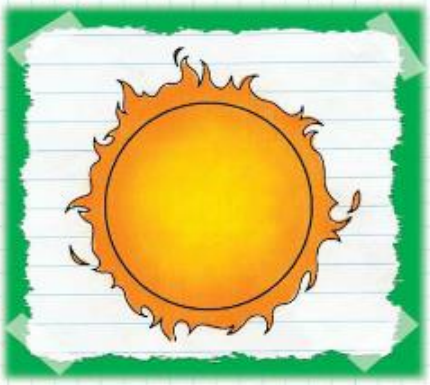


Objects in Our Solar System

A system consists of parts that make up a whole. What are the different parts that make up our solar system? Put an *X* next to each of the objects you think are part of our solar system.

_____ planets	_____ the Sun	_____ nearby stars other than the Sun
_____ distant stars	_____ constellations	_____ asteroids
_____ comets	_____ moons	_____ human-made satellites
_____ galaxies	_____ black holes	_____ universe

Explain your thinking. Describe what determines whether an object is part of our solar system.

SUBMIT CLEAR


FLORIDA
Chapter 2
The Solar
SYSTEM

FLORIDA BIG IDEAS

1 The Practice of Science

3 The Role of Theories, Laws, Hypotheses, and Models

5 Earth in Space and Time

The Big Idea

Think About It!

What kinds of objects are in the solar system?

This photo, taken by the Cassini spacecraft, shows part of Saturn's rings and two of its moons. Saturn is a planet that orbits the Sun. The moons, tiny Epimetheus and much larger Titan, orbit Saturn. Besides planets and moons, many other objects are in the solar system.

1. How would you describe a planet such as Saturn?

2. How do you think astronomers classify the objects they discover?

3. What types of objects do you think make up the solar system?

Get Ready to Read

SUBMIT SHOW ANSWERS CLEAR

What do you think about the solar system?

Before you read, decide if you agree or disagree with each of these statements. As you read this chapter, see if you change your mind about any of the statements.

	AGREE	DISAGREE
1 Astronomers measure distances between space objects using astronomical units.	☐	☐
2 Gravitational force keeps planets in orbit around the Sun.	☐	☐
3 Earth is the only inner planet that has a moon.	☐	☐
4 Venus is the hottest planet in the solar system.	☐	☐
5 The outer planets also are called the gas giants.	☐	☐
6 The atmospheres of Saturn and Jupiter are mainly water vapor.	☐	☐
7 Asteroids and comets are mainly rock and ice.	☐	☐
8 A meteoroid is a meteor that strikes Earth.	☐	☐

SUBMIT SAMPLE ANSWERS CLEAR

Inquiry **Are these stars?**

1. Did you know that shooting stars are not actually stars? The bright streaks are small, rocky particles burning up as they enter Earth's atmosphere. Why is the term *shooting star* misleading? These particles are part of the solar system and are often associated with comets. What types of objects do you think make up the solar system?

What is the solar system?

Have you ever made a wish on a star? If so, you might have wished on a planet instead of a star. Sometimes, as shown in **Figure 1,** the first starlike object you see at night is not a star at all. It's Venus, the planet closest to Earth.

It's hard to tell the difference between planets and stars in the night sky because they all appear as tiny lights. Thousands of years ago, observers noticed that a few of these tiny lights moved, but others did not. The ancient Greeks called these objects planets, which means "wanderers." Astronomers now know that the planets do not wander about the sky; the planets move around the Sun. The Sun and the group of objects that move around it make up the solar system.

Active Reading **2. Recall** What objects do the planets in the solar system move around?

A few of the tiny lights that you can see in the night sky are part of our solar system. Almost all the other specks of light are stars. They are much farther away than any objects in our solar system. Astronomers have discovered that some of those stars have planets moving around them.

SUBMIT SHOW ANSWERS CLEAR

Figure 1 When looking at the night sky, you will likely see stars and planets. In the photo below, the planet Venus is the bright object seen above the Moon.

Objects in the Solar System

The center of the solar system is the Sun, a **star**. Inside the Sun, a process called nuclear fusion produces an enormous amount of energy. It emits some of this energy as light. The Sun is the largest object in the solar system. Its diameter is about 1.4 million km—ten times the diameter of the largest planet, Jupiter. Its mass makes up about 99 percent of the entire solar system's mass. The Sun's great mass applies gravitational forces to objects in the solar system. Gravitational forces cause the planets and other objects to move around, or **orbit**, the Sun.

SCIENCE USE V. COMMON USE

star

Science Use an object in space made of gases in which nuclear fusion reactions occur that emit energy

Common Use a shape that usually has five or six points around a common center

REVIEW VOCABULARY

orbit

(noun) the path an object follows as it moves around another object

(verb) to move around another object

The Law of Universal Gravitation

In the late 1600s, an English scientist and mathematician, Sir Isaac Newton, developed the law of universal gravitation. This law states that all objects are attracted to each other by a gravitational force. The strength of the force depends on the mass of each object and the distance between their centers.

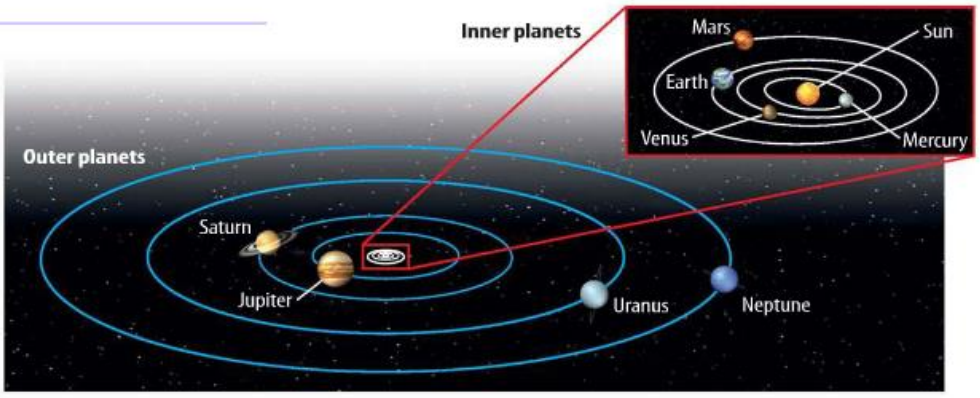
3. NGSSS Check **Explain** What is the law of universal gravitation?. SC.8.E.5.4

Gravity and orbits Newton realized that gravity's attractive force could explain why planets orbit the Sun, as shown in **Figure 2.** He realized that the planets did not travel in a straight line because of gravitational attraction. Without gravity the planets would continue to travel in a straight line and would not orbit the Sun. The same is true for Earth and the Moon, the other planets and their moons, stars, and all other orbiting objects in the universe.

Figure 2 The orbits of the inner and outer planets are shown to scale. The Sun and the planets are not to scale.

Active Reading **4. Identify** What keeps the planets in their orbits?

SUBMIT SHOW ANSWERS CLEAR



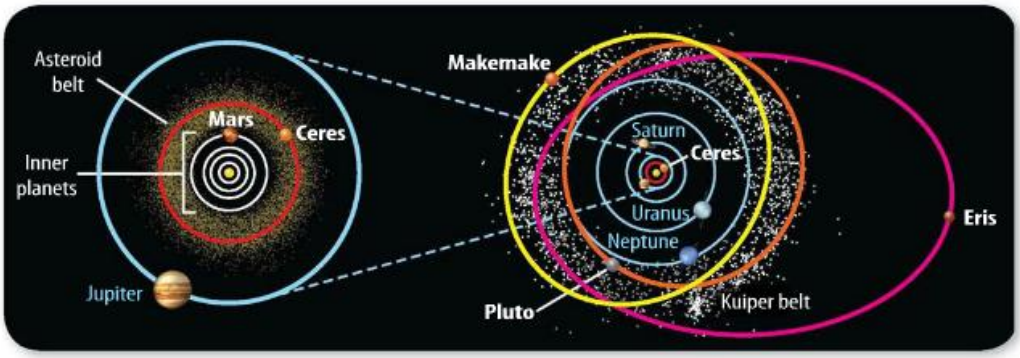


Figure 3 Ceres, a dwarf planet, orbits the Sun as planets do. The orbit of Ceres is in the asteroid belt between Mars and Jupiter.

5. Visual Check **Locate** Which dwarf planet is farthest from the Sun?

Objects That Orbit the Sun

Planets Astronomers classify eight objects that orbit the Sun as planets, as shown in **Figure 2.** An object is a planet only if it orbits the Sun and has a nearly spherical shape. Also, the mass of a planet must be much larger than the total mass of all other objects whose orbits are close by.

Inner Planets and Outer Planets As shown in **Figure 2,** the four planets closest to the Sun are the inner planets—Mercury, Venus, Earth, and Mars. These planets are made mainly of rocky materials. The four planets farthest from the Sun are the outer planets. The outer planets, Jupiter, Saturn, Uranus (YOOR uh nus), and Neptune, are made mainly of ice and gases. The outer planets are much larger than Earth and are sometimes called gas giants.

Click below.

abc

6. NGSSS Check **Explain** Highlight how the inner planets differ from the outer planets. SC.8.E.5.7

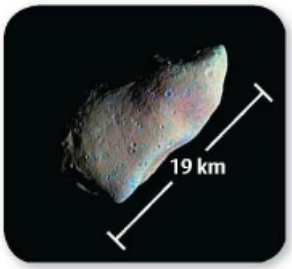
WORD ORIGIN
asteroid
from Greek *asteroeides,* means "resembling a star"

Dwarf Planets Some objects in the solar system are classified as dwarf planets. A dwarf planet is a spherical object that orbits the Sun with many objects orbiting near it. But, unlike a planet, a dwarf planet does not have more mass than objects in nearby orbits. **Figure 3** shows the locations of four dwarf planets. Dwarf planets are made of rock and ice and are smaller than Earth.

Asteroids *Millions of small, rocky objects called* **asteroids** *orbit the Sun in the asteroid belt between the orbits of Mars and Jupiter.* The asteroid belt is shown in **Figure 3.** Asteroids range in size from less than a meter to several hundred kilometers in length. Unlike planets and dwarf planets, asteroids, such as the one shown in **Figure 4,** usually are not spherical.

Comets *A* **comet** *is made of gas, dust, and ice and moves around the Sun in an oval-shaped orbit.* Comets come from the outer parts of the solar system. There might be 1 trillion comets orbiting the Sun.

Figure 4 The asteroid Gaspra orbits the Sun in the asteroid belt. Its odd shape is about 19 km long and 11 km wide.

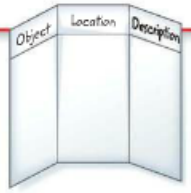


SUBMIT SHOW ANSWERS CLEAR

Active Reading

FOLDABLES® LA.8.2.2.3

Make a tri-fold book from a sheet of paper and label it as shown. Use it to summarize information about the types of objects that make up the solar system.



The Astronomical Unit

On Earth, distances are often measured in meters (m) or kilometers (km). Objects in the solar system, however, are so far apart that astronomers use a larger distance unit. *An* **astronomical unit** *(AU) is the average distance from Earth to the Sun—about 150 million km.* **Table 1** lists each planet's average distance from the Sun in km and AU.

7. NGSSS Check **Define** What is an astronomical unit and why is is used? SC.8.E.5.1, SC.8.E.5.7

Table 1 Average Distance of the Planets from the Sun

Planet	Average Distance (km)	Average Distance (AU)
Mercury	57,910,000	0.39
Venus	108,210,000	0.72
Earth	149,600,000	1.00
Mars	227,920,000	1.52
Jupiter	778,570,000	5.20
Saturn	1,433,530,000	9.58
Uranus	2,872,460,000	19.20
Neptune	4,495,060,000	30.05

Table 1 Because the distances of the planets from the Sun are so large, it is easier to express these distances using astronomical units rather than kilometers.

The Motion of the Planets

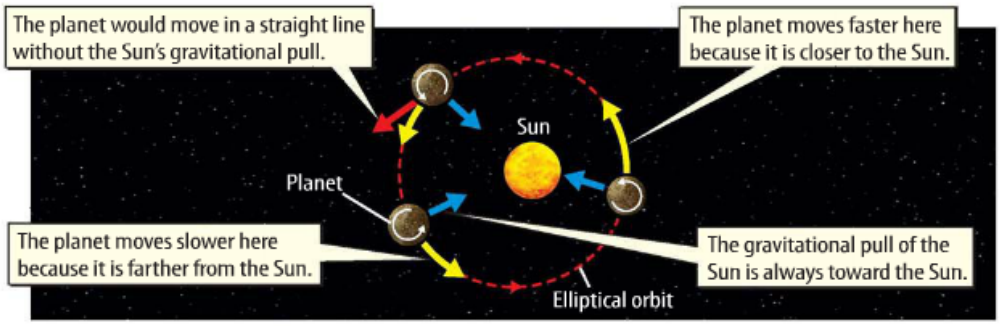
Have you ever swung a ball on the end of a string in a circle over your head? In some ways, the motion of a planet around the Sun is like the motion of that ball. As shown in **Figure 5** on the next page, the Sun's gravitational force pulls each planet toward the Sun. This force is similar to the pull of the string that keeps the ball moving in a circle. The Sun's gravitational force pulls on each planet and keeps it moving along a curved path around the Sun.

Active Reading **8. Summarize** What causes planets to orbit the Sun?

Revolution and Rotation

Objects in the solar system move in two ways. They orbit, or revolve, around the Sun. *The time it takes an object to travel once around the Sun is its* **period of revolution**. Earth's period of revolution is one year. The objects also spin, or rotate, as they orbit the Sun. *The time it takes an object to complete one rotation is its* **period of rotation**. Earth has a period of rotation of one day.

SUBMIT SHOW ANSWERS CLEAR



Planetary Orbits and Speeds

Earth was once thought to be the center of our solar system. In this geocentric model, the Sun, the Moon and planets revolved in circular orbits around a stationary Earth. In the early 1500s, Nicholas Copernicus proposed that Earth and other planets revolve in circular orbits around a stationary Sun, a heliocentric model.

In 1600s, Johannes Kepler discovered that planets' orbits are ellipses, not circles. An ellipse contains two fixed points, called foci (singular, *focus*). Foci are equal distance from the ellipse's center and determine its shape. As shown in **Figure 5,** the Sun is at one focus. As a planet revolves, the distance between it and the Sun changes. Kepler also discovered that a planet's speed increases as it gets nearer to the Sun.

Figure 5 Planets and other objects in the solar system revolve around the Sun because of its gravitational pull on them.

Active Reading **9. Name** What is this model of the solar system called?

Click below.

abc **10. NGSSS Check Cite** Underline the shape of the planets' orbits. SC.8.E.5.7

SUBMIT SHOW ANSWERS CLEAR

Inquiry LAB STATION SC.8.N.1.1 SC.8.E.5.7

Try It!

MiniLab *How can you model an elliptical orbit?* at connectED.mcgraw-hill.com

Apply It! After you complete the lab, answer these questions.

1. What is an ellipse? What is another example of an ellipse?

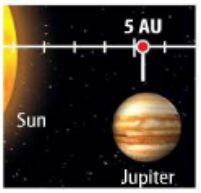
2. Which ellipse will have a shorter period of revolution?

SUBMIT SHOW ANSWERS CLEAR

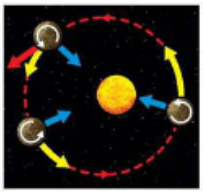
Lesson Review 1

Visual Summary

The solar system contains the Sun, the inner planets, the outer planets, the dwarf planets, asteroids, and comets.



An astronomical unit (AU) is a unit of distance equal to about 150 million km.



The speeds of the planets change as they move around the Sun in elliptical orbits.

Use Vocabulary

1. **Compare and contrast** a *period of revolution* and a *period of rotation.* SC.8.E.5.7

2. **Define** *dwarf planet* in your own words.

3. **Distinguish** between an *asteroid* and a *comet.* SC.8.E.5.3

Understand Key Concepts

4. **Summarize** how and why planets orbit the Sun and how and why a planet's speed changes in orbit. SC.8.E.5.4

5. Which statement is true? SC.8.E.5.8
   - (A) Earth's revolution is circular.
   - (B) Earth's revolution is elliptical.
   - (C) Earth's distance from the Sun is constant.
   - (D) Earth's average distance from the Sun is 2 astronomical units.

Interpret Graphics

6. **Take Notes** List information about five objects or group of objects in the solar system mentioned in the lesson. SC.8.E.5.7

Object	Description

Critical Thinking

7. **Evaluate** How would the speed of a planet be different if its orbit were a circle instead of an ellipse? SC.8.E.5.7

SUBMIT SHOW ANSWERS CLEAR