Ages:
4th grade – high school

Duration:
45 minutes

Materials:
- Observation sheet 1 and 2 for each student
- Access to horizon for a year or use of planetarium program such as Stellarium: www.stellarium.org
- A video projector
- Provide each group of students with access to a computer with the program downloaded, if working in groups

SunWatchers

Overview —

Students observe the sunrise and sunset positions of the Sun and its altitude in the sky over a year to connect with the Sun's apparent motions over a year.

Objective —

- Students will observe and chart the position of the Sun at different months during a year.
- Students will describe how the apparent path of the Sun changes.
- Students will compare the length of a day during different months based on their observations.

Before You Start: **Before You Start:** If you are going to use a planetarium program, download the software and spend time becoming familiar with its capabilities. Set up the video projector, and connect it to your computer.

Activity —

1. Hand out copies of the Observation Sheets. Ask the students to point on their sheet to where the northeast horizon would be, and where 20 degrees up in the sky would be, to help them become familiar with the sheets.

2. Use the planetarium program to observe the rising and setting positions of the Sun, and its height at noon, for one date. Invite all of the students to record the positions and the times of sunrise and sunset, and the position of the Sun at noon on their sheets.

3. Break the students up into small groups of 2-4, and assign each group 2 months. Ask them to observe and record the sun's positions for 5 days spread over those 2 months (ex: January 5, January 15, January 31, February 10, February 20).

4. Bring the groups together to discuss their results. Are there patterns they can detect?

Patterns you would like the students to observe: in the summer, the Sun rises early in the northeast and sets late in the northwest—and the days are longer. In the spring and fall, the Sun rises in the east and sets in the west. In the winter, the Sun rises late in the southeast and sets early in the southwest and the days are shorter.

In the summer, the Sun's altitude at noon is very high; it is very low in the winter.

Background —

Because of the tilt of the Earth's axis, those living in the northern hemisphere in winter see the Sun rise in the southeast and then set after a short day in the southwest. In the summer, the Sun rises in the northeast and sets after a long day in the northwest; during the day, the Sun moves significantly higher in the sky than in winter and the day is significantly longer. On the first day spring and fall, the Sun rises due east and sets due west, with a day that is about 12 hours long.

The higher the Sun is in the sky, the more intense the sunlight is. During summer, the Sun is at its highest and the temperatures are warmer than during winter.

Ties to Standards —

Connections to the National Science Standard(s)

Content Standard D Earth and Space Science, (grades 5—8): Most objects in the solar system are in regular and predictable motion. Those motions explain such phenomena as the day, the year, phases of the moon, and eclipses.

Standards A&G (grades 9–12): Identify questions about seasonal changes using their own observations. Using logic and mathematical data, formulate an explanation about, and conceptual understanding of, how latitude affects seasonal variations. Critique and communicate explanations.

Texas TEKS

Scientific investigation and reasoning.

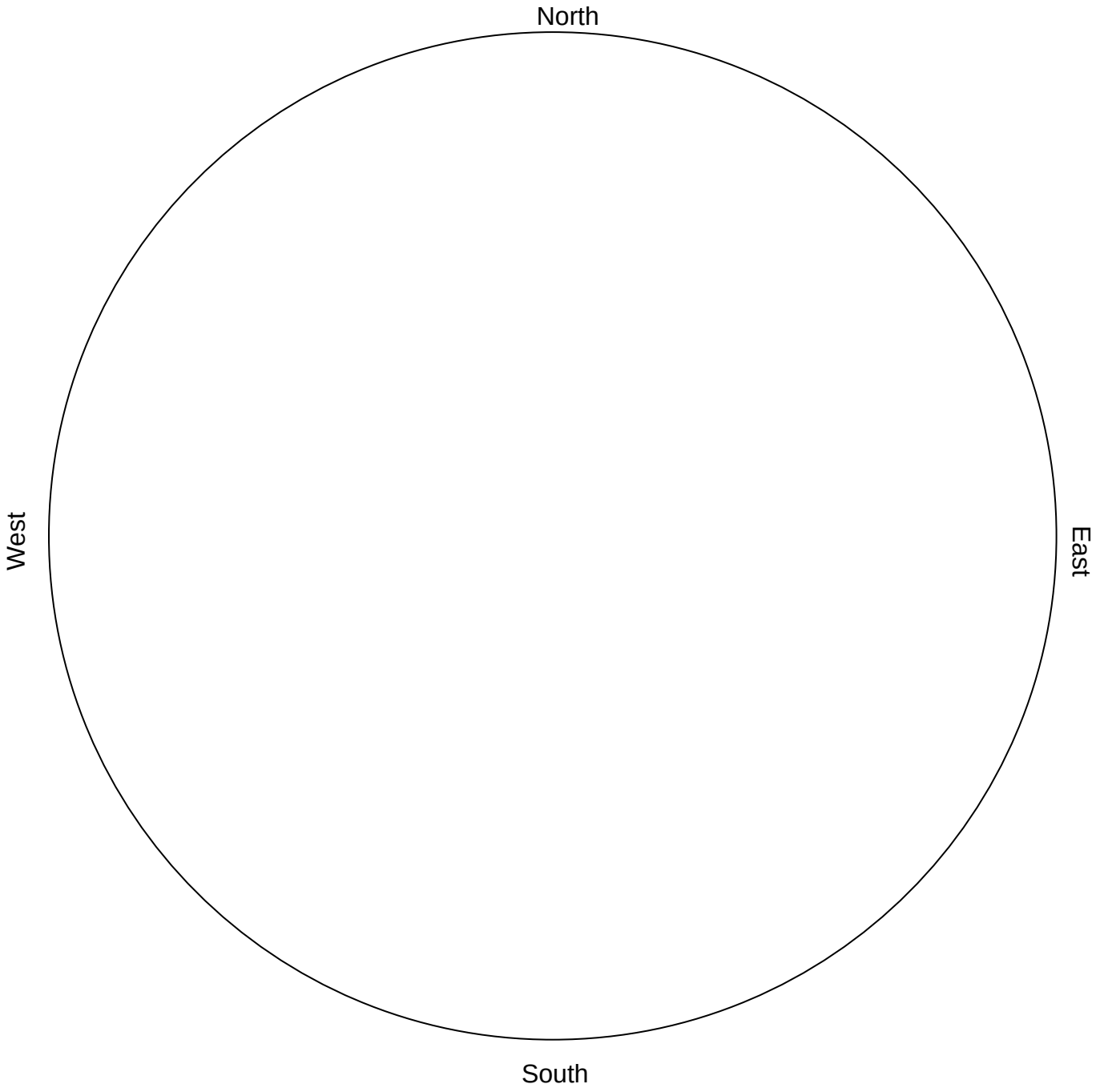
(2) Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and field investigations. The student is expected to:
- (A) plan and implement comparative and descriptive investigations by making observations, asking well-defined questions, and using appropriate equipment and technology;
- (B) design and implement experimental investigations by making observations, asking well-defined questions, formulating testable hypotheses, and using appropriate equipment and technology;
- (D) construct tables and graphs, using repeated trials and means, to organize data and identify patterns; and
- (E) analyze data to formulate reasonable explanations, communicate valid conclusions supported by the data, and predict trends.

(3) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions and knows the contributions of relevant scientists. The student is expected to:
- (A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student

TEKS Science Content Standards

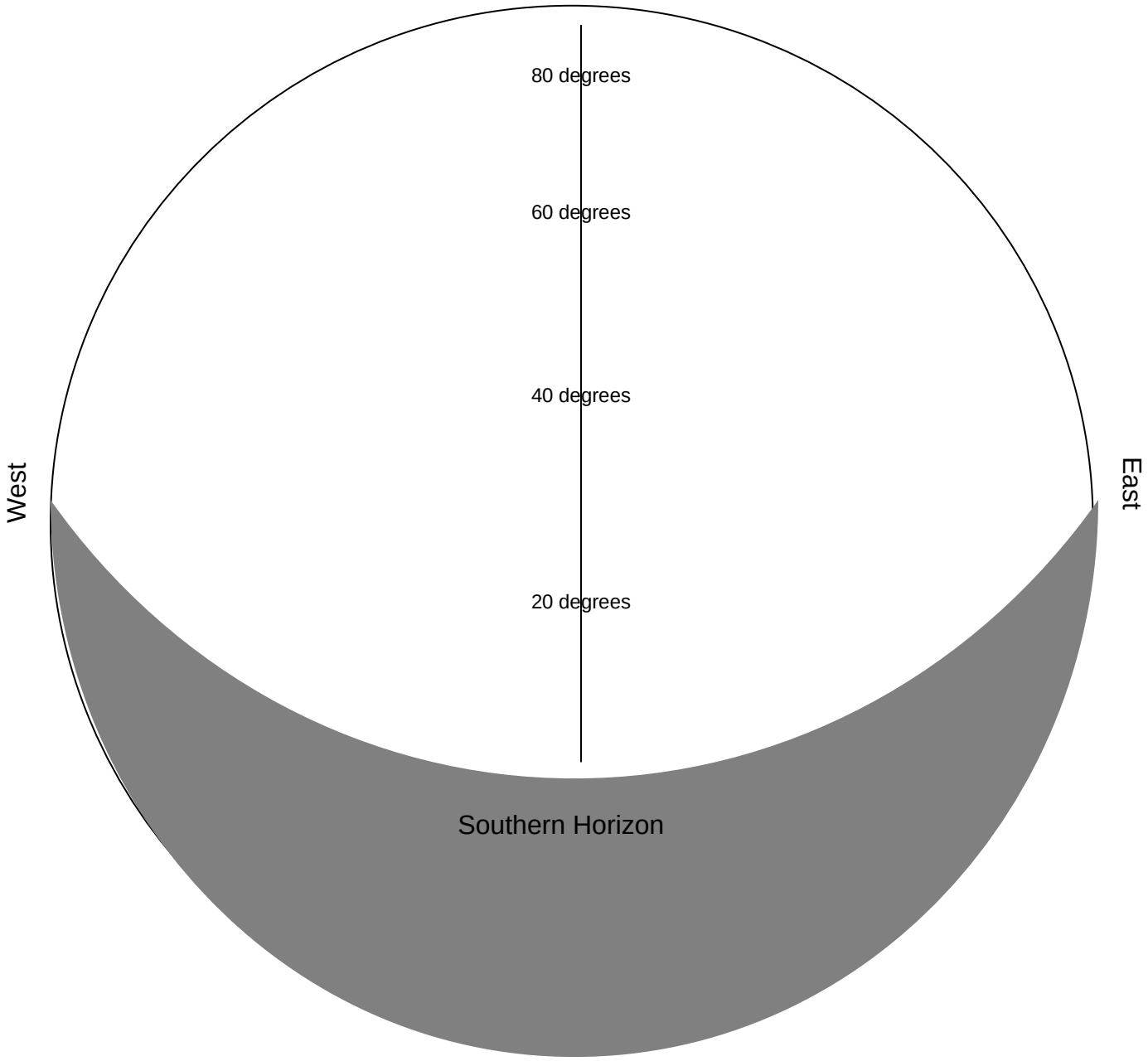
4(8) Earth and space. The student knows that there are recognizable patterns in the natural world and among the Sun, Earth, and Moon system. The student is expected to:
- (C) collect and analyze data to identify sequences and predict patterns of change in shadows, tides, seasons, and the observable appearance of the Moon over time.

Sun's Position Observation Sheet 1
Sunrise and Sunset



Directions:
Mark the sunrise and sunset positions for 6 different days spread throughout the year. Make a note of the date and time (ex: "6:08 am Sept. 16") next to the mark.

Sun's Position Observation Sheet 2
Height in Sky at Noon



Directions:
Standing facing South at about noon, observe the altitude of the Sun In the sky for 6 different days throughout the year. Mark the Sun's positions with a note of the date (ex: "Sept. 16").