

Dear Families,

Our class is beginning a Science Companion® unit about the solar system.

Learning about the solar system is challenging for children this age. The children will be asked to think about familiar things—the sun, moon, and stars, as well as shadows—in new ways. During a series of activities over the school year, they will identify how the length of a day changes over the year, how the position of the sun in the sky changes slowly from day to day, and how the shape of the moon cycles through a pattern. After they recognize these patterns, they will explore and address questions about why these things happen, such as: Why are there seasons? Why does the moon change shape? These are questions that scientists have asked for thousands of years.

From time to time, your child will bring home handouts called **Family Links**. These handouts will give you information about what your child is learning and offer suggestions about how you can help. They will be your link to the classroom. There are three kinds of Family Link handouts:

- **Homework** assignments your child will be expected to complete and return to class.
- **Fact Sheets** containing information you and your child can read and refer back to about the topics your child is learning. These fact sheets provide enough information to give you confidence about your own knowledge of the topic, so you can help your child learn.
- **Home Activities** for you and your child to do together if you have the time and are interested in learning more. They are not required homework.

If you have a computer at home with access to the Internet, there are wonderful sites for children where they can look at pictures from space and delve as deeply into the topic as their interest takes them. Visit <http://www.sciencecompanion.com/links> to find descriptions of recommended web sites.

Your child's study of the solar system may inspire questions. Whether you know a great deal about the solar system already or will be learning right along with your child, your interest and assistance will enhance your child's learning experience.

This is going to be fun for the class. We hope you enjoy it too. The following pages outline the unit and describe some common misconceptions that people have about the solar system.

Sincerely,

A Brief Outline of the Our Solar System Unit

Note: Due to time available or local science standards, your child's class may cover all or some of these topics.

Learning about the Sun's Daily Pattern and the Sun's Annual Pattern

We begin our study of the sun by observing it as it moves across the sky. By recording the shapes of the shadows cast by the sun throughout the course of a day, we can tell how high the sun is in the sky (as seen from our location on Earth). We will discover the patterns of how the sun appears to move in a day.

As a class, we will track sunrise and sunset data to see how the length of daylight changes over the course of the year.

We will repeat our observations of the sun and its shadows in the fall, around the winter solstice, and in the spring. The children will observe how the height of the sun (as viewed from Earth) changes over the course of the seasons and the year. We will use hands-on models to show how Earth moves in relationship to the sun, and how these movements explain our observations of the sun and its shadows.

Big Ideas:

- The sun appears to travel through the sky in a predictable daily pattern.
- The sun's daily pattern can be explained by the rotation of Earth.
- The apparent path of the sun across the sky changes slowly over a year.
- The length of daylight slowly changes over the year.
- The sun's annual pattern is the result of Earth orbiting the sun once a year.

Learning about the Moon's Cycle

The children will observe the moon for a month, recording observations in the daytime and nighttime. They'll learn the patterns of how the moon moves across the sky, and how the shape we can see from Earth changes over the month. The children will have a chance to model how the moon is lit by sunlight as it moves around the Earth.

Big Ideas:

- Like the sun, the moon appears to move across the sky daily. Sometimes you can see the moon during the day.
- The observable shape of the moon changes from day to day in a predictable pattern. The moon's cycle takes about a month.
- 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.

Learning about Stars and Planets

We will learn about stars outside our solar system and planets in our solar system.

Big Ideas:

- The sun is the center of our solar system, and Earth is one of nine planets that orbit it.
- The stars lie outside our solar system.
- The sun is a star like all other stars. 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.
- Each planet has unique characteristics that distinguish it from other planets.
- Vast distances exist between the planets that orbit around our sun.

Misconceptions About the Solar System

Children are curious about our solar system, and many have formed their own explanations for the things they have observed or heard about. Researchers who interviewed children about the solar system found that some children had ideas like these:¹

- The Earth we live on is flat and not round like a ball.
- Nighttime is caused because the sun hides, goes to sleep, turns off, goes out, is on the ground, hides behind trees, or goes behind hills.
- The shape of the moon changes because the shadow of Earth falls on the moon.
- The difference in temperature over the seasons is caused by Earth being a different distance from the sun during parts of its orbit.

Children are not the only ones with misconceptions about how Earth, the sun, and the moon interact. In one study interviewers asked Harvard professors and students at graduation what caused the seasons.² Many of the adults interviewed had the mistaken idea that winter is caused because Earth is farther from the sun during that part of its yearly journey around the sun. Even though some of these adults had taken courses in physics and relativity, they had developed and retained incorrect views formed by misleading pictures in textbooks—pictures that seemed to represent the orbit of Earth around the sun as an exaggerated oval instead of the almost circular shape it actually is.

Correcting Misconceptions

Studying the solar system poses the challenge that objects like the sun, moon, and stars cannot be touched or viewed up close. However, this unit includes several ways for your child to experience the solar system and discover how it is put together.

Your child's class has the opportunity to correct misconceptions. By studying our solar system, the children can learn that:

- Earth is a sphere. It rotates around its axis once a day and orbits the sun once a year.
- Nighttime is caused by the daily rotation of Earth. The part of Earth where we are turns away from the sun at night.
- The lit portion of the moon that we see is reflected sunlight. The shape that we see depends on where the moon is in its orbit of Earth. The shadow of Earth only falls on the moon during lunar eclipses.
- The difference in temperature over the seasons is caused by the tilt of Earth on its axis, and by its yearly orbit of the sun. During winter in the northern hemisphere, the North Pole is tipped away from the sun. During summer in the northern hemisphere, Earth is a half-orbit away from its "winter" position, and the North Pole is tipped toward the sun.

¹ Driver, R., Squires, A., Guesne, E., Tiberghien, A. *Children's Ideas in Science*. Philadelphia: Open University Press, 1985.
Driver, R., Squires, A., Rushworth, P., and Wood-Robinson, V. *Making Sense of Secondary Science*. New York: Routledge, 1994.

² Private Universe Project. *A Private Universe* [Videotape]. Cambridge, MA: Harvard-Smithsonian Center for Astrophysics, 1989.