

California State Standard Set 5

Section 5 — Earth Sciences

Understanding the organization and configuration of our Solar System is at the heart of this chapter. Students will be exposed to understanding and describing the relative motions of the planets. Having already had exposure to the concept of the Earth's movement in space in relation to the Sun and Moon, students will study the composition of the Sun and the other components of the planets. The relationship between gravity and planetary orbits will be explored.



Teachers' Standards Checklist

Skills and Concepts covered in the Standard Set 5 section.

Standard Set	Dates Completed and Comments
<p>Standard Set 5. Earth Sciences (The Solar System) The solar system consists of planets and other bodies that orbit the Sun in predictable paths. As a basis for understanding this concept:</p>	
<p>a. Students know the Sun, an average star, is the central and largest body in the solar system and is composed of primarily hydrogen and helium.</p>	
<p>b. Students know the solar system includes the planet Earth, the Moon, the Sun, eight other planets and their satellites, and smaller objects, such as asteroids and comets.</p>	
<p>c. Students know the path of a planet around the Sun is due to the gravitational attraction between the Sun and the planet.</p>	

Lesson Plan — Standard Set 5

Title: The Magic of Bodies in Space

Objectives:

Conceptual - Students will:

- Expand their knowledge of the Sun and the Solar System to include its composition, and gravitational influences.

Behavioral - Students will be able to:

- Demonstrate prior knowledge of the Sun and the solar system
- Share ideas with a group
- Create and name categories related to concept of space
- Use a graphic organizer to display information

California Standard(s)

Science — Introduction to Standard Set 5. Earth Sciences

Focus Question: What do you know about the Earth and Sun?

Materials:

Large chart with columns for groups, one marker per group, one sheet of writing paper per group, copies of the Categories Chart one per student

Procedure:

1. Present students with a model of the solar system. Ask them to conduct a “write around”, which is an activity where students begin with one sheet of writing paper. In groups of four, one student takes the paper and writes one thing he/she knows about the solar system. Then the student passes the paper to the next person who has to read what the first person wrote, and writes something different. The group conducts the write around for five minutes.
2. The groups will share their ideas by entering some of their responses onto a large piece of chart paper made by the teacher. Each group will have a column of their own to enter responses in. It may resemble this:

Group 1	Group 2	Group 3	Group 4	Group 5
There are 9 planets in the solar system.	The Sun is the center of the solar system.	Earth has one moon.	The planets travel around the Sun.	Other things move around in space.

Lesson Plan — Standard Set 5

3. After all groups have put most of their responses on the large chart, direct them to now create categories using some of the ideas on the chart. Distribute the Categories Chart to each student, and direct students to place each idea into a category. Once the category is completed, put a name for the category at the top. It should resemble this:

The Sun	The Earth	The Planets	Objects in space	People in space
The Sun is the center of the solar system. The Sun gives the Earth light and heat.	The Earth revolves around the Sun. The Earth has one moon.	The planets orbit around the Sun. There are nine planets	There are objects in the solar system that roam around space. Other objects are called comets.	People travel to space. Astronauts have to be great science students.

Although a group activity, each student must be accountable for making his/her own Categories Chart.

4. When groups are done, students will circulate around the room and share their categories and ideas.
5. Reconvene as a class, and share categories with the teacher.
6. Teacher will inform students that in this unit they will learn more in-depth information about the Sun, the Earth, and other celestial bodies.

Assessment:

Students will hand in their Categories Charts for the teacher to evaluate to develop an understanding as to what the students know about the Earth in Space.

Home/School Connection:

Ask students to present the Categories Chart to their parent/guardian with the names of the categories blank. Have parents try to guess the names of the categories and fill them in.

Lesson Plan — Standard Set 5

Categories Chart

California Content Standards — Grade 5

Standard Set 5. Earth Sciences (The Solar System)

5. The solar system consists of planets and other bodies that orbit the Sun in predictable paths.
- 5.a. Students know the Sun, an average star, is the central and largest body in the solar system and is composed primarily of hydrogen and helium.

Notes to Teacher



No one can question the importance of the Sun to life on Earth. Students begin their formal study about the Sun in Grade 1 when they recognize that the Sun warms the land, air, and water around us. They continue their investigation of the Sun in Grade 3 as they begin to explore how the Sun's position in the sky changes during the day and during the seasons.

In this section, students look at the Sun's place in our solar system as well as its composition. In Standard Set 1 students have the opportunity to study some representative elements including hydrogen and helium. Now they find that those two gases are responsible for the Sun's energy.

Touching on the long ago debate about whether Earth is the center of the universe or whether the Sun is, introduces students not only to the "heliocentric" (Sun-centered) model but also to the broader idea of history of science. Many students at this stage in their science study are intrigued by how we have arrived at this stage of "knowing" about science. They should be encouraged to research areas of interest to them. Many students are fascinated by space study. This section is the perfect "launching pad".

Key Words:



These words are introduced to the student in the context of this section. Students should be encouraged to add these words to their "Personal Word Glossary", their journals, and to the word wall.

Star – a large body in space that produces its own energy.

Students should be reminded that our Sun is a star. The stars we see at night are also "suns". They seem very small only because of the great distances between Earth and them.

Sun – the name we give the star that is at the center of our solar system.

California Content Standards

5.a. Students know the Sun, an average star, is the central and largest body in the solar system and is composed primarily of hydrogen and helium.

Hydrogen – a lightweight gas that reacts easily with other elements.

Students will encounter hydrogen as they study the periodic table. It has an atomic number of 1 because it has only one proton in its nucleus. Hydrogen is highly flammable.

Helium – a lightweight gas that does not react easily with other elements.

Helium, atomic number 2, is part of a group called the noble gases because it (and they) do not readily react with other elements.

Solar – something related to the Sun, ex. solar system.

Students will already be familiar with “solar” as an adjective, ex. solar panel, solar cooker, solar energy.

Background Information

Students are reminded that the Sun is responsible for all life on Earth, that is to say, we would have no life if the Sun’s energy did not reach this planet. Indirectly students studied this while learning, in Grade 3, about different environments in which plants and animals live. After all, environmental conditions like temperature, seasonal changes, amount of water, weather, are all related back to the Sun. In Grade 4, students studied food chains and food webs that begin with plants. Again, all organisms depend on the Sun, ultimately.

As students study the composition of the Sun in this section they will learn that energy is created by the pressure and extreme heat fusing hydrogen atoms together. Hydrogen atoms have one proton in their nucleus. When they are pushed together with such pressure, the two protons fuse. In this way they create a nucleus with two protons. When two protons are in the nucleus, a helium atom is formed.

We call this “nuclear fusion” (as opposed to nuclear fission where the nucleus is split apart). Both of these processes create tremendous energy. The energy from the nuclear fusion in the Sun is what keeps Earth going. Students will learn the specifics later in their study of chemistry and physics, for now, they need to know that the Sun creates energy and is composed of helium and hydrogen.

California Content Standards

5.a. Students know the Sun, an average star, is the central and largest body in the solar system and is composed primarily of hydrogen and helium.

Learning Strategies and Scaffolding

Throughout this Standard Set students must come to grips with some abstract concepts including great distances and great sizes. They are encouraged to read and visit the Internet where relational size models can be portrayed in exciting ways.

The NASA (National Aeronautics and Space Administration) website presents this material through many photos sent back to Earth from manned and unmanned space missions which have been collecting data for decades.

For those students as intrigued with looking back in time as looking forward, there are many great astronomers and physicists who have worked over centuries to understand the solar system. In the text students are introduced to Copernicus, the Polish astronomer from the 1500's who is credited with proving that the Sun is the center of our universe.

As with most science, his theories and findings were further investigated. Students can research Copernicus and his successors, Galileo and Kepler, to name just two, who took his information and explored it further. Subsequent findings helped clarify the thinking of the world at the time and ever since.

Students should also be encouraged to look to other parts of the world for other civilizations' ideas and discoveries about the Sun and the universe. Aztec and Maya civilizations, for example, centered much of their beliefs on the role of the Sun. They built pyramids to study the movement of the Sun. Students may wish to study these ancient structures, like Stonehenge in England and the temple at Karnak in ancient Egypt, built to trace the Sun's movement. Some students might wish to make a presentation to the class of their findings, others might draw pictures or diagrams of the temples, and others may try their hands at building models of the structures.



The Author
29 Moon Crescent
Earth Orbit
Milky Way
24826

Dear Student,

In this section you will have a chance to review what you remember about Earth's orbit around the Sun and the Moon's orbit around Earth.

Sometimes the Sun is referred to as a "ball of fire". Do you think so? You'll know for sure after you have studied this section.

The Sun is at the center of our solar system. As you know, Earth is not the only planet orbiting around the Sun. In this section we'll find out about more planets and other celestial bodies in orbit around our Sun.

And, you'll solve the mystery of how those orbits actually work!

Yours truly,

The Author



California Content Standards — Grade 5

Standard Set 5. Earth Sciences (The Solar System)

5. The solar system consists of planets and other bodies that orbit the Sun in predictable paths.
- 5.a. Students know the Sun, an average star, is the central and largest body in the solar system and is composed primarily of hydrogen and helium.

The Story



Ancient people were excellent scientists. They observed everything around them and asked questions. They often came up with answers, based on their observations. These ancient astronomers (scientists who study the solar system) observed the Sun moving across the sky all day long. They watched the Moon moving across the sky at night, and, sometimes even in the daytime. Their conclusion: Earth is the center of the universe.

Earth at the center of everything makes sense, based on what those ancient people saw. More observations through time, and further questions that were investigated (and continue to be investigated) showed that Earth is **not** the center of the universe after all.

In the 1500's a Polish scientist named, Copernicus, used mathematics and his observations of the sky (without a telescope, which was not invented for another 100 years) to reach a startling conclusion. His theory was that the Sun was actually the center of our solar system.

Astronomers have continued to explore space. They have discovered that many planets besides Earth orbit our Sun. They have found asteroid belts, comets, and even other solar systems with their own Suns!

Focus Question

Think about our own solar system. Where is the Sun located?




The center.

Answer

California Content Standards

5.a. Students know the Sun, an average star, is the central and largest body in the solar system and is composed primarily of hydrogen and helium.

Key Words:

Star —	a large body in space that produces its own energy	
Sun —	the name we give the star that is at the center of our solar system	
Hydrogen —	a lightweight gas that reacts easily with other elements	
Helium —	a lightweight gas that does not react easily with other elements	
Solar —	something related to the Sun, ex. solar system	

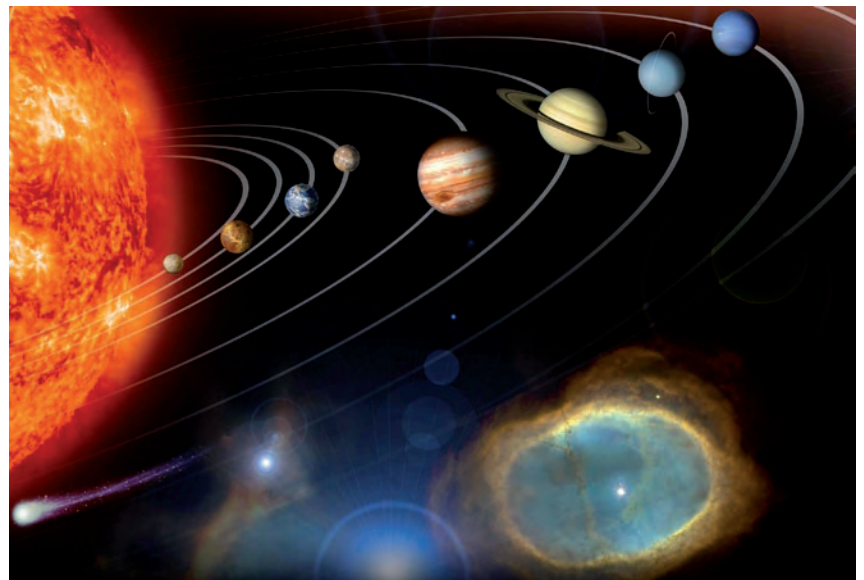
The Sun

The Sun is the largest body in our solar system. Although it is an average size star, it seems huge to us.

Earth, as we know it, would not exist without the Sun. Without the Sun's light energy, plants could not make their own food.

Without plants, you know what would happen to the animals!

Without the warmth of the Sun, even though it is approximately 150,000,000 kilometers (93 million miles) away from Earth, all the water here would freeze. It would get so cold that no life could exist.



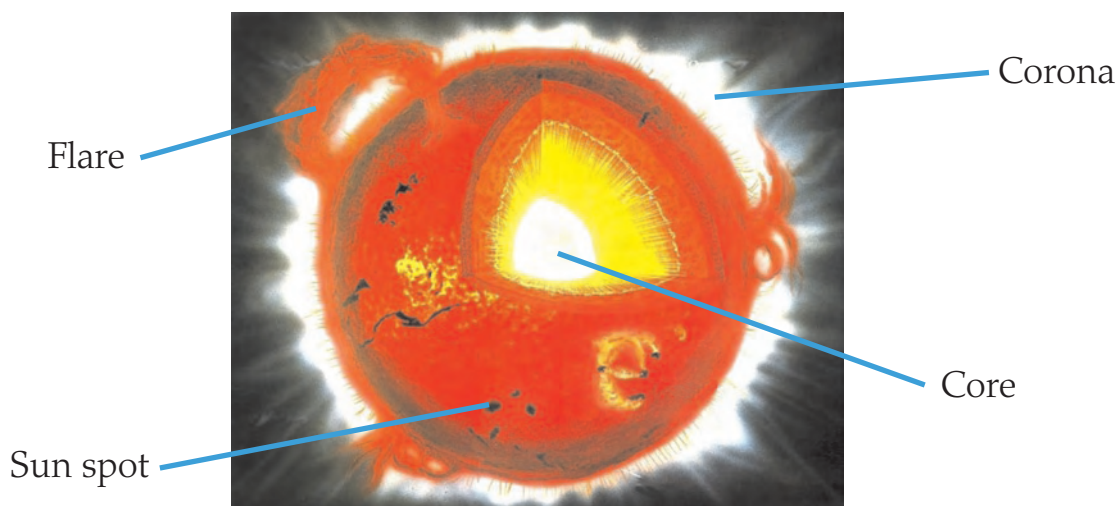
"How does the Sun make all this heat and light energy?"



California Content Standards

5.a. Students know the Sun, an average star, is the central and largest body in the solar system and is composed primarily of hydrogen and helium.

Like all stars, the Sun is made up of gases. Our Sun is made up mainly of hydrogen and helium. Because there is so much pressure and such extreme heat in the Sun, hydrogen atoms join together in a process called “fusion”. Two hydrogen atoms “fusing” together form a helium atom. The process creates a tremendous amount of energy. On Earth we can see that energy in the form of light and feel it in the form of heat.



Astronomers want to learn more about the Sun. They know that the bright ring around the outside is part of the Sun’s atmosphere. It is called the “corona”. They also know that sometimes there is an extra high-energy explosion of hydrogen called a “flare”. They know that sometimes there are storms on the surface of the Sun. These storms are called “sunspots”. By observing the sunspots scientists have discovered that the Sun rotates just like Earth does. They know that sunspots occur according to a cycle and have something to do with magnetic fields; but they don’t know why and they don’t know what.

“Scientists do know that the more they find out, the more questions there are.”



Focus Question

A lot of energy is continuously created by the Sun. How is this energy created?



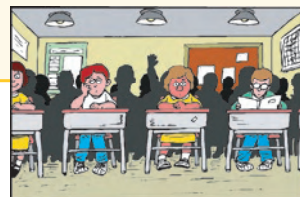
Hydrogen gas is combining to form helium atoms. A lot of energy is released during this reaction.

Answer

California Content Standards

5.a. Students know the Sun, an average star, is the central and largest body in the solar system and is composed primarily of hydrogen and helium.

Test Practice Questions



1. Which body is at the center of our solar system?

- A. Earth
- B. Sun
- C. star cluster
- D. orbitals

Answer: B

2. What effect would be seen on Earth if there were no Sun?

- A. photosynthesis would stop
- B. the rate of photosynthesis would increase
- C. oceans would flood coastal plains
- D. rivers would flow more slowly

Answer: A

3. The Sun is mainly made up of

- A. helium and nitrogen
- B. fire and oxygen
- C. steam and hydrogen
- D. hydrogen and helium

Answer: D

4. Earth and other planets orbit

- A. around the Sun
- B. inside the Sun
- C. around each other
- D. differently every solar year

Answer: A



California Content Standards

5.a. Students know the Sun, an average star, is the central and largest body in the solar system and is composed primarily of hydrogen and helium.

Science and Literacy Strategies

Literacy Strategy: Comprehension Check: Question.

Standard 5.a. — The Sun and Earth

Our solar system, as we understand it today, consists of the Sun (which we call our star), nine planets and their moons, and other objects that roam outer space. The Sun radiates its energy in all directions through space. This energy, called radiant or heat energy, provides all the heat and light for the planets in our solar system.

The Sun is considered a star because it is made of gases, called hydrogen and helium, just like other bodies in space that make their own energy. Hydrogen is a lightweight gas that reacts with other elements. Helium is a lightweight gas that does not react easily with other elements. The core, or the inside of the Sun is extremely hot. The reason for this is the hydrogen atoms combine to form helium atoms and release a tremendous amount of energy. The Sun's energy is stronger than any type of energy on Earth.

Comprehension Check: Question. Why do we call the Sun our "star"?

The Sun and Earth have a special relationship. The Earth revolves around the Sun; it receives heat and light necessary for life to exist. Do you remember when we learned about living organisms and the things they need to live and grow? Light was one of those important ingredients, and light from the Sun provides plant life with this essential ingredient.

AH HA! Making a Connection in Learning: When you make a connection like this one, stop and write it down.

What is the connection between the Sun and living organisms on Earth?