# The Outer Planets

#### **BEFORE YOU READ**

After you read this section, you should be able to answer these questions:

- Which planets are known as the outer planets?
- What properties do the outer planets share?

# **How Are the Outer Planets Different from the Inner Planets?**

The outer planets are very large and are made mostly of gases. These planets are called **gas giants**. Unlike the inner planets, they have very thick atmospheres and not very much hard, rocky material on their surfaces.

## Which Planet Is the Biggest?

Jupiter is the largest planet in our solar system. Its mass is twice as large as the other eight planets combined. Even though it is large, Jupiter's rotation takes less than 10 hours.

Like the sun, Jupiter is made mostly of hydrogen and helium. Jupiter's atmosphere also contains small amounts of ammonia, methane, and water. These gases form clouds in the outer part of Jupiter's atmosphere. The outer atmosphere also contains storms, such as the Great Red Spot. This huge storm is about 3 times the diameter of Earth. It has lasted for over 400 years!

Deeper into Jupiter's atmosphere, the pressure is so high that hydrogen turns to liquid. Deeper still, the pressure is even higher. Because of the high pressures, the inside of Jupiter is very hot. It is so hot that Jupiter produces more heat than it gets from the sun.

The information that scientists have about Jupiter has come from five space missions: *Pioneer 1*, *Pioneer 2*, *Voyager 1*, *Voyager 2*, and *Galileo*. The Voyager probes showed that Jupiter has a thin, faint ring.

### **Facts About Jupiter**

Distance from sun	5.20 AU
Period of rotation	9 hours, 55.5 minutes
Period of revolution	11 Earth years, 313 days
Diameter	142,984 km
Density	1.33 g/cm <sup>3</sup>
Surface gravity	236% of Earth's

National Science Education Standards ES 1c, 3a, 3b

	_
STUDY TIP	3

**Compare** In your notebook, create a chart showing the similarities and differences among the outer planets.

/	
V	<b>READING CHECK</b>
)	

<b>1. List</b> Give four gases
that are found in Jupiter's
atmosphere.

### TAKE A LOOK

**2. Identify** Which of the facts in the table could you use to infer that Jupiter has a shorter day than Earth does?

Name	Class	Date	

**SECTION 3** The Outer Planets continued

# What Are Saturn's Rings Made Of?

Saturn is the second-largest planet in the solar system. Like Jupiter, Saturn is made up mostly of hydrogen with some helium and traces of other gases and water. Saturn has about 764 times more volume than Earth and about 95 times more mass. Therefore, it is much less dense than Earth.

# Critical Thinking

3. Compare About how many times does Earth revolve around the sun in the time it takes Saturn to revolve once?

#### **Facts About Saturn**

Distance from sun	9.54 AU
Period of rotation	10 hours, 42 minutes
Period of revolution	29 Earth years, 155 days
Diameter	120,536 km
Density	0.69 g/cm <sup>3</sup>
Surface gravity	92% of Earth's

The inside of Saturn is probably similar to the inside of Jupiter. Also, like Jupiter, Saturn gives off more heat than it gets from the sun. Scientists think that Saturn's extra energy comes from helium condensing from the atmosphere and sinking toward the core. In other words, Saturn is still forming.

Saturn is probably best known for the rings that orbit the planet above its equator. They are about 250,000 km across, but less than 1 km thick. The rings are made of trillions of particles of ice and dust. These particles range from a centimeter to several kilometers across.



4. Identify What two materials make up the rings of Saturn?



This picture of Saturn was taken by the Voyager 2 probe.

# **How Is Uranus Unique?**

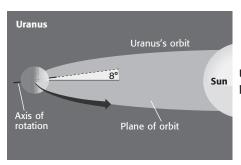
Uranus is the third-largest planet in the solar system. It is so far from the sun that it does not reflect much sunlight. You cannot see it from Earth without using a telescope. ✓

Uranus is different from the other planets because it is "tipped" on its side. As shown in the figure below, the north and south poles of Uranus point almost directly at the sun. The north and south poles of most other planets, like Earth, are nearly at right angles to the sun.

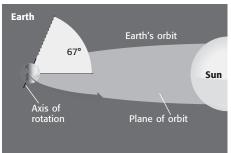
For about half the Uranian year, one pole is constantly in sunlight, and for the other half of the year it is in darkness. Some scientists think that Uranus may have been tipped over by a collision with a massive object.



5. Identify Why can't Uranus be seen from Earth without a telescope?



Uranus is tilted so that its poles point almost directly at the sun.



In contrast, Earth's poles, like those of most other planets, are nearly at right angles to the sun.

## TAKE A LOOK

**6. Explain** Why do scientists say that Uranus is "tipped over"?

Like Jupiter and Saturn, Uranus is made mostly of hydrogen, helium, and small amounts of other gases. One of these gases, methane, filters sunlight and makes the planet look bluish-green.

#### **Facts About Uranus**

Distance from sun	19.22 AU
Period of rotation	17 hours, 12 minutes
Period of revolution	83 Earth years, 273 days
Diameter	51,118 km
Density	1.27 g/cm <sup>3</sup>
Surface gravity	89% of Earth's

## TAKE A LOOK

**7. Compare** How does the length of a year on Uranus compare to the length of a year on Earth?

Name	Class	Date
SECTION 3 The Outer Planets continued		

V	READI	NG CH	HECK
0	Evolain	What	ovidor

**8. Explain** What evidence did astronomers have that Neptune existed before they actually observed it?

TA	KE		1			V
IA		A	_	V	V	

**9. Compare** How does Neptune's average distance from the sun compare to Earth's?

## What Is Neptune Like?

Some astronomers predicted that there was a planet beyond Uranus before the planet was observed. Uranus did not move in its orbit exactly as they expected. The force of gravity due to another large object was affecting it. Using predictions of its effect on Uranus, astronomers discovered Neptune in 1846.

Neptune is the fourth-largest planet in the solar system. Like the other gas giants, Neptune is made up mostly of hydrogen, helium, and small amounts of other gases. It has a deep blue color, which is caused by methane in its atmosphere.

Clouds and weather changes are seen in the atmosphere of Neptune. The spacecraft *Voyager 2* flew past Neptune in 1989 and observed a Great Dark Spot in the southern hemisphere. This spot was a storm as large as Earth. It moved across the planet's surface at about 300 m/s. By 1994, the Great Dark Spot had disappeared. Another dark spot was then found in the northern hemisphere. *Voyager 2* images also showed that Neptune has very narrow rings.

## **Facts About Neptune**

Distance from sun	30.06 AU
Period of rotation	16 hours, 6 minutes
Period of revolution	163 Earth years, 263 days
Diameter	49,528 km
Density	1.64 g/cm <sup>3</sup>
Surface gravity	112% of Earth's

# Why Is Pluto Called a Dwarf Planet?

Pluto has been called the ninth planet since its discovery in 1930. However, in 2006, astronomers defined *planet* in a new way. Pluto does not fit the new definition of a planet. So, Pluto has been reclassified as a dwarf planet.

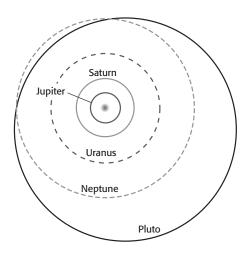
A *dwarf planet* is any object that orbits the sun and is round because of its own gravity, but has not cleared its orbital path. In addition to Pluto, Eris and Ceres have been classified as dwarf planets. Eris is larger than Pluto. Ceres was previously classified as an asteroid.

#### A SMALL WORLD

Pluto is made of rock and ice and has a thin atmosphere made of methane and nitrogen. Scientists do not know if Pluto formed along with the planets.

#### **AN UNUSUAL ORBIT**

The shape of Pluto's orbit is different from the shapes of the outer planets. As shown in the figure below, sometimes Pluto is closer to the sun than Neptune. At other times, Neptune is closer to the sun.



The shape of Pluto's orbit is very different from the orbits of other planets.

#### **Facts About Pluto**

Distance from sun	39.5 AU
Period of rotation	6 days, 10 hours
Period of revolution	248 Earth years, 4 days
Diameter	2,390 km
Density	1.75 g/cm <sup>3</sup>
Surface gravity	6% of Earth's

### A LARGE MOON

Pluto's moon, Charon, is more than half the size of Pluto. From Earth, it is hard to separate the images of Pluto and Charon because they are so far away. Charon may be covered by frozen water.

TAKE A LOOK

**10. Compare** How is Pluto's orbit different from the orbits of the other outer planets?

0
11. Infer How do you think
scientists learned that Pluto
has a moon if it is difficult to
separate their images?

Critical Thinking

Convright © by Holt	Rinehart and Winston	All rights reserved

ection 3 Rev	iew	NSES ES 1c, 3a, 3
CTION VOCABULARY	,	
as giant a planet that he atmosphere, such as Ju Neptune	as a deep, massive piter, Saturn, Uranus, or	
Identify What is the	e main element found in the at	tmosphere of a gas giant planet?
. Compare Fill in the	e blanks to complete the table.	
Planet	Distance from sun	Period of revolution
	5.20 AU	11 Earth years, 313 days
	9.54 AU	29 Earth years, 155 days
		OZ Farth was a 277 days
	19.22 AU	83 Earth years, 273 days
	are the surface temperature a et's distance from the sun?	163 Earth years, 263 days
related to the plane  Make Comparisons solar system? In yo	are the surface temperature a et's distance from the sun?  How do the gas giants differ f	163 Earth years, 263 days and length of year on a planet
. Make Comparisons solar system? In yo	are the surface temperature a et's distance from the sun?  How do the gas giants differ four answer, discuss composition	163 Earth years, 263 days and length of year on a planet from the inner planets of the
. Make Comparisons solar system? In yo length of a year, an	are the surface temperature a et's distance from the sun?  How do the gas giants differ four answer, discuss composition	163 Earth years, 263 days and length of year on a planet from the inner planets of the on, size, distance from the sun,