

THE SOLAR SYSTEM

A Science A-Z Earth Series

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KEY ELEMENTS USED IN THIS BOOK

The Big Idea: Learning about our solar system can give students a sense of wonder and perspective. They can ponder and appreciate Earth's crucial position in our solar system, which makes this planet such an ideal place for us to live. Students may also consider how small our entire world is compared to some of our fellow planets, the Sun, and the vastness of space. For some students, this perspective might provide a sense of scale for their own panoramas and concerns. It may also help students understand why many people are excited about the prospects of discovering and exploring new solar systems, both within our galaxy and beyond.

Key words: asteroid, asteroid belt, atmosphere, atom, comet, crater, diameter, dwarf planet, Earth, gas, gas giant, gravity, heat, helium, hydrogen, Jupiter, Kuiper Belt, light, liquid, Mars, matter, Mercury, methane, moon, Neptune, orbit, oxygen, planet, Pluto, plutoid, revolution, rotation, Saturn, solar system, star, surface, tail, temperature, terrestrial, Uranus, Venus

Key comprehension skill: Interpret graphs, charts, and diagrams
Other suitable comprehension skills: Cause and effect; compare and contrast; classify information; main idea and details; identify facts; elements of a genre

Key reading strategy: Visualize
Other suitable reading strategies: Ask and answer questions; summarize; connect to prior knowledge; using a table of contents and headings; using a glossary and boldfaced terms

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Introduction

The **solar system** is our home in space. It's special to us because it's where we live. Understanding our solar system and how it formed might give us clues about other solar systems.

Let's take an imaginary flight through the solar system. We'll start at the center: the Sun. As we move away from the Sun, we will pass many **planets** and other objects. One of those planets is our own Earth. All the objects in the solar system are circling the Sun. In this book, you will read about all parts of the solar system. Climb aboard! Let's begin our journey.

THE SUN AND PLANETS OF OUR SOLAR SYSTEM



The planets in our solar system

The Sun

The Sun is one of many, many **stars** in the universe. Stars are huge, fiery balls of gas. The Sun is made mostly of a gas called *hydrogen*.

The Sun is medium-sized compared to other stars. It looks bigger because it is so much closer. The Sun is about 150 million kilometers (93 million mi.) from Earth. Other stars are trillions of kilometers away.

Atoms of hydrogen in the center of the Sun are forced together by heat and pressure. They join to form a gas called *helium*. This process gives off huge amounts of energy and causes the Sun to be hot and bright.

Temperatures in the Sun vary. The hottest part of the Sun is its center. The surface of the Sun is much cooler.

The Sun has nearly all of the matter in the solar system. The Sun's huge amount of matter gives it very strong **gravity**. Gravity is a force of attraction between all objects in the universe. Gravity keeps the planets **orbiting** the Sun. It also keeps **moons** orbiting planets.

WOWSER!

Over time, the Sun's supply of hydrogen will almost run out. The Sun will then begin to cool down. But it will take 5 billion years for the Sun to use up that much hydrogen!



Fast Facts About the Sun

• Diameter:	1.39 million kilometers (864,000 mi.)
• Temperature:	Core: about 15 million °C (27 million °F) Surface: about 5,500°C (10,000°F) Corona: more than 1 million °C (1.8 million °F)
• Mass, compared with Earth:	332,000 times as massive

The Planets

Our trip through the solar system will take us by eight planets. The number used to be nine. But one planet, Pluto, is no longer called a planet.

Scientists place the planets into two groups. Mercury, Venus, Earth, and Mars are called the **terrestrial** (tuh-RES-tree-ul) planets. They have solid, rocky surfaces. *Terrestrial* means “like Earth.”

Saturn, Jupiter, Uranus, and Neptune are called **gas giants**. They do not have a solid surface. You wouldn't be able to breathe the air on these planets.

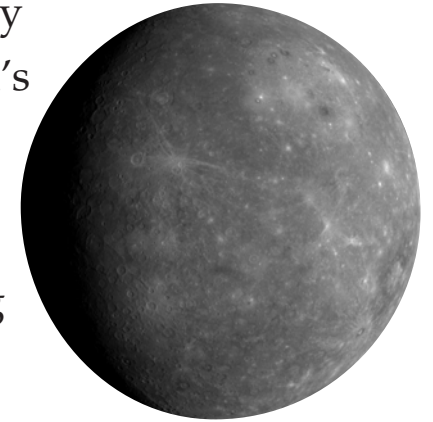


Here's a memory aid to remember the order of the planets from the Sun (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune):
My Very Educated Mother Just Showed Us Neptune.



The Terrestrial Planets

The first planet we see as we leave the Sun is Mercury. It is small and covered with **craters**. Mercury looks a lot like Earth's Moon. And like the Moon, it has no air.



If you were standing on Mercury, the Sun would look three times larger than it does on Earth. When the Sun is overhead on Mercury, the temperature rises to about 430°C (800°F). After sunset, it drops to about -170°C (-280°F).

Fast Facts About Mercury

- Diameter: 4,879 kilometers (3,032 mi.)
- Average distance from the Sun: 58 million kilometers (36 million mi.)
- Period of rotation (one turn on axis): 59 Earth days
- Period of revolution (one orbit around Sun): 88 Earth days
- Number of moons: 0

The next planet we will see is Venus. It is the brightest object in our sky, except for the Sun and Moon. It is called the Morning or Evening Star because it can be seen before dawn or after sunset.

Venus has thick clouds that trap energy from the Sun. The temperature is about 470°C (880°F). The planet has many volcanoes.



Almost all of Venus's surface is hardened lava. Scientists think Venus got a whole new surface millions of years ago. Huge lava flows covered almost all of Venus and hardened.

Fast Facts About Venus

- Diameter: 12,104 kilometers (7,521 mi.)
- Average distance from the Sun: 108 million kilometers (67 million mi.)
- Period of rotation: 243 Earth days
- Period of revolution: 225 Earth days
- Number of moons: 0

The third planet we will see is the most familiar. It is Earth, our home planet.



As far as we know, it is the only planet in our solar system with life. It is also the only one with large amounts of surface water.

Earth lies in a region of the solar system where liquid water can exist. This was needed for the development of life.

Our planet's air is about one-fifth oxygen. Oxygen is always being produced by the many green plants on Earth.

Fast Facts About Earth

- Diameter: 12,756 kilometers (7,926 mi.)
- Average distance from the Sun: 150 million kilometers (93 million mi.)
- Period of rotation: 23.93 hours
- Period of revolution: 365.24 days
- Number of moons: 1

The next planet is Mars. It has a reddish color and a thin atmosphere. The red color is caused by rust in rocks.

It is cold on Mars. The temperature sometimes drops to -87°C (-125°F). Scientists have learned that Mars has ice at its poles. Mars probably had oceans and rivers on its surface long ago. Today, salty water flows in some areas during the warmer months.



Mars often has big dust storms. The planet has the solar system's largest volcanic mountain.

Fast Facts About Mars

- Diameter: 6,794 kilometers (4,222 mi.)
- Average distance from the Sun: 228 million kilometers (142 million mi.)
- Period of rotation: 24.6 Earth hours
- Period of revolution: 687 Earth days
- Number of moons: 2

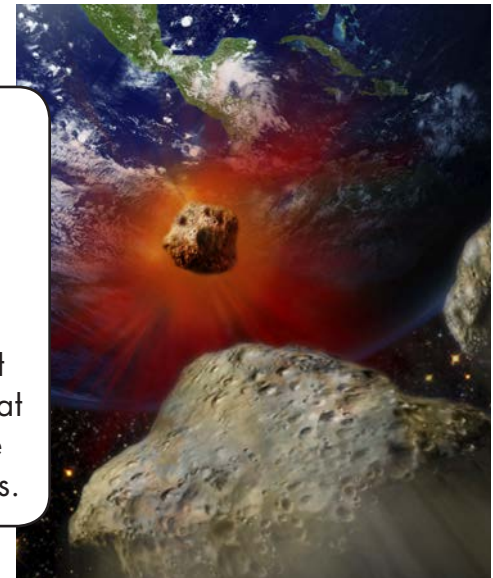
Between Mars and Jupiter is a large area full of **asteroids**. This area is called the *asteroid belt*.

Asteroids are chunks of rock left over from the birth of the solar system. Some asteroids are the size of small boulders. Others are huge. Altogether, there are millions of asteroids.

The largest object in the asteroid belt is the dwarf planet Ceres. It is about 940 kilometers (584 mi.) in diameter.



Earth has been struck by many asteroids in its history. About 65 million years ago, a huge asteroid smashed into what is now Mexico. That asteroid may have killed the dinosaurs.



The Gas Giants

Next, we will visit the four gas giants. The first one we come to is Jupiter.

Jupiter is the biggest planet in the solar system. You wouldn't be able to breathe the atmosphere on Jupiter. It's mostly hydrogen and helium. Jupiter may have an icy center the size of Earth.



Jupiter's atmosphere has large bands. They are caused by strong winds. A feature of the atmosphere is the Great Red Spot. This is a huge spinning storm. It has existed for at least 300 years.

Fast Facts About Jupiter

- Diameter: 142,984 kilometers (88,486 mi.)
- Average distance from the Sun: 778 million kilometers (484 million mi.)
- Period of rotation: 9.9 Earth hours
- Period of revolution: 11.9 Earth years
- Number of moons: 63

The second gas giant we'll see is Saturn. This planet is famous for its beautiful rings.



Like Jupiter, Saturn has an atmosphere that is divided into bands. They are caused by very fast winds.

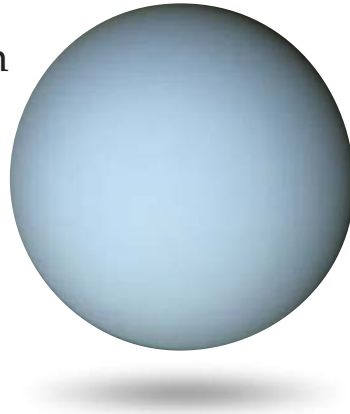
Saturn's rings reach far into space, but they are fairly thin. The rings are made of pieces of rock and ice. Scientists think the rings are the remains of **comets** and other objects. The objects broke apart near the planet, and their pieces formed rings.

Fast Facts About Saturn

- Diameter: 120,536 kilometers (74,898 mi.)
- Average distance from the Sun: 1.4 billion kilometers (886 million mi.)
- Period of rotation: 10.7 Earth hours
- Period of revolution: 29.4 Earth years
- Number of moons: 60

Uranus (YOOR-uh-nus or yuh-RAY-nus) is the next planet we come to.

Uranus is a blue-green planet. Uranus gets its color from a gas called *methane*. The methane is above the clouds. The clouds reflect sunlight back up through the methane. The methane absorbs some of the light. The light that passes through is blue-green.



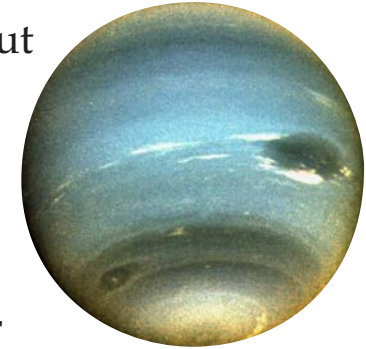
Under all the gas and clouds, Uranus has an icy center. It is made of frozen water and other materials.

Fast Facts About Uranus

- Diameter: 51,118 kilometers (31,763 mi.)
- Average distance from the Sun: 2.87 billion kilometers (1.78 billion mi.)
- Period of rotation: 17.24 Earth hours
- Period of revolution: 84 Earth years
- Number of moons: 27

Do you see that big object up ahead? It's Neptune, the last planet on our journey.

Neptune has a bluish color. But it's even brighter than Uranus. Scientists think that Neptune's color is also caused by methane. But they don't know why it is so bright.



Neptune has a solid center of ice and other frozen materials. The planet is so far from the Sun that it gets almost no energy. One of its moons, Triton, is the coldest place astronomers have found in the solar system.

Fast Facts About Neptune

- Diameter: 49,528 kilometers (30,775 mi.)
- Average distance from the Sun: 4.5 billion kilometers (2.8 billion mi.)
- Period of rotation: 16.1 Earth hours
- Period of revolution: 164.8 Earth years
- Number of moons: 13

Dwarf Planets

We're not at the end of our journey yet. Now we'll see some much smaller objects. In 2006, astronomers decided that Pluto would no longer be called a planet. It and other small planets would now be called **dwarf planets**.

Dwarf planets are mostly like Pluto. For that reason, astronomers decided to call them *plutoids*.

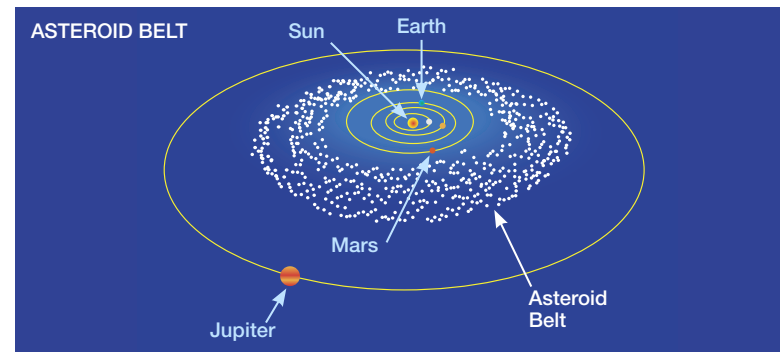
Plutoids orbit the Sun in a distant part of the solar system. It is called the Kuiper (KY-per) Belt. This area is full of icy objects. Astronomers think they will find more plutoids there.

Artist's impression of the New Horizons spacecraft encountering a Kuiper Belt object



In 2009, there were four known plutoids. Two of them were Pluto and a dwarf planet named Eris. The other two were Makemake (MAA-kee MAA-kee) and Haumea (how-MAY-uh). Makemake is named for a god worshipped by the people of Easter Island in the Pacific Ocean. Haumea, which is shaped like a rounded football, is named for a Hawaiian goddess.

Not all dwarf planets are plutoids. To be a plutoid, a dwarf planet must orbit beyond Neptune. Ceres is a dwarf planet, but it is not a plutoid. That is because it orbits in the asteroid belt.



Moons of the Solar System

Many of the planets we passed on our journey had moons. The solar system has 171 known moons. A moon is an object that orbits a planet.

The moon that people know best is our own Moon. It is one of the largest moons in the solar system. It is dry, airless, and covered with mountains and craters.

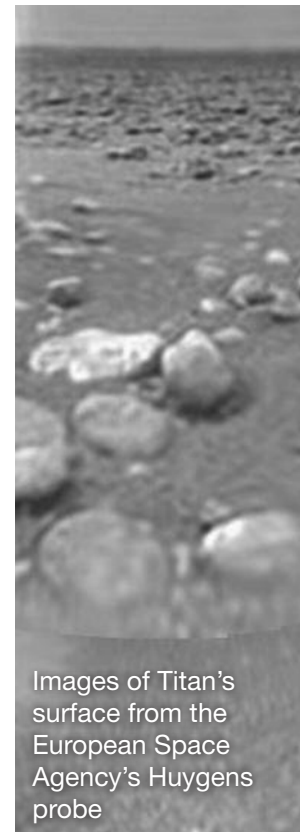
Scientists think our Moon was created about 4.5 billion years ago. They believe an object the size of Mars smashed into Earth. Material thrown into orbit around Earth came together to form the Moon.



This is an artist's idea of the kind of collision that created the Moon.

The largest moon in the solar system is Ganymede (GAN-uh-mede).

It is one of Jupiter's moons. Ganymede and two other moons of Jupiter have icy crusts that may cover liquid oceans.



Images of Titan's surface from the European Space Agency's Huygens probe

Saturn's moons are also of scientific interest. Titan is especially interesting. Titan is the second-largest moon in the solar system. It is covered by thick orange clouds. Astronomers are using a spacecraft with radar to probe Titan's surface.



Comets

Comets are some of the most dramatic objects in the solar system. They move slowly across the sky, trailing a bright tail. Then their light fades.

A comet is made of ice, frozen gases, rocks, and dust. As a comet moves close to the Sun, it starts to warm up. A flow of light and particles from the Sun pushes material away from the comet. That's what forms the tail.

Most comets come from the Kuiper Belt. Others come from a farther-away region called the *Oort Cloud*. About a dozen new comets are sighted each year.

Conclusion

We've taken a quick trip through the solar system and seen many wonderful things. Now, when you look up at the Sun, you'll understand how it produces its light. And when you see the Moon or Venus in the evening sky, you'll know more about them, too.

Our solar system is full of wonders. You can see some of these amazing things for yourself. A simple backyard telescope can reveal many of them to your own eyes.

Now that you understand our incredible solar system, think about what lies beyond. There must be many other wonders to be discovered.



An artist's idea of what another solar system might look like

Glossary

asteroids	irregularly shaped rocks that orbit stars (p. 12)
comets	space objects made of ice and dust that orbit a star and develop a long, bright tail as they near their star (p. 14)
craters	holes in the ground caused by the impact of an object from space (p. 8)
dwarf planets	nearly round objects that orbit a star, are smaller than a planet, and are not satellites of another object (p. 17)
gas giants	large planets that are mainly made up of gases (p. 7)
gravity	the force that pulls all objects toward each other (p. 6)
moons	solid objects that travel around a planet; natural satellites (p. 6)

orbiting	revolving around another object (p. 6)
planets	very large objects that orbit a star (p. 4)
solar system	a group of objects in space that orbit a star (p. 4)
stars	bodies in outer space, made of hot gases, that shine in the night sky (p. 5)
terrestrial	like Earth; describes planets that are rocky and Earthlike in size (p. 7)

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