

Organizing Topic — Investigating the Sun-Earth-Moon System

Standards of Learning

- 4.1 The student will plan and conduct investigations in which
- a) distinctions are made among observations, conclusions, inferences, and predictions;
 - b) hypotheses are formulated based on cause-and-effect relationships;
 - c) variables that must be held constant in an experimental situation are defined;
- 4.7 The student will investigate and understand the relationships among the Earth, moon, and sun. Key concepts include
- a) the motions of the Earth, moon, and sun (revolution and rotation);
 - b) the causes for the Earth's seasons and phases of the moon;
 - c) the relative size, position, age, and makeup of the Earth, moon, and sun; and
 - d) historical contributions in understanding the Earth-moon-sun system.

Essential Understandings, Knowledge, and Skills

Correlation to Textbooks and Other Instructional Materials

The students should be able to

- differentiate between rotation and revolution;
- describe how the Earth's axial tilt causes the seasons;
- model the formation of the eight moon phases, sequence the phases in order, and describe how the phases occur;
- describe the major characteristics of the sun, including its approximate size, color, age, and overall composition;
- create and describe a model of the sun-Earth-moon system with approximate scale distances and sizes;
- compare and contrast an Earth-centered model of the solar system to the sun-centered one;
- analyze the differences in what Aristotle, Ptolemy, Copernicus, and Galileo observed and what influenced their conclusions;
- compare and contrast the surface conditions of the Earth, moon, and sun;
- describe a contribution of the NASA Apollo missions to our understanding of the moon.

What's the Difference?

Organizing Topic Investigating the Sun-Earth-Moon System

Overview Students investigate the similarities and differences among the sun, Earth, and moon.

Related Standards of Learning 4.7c

Objectives

The students should be able to

- describe the major characteristics of the sun, including its approximate size, color, age, and overall composition;
- compare and contrast the surface conditions of the sun, Earth, and moon.

Materials needed

- Computer
- Research materials
- Materials for making a brochure
- Attached fact sheets

Instructional activity

Content/Teacher Notes

This activity may be done in small groups or individually. For additional information, see the following NASA Web sites for lithographs of and corresponding information about each celestial body:

- http://www.nasa.gov/pdf/62227main_Sun_Lithograph.pdf
- http://www.nasa.gov/pdf/62209main_Earth_Lithograph.pdf
- http://www.nasa.gov/pdf/62217main_Moon_Lithograph.pdf

Introduction

1. Review information students have previously learned about the sun, Earth, and moon.

Procedure

1. Assign students the task of making a PR brochure about the sun, Earth, or moon, advertising the celestial body and convincing the rest of the universe that it is the best star, planet, or moon in the universe. They should include facts from the lithographs and/or fact sheets included in this lesson.
2. Once students complete their brochure, have them meet with two other students who have done the other assignments. Challenge the small groups to come up with a chart of how the three bodies are alike and different, based on the information in their brochures and what they learned from making the brochures.

Sample assessment

- Have students compare different aspects of the sun, Earth, and moon. For example, they could compare their surfaces or their sizes.

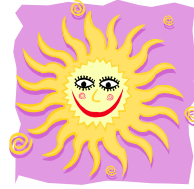
Follow-up/extension

- Have students make a poster about the sun, Earth, or moon.

Resources

- *Earth in Space: SOL Teacher-Instruction Module*. Science Museum of Virginia. <http://www.smv.org>. A comprehensive set of astronomy lessons and resources for grades K–6.
- *Exploring the Moon: A Teacher's Guide with Activities for Earth and Space Sciences*. NASA. http://www.nasa.gov/pdf/58199main_Exploring.The.Moon.pdf.
- *Langley Research Center*. NASA. <http://www.nasa.gov/centers/langley/about/index.html>.
- *NASA Space Place*. <http://spaceplace.nasa.gov/en/kids/>. A resource for students and teachers.
- *National Aeronautics and Space Administration (NASA)*. <http://www.nasa.gov>.

Sun Facts



- The sun is an average-sized yellow star, about 110 times the diameter of the Earth. (The sun is about 1.39 million kilometers in diameter.)
- The sun has 330,000 times the mass of the Earth and is 93 million miles (150 million km) away from the Earth on average.
- Light from the sun takes about eight minutes to reach Earth.
- The sun is composed of very hot gases, mostly hydrogen and helium, with smaller amounts of other gases.
- The temperature of the sun is about 60,000°C on the surface. Its yellow color comes from its surface temperature.
- The sun's temperature at its center is about 15,000,000°C (27,000,000°F). The sun's energy (heat and light) comes from nuclear reactions, which turn hydrogen into helium.
- The sun has been shining for about 5 billion years and is expected to shine for about another 4.5 billion years.
- Our sun is a star that is modest in size and shines with a calm and steady light at this time in its life cycle. Unlike many stars, it does not have a companion or twin.
- All these things help to make it possible for life to exist on Earth.

Earth Facts



- The Earth is 12,756 kilometers (7,927 miles) in diameter
- The Earth is the third planet from the sun and is about 150 million kilometers (93 million miles) from the sun.
- The sun provides the energy that gives light and heat to the Earth. The Earth is close enough to the sun to be warm, but far enough away so that we don't burn up.
- The Earth has an atmosphere rich in oxygen and nitrogen. The atmosphere helps to support life and protects living creatures from some of the sun's harmful rays. In fact, Earth is the only planet we know of that has living things on it.
- The Earth has large amounts of life-supporting water. Almost three quarters of the planet's surface is covered by water.
- The Earth has seven large landmasses, called "continents."
- Water occurs naturally in all three phases (ice, water, and water vapor) on Earth.

Moon Facts



- The moon is about one-fourth the diameter of the Earth.
- On the surface of the moon, gravity is about one-sixth that of Earth.
- The moon actually rotates exactly once each time it orbits, which means that it keeps the same face toward the Earth all the time. It takes about 29.5 days for the moon to go through all of its phases from one full moon to the next full moon.
- The moon was probably formed very early in our solar system when something the size of a planet collided with Earth. From this collision, the moon was formed.
- The surface of the moon is actually darker than the Earth's surface.
- Of all the sun's light hitting the moon, about 11 percent is reflected.
- The surface of the moon has many large, dark areas, which give the moon its "man in the moon" appearance. These are ancient lava flows, called "maria," which means "seas." Early astronomers thought these dark areas were made of water.
- The moon has many craters caused by collisions from asteroids. Early astronomers originally thought they were caused by volcanoes.
- The Apollo missions to the moon (1969-1972) are thought by some scientists to be the most important science investigation in history.