun rise?
- Q9: Where in the sky was the Sun seen at noon?
- Q10: In what direction will the Sun set?

## Homework:

**H1.** Pick a location from which to observe the position of the Sun over the next week. Identify the location from where you will be observing either at sunset or sunrise and have an unobstructed view that spans at least three cardinal directions. Draw your location making sure to provide the following:

- a. name of the place.
- b. horizon.
- c. an outline of any feature that blocks your view of the horizon such as buildings, trees, or mountains.
- d. labels of major features in your sketch.
- e. label the location of three cardinal directions on your horizon.
- f. look up the longitude and latitude of your location and label your drawing.

**H2.** From your choice location (H1), observe a sunrise or sunset and record the following information in an observing log at least three times over the week:

- a. Mark in your drawing the direction of the sunrise or sunset. The only safe time to look directly at the Sun with your naked eye is when most of its light is scattered or obscured by clouds, the horizon or other objects. **Do not look directly at the Sun** unless you are 100% certain that it's safe. It's your responsibility to be cautious and let your body's instinctive aversion to bright light guide you in your observations. Enjoy a beautiful sunrise or sunset, sensibly.
- b. Record the exact time and date of your observation.
- c. Record comments: If there were any pertinent factors that may have affected your observation, note them on your piece of paper.
- d. Identify the observer: Make sure your name is on your piece of paper.

**H3.** Define the following terms verbally and visually:

Horizon  
Zenith  
Azimuth  
Altitude  
Meridian  
Local Sky

North

