Lessons at a Glance

Science Content: Big Ideas

The Our Solar System Unit concentrates on the following Big Ideas. Along with the scientific Habits of Mind discussed on page 6, these concepts should be reinforced throughout the unit. The lessons in which each Big Idea is introduced or is a major focus are indicated in parentheses.

Introductory Lesson

- Science consists of the actions you take and the tools you use to wonder, think, try, observe, record, discover, and wonder anew. (Lesson 0)

The Sun's Daily Pattern

- The sun appears to travel through the sky in a predictable daily pattern. (Lessons 1, 2, 3, 4, 5, 6, 7)
- The sun's daily pattern can be explained by the rotation of Earth. (Lessons 6, 7)

The Sun's Annual Pattern

- The apparent path of the sun across the sky changes slowly over a year. (Lessons 4, 5, 14, 15, 16, 17, 18)
- The length of daylight slowly changes over the year. (Lesson 8, 14, 15, 16, 17, 18)
- The sun's annual pattern is the result of Earth orbiting the sun once a year. (Lesson 19)

Our Moon's Cycle

- Like the sun, the moon appears to move across the sky daily. Sometimes you can see the moon during the day. (Lesson 9)
- The observable shape of the moon changes from day to day. The moon's cycle takes about a month. (Lesson 10)
- Wondering about the world leads to scientific investigations and research. (Lesson 11)
- The observable shape of the moon changes from day to day in a predictable pattern. The moon's cycle takes about a month. (Lesson 12)
- The moon's shape seems to change from day to day because we see different views of the moon's sun-lit portion as the moon orbits around Earth. The moon's cycle takes about a month, the time it takes for the moon to orbit Earth. (Lesson 13)

Stars and Planets

- The sun is a star like all other stars. (Lessons 20, 22, 23)
- The sun is the center of our solar system, and Earth is one of nine planets that orbit it. (Lessons 20, 21, 23)
- Like the sun appears to move across a daytime sky, the stars appear to move across the nighttime sky because Earth rotates on its axis. (Lessons 22 and 23)
- Nine planets orbit around our sun. (Lessons 24, 25, 26)
- Each planet has unique characteristics that distinguish it from other planets. (Lessons 24 and 25)
- Vast distances exist between the planets. (Lesson 26)

Skill Building Activities

- Scientists use models to represent things that are too big, small, fast, slow, far away, or dangerous to observe in the real world. (Skill Building Activity 1)
- Scale models represent real objects but are different sizes than the actual objects. Scientists make scale models to help them look at something that is hard to study otherwise. (Skill Building Activity 2)
- Line graphs are charts that measure how data changes over a period of time. (Skill Building Activity 3)
- Elapsed time can be calculated by adding the number of hours and minutes that have passed between a beginning and ending time. (Skill Building Activity 4)

Lesson Overviews

The following overviews briefly summarize each lesson in the Our Solar System Unit. Core lessons are indicated with an asterisk (*). Suggestions for scheduling and flexible implementation are shown in gray.

Lesson 0: Doing Science

Children sharpen their awareness of scientific thinking as they conduct a self-directed exploration and then reflect on the processes they engaged in. In the context of these experiences, they are introduced to the work of scientists and to the Science Companion "I Wonder" circle, which provides a visual representation of many of the facets of scientific inquiry, exploration, and discovery.

*Lesson 1: Daytime and Nighttime**

Our Solar System Unit lessons 1-3 and 6-7 create a cluster that focuses on the sun's daily pattern. This lesson introduces the concept of a daily pattern with a science talk that explores children's ideas about the reasons for daytime and nighttime.

*Lesson 2: A Sense of Sun**

This is the second lesson in the Sun's Daily Pattern cluster. Through outdoor observations and indoor discussions, the children use their senses to experience the sun. They consider the sun as Earth's source of light and think about the effect sunlight has on Earth in terms of heat and shadows. They also do several activities in which they manipulate their own shadows to get a sense of how shadows indicate the position of the sun.

This lesson requires a clear, bright day.

*Lesson 3: Watching the Sun for a Day**

Children observe the sun several times throughout the day and discern how it seems to move across the sky. In addition, they learn about the variables, such as landmarks and shadows, needed to make accurate observations of the sun. Later lessons in this cluster have the children consider that a rotating Earth and a stationary sun make the sun appear to move across the sky.

This lesson requires a clear day during which the sun is visible. A minimum of three observations is needed, so do this lesson in one day or over several days (at different times of day) within one week.

*Lesson 4: The Sun in Fall: Data Collection**

Lessons 4-5, 8, and 14-19 in this unit create a cluster of lessons that focus on the sun's annual pattern. In this lesson the children use scientific tools to observe shadows and record the sun's position several times during the day. They confirm their observation from the previous lessons that the sun's relative position changes during the day, and they collect data they will compare to data collected using the same tools in winter (Lesson 14) and spring (Lesson 16). Collecting data in each season challenges the children to look at how the sun's apparent path across the sky changes over the course of the year.

Hold this lesson on a clear, sunny day as close to the autumnal equinox (about September 21 in the northern hemisphere) as possible. If all observations cannot be completed in one day, you can continue this lesson any time over the course of a week to obtain similar results.

*Lesson 5: Modeling the Sun in Fall**

This lesson, part of the Sun's Annual Pattern cluster, challenges the children to use flashlights with the sky dome and shadow-recording tool to model the sun's position in the sky throughout the day. They confirm previous observations that the sun's relative position changes during the day.

*Lesson 6: Our Models of Daytime and Nighttime**

Working in teams, children create models that help explain their observations of daytime and nighttime and the sun's apparent movement across the sky during the daytime. By evaluating each other's models, the children begin to understand that what they have observed about daytime and nighttime is caused by Earth's rotation on its axis every day.

Try to teach this lesson soon after Lesson 5 and also after teaching the Skill Building Activity "Using Models in Science."

*Lesson 7: Earth Rotates**

This is the last lesson in the Sun's Daily Pattern cluster. In this lesson, the children compare and contrast the models they created in the previous lesson to the model of Earth's rotation that scientists have developed. The children use the models to discern that the rotation of Earth explains their observations of daytime and nighttime and the apparent movement of the sun across the sky.

*Lesson 8: Class Astronomer**

Children become familiar with the work of astronomers by collecting sunrise and sunset data on a daily, then weekly, basis and learn how to calculate elapsed time to determine the length of daylight for each day. They record the data collected and begin to look for patterns as the year progresses. All the data is graphed and analyzed in Lesson 18, "Predicting the Sun in Summer."

This lesson also introduces the role of class astronomer. The class job begins with collecting weekly sunrise and sunset data, and recording the data on sunrise and sunset charts. During the lessons about the moon's cycle, the job includes recording moon phase data as well.

This lesson must be taught in two sessions. One or both sessions can be taught during mathematics. Try to teach the first session on a Monday so you can record five consecutive days of sunrise and sunset data. Schedule the second session the following week to allow children to reflect on the data they collected and to introduce the class astronomer job and routines.

For states using daylight savings time, try to teach this lesson after the change from daylight saving time to standard time on the last Sunday in October.

Lesson 9: Watching the Moon for a Day

Our Solar System Unit lessons 9-13 create a cluster of lessons that focus on the moon. In this lesson, the children observe the moon multiple times on a single day and discern how it appears to move across the sky.

Teach this lesson on a clear day any time the moon is visible during school hours, even before you begin the rest of the Our Moon's Cycle cluster. To determine appropriate dates and times, see the Teacher Directions "Finding the Moon in the Sky" on page 176.

Lesson 10: Watching the Moon for a Month

The children learn how to conduct daily observations of the moon and record its shape over one lunar cycle. Daily observations continue over the next four weeks, when they discover the pattern of the moon's phases. They also reflect on keeping accurate and honest data.

Teach this lesson at a time when you will have 28 consecutive days for the children to observe the moon through one lunar cycle. Avoid scheduling it during a month with school breaks (such as winter break).

Lesson 11: Wondering About the Moon

In this lesson of the Our Moon's Cycle cluster, the children wonder about the moon and create a "K-W-P-L" (Know-Want to Know-Predict-Learned) chart of their ideas. They also think of strategies for researching their ideas about the moon.

Lesson 12: The Moon's Cycle

The children review and reflect on the moon phase data they collected over the previous month. They place pictures in order, making a flipbook of the moon's changing shape that models the moon's monthly cycle. The children also record their current ideas about what they think causes the moon's cycle.

Teach this lesson after the children have collected and recorded moon observation data for one month.

Lesson 13: Modeling the Moon's Cycle

This is the last lesson in the Our Moon's Cycle cluster. In this lesson the children practice using a model that explains the cause of the moon's cycle, a concept that is usually not introduced until a later grade. However, the children's prior experience with models in this unit has created a foundation for building meaningful models from abstract concepts.

Prior to this lesson, it would be helpful if the children have already completed the Skill Building Activity "Using Models in Science" on page 376.

*Lesson 14: The Sun in Winter: Data Collection**

This lesson, part of the Sun's Annual Pattern cluster, challenges children to look at how the sun's apparent path across the sky has changed since their observations in the fall. The children again use tools to observe shadows and record the sun's position several times during the day. They use the data collected in this lesson for modeling and comparing in Lesson 15.

Hold this lesson on a clear, sunny day as close as possible to the winter solstice (about December 21 in the northern hemisphere). If all observations cannot be completed in one day, you can continue this lesson any time over the course of a week to obtain similar results.

*Lesson 15: The Sun in Winter: Modeling and Comparing**

This lesson, part of the Sun's Annual Pattern cluster, challenges the children to use a flashlight with the sky dome and shadow-recording tool to model the sun's apparent path across the sky throughout the day. This exploration compares and contrasts data collected in the fall and the winter.

*Lesson 16: The Sun in Spring: Data Collection**

This lesson, part of the Sun's Annual Pattern cluster, is the final lesson where children look at how the sun's apparent path across the sky changes over the course of the year. The children again use tools to record the sun's position several times during a day. They use the data collected in this lesson for modeling and comparing in Lesson 17.

Hold this lesson on a clear, sunny day as close to the vernal equinox as possible (about March 21 in the Northern Hemisphere). If all observations cannot be completed in one day, you can continue this lesson any time over the course of a week to obtain similar results.

*Lesson 17: The Sun in Spring: Modeling and Comparing**

This lesson, part of the Sun's Annual Pattern cluster, challenges the children again to use a flashlight with the sky dome and shadow-recording tool to model the sun's apparent path across the sky throughout the day. The exploration compares and contrasts data collected in the fall, winter, and spring.

*Lesson 18: Predicting the Sun in Summer**

In this lesson, the children compile all the daylight data they collected over the past six months on a line graph. They then compare the graph to all the other information they collected during the sun's annual pattern lessons, and identify patterns and trends. With this information, they recognize they can make an educated prediction about the sun's pattern in summer.

Consider teaching this lesson over two days. One or both sessions could be taught during mathematics.

For states using daylight savings time, try to teach this lesson before the change from standard time to daylight savings time on the first Sunday in April.

*Lesson 19: Modeling Earth's Orbit Around the Sun**

In this lesson, the last of the Sun's Annual Pattern cluster, the children model the yearly orbit of Earth around the sun. They carry a globe around a light that represents the sun, and observe the relative positions of the globe and the "sun" during different "seasons" of the year. In addition, children become aware of the tilt of the globe, and consider how Earth's tilt relates to changes in the length of daylight and height of the sun in the sky throughout the year.

Lesson 20: Relative Sizes of the Sun, Moon, and Earth

This lesson opens a cluster of lessons about stars and planets (Lessons 20-26), but it is also pertinent to earlier lesson clusters about the sun and moon. In this lesson the children view the comparative sizes of scale models of Earth, the moon, and the sun. They think about how the sun and the moon can appear to be the same size in the sky when, in fact, they are vastly different sizes, and learn this illusion is created because the sun is much farther away from Earth than the moon.

Lesson 21: Wondering About Our Solar System and Beyond

The children wonder about the solar system and create a class "K-W-P-L" (Know-Want to Know-Predict-Learned) chart of their ideas about the solar system and what lies beyond it.

*Lesson 22: Stars Outside Our Solar System**

After reviewing that the sun is in the center of our solar system, children focus on how stars appear to move across the nighttime sky and discover why we don't see stars during the daytime. This lesson is the first of two that address stars outside our solar system.

Lesson 23: Stars and Planets

Following Lesson 22, this lesson concludes an introduction to stars outside our solar system, and, together with Lessons 24-26, creates a series of lessons about the planets within our solar system. Children study several pictures of planets and their changing positions against a stable background of stars.

Lesson 24: Researching the Planets

Children continue learning about objects in our solar system, by using nonfiction books and the Internet (if available) to gather information about a planet they choose to investigate. In Lesson 25 they create a report that communicates their research results.

You can teach this lesson during language arts.

Lesson 25: Describing the Planets

Children prepare a creative report describing their chosen planet using research gathered in Lesson 24.

You can teach this lesson during language arts. Anticipate spending more than one class session having children create and share their reports.

Lesson 26: The Scale of Our Solar System

In the final lesson about the objects in our solar system, children investigate the scale of the solar system by trying to understand the size of the planets and how far apart they are relative to the sun. Children carry tiny scale models of the planets and pace the immense distances between them.

*Skill Building Activity 1: Using Models in Science**

Children study various types of models and learn how they are used in science. They also make models of their own.

Skill Building Activity 2: Building to Scale

In this lesson, children receive a concrete introduction to the concept of scale. They begin by thinking about when changes in scale might be useful in making scientific models. Then they use pattern blocks to make shapes at larger scales, and talk about the fractions that identify the scales they used. The lesson concludes with the children sharing toys that represent real objects, comparing the scales of similar objects, and creating models with objects of the same or similar scale.

This lesson is suitable for flexible implementation with mathematics.

*Skill Building Activity 3: Making Line Graphs**

Scientists rely on graphs to help them analyze data they have collected. A line graph is especially useful to scientists when they need to measure how data changes over a period of time. This activity provides a basic introduction on how to organize data on a line graph and how to use it as a tool to understand the data displayed. By looking for trends on a line graph, the children learn how to make educated predictions, a skill needed for many science activities.

You can teach this lesson during mathematics.

*Skill Building Activity 4: Elapsed Time**

Children explore measuring time by using a paper clock or Judy Clock to calculate the amount of time that elapses between various starting and ending times.

You can teach this lesson during mathematics.