Day and Night

Overview

Students simulate day and night using a central light source as the sun and their own heads as the Earth. They also graph sunrise and sunset times throughout the year to see how day lengths vary with the seasons. This activity does not address the connection between the seasons and the Earth's tilt on its axis. That connection is made in the next activity (**Seasons**). This activity also exercises computer skills, including:

- using a spreadsheet to organize data,
- using a spreadsheet to calculate with simple formulas,
- using a spreadsheet to represent and explain data.

Throughout this guide, all information in italics is a "teacher tip."

North Carolina Essential Science Standards

6.E.1.1 Explain how the relative motion and relative position of the sun, earth and moon affect the seasons, tides, phases of the moon, and eclipses.

Background

Day and night results from the rotation of the Earth around its axis. As the world turns, the half that faces the sun experiences daytime while the other half experiences night. The Earth rotates to the left (counterclockwise) if we think of the North Pole as "up" in space. The Earth rotates toward the east. As a result, everything in the sky, including the sun, rises in the east and sets in the west.

Materials

Materials for the whole class

- 1 lamp with a bare bulb
- 1 extension cord
- Duct tape
- Clear or masking tape
- Ability to project BLM 6 for the class to see

Materials for individual students

- 1 U.S. map mask cut out from BLM 4, with eye-holes cut out
- Access to almanac/weather information in a daily newspaper, or
- Access to almanac/weather information on the internet.
- 1 copy BLM 5 Sunrise/Sunset Times For the First Day of the Month in Central North Carolina
- graph paper
- *Science notebook
  * *supplied by the teacher*

Preparation

1. Make 1 copy per three students and cut out the U.S. map masks to make one map per student. Either cut the eye-holes or have students do it.
2. Set up the lamp in the center of the room. If you use the extension cord, tape it securely to the floor so that no one can trip over it.
3. Make 1 copy per student of BLM 5 Sunrise/Sunset Times For the First Day of the Month in Central NC
4. Be sure you can project BLM 6.

Procedure

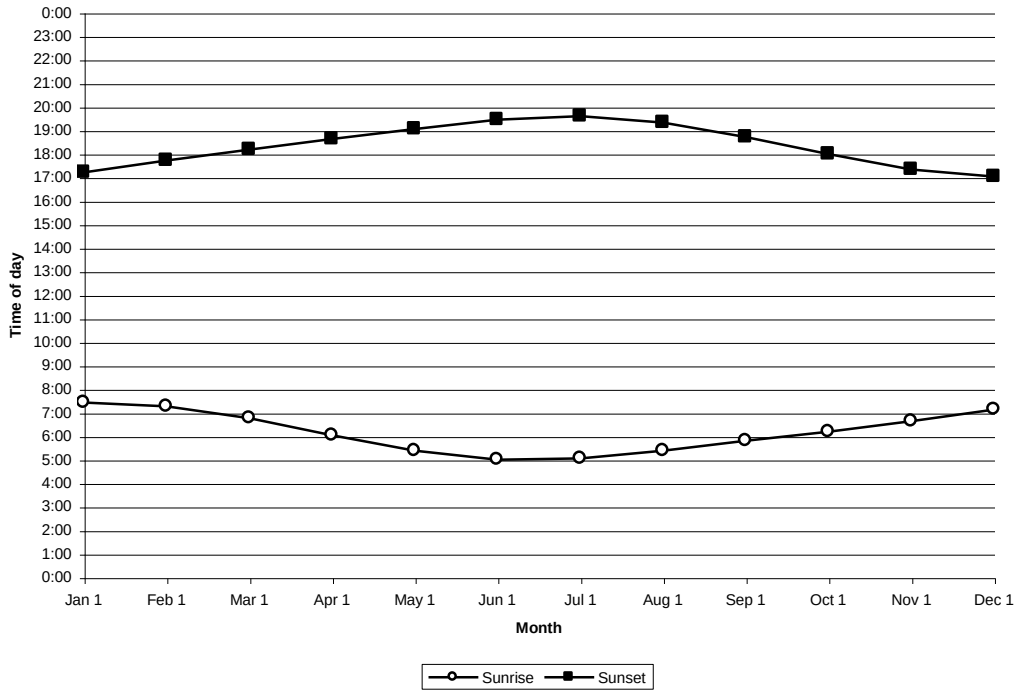
1. *Day/night simulation*: Ask students what is meant by the terms day and night *[Is it when the sun goes down? Is it when it's completely dark? Is it after a certain time, such as 6pm?]*. Ask what they think causes day and night.
2. Have students hold the map masks on their faces so that they can look out of both eye holes.
3. Position students in a circle around the darkened room with the lamp in the center. With students in place, lead them through the following:
   a. Have students hold their map masks in front of their faces and ask them to imagine that their heads are the Earth. The tops of their heads represent the North Pole. Leaving their masks in place, ask them which eye is east and which eye is west. Still leaving masks on their faces, ask them to work with other students to figure out which eye (left or right) is on the east coast, and which eye on the west coast *[left eye on the east coast, right eye on the west coast]*.
   b. When everyone understands that the left eye is in North Carolina, say that that eye represents someone looking up into the sky. Ask them to turn their head until the left corner of that left eye just barely sees the light bulb. That would be sunrise in North Carolina.
   c. Without students moving their heads, ask what light their right (California) eye sees. Ask what students think the sky looks like to people in California when it's sunrise in North Carolina.
   d. Without saying which way to turn, ask them to close their left eye and turn until the left corner of their right eye barely sees the bulb. This is sunrise in California. Ask students to open their left, North Carolina eye. What does the bulb look like to that eye? What time of day do students think it is in North Carolina when it is sunrise in California? Ask which way they turned their heads, left or right?
   e. Continue this process. Ask students to turn until their North Carolina eye looks directly at the bulb. This is noon in North Carolina. What does it look like in California? Continue through sunset, midnight (directly away from the bulb), and sunrise in North Carolina, each time asking what the other (California) eye sees. Ask which way students turned to make this all happen. *[At this point, tell all students turn in the direction the Earth turns, to the left, or counterclockwise. It is important that they all make this connection.]*

f. Call out different times of day and either North Carolina or California, and ask students to position their heads in the appropriate way. For example, "show me sunset in California," or "show me midnight in North Carolina."

4. *Graphing*: Ask students if the sun rises and sets at the same time every day. Some might know that the sun rises later and sets earlier in the winter.

   a. Give out BLM 5 Sunrise/Sunset Times for the First Day of the Month in Central North Carolina. Ask students to graph the sunrise and sunset times through a year, with the date on the x-axis and the sunrise/sunset times on the y-axis. Ask them to make two separate lines, one for sunrise, and one for sunset, with a key showing which is which. A graph might look like the one below (the one below uses military time on the y-axis, but students will use ordinary time):

Sample Graph: **Sunrise/Sunset Times For the First Day of the Month in Central North Carolina**



   b. After students graph the data, ask them to interpret the graph. *[Possible responses: The sun rises earlier and sets later in the summer months. Days are shorter in winter (sunrise and sunset lines are closer together) and longer in summer (lines are further apart).]*

   c. Although the actual longest and shortest days of the year are not in the data table, ask them to calculate the longest and shortest days that *are* in the data table.

   d. Ask students to keep their graphs to use in the next activity.

5. Project BLM 6 Sunrise and Sunset Times Durham, NC; Quito, Ecuador; Santiago, Chile. Point out that there are 3 kinds of lines, some marked with circles, some with

x's and some with blocks. Ask students to look at their own graphs and find which line represents Durham.

a. Ask what students notice about the other two lines.

b. Point out that the title of the graph lists 3 cities, and that Quito, Ecuador is on the Equator, and Santiago, Chile is about the same latitude as Durham, except South of the equator. Project a world map and have students locate the three cities on it.

c. As a class, identify which line represents Quito, and which Santiago, and give reasons. Project BLM 7, which has a key showing which line represents which city. Discuss the following
   - when the sun rises earliest in the Northern *[June]* and Southern Hemispheres. *[December]*.
   - which month has the most hours of daylight in the Southern Hemisphere *[December]* and the fewest hours of daylight in the Northern Hemisphere *[December]*.
   - changes they see in sunrise and sunset times at the equator throughout the year. *[Sunrise and sunset times change very little throughout the year at the equator.]*

Discussion

1. What causes day and night? *[The Earth's rotation about its axis causes it. Any area on Earth experiences day when it faces the sun, and it experiences night when it faces away from the sun]*.
2. What is a solstice? An equinox? How do these relate to the proportion of daylight and darkness*?[A solstice has either the most (summer) or least (winter) hours of light. An equinox (autumn or spring) has approximately equal day and night.]*

    - Are students' graphs accurate and complete? Can students interpret graphs to answer some of the following questions:
    - Which month has the longest day of the year? *[June in the Northern Hemisphere]* The shortest? *[December]*
    - How do these months correspond to the seasons*? [Summer and winter, respectively]*
    - When do day lengths change fastest? *[equinoxes]* Slowest? *[solstices]*

BLM 4

BLM 5

Sunrise/Sunset Times for the First Day of the Month for Central North Carolina

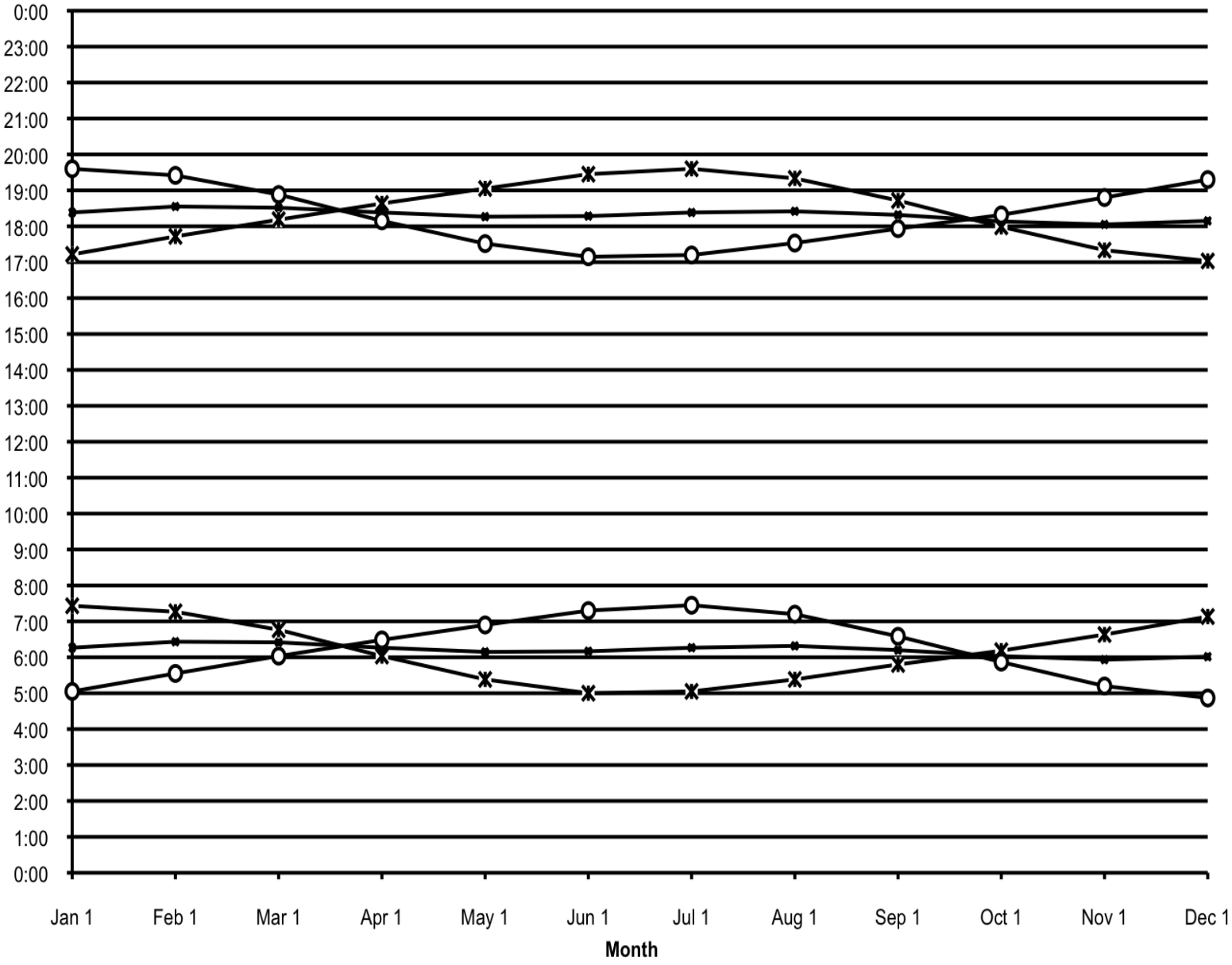
January		February		March		April	
rises (a.m.)	sets (p.m.)	rises (a.m.)	sets (p.m.)	rises (a.m.)	sets (p.m.)	rises (a.m.)	sets (p.m.)
7:26	5:12	7:17	5:42	6:45	6:11	6:01	6:38

May		June		July		August	
rises (a.m.)	sets (p.m.)	rises (a.m.)	sets (p.m.)	rises (a.m.)	sets (p.m.)	rises (a.m.)	sets (p.m.)
5:23	7:03	5:00	7:27	5:03	7:36	5:23	7:20

September		October		November		December	
rises (a.m.)	sets (p.m.)	rises (a.m.)	sets (p.m.)	rises (a.m.)	sets (p.m.)	rises (a.m.)	sets (p.m.)
5:48	6:42	6:11	5:59	6:39	5:19	7:08	5:01

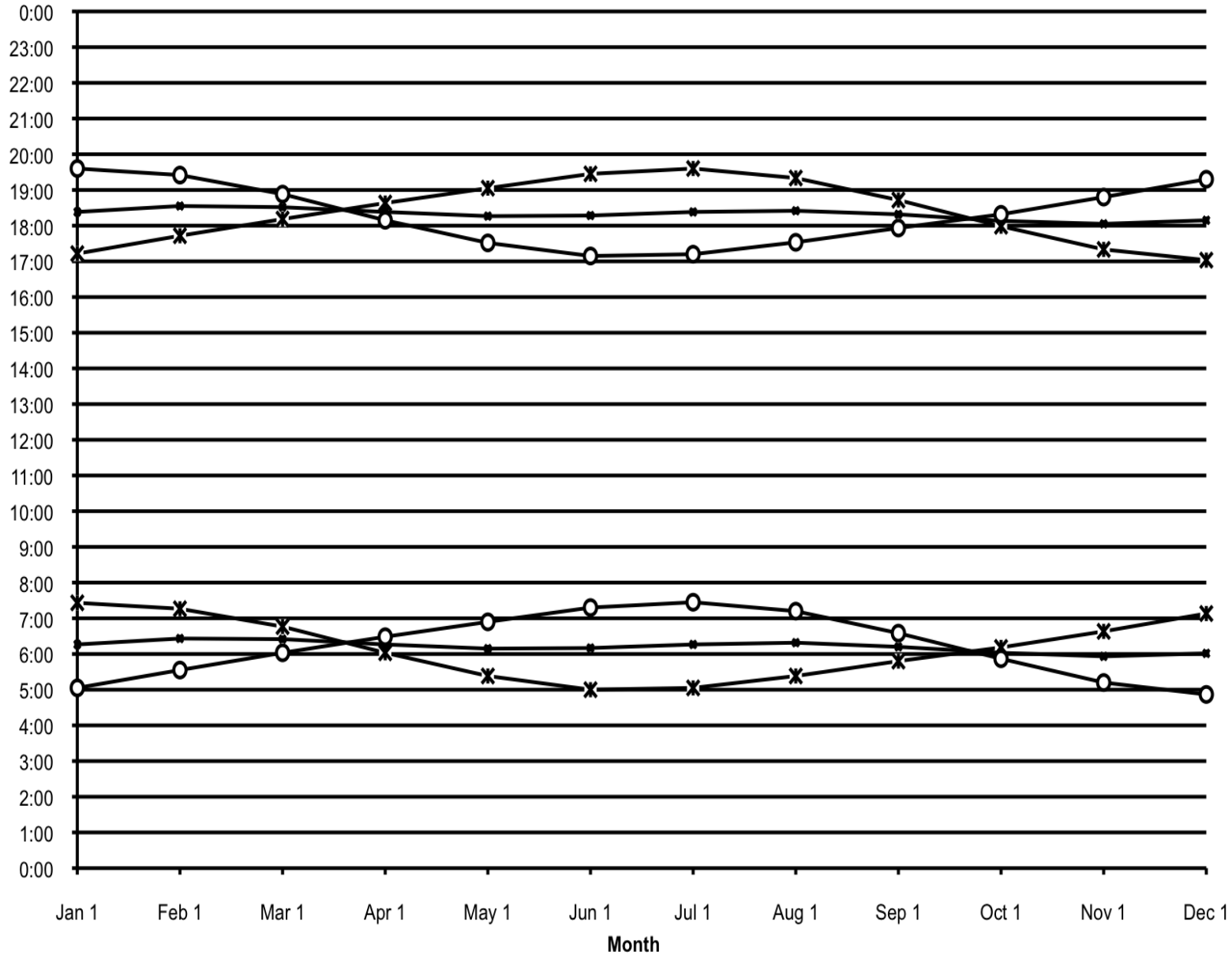
BLM 6

Sunrise and Sunset Times
Durham, NC; Quito, Ecuador; Santiago, Chile.



BLM 7

Sunrise and Sunset Times
Durham, NC; Quito, Ecuador; Santiago, Chile.



Key

x — rise and set Durham

— rise and set Quito

o — rise and set Santiago