

What Is Jupiter? (Grades 5-8)

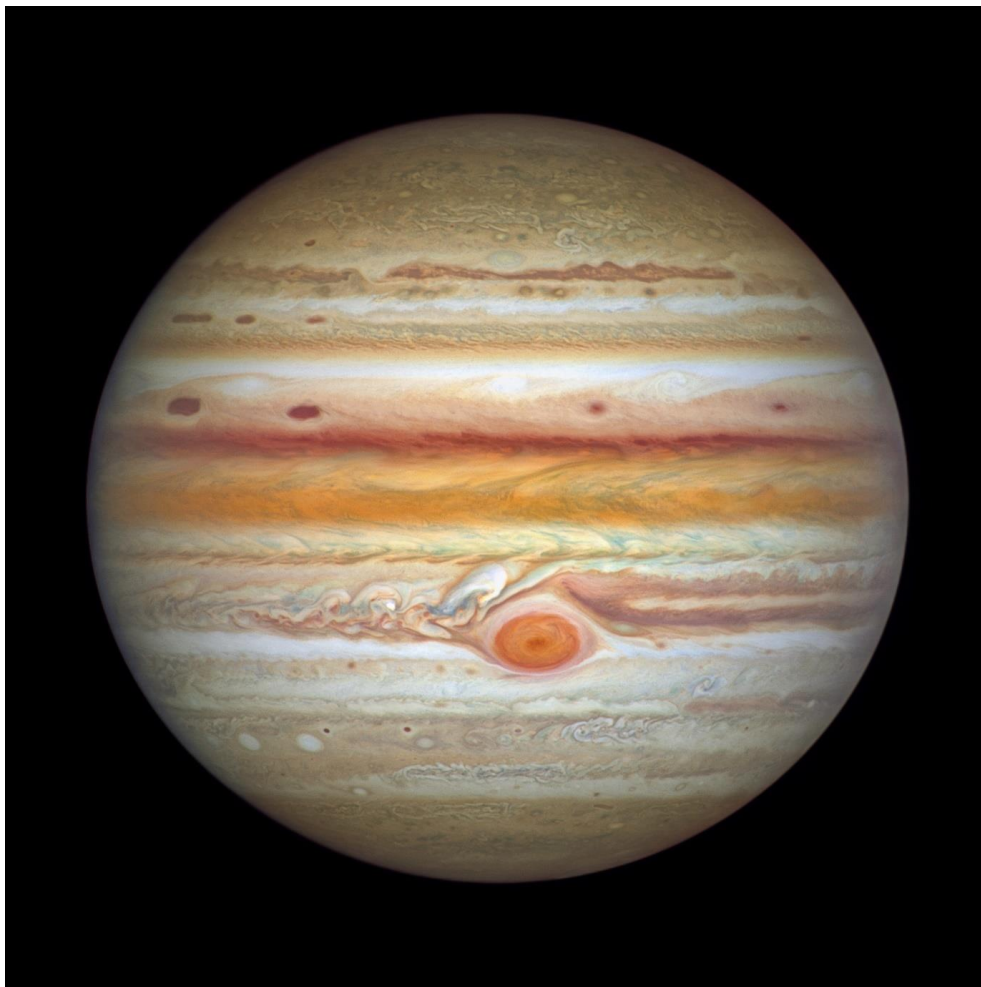
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This article is for students grades 5-8.

Jupiter is the largest planet in the solar system. It is approximately 143,000 kilometers (about 89,000 miles) wide at its equator. Jupiter is so large that all of the other planets in the solar system could fit inside it. More than 1,300 Earths would fit inside Jupiter.

Jupiter is like a star in composition. If Jupiter had been about 80 times more massive, it would have become a star rather than a planet.



Jupiter is the fifth planet from the sun. Jupiter's average distance from the sun is 5.2 astronomical units, or AU. This distance is a little more than five times the distance from Earth to the sun. When

viewed from Earth, Jupiter is usually the second brightest planet in the night sky, after Venus. The planet is named after Jupiter, the king of the Roman gods in mythology.

Words to Know

astronomical unit (AU): the average distance from the sun to Earth – about 149 million kilometers (93 million miles). Earth is 1 AU from the sun.

atmosphere: the layer of gases surrounding a planet.

magnetic field: the area around a planet that has a magnetic force

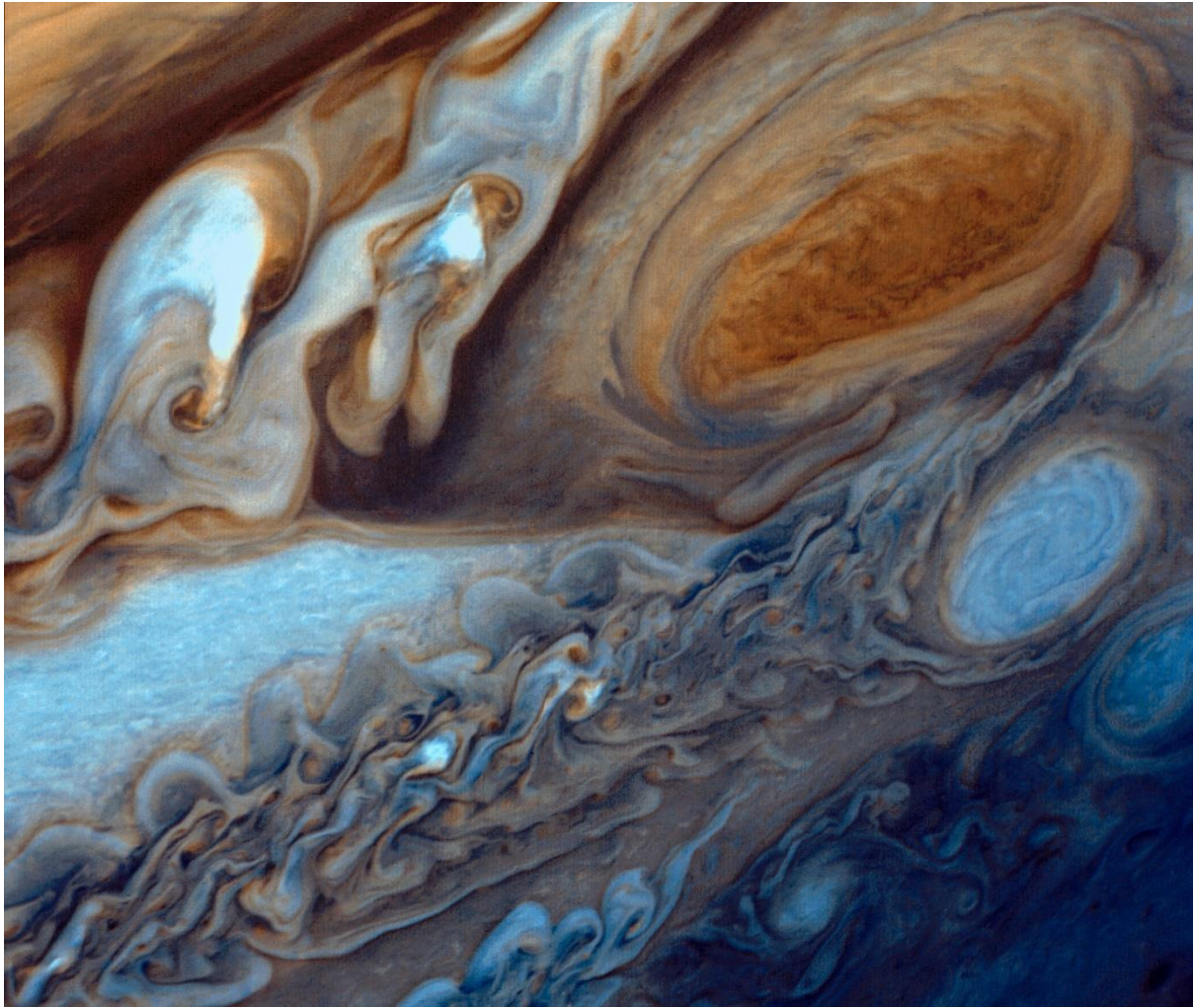
What Is Jupiter Like?

Jupiter is called a gas giant planet. Its atmosphere is made up of mostly hydrogen gas and helium gas, like the sun. The planet is covered in thick red, brown, yellow and white clouds. The clouds make the planet look like it has stripes.

One of Jupiter's most famous features is the Great Red Spot. It is a giant spinning storm, resembling a hurricane. At its widest point, the storm is about 3 1/2 times the diameter of Earth. Jupiter is very windy. Winds range from 192 mph to more than 400 mph.

Jupiter has three thin rings that are difficult to see. NASA's Voyager 1 spacecraft discovered the rings in 1979. Jupiter's rings are made up mostly of tiny dust particles.

Jupiter rotates, or spins, faster than any other planet. One rotation equals one day. Jupiter's day is only about 10 hours long. Jupiter's orbit around the sun is elliptical, or oval-shaped. Jupiter takes 12 Earth years to make one revolution around the sun, so one year on Jupiter is equal to 12 years on Earth.



Jupiter's red spot

Credits: NASA

The temperature in the clouds of Jupiter is about minus 145 degrees Celsius (minus 234 degrees Fahrenheit). The temperature near the planet's center is much, much hotter. The core temperature may be about 24,000 degrees Celsius (43,000 degrees Fahrenheit). That's hotter than the surface of the sun!

If a person could stand on the clouds at the top of Jupiter's atmosphere, the force of gravity he or she would feel would be about 2.4 times the force of gravity on the surface of Earth. A person who weighs 100 pounds on Earth would weigh about 240 pounds on Jupiter.

Jupiter has an extremely powerful magnetic field, like a giant magnet. Deep under Jupiter's clouds is a huge ocean of liquid metallic hydrogen. On Earth, hydrogen is usually gas. But on Jupiter, the pressure is so great inside its atmosphere that the gas becomes liquid. As Jupiter spins, the swirling, liquid metal ocean creates the strongest magnetic field in the solar system. At the tops of the clouds (tens of thousands of kilometers above where the field is created), Jupiter's magnetic field is 20 times stronger than the magnetic field on Earth.

Words to Know

satellite: a natural moon or man-made object that orbits a planet or other object

evolution: a process of change in a certain direction

aurora: a natural display of light in the sky

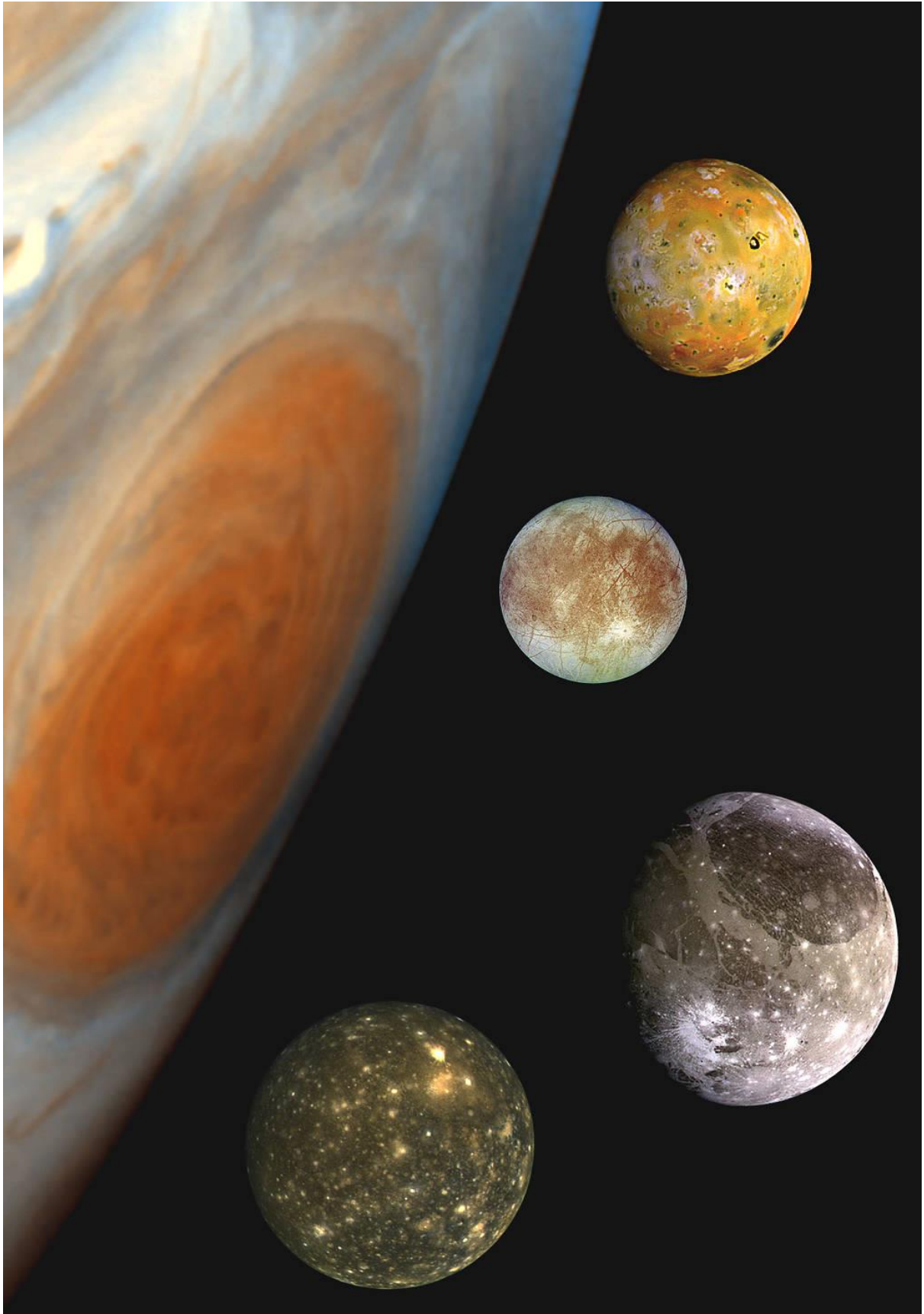
How Many Moons Does Jupiter Have?

Jupiter has 53 named moons. Scientists have discovered 26 more. But those 26 moons do not have official names. Scientists now think Jupiter has 79 moons. The most recent moons were discovered in 2017. The planet's four largest moons are Ganymede (GAN-i-meed), Callisto (kuh-LIS-toe), Io (eye-OH), and Europa (yur-O-puh).

These four moons are called the Galilean satellites. Italian astronomer Galileo Galilei discovered these moons in 1610.

The largest of Jupiter's moons is Ganymede. It is the largest moon in the solar system. Ganymede is larger than the planet Mercury and three-fourths the size of Mars. Ganymede is the only moon in the solar system known to have its own magnetic field. Ganymede and Callisto have many craters and appear to be made of ice and rocky material.

Io has many active volcanoes. The volcanoes produce gases containing sulfur. The yellow-orange surface of Io is most likely made of sulfur from the volcanic eruptions. Europa is the smallest of the Galilean satellites. Europa's surface is mostly water ice. Beneath the ice may be an ocean of water or slushy ice. Europa is thought to have twice as much water as Earth.



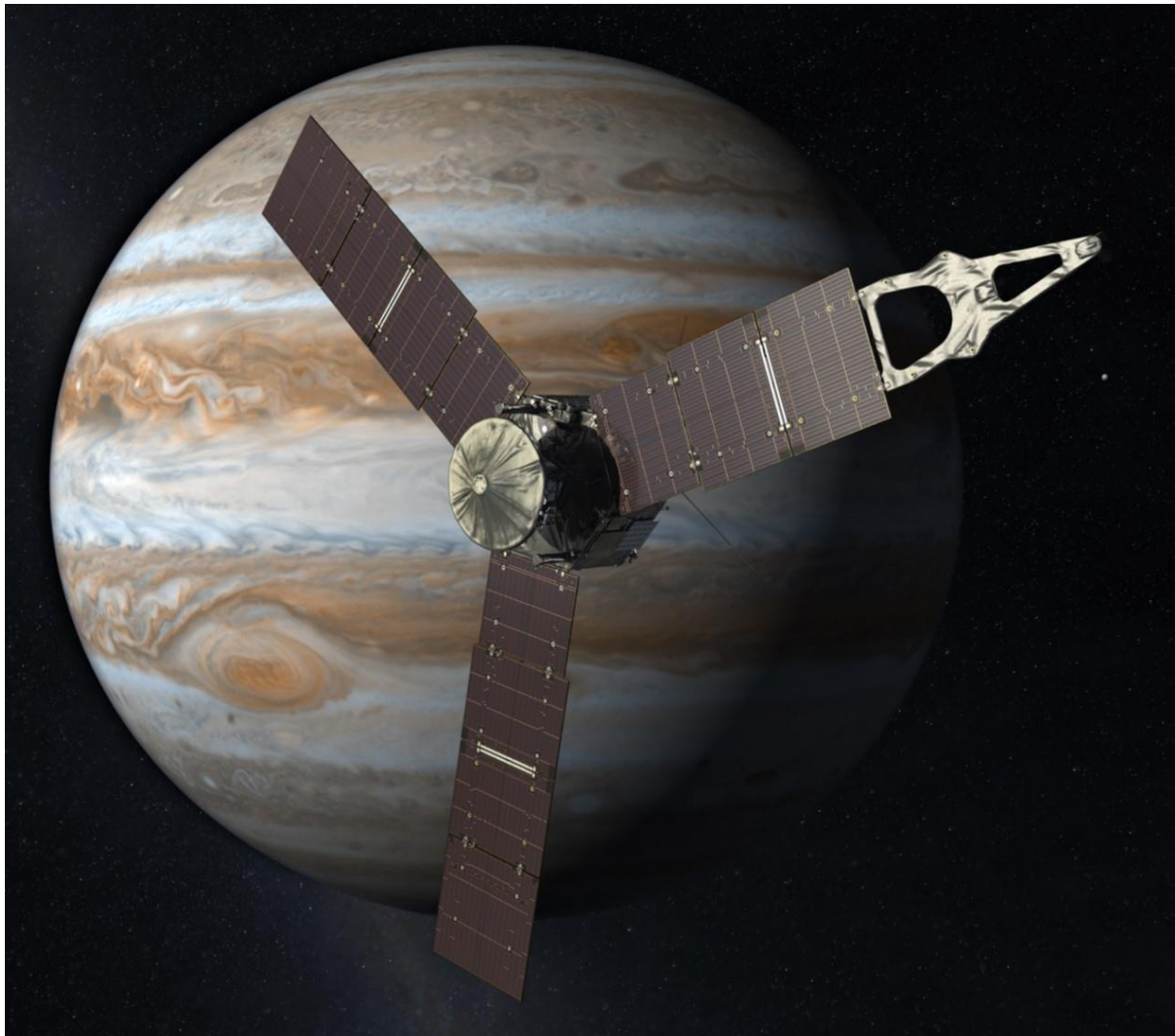
How Has NASA Studied Jupiter?

NASA astronomers have used telescopes on Earth to study Jupiter. Astronomers also have used telescopes like the Hubble Space Telescope that orbit Earth. From 1979 to 2007, eight NASA spacecraft studied Jupiter: Pioneer 10, Pioneer-Saturn, Voyager 1, Voyager 2, Ulysses, Galileo, Cassini and New Horizons. (The Ulysses, Cassini and New Horizons missions flew by Jupiter on their way to planets and locations farther in the solar system.) These missions studied Jupiter's atmosphere, moons and rings. The missions also took close-up images of the planet's unique features. The first mission to Jupiter was Pioneer 10, launched in 1972.

How Is NASA Exploring Jupiter Today?

A new spacecraft named Juno is now orbiting Jupiter. NASA's Juno spacecraft launched in 2011 and arrived at Jupiter on July 4, 2016. The goal of Juno is to help scientists better understand the origin and evolution of Jupiter and how planets form.

Juno is using Jupiter's magnetic field, gravitational field (the force field of gravity around the planet) and naturally occurring radio waves to study the mysterious interior of the giant planet. The spacecraft is taking the first pictures of Jupiter's polar regions and studying the huge auroras that light up Jupiter's north and south poles.



[More About Jupiter](#)

[All About Jupiter](#)



Jupiter is a stormy planet that is probably best known for its Great Red Spot. The spot is actually a giant, wild storm that has been raging for more than 300 years. Credit: NASA/JPL-Caltech

Jupiter is the biggest planet in our solar system. It's similar to a star, but it never got massive enough to start burning. It is covered in swirling cloud stripes. It has big storms like the Great Red Spot, which has been going for hundreds of years. Jupiter is a gas giant and doesn't have a solid surface. It is still unclear if deeper down, Jupiter has a central core of solid material or if it may be a thick, super-hot and dense soup. Jupiter also has rings, but they're too faint to see very well.

Explore Jupiter! Click and drag to rotate the planet. Scroll or pinch to zoom in and out. Credit: NASA Visualization Technology Applications and Development (VTAD)



Credit: NASA/JPL-Caltech

Structure and Surface

- Jupiter is the biggest planet in our solar system. It is actually more than twice as massive than the other planets of our solar system combined.
- Jupiter is a gas giant. It is made mostly of hydrogen and helium.
- Jupiter has a very thick atmosphere.
- Jupiter has rings, but they're very hard to see.
- The giant planet's Great Red Spot is a centuries-old storm bigger than Earth.

Time on Jupiter

- One day on Jupiter goes by in just 10 hours.
- One year on Jupiter is the same as 11.8 Earth years.

Jupiter's Neighbors

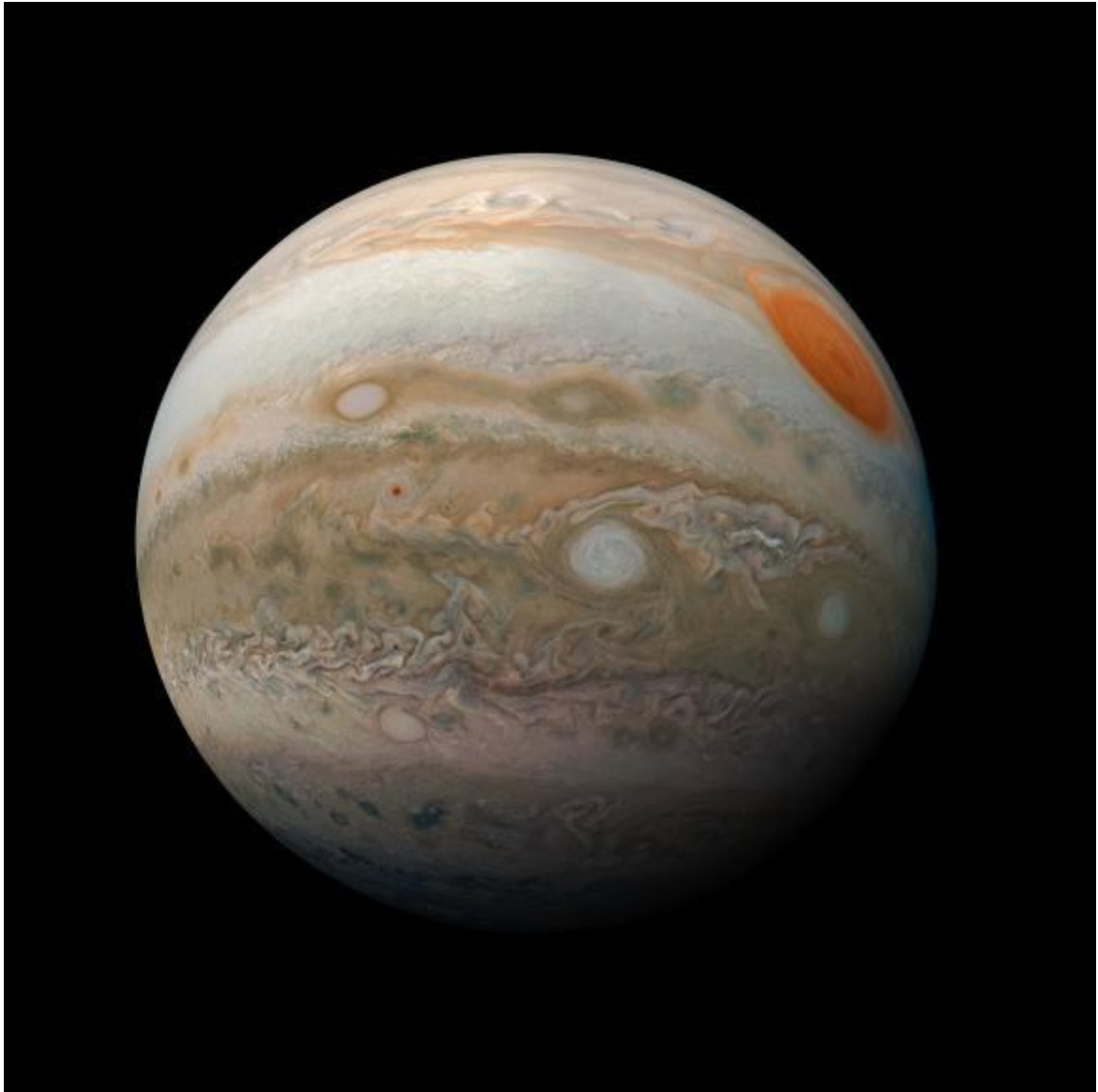
- Jupiter has 95 [officially recognized](#) moons.

- Jupiter is the fifth planet from the Sun. That means Mars and Saturn are Jupiter's neighboring planets.

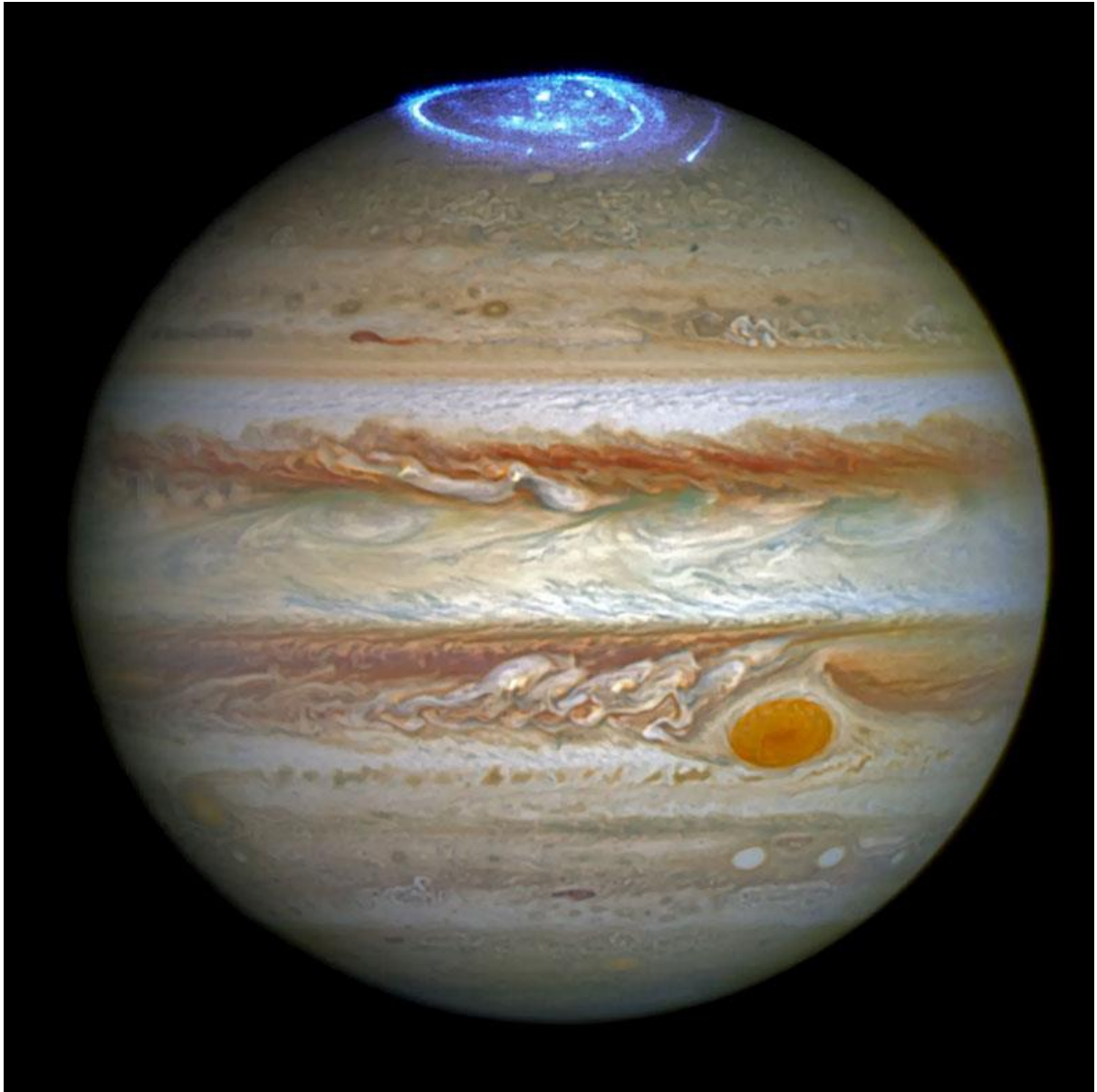
Quick History

- Jupiter has been known since ancient times because it can easily be seen with just our eyes. No special equipment is needed.
- Jupiter has been visited or passed by [several spacecraft](#), orbiters and probes, such as Pioneer 10 and 11, Voyager 1 and 2, Cassini, New Horizons, and Juno.
- Jupiter has [auroras](#), just like Earth! Not only are the auroras huge in size, they are also hundreds of times more energetic than auroras on Earth. And, unlike those on Earth, they never cease.

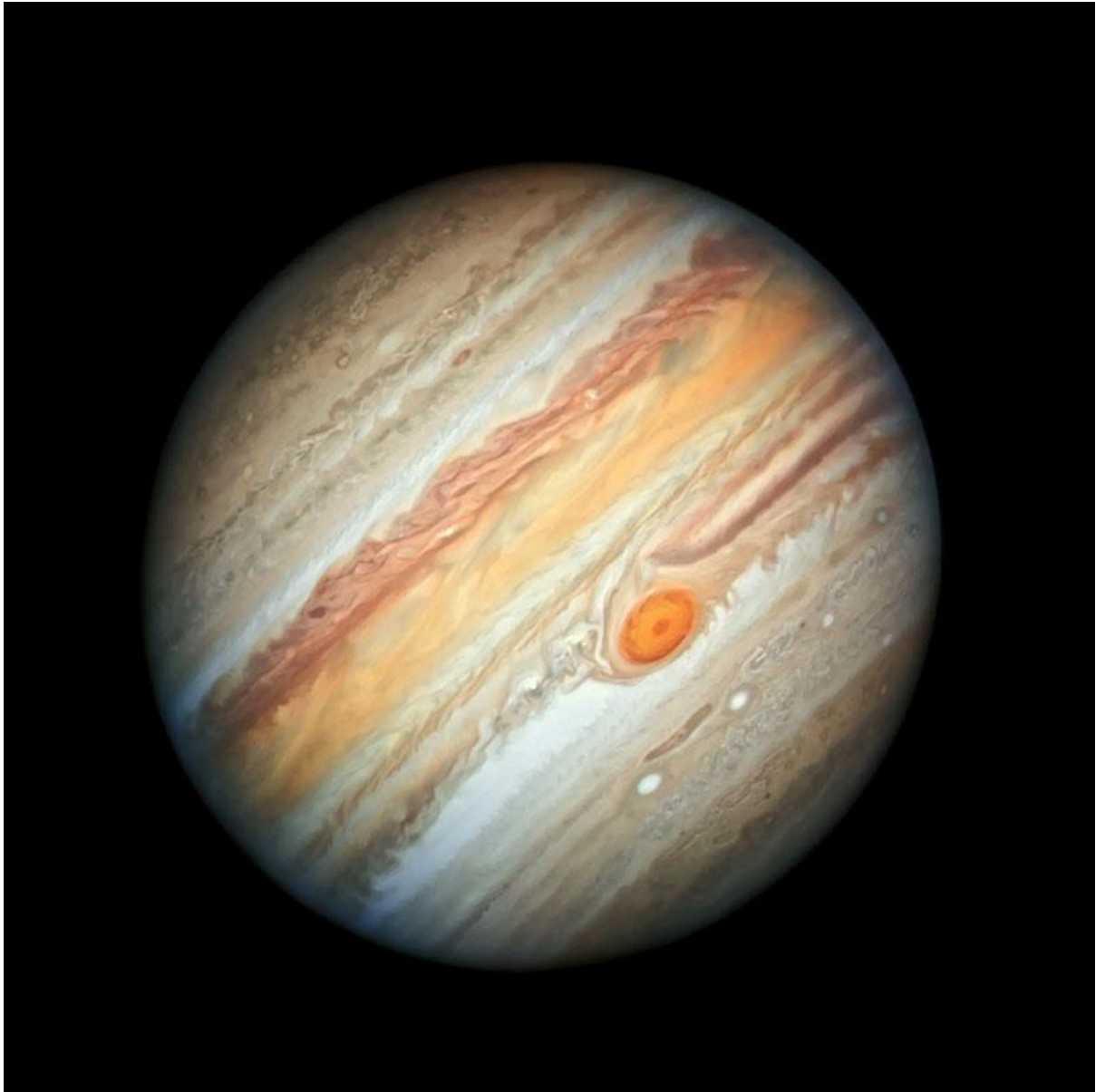
What does Jupiter look like?



This striking view of Jupiter's Great Red Spot and turbulent southern hemisphere was captured by NASA's Juno spacecraft as it performed a close pass of the gas giant planet. Credit: Enhanced image by Kevin M. Gill (CC-BY) based on images provided courtesy of NASA/JPL-Caltech/SwRI/MSSS



Astronomers are using NASA's Hubble Space Telescope to study auroras — stunning light shows in a planet's atmosphere — on the poles of the largest planet in the solar system, Jupiter. Credits: NASA, ESA, and J. Nichols (University of Leicester)



This new Hubble Space Telescope view of Jupiter, taken on June 27, 2019, reveals the giant planet's trademark Great Red Spot, and a more intense color palette in the clouds swirling in Jupiter's turbulent atmosphere than seen in previous years. The colors, and their changes, provide important clues to ongoing processes in Jupiter's atmosphere. Credit: NASA, ESA, A. Simon (Goddard Space Flight Center), and M.H. Wong (University of California, Berkeley)

Facts About Jupiter

Jupiter is a world of extremes.

Jupiter is the largest planet in our solar system. If Jupiter was a hollow shell, 1,000 Earths could fit inside. Jupiter also is the oldest planet, forming from the dust and gases left over from the Sun's formation 4.5 billion years ago. But it has the shortest day in the solar system, taking only 10.5 hours to spin around once on its axis.

What's It Like Inside Jupiter?

It's really hot inside Jupiter! No one knows exactly how hot, but scientists think it could be about 43,000°F (24,000°C) near Jupiter's center, or **core**.



The reddish brown and white stripes of Jupiter are made up of swirling clouds. The well-known Red Spot is a huge, long-lasting storm. Image credit: NASA/JPL/Space Science Institute

[Jupiter](#) is made up almost entirely of hydrogen and helium. On the surface of Jupiter—and on Earth—those elements are gases. However inside Jupiter, hydrogen can be a liquid, or even a kind of metal.

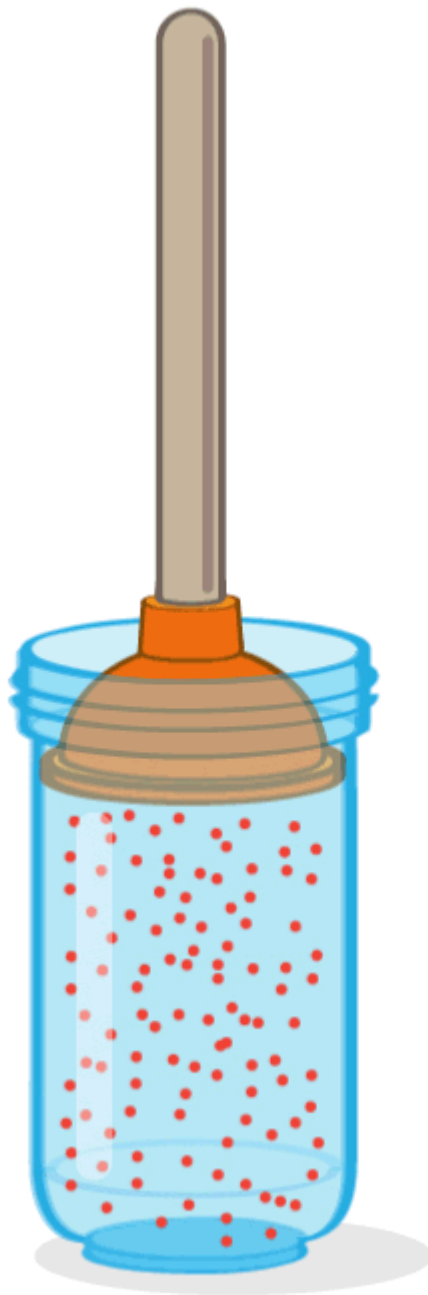
These changes happen because of the tremendous temperatures and **pressures** found at the core.

What is pressure?

Have you ever gone swimming at the deep end of a pool? Did you notice that your ears started to hurt a little bit when you were under water? The deeper you dive, the more water there is on top of you. All of that water presses on your body—and that's pressure.

The same type of pressure happens in Jupiter's core. Under low pressure, particles of hydrogen and helium, called molecules, have lots of room to bounce around. This is when hydrogen and helium are gases.

However, the weight of all this hydrogen and helium is really heavy. This weight presses down toward the planet's core, creating high pressure. The molecules run out of room to bounce around, so instead, they slow down and crowd together. This creates a liquid.



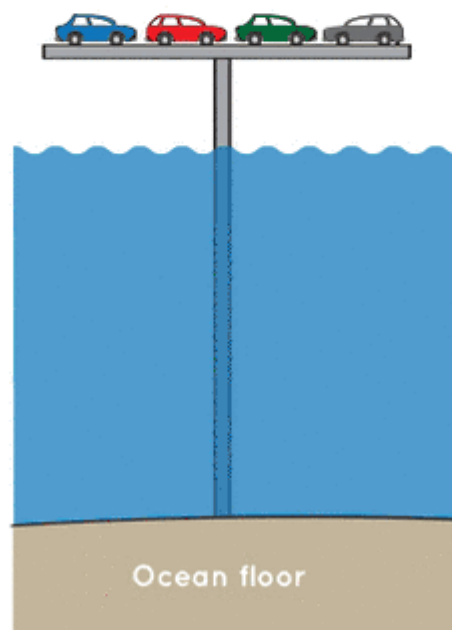
How much pressure would you find at the center of Jupiter?

Imagine if you swam to the bottom of the Pacific Ocean. You would feel more than 16,000 pounds of force pressing down on every square inch of your body. That is approximately the weight of four cars!

The pressure at the center of Jupiter is much higher. At Jupiter's core, you would feel as much as 650 million pounds of pressure pressing down on every square inch of your body. That would be like having approximately 160,000 cars stacked up in every direction all over your body!

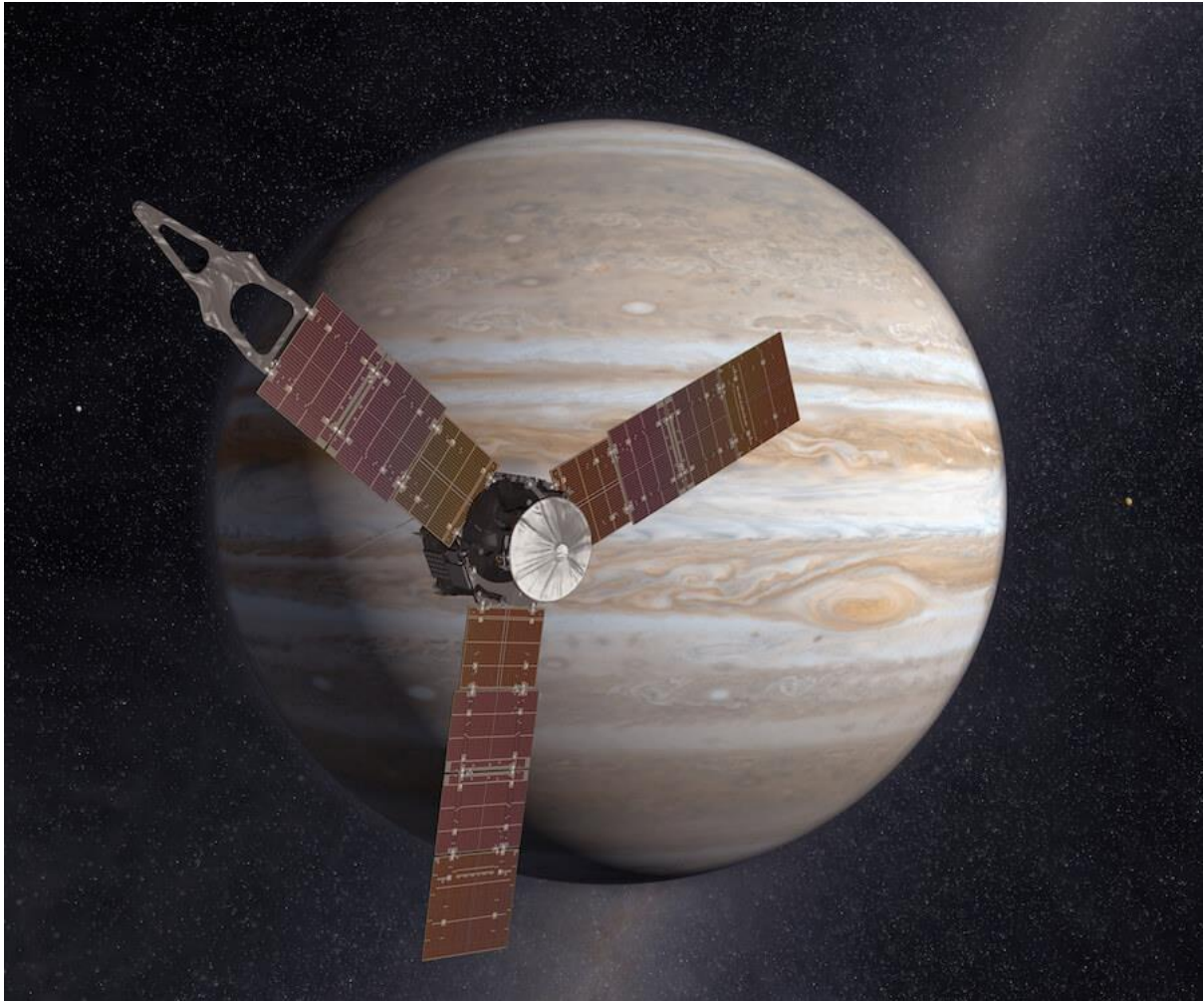
**Pressure on the ocean floor
is equal to the weight of**

4 cars



What lies at the very center of Jupiter?

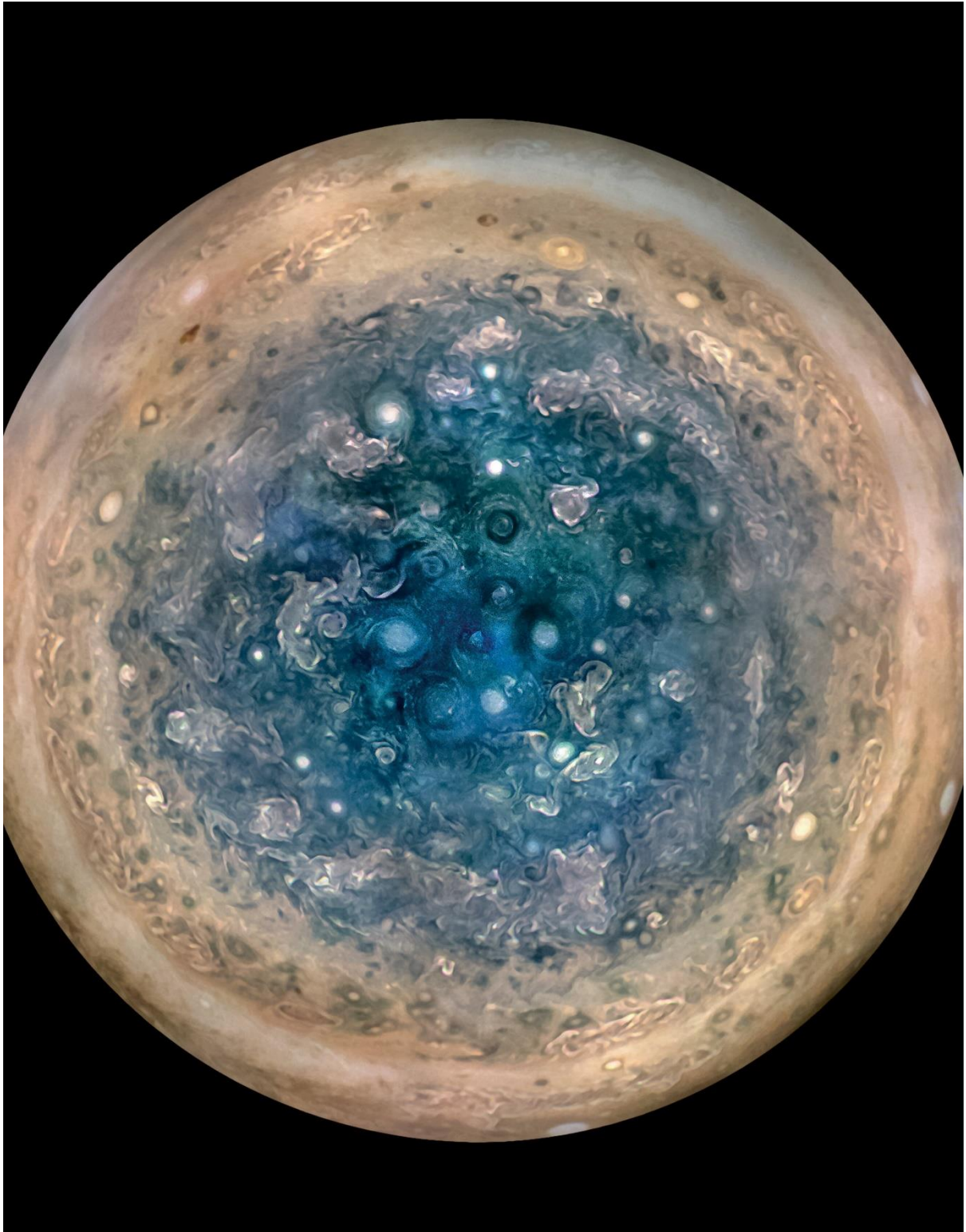
At the moment, scientists aren't 100% sure. It may be that the planet has a solid core that is bigger than Earth. But some scientists think it could be more like a thick, boiling-hot soup.



This is an artist's concept of the Juno spacecraft in front of Jupiter. Juno launched in 2011 and arrived at Jupiter on July 4, 2016. Image credit: NASA/JPL-Caltech

NASA's Juno mission is designed to find answers to such remaining questions about Jupiter. The spacecraft is orbiting the giant planet, swooping in for close-up looks to get more detailed information.

[Juno](#) has already made many new discoveries about Jupiter. Scientists hope that information from Juno will help us measure Jupiter's mass and figure out whether or not the giant planet's core is solid.



Juno has captured the first images we've ever seen of Jupiter's poles. Pictured here is the South Pole with its surprising bluish color and many Earth-sized storms. Credit: NASA/JPL-Caltech/SwRI/MSSS/Betsy Asher Hall/Gervasio Robles

Europa: Jupiter's Ocean World

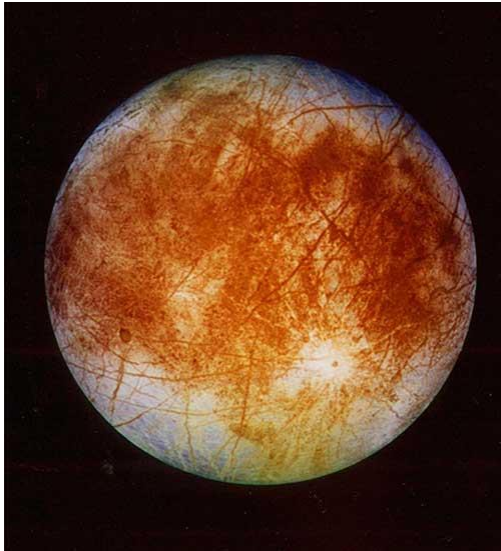
The Short Answer:

What is Europa?

Europa is one of Jupiter's moons. Scientists believe that Europa is especially notable because it may have twice as much water as Earth, though it is so cold on Europa that water on the surface of this moon is frozen.



Credit: NASA/JPL-Caltech



This image of Jupiter's beautiful moon Europa was taken by the Galileo Orbiter spacecraft in 1998.
Credit: Galileo Project/JPL/NASA

There are a few places in our solar system where scientists think it might be possible to find life beyond Earth. Jupiter's moon **Europa** is one of those places.

It is a long way from the Sun—more than five times farther than the distance between Earth and the Sun. It is so cold on Europa that water on the surface of the moon is frozen as hard as rock. We can usually crack our Earth's winter ice with an ice pick. On Europa, it would take a jack hammer!

What is Europa like?

Europa is smaller and colder than Earth. It's slightly smaller in size than Earth's Moon. It's so cold because it's a long way from the Sun—more than five times farther than the distance between the Sun and Earth.

Water is a key ingredient for life. Scientists think that Europa has lots of water. In fact, it might have more than twice as much water as Earth. However, it's so cold there that any water on the surface is frozen as hard as rock.

What could possibly live there?

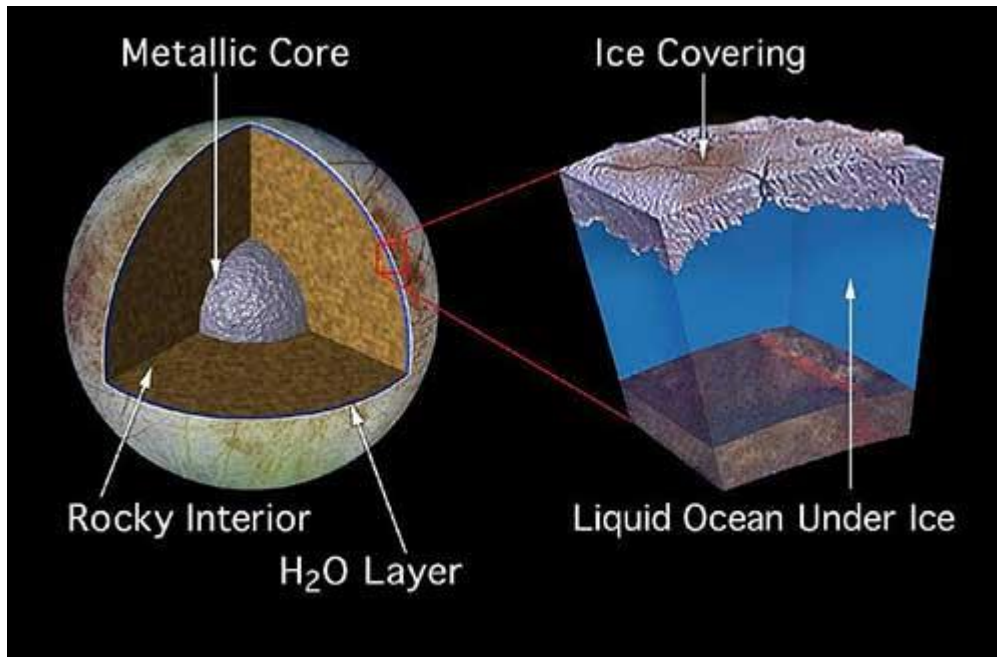


An illustration of what it might look like if you were standing on Europa's frozen surface. Image credit: NASA/JPL-Caltech

NASA's **Galileo** mission found good evidence that underneath this rock-hard, icy crust there is a huge, salty, liquid ocean. Since there are lots of tiny creatures that live in very harsh water environments here on Earth, it's possible that this type of life could also exist on Europa.

What keeps the water under the ice in liquid form if the surface is so cold?

Europa's tides prevent it from freezing solid. On Earth, tides are caused by the gravitational pull of the Moon. On Europa, tides are caused by the tremendous gravitational pull of Jupiter. This gravitational pull is also what holds Europa in orbit around Jupiter.

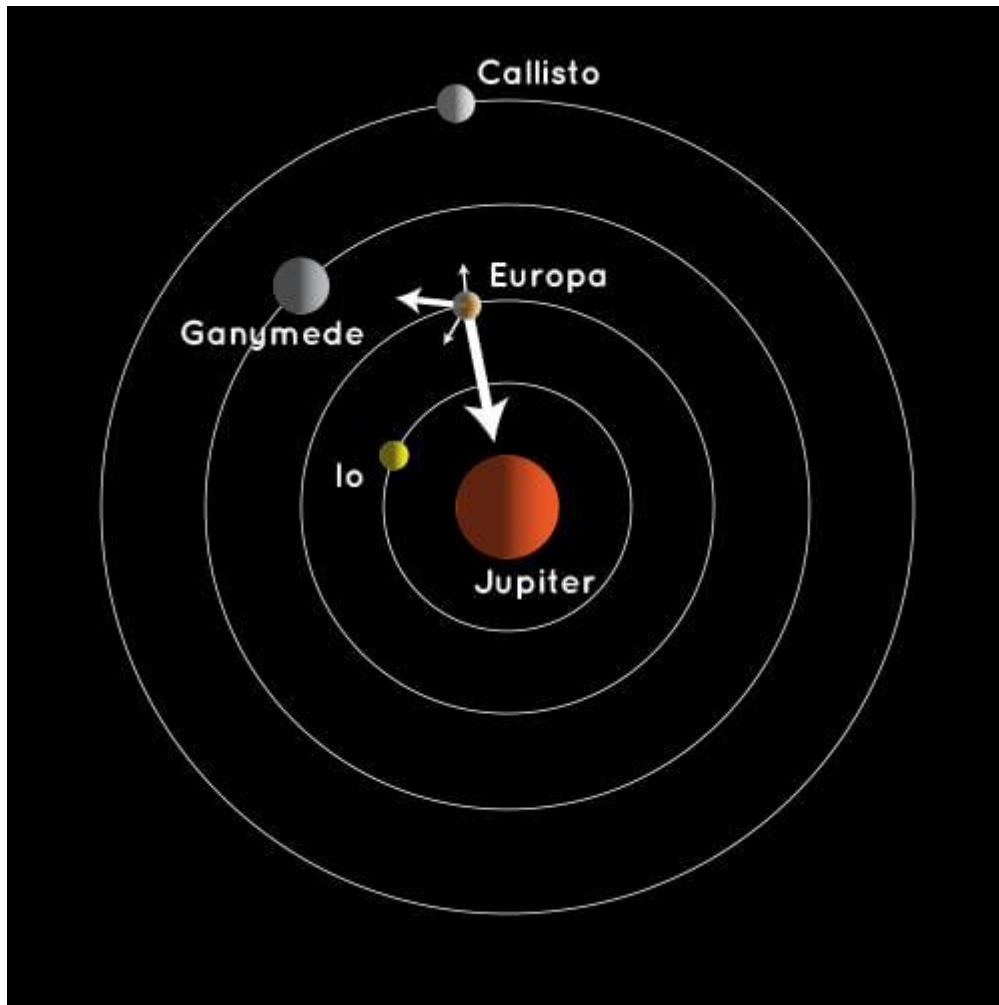


Evidence from NASA's Galileo mission suggested that there might be a liquid water ocean underneath Europa's icy crust. Image credit: NASA/JPL

Just like Earth's Moon, one side of Europa is gravitationally locked to Jupiter. That means Europa always has the same side facing Jupiter as it orbits. Its orbit is also not a perfect circle. So, sometimes Europa is farther away from Jupiter and sometimes it is closer.

Jupiter's strong gravity constantly tugs on Europa. The pull is strongest on the side that always faces Jupiter. When Europa is close to Jupiter in its orbit, Jupiter's gravity pulls even harder on this side. When Europa is farther away, the pull is less strong. That means Europa is constantly stretching as it orbits Jupiter.

Gravitational pulls from a couple of Jupiter's other large moons, Io and Ganymede, tug on Europa, too. The pull of these moons also changes the shape of Europa's orbit around Jupiter. This is one reason why Europa's orbit is not circular and is always changing.



The arrows coming out of Europa in this illustration are called vectors. They represent the strength and direction of tug of Jupiter and the other moons on Europa. The strength of the gravitational pull changes as the distances and directions from Europa to the moons change.

As gravitational pulls tug Europa this way and that, the friction from all this flexing creates internal heat. This heat keeps the water under the surface liquid, and liquid water is necessary for life.

How will NASA study Europa?

NASA is building a spacecraft to visit Europa, called **Europa Clipper**. This mission will travel to Europa and investigate whether the icy moon could harbor conditions suitable for life.