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Vocabulary Words

aphelion (a fēl' yən): the point farthest from the sun in the orbit of a planet

perihelion (per' ə hēl' yən): the point nearest the sun in the orbit of a planet

△ **Pronounce these words to someone.**

Uranus

Uranus was discovered by Sir William Herschel in 1781 as he was looking through his large reflecting telescope. He named this planet “George’s Star” in honor of his king. In our imaginary trip we just zipped up here from one planet to another in a short time. In August of 1977 the space probe Voyager 2 left Cape Canaveral, Florida, and reached Uranus in January of 1986. It took 8 ½ years to reach the planet! That should give you some idea of the immense distances between planets.

On Uranus, we’re 2.87 billion kilometers (1.78 billion miles) from the Sun. Though Uranus is smaller than Jupiter and Saturn, it is still a giant. Its diameter is four times larger than Earth’s.

Our day up here will be about 17 hours and 14 minutes, but I’m sure you won’t want to stay a year. A year on Uranus is equal to 84 earth-years. If you lived up here, you’d have only one birthday during your entire life.

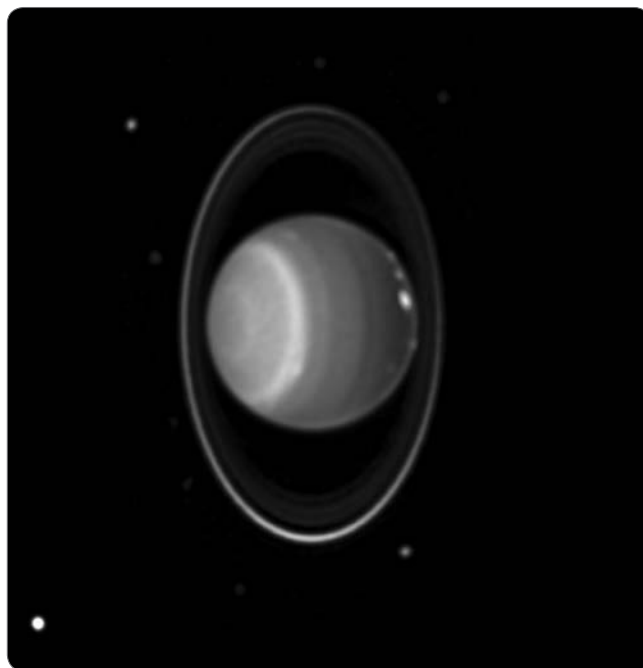
Uranus is tilted so far that it actually lies on its side as it rotates. This tilt causes its poles to receive dim sunlight for 42 years and then darkness for 42 years.

Uranus

Orbital Distance:	2.87 billion km
Length of Day:	17 hr 14 min
Length of Year:	84 years
Diameter:	50,700 km
Surface Gravity:	0.89 g
Avg. Temperature:	-197.2°C
Moons:	27

Surface gravity on Uranus is 0.89 g and its mass is 14.5 times that of Earth. By 1948 astronomers had discovered five large moons orbiting Uranus. When Voyager 2 flew past the planet in 1986, it found ten more moons. They are small—10 to 12 miles in diameter, sooty black moons in a black sky. The moons of Uranus are outstanding because of their great variety of surfaces. There are craters, high rocky mountains, icy canyons, and long valleys. Further investigation of Uranus’ moons since the flyby of Voyager 2 has brought the number of moons to twenty-seven.

Uranus appears blue-green through its cloud cover. Clouds circle Uranus with winds of up to 900 km (560 miles) per hour. These clouds indicate there is some kind of weather on Uranus, but only God knows what kind!



Uranus rotates on its side and has faint rings.

Wikimedia Commons/NASA/JPL/STScI

Lesson 7

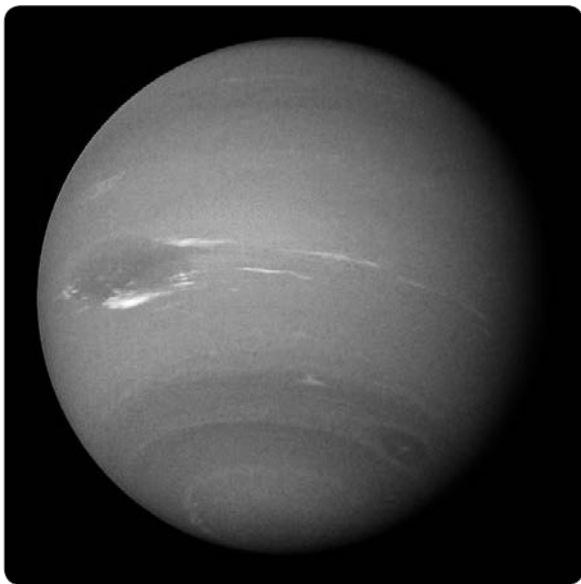
Voyager 2 discovered Uranus has narrow rings. They are made up of small dark particles. Such marvelous exploration of a planet almost two billion miles away was possible because of God's perfect timing of the universe and His gift of knowledge to man.

Neptune

Neptune was discovered using mathematics and a telescope. An English astronomer, John Adams, and a French astronomer, Urbain Le Verrier, used mathematical calculations to predict where another planet should exist. In 1848 Galle, a German astronomer, used a telescope to locate this planet within one degree of where Le Verrier had predicted it would be!

Neptune

Orbital Distance:	4.5 billion km
Length of Day:	16 hr 6 min
Length of Year:	165 years
Diameter:	49,200 km
Surface Gravity:	1.14 g
Avg. Temperature:	-210°C
Moons:	14



The Great Dark Spot can be seen in this picture of Neptune taken by Voyager 2.

Voyager 2 came near Neptune in August of 1989. It sent back thousands of pictures of the planet. Scientists were surprised to see rings around Neptune. The pictures also showed six previously unknown moons, and a large storm in Neptune's atmosphere called the Great Dark Spot.

Neptune has the strongest winds in the solar system. Voyager 2 measured the winds in the Great Dark Spot at 2,400 kilometers (1,500 miles) per hour!

Neptune makes one rotation in approximately 16 hours. It revolves around the sun once every 165 years. What a long year! You couldn't even live long enough to celebrate one birthday out here.

We're a long way from the sun—4.5 billion kilometers (2.79 billion miles)!

The temperature here is around -210°C (-340°F). Burr! I'm ready to leave this cold, lifeless place. How about you?

Pluto

This dwarf planet is farther away from the sun than any planet. It is an average distance of 5.90 billion kilometers (3.66 billion miles) from the sun. This is 39.5 times the distance from the sun to the earth! Its **aphelion** is 7.31 billion kilometers (4.53 billion miles) and its **perihelion** is 4.44 billion kilometers (2.75 billion miles). At its nearest point to the sun, Pluto actually comes inside Neptune's orbit. But most of the time Pluto's very elliptical path is beyond Neptune's orbit. The orbit of Pluto is different in another way. When compared to the orbits of the planets, the orbit of Pluto is tilted. Because it orbits so far from the sun, Pluto takes around 248 years to make one complete revolution.

Pluto was discovered in 1930 by the young astronomer Clyde Tombaugh. As he looked through photographs of the night sky, he noticed that one of the bright dots on a series of photos seemed to move. After further measurements confirmed his finding, it was announced that Clyde had found the ninth planet!

Pluto	
Orbital Distance:	5.90 billion km
Length of Day:	6.4 days
Length of Year:	248 years
Diameter:	2,370 km
Surface Gravity:	0.063 g
Avg. Temperature:	-229°C
Moons:	5



A picture of Pluto taken by New Horizons.

Later investigations with more powerful telescopes, including the Hubble Space Telescope, showed that Pluto has a total of five moons. The largest, Charon (ker' ən), is just over half the size of Pluto.

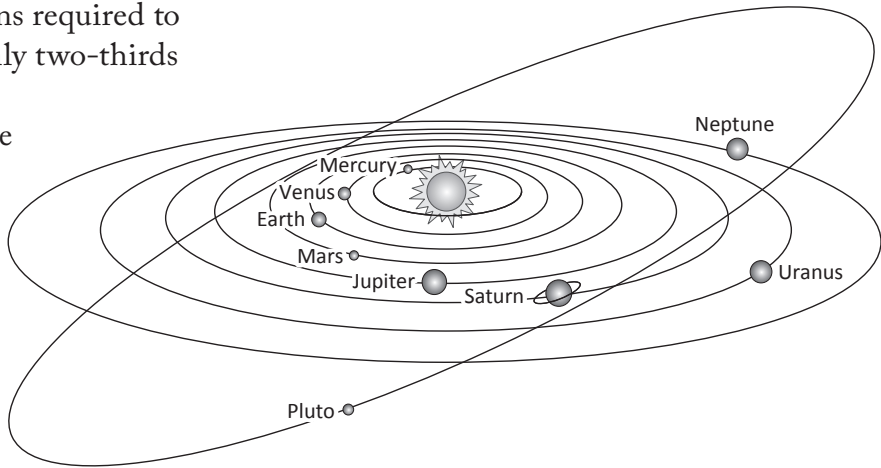
For many years Pluto was considered a planet. However, in 2006, an international group of astronomers decided to downgrade Pluto from a planet to a dwarf planet. This decision was reached because Pluto was too small and did not meet all the conditions required to be a planet. Pluto's diameter is only two-thirds that of our Moon.

In 2015 the New Horizons space probe flew by Pluto. It took pictures and measurements as it sped past the dwarf planet at 49,600 kilometers (30,800 miles) per hour. Scientists were finally able to clearly see the object that had once been only a blur in their best telescopes. They found that Pluto had a relatively smooth

surface with few craters, and 11,000 foot-high mountains of ice.

Pluto's average temperature is estimated to be -229°C (-373°F). It's no place for us!

Let's head back to Earth!



Pluto's orbit is tilted compared to the planets.

Study Exercises



Answer the questions.

1. Who discovered Uranus? _____
2. What is unusual about the tilt of Uranus? _____
3. How was Pluto discovered? _____

Lesson 7



Circle the letters of the answers.

4. What were the two reasons Pluto was downgraded to a dwarf planet?
 - a. It was too small.
 - b. Its orbit was different than the rest of the planets.
 - c. It did not meet the required conditions for planets.
 - d. It was hard to study because it is so far from earth.



Use the words and numbers to complete the statements. One answer will be used twice.

Charon	Pluto	8
Galle	Le Verrier	27
Adams	Voyager 2	165

5. It took Voyager 2 over _____ years to reach Uranus.
6. Uranus has _____ moons.
7. Neptune's location was predicted by _____ and _____ using mathematical calculations.
8. The astronomer _____ discovered Neptune very close to its predicted location.
9. The _____ spacecraft visited Neptune in 1989.
10. Neptune circles the sun once every _____ years.
11. The orbit of _____ is tilted.
12. Pluto's moon _____ is just over half the size of Pluto.
13. The diameter of _____ is about two-thirds the size of our Moon.



Write *true* if the statement is *true* and *false* if it is *false*. Correct any false statements.

14. _____ The unusual tilt of Uranus causes its poles to have 52 years of light.
15. _____ *Uranus* has faint, narrow rings.
16. _____ *Uranus* has the strongest winds in the solar system.
17. _____ The Great Dark Spot is a storm on *Neptune*.
18. _____ The *New Horizons* space probe flew past Pluto.

Looking Back



Underline the correct choice.

19. It takes Jupiter **12, 24** years to orbit the sun.
20. The Great Red Spot is a large **storm, crater** on Jupiter.
21. The largest planet in the solar system is **Mars, Jupiter**.
22. Jupiter's moon **Ganymede, Ceres** is larger than Mercury.
23. Saturn has large, beautiful **moons, rings** made of ice and rock.
24. Jupiter appears slightly flattened because of how fast it **revolves, rotates**.
25. Jupiter's surface gravity is 2.53 g, which means its gravity is **greater, less** than Earth's gravity.
26. Saturn and Jupiter are known as the "**gas giants,**" "**giant storms**" because they are large and covered in gas.



Complete the activity.

27. Record the moon phase on page 39.

Did You Know?

- ▶ Pluto's moon Charon has a canyon that is about as deep as Mount Everest is high.
- ▶ There are estimated to be at least ten more dwarf planets out beyond the orbit of Pluto.
- ▶ Neptune's moon Triton orbits clockwise around Neptune. This is the opposite direction of every other large moon in the solar system.