Astronomy

Grade 3 Subjects: Science, Math Updated in 2024

Sunrise/Sunset

Overview

Does the sun shine longer during certain times of the year? What effect does that have on temperatures and the seasons? Students will collect and record the sunrise and sunset data from the *Minnesota Weather Guide Environment™ Calendar,* calculate day length, graph the results and draw conclusions about the effects of changing day length.

Background

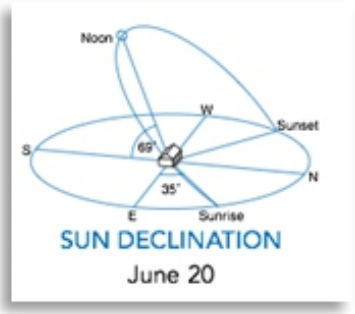
Changes in day length and the angle at which the sun strikes the Earth's surface are what drive the changing seasons. These two effects are greater at the poles and less at the equator and caused by the fact that the Earth rotates on an axis that is tilted 23.5° from the perpendicular.

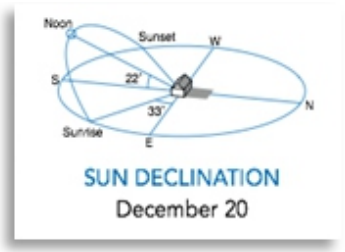
The following information is provided for teacher understanding and not intended as content for students.

During summer in the northern hemisphere, the north pole is tilted toward the sun and the sun rises earlier, climbs higher and sets later than it does at equinox. On June 20 or 21, Summer Solstice, the 23.5° tilt is pointed directly toward the sun. On that date we have our longest day and at noon the sun climbs to its highest point in the sky (about 68° above the horizon in the Twin Cities).

During our Winter Solstice, about December 20-21, we have our shortest day and at noon the sun only rises to 22° above the horizon, so very little solar energy is absorbed.

Twice a year the tilt of the Earth's axis is parallel to and not pointed toward or away from that of the sun, so day and night are the same length or equal. These two days, called Spring and Fall Equinox, fall on March 20 or 21 and September 20 or 21.





Time:

Day 1 - 60 minutes
Day 2 - 60 minutes

Skills:

Critical thinking
Recording
Data collecting
Interpreting
Forecasting
Drawing conclusions
Predicting
Writing

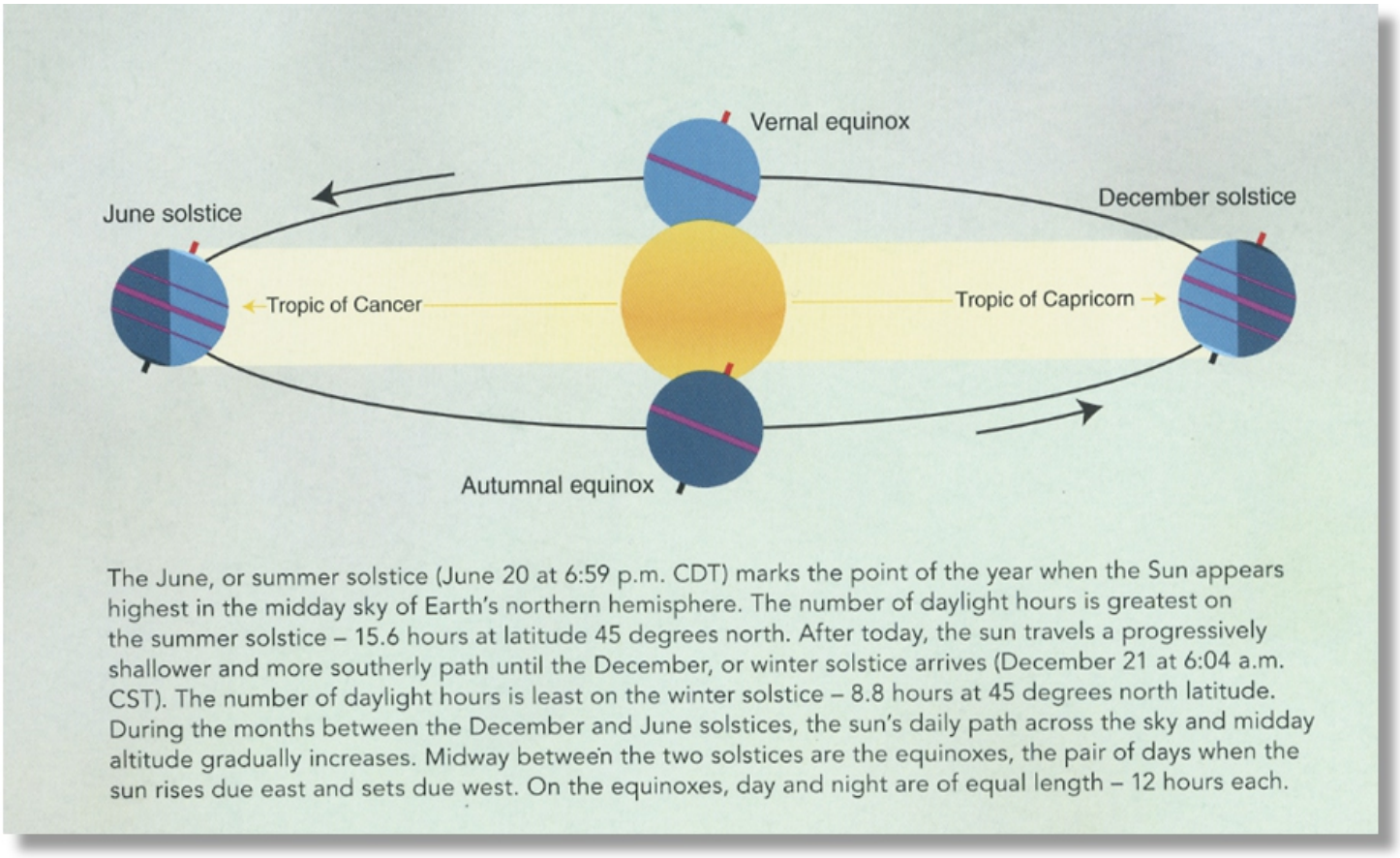
Vocabulary:

angle
sun declination

Materials Needed:

· *Minnesota Weather Guide Environment™ Calendar*
· *Sun up Sun Down* by Gail Gibbons
· *Sunshine Makes the Seasons* by Franklyn Branley
· chart paper
· markers
· blank calendar for each student;
· pencils

The following diagram presents the whole annual cycle showing the Earth's position for all four dates.



Illustrations: *Minnesota Weatherguide Environment™ Calendar*

The Activity

Day 1

Warm Up

1. Read the book *Sunshine Makes the Seasons* or *Sun Up Sun Down*.

2. Discuss with students that a great way to use data is to collect it over time and then look at the collected data to see what we can learn from it. Use the *Minnesota Weatherguide Environment™ Calendar* to show how data has been collected and may be used to form conclusions and to help predict what could happen during a specific month. For instance, the calendar is full of examples of how data is used to make a prediction as to when the first robins arrived or when the first frost will occur.

3. Explore the *Minnesota Weather Guide Environment™ Calendar* with the students. Point out the features of the *calendar* such as what is included each day as well as all the information in between the pages of each month. Direct student focus to the sunrise and sunset information. Show the students that every Wednesday, the *calendar* lists the number of hours and minutes of daylight for that day. The other days just provide the sunrise and sunset times.

4. Do some sample addition and subtraction problems on large chart paper or the board, to show the students how to calculate the total daylight hours using the sunrise and sunset times. Point out that the number of night time hours can then be found by subtracting daylight hours from 24 hours in a day. Ask students what could be learned by recording the daylight hours for one calendar month?

Day 2

1. Project *Minnesota Weatherguide Environment™ Calendar* image for November, and explain that they will be collecting data from the daily sunrise and sunset times.

2. Tell students that they are going to record the sunrise and sunset for one month and then calculate daylight hours for the month of November. They will do this by graphing the amount of daylight on each of the days.

3. Have students present and compare their graphs. Ask them if days are getting longer or shorter? Shorter. How much shorter is the day length on November 30th compared to the 1st? Depending on the year, approximately 1 hour 6 minutes ±. Ask students to predict what effect shorter days should have on temperatures? Temperatures should begin to fall. Ask, how could we learn from the *Minnesota Weatherguide Environment™ Calendar* if the temperatures do fall in November? They could record and graph the normal maximum or minimum temperature data listed on the calendar for each day of the month. "Normal temperature" is an average for the last 30 years—see *How to use the Weatherguide* inside the front cover. Based on their observations for November, ask students to predict if the days will continue to get shorter? Yes. Ask them, can this continue for a long time? No, we would soon have no daylight. How could they find when this trend changes? They could keep tracking the day length until they saw the days start to grow longer—about December 20th or 21st (Winter Solstice).

4. Repeat this exercise for the month of March. Ask if the days are getting longer or shorter? Longer.
How much longer is the daylight on March 30th compared to March 1st? Depending on the year, approximately 1 hour 34 minutes ±. Is there any date when day and night is almost the same length? March 20th or 21st, depending on the year, is the spring or vernal equinox. Ask students to predict if temperatures should get higher or lower during March? They should get higher. Ask students how they would find an answer to that question from the data in the calendar. Graph the daily normal. Ask if the days will continue to get longer? *Yes.* How could they find out how long this trend will continue? Track day length until they see days start to grow shorter—about June 20th or 21st (Summer Solstice).

Questions for Discussion

· Is there any other day during the year when the length of the day and night is almost equal?
The other day is September 20 or 21, autumn equinox.
· What is the longest day of the year?
June 20 or 21.
· How long would the day be on June 21st if we lived at the North Pole?
The sun would not set that day—24 hours of daylight. At the South Pole? The sun would not rise on that day—total darkness.
· Why do the seasons change so little around the equator?
The days are all about the same length and at noon the sun is directly overhead 90° at equinox, or at least 66.5° or more above the horizon (90°-23.5°=66.5°).

Extensions

· Have students pick the month of their birthday and graph the length of daylight and the normal temperatures.
· Have students calculate and graph both day length and night length for a given month.
· Students could calculate the day length for September and compare with March, the other month for equinox.

Resources

Minnesota Weather Guide Environment™ Calendar
online: https://jeffersfoundation.org/programs/calendar-in-the-classroom/
Sun up Sun Down by Gail Gibbons
Sunshine Makes the Seasons by Franklyn Branley
Music
Sun Up Sun Down by Billy B. Album contains the nominal song Sunup Sundown and One Trip Around the Sun.
http://billybproductions.com

Minnesota Academic Standards Met

3-D Science Standards
Science Practices:
4. Analyzing and Interpreting Data
5. Using Mathematics and Computational Thinking
8. Obtaining, Evaluating and Communicating Information

Crosscutting Concepts:
1. Patterns
3. Scale, Proportion, and Quantity

Disciplinary Core Ideas:
ESS1: Earth's place in the universe
3rd Grade: Identify and describe patterns in the amount of daylight in different times of the year
3rd Grade: Record observations of the sun, recognize patterns in data.

Math Standards

Grade	Strand	Anchor Standard	Code	Benchmark
3	Data Analysis	Data Sciences: Identify, formulate and investigate statistical questions by collecting data considering cultural perspectives, analyzing and interpreting data and communicating the results.	3.1.1.1	Notice and describe patterns in data-rich situations or given data sets. (MP7)
3	Data Analysis	Data Sciences: Identify, formulate and investigate statistical questions by collecting data considering cultural perspectives, analyzing and interpreting data and communicating the results.	3.1.1.4	Make predictions and recognize that the amount and source of the data impacts the accuracy of predictions. (MP4, MP8)