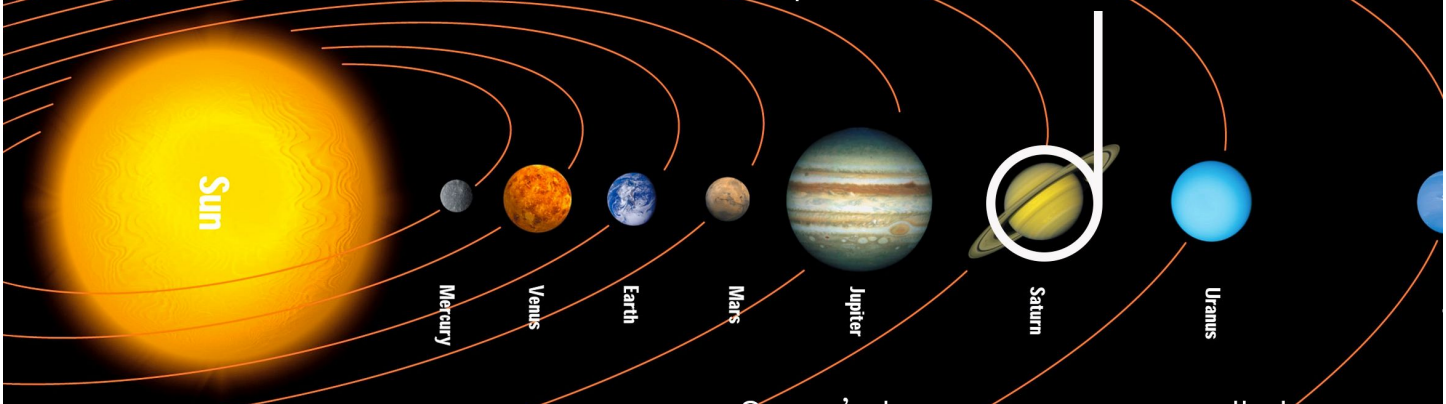
Trim the top and bottom borders of each infographic. Align the bottom of the first page of each infographic to the top of the next page and use tape to attach them.

SATURN'S MOONS

Saturn has dozens of known moons. Some estimate that it has 150 moons. Many of these moons are very small. The largest moons are worlds in their own right, and good places to look for life.



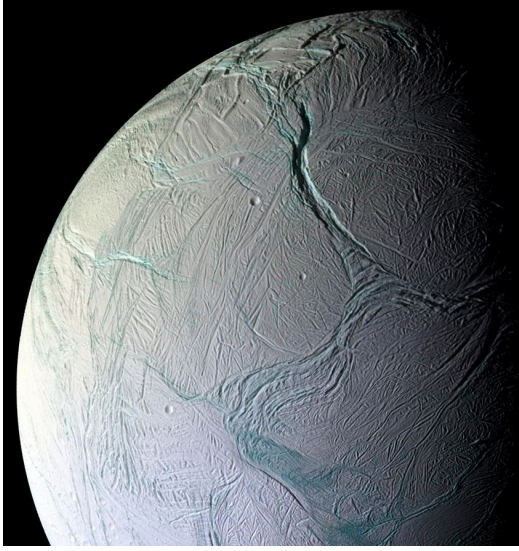
Saturn's largest moons are called moons because they go around a planet. If these moons broke free of Saturn's gravity and began to orbit the Sun, we would call them planets.

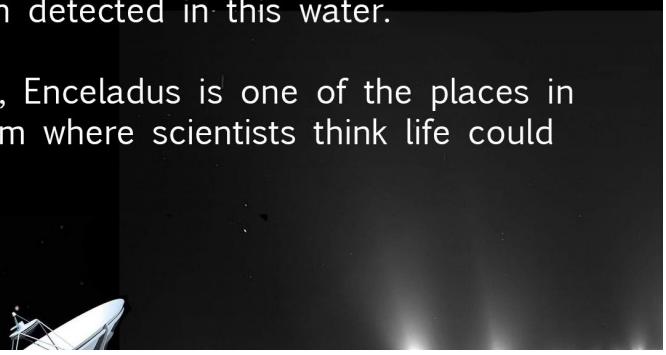
ENCELADUS

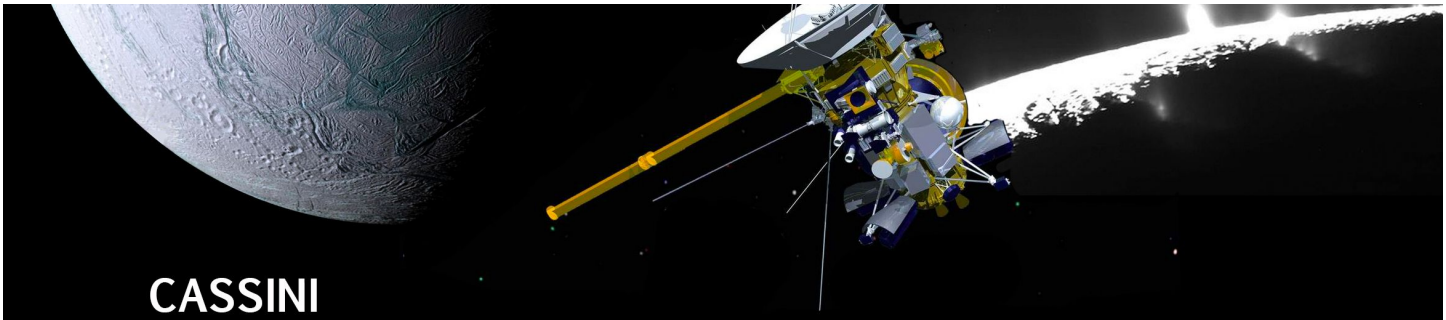
Enceladus is covered in water ice. Underneath the ice there is a giant ocean of liquid water.

Jets of water spray out from the underground ocean. Chemicals that form the building blocks of life on Earth have been detected in this water.

Because of this, Enceladus is one of the places in our Solar System where scientists think life could exist.







CASSINI

The Cassini spacecraft visited Saturn. Cassini sent back photos of Saturn and its moons.

TITAN

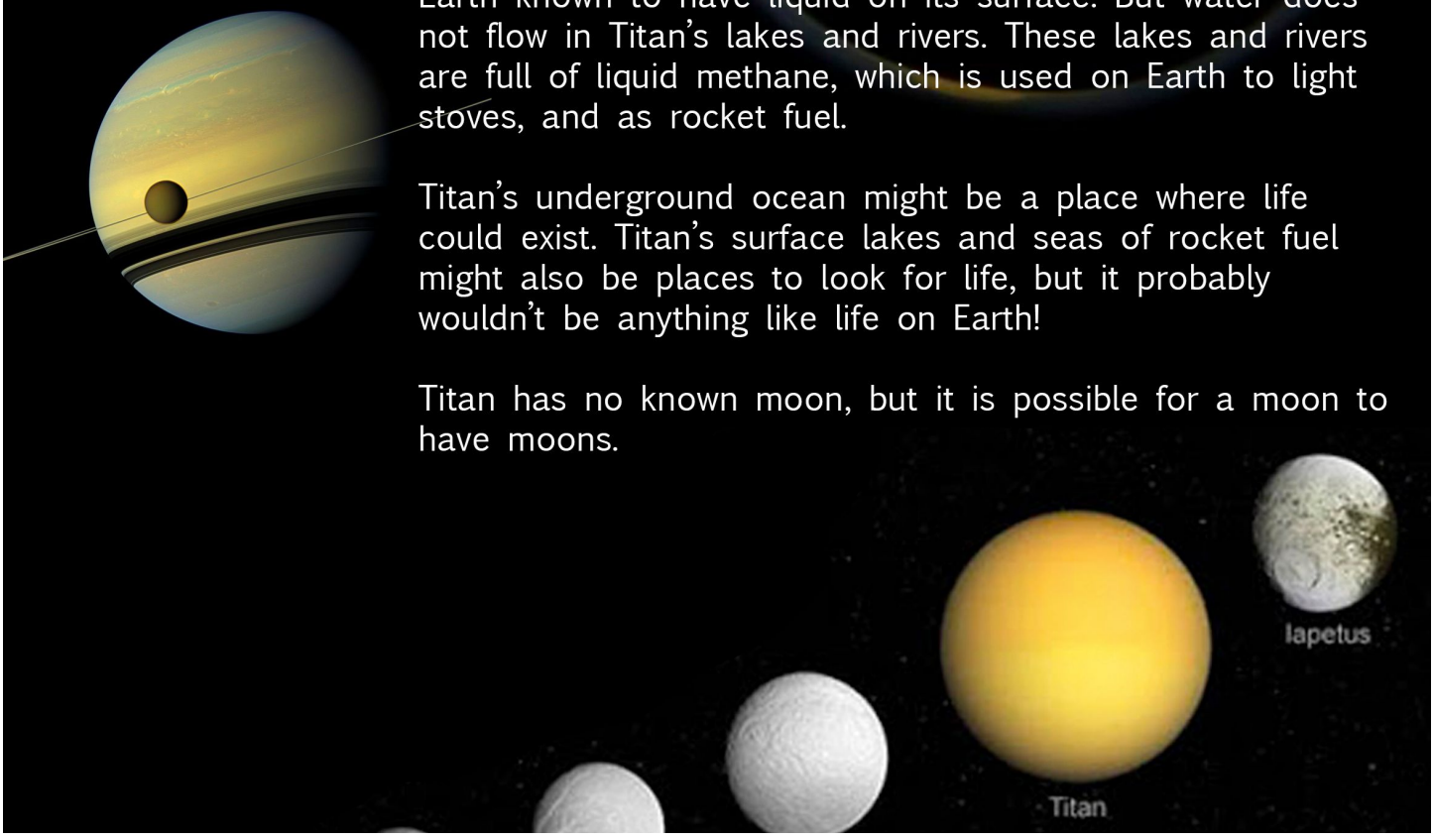
Saturn's largest moon Titan is the second largest moon in the solar system. It is bigger than planet Mercury. Titan has a surface of water ice. Titan probably has a liquid water ocean beneath its surface.

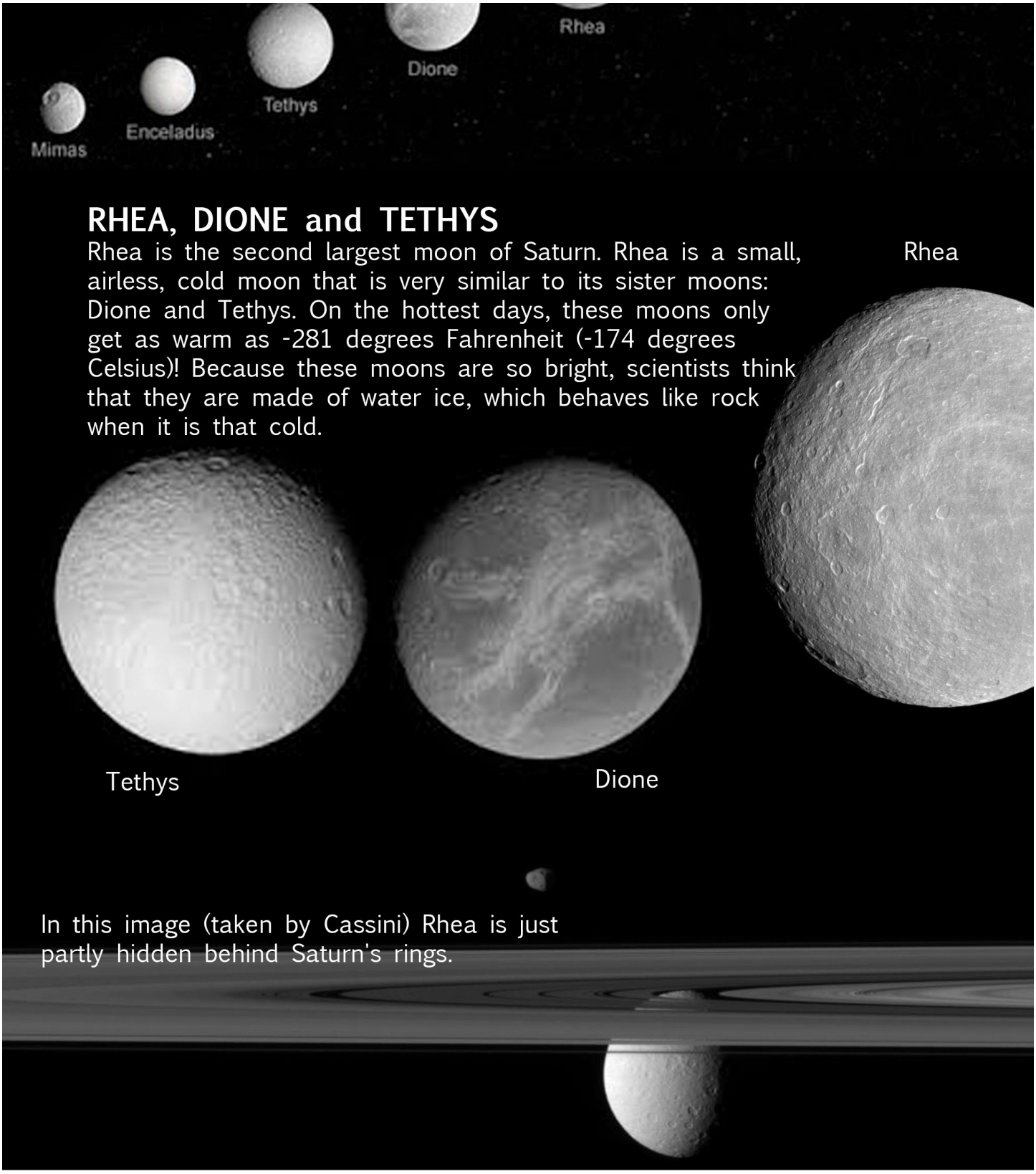
Titan is the only moon in the solar system with a thick atmosphere. The air is dense enough that you could walk around without a spacesuit. But you would need an oxygen mask to breathe, and protection from the bitter cold.

Titan is also the only place in the Solar System other than Earth known to have liquid on its surface. But water does not flow in Titan's lakes and rivers. These lakes and rivers are full of liquid methane, which is used on Earth to light stoves, and as rocket fuel.

Titan's underground ocean might be a place where life could exist. Titan's surface lakes and seas of rocket fuel might also be places to look for life, but it probably wouldn't be anything like life on Earth!

Titan has no known moon, but it is possible for a moon to have moons.





RHEA, DIONE and TETHYS

Rhea is the second largest moon of Saturn. Rhea is a small, airless, cold moon that is very similar to its sister moons: Dione and Tethys. On the hottest days, these moons only get as warm as -281 degrees Fahrenheit (-174 degrees Celsius)! Because these moons are so bright, scientists think that they are made of water ice, which behaves like rock when it is that cold.

Rhea

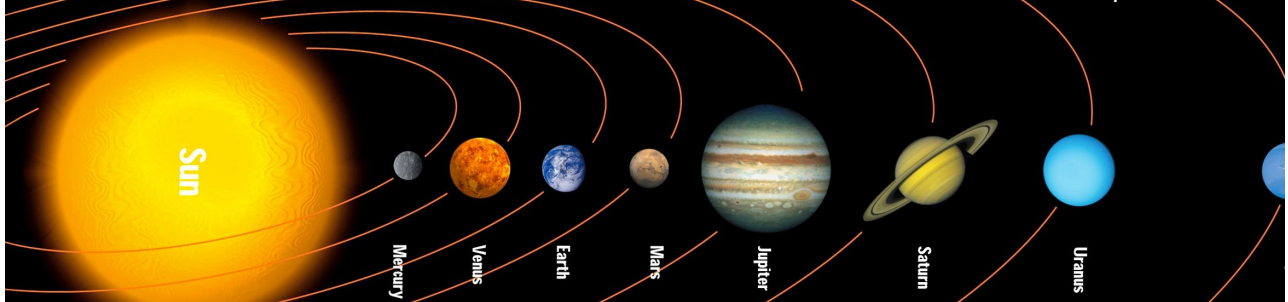
Tethys

Dione

In this image (taken by Cassini) Rhea is just partly hidden behind Saturn's rings.

DWARF PLANETS

Dwarf planets, so called because they are smaller than the planets shown below, are mostly found beyond the orbit of Neptune, in a place called the Kuiper Belt.



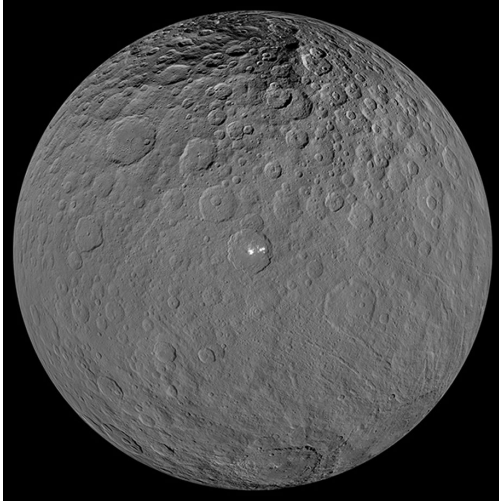
A dwarf planet orbits the Sun, unlike a Moon. A dwarf planet must also be round, unlike the oddly shaped rocky asteroids. But in order to be considered a "classical planet," like Earth or Jupiter, an object must be large enough that the gravity force has cleared the area that it orbits in. These objects either fall into the planet, or are flung into space. Dwarf planets like Pluto have not done this.

There may be hundreds of dwarf planets in our Solar System. Right now, we only know about a handful of these, becase they are small, and far away, which makes them difficult to spot.

PLUTO

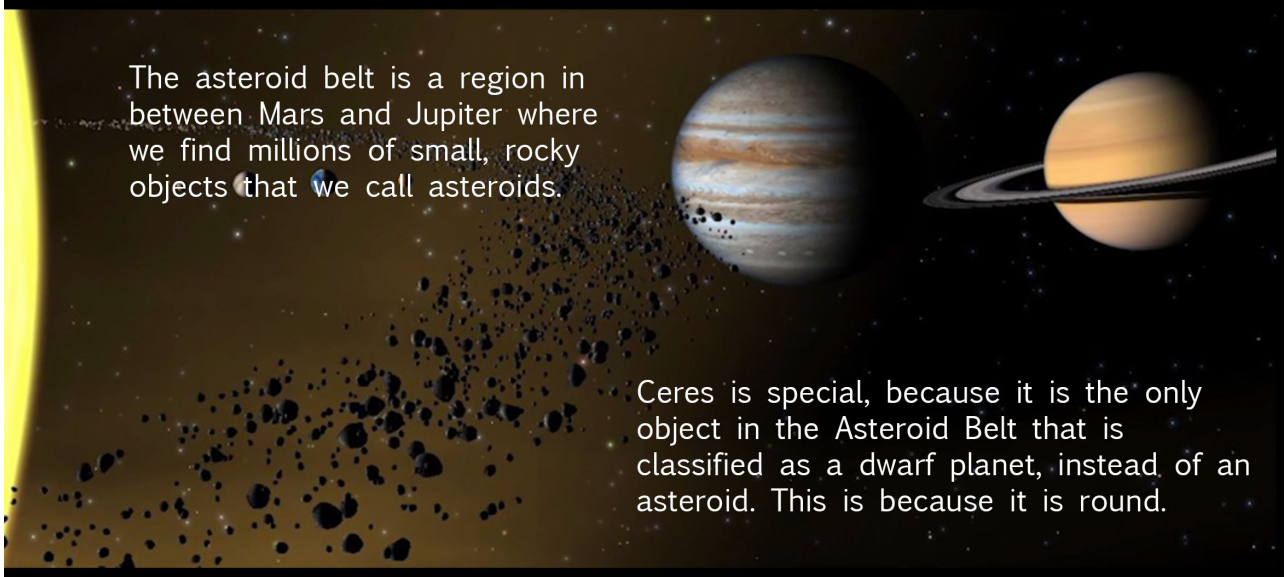
Pluto is perhaps the most well known dwarf planet, and one of the largest. It is 1473 miles in diameter, and was discovered in 1930. Pluto is very far from the Sun, 3.6 billion miles (5.8 billion km) away on average, about 40 times as far as Earth, in a region called the Kuiper Belt. Because it is so far, Pluto takes 248 Earth years to go around the Sun once, and is very, very cold. Pluto has several moons, including one called Charon that is almost half the size of Pluto. The little moon is so big that Pluto and Charon are sometimes referred to as a double dwarf planet.

Some people were very upset when astronomers decided that Pluto was a dwarf planet in 2006. Some people marched with signs to show how they felt. But just like every classical planets is unique, each dwarf planet is also unique. Astronomers decided to call these planets dwarf planets because it is convenient for organizing the great diversity of objects in our Solar System, not because they are fundamentally different, or less important.



CERES

Ceres' radius is just 296 miles (476 km). If Earth were the size of a nickel, Ceres would be about as big as a poppy seed. But even so, Ceres is big enough that the force of gravity has pulled it into a round shape, unlike its asteroid neighbors. Scientists would like to search for possible signs of life on Ceres. It has something many other planets don't: water

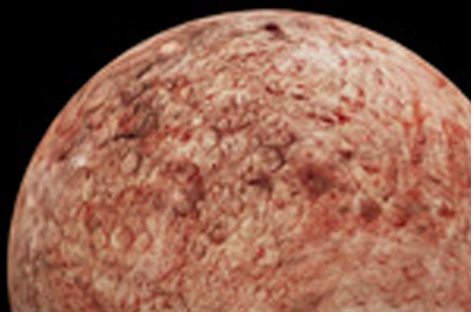


The asteroid belt is a region in between Mars and Jupiter where we find millions of small, rocky objects that we call asteroids.

Ceres is special, because it is the only object in the Asteroid Belt that is classified as a dwarf planet, instead of an asteroid. This is because it is round.

MAKEMAKE

Along with fellow dwarf planets Pluto, Eris and Haumea, Makemake is in the Kuiper Belt, a region outside the orbit of Neptune. Slightly smaller than Pluto, Makemake is the second-brightest object in the Kuiper Belt as seen from Earth (Pluto is the brightest). It takes about 305 Earth years for this dwarf planet to make one trip around the sun.



Makemake holds an important place in the

history of solar system studies because it—along with Eris—was one of the objects whose discovery prompted the International Astronomical Union to reconsider the definition of a planet and to create the new group of dwarf planets.

Makemake is named after the Polynesian Rapanui god of fertility.

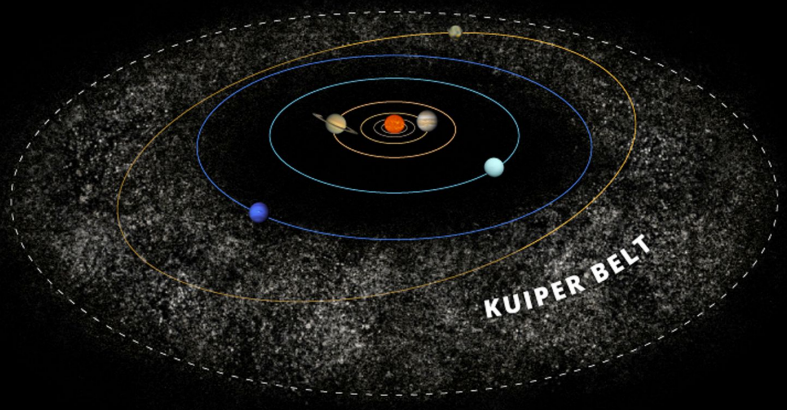
HAUMEA

Haumea is in the Kuiper belt and is about the same size as Pluto. Haumea is one of the fastest rotating large objects in our solar system. Its fast spin distorts Haumea's shape, making this dwarf planet look like a football. Haumea was named after the Hawaiian goddess of fertility. Haumea has two known moons: Namaka and Hi'iaka. Hi'aka is the patron goddess of the island of Hawaii and of hula dancers. Namaka is a water spirit in Hawaiian mythology.

ERIS

Eris is one of the largest known dwarf planets in our solar system. It's about the same size as Pluto, but is three times farther from the Sun.

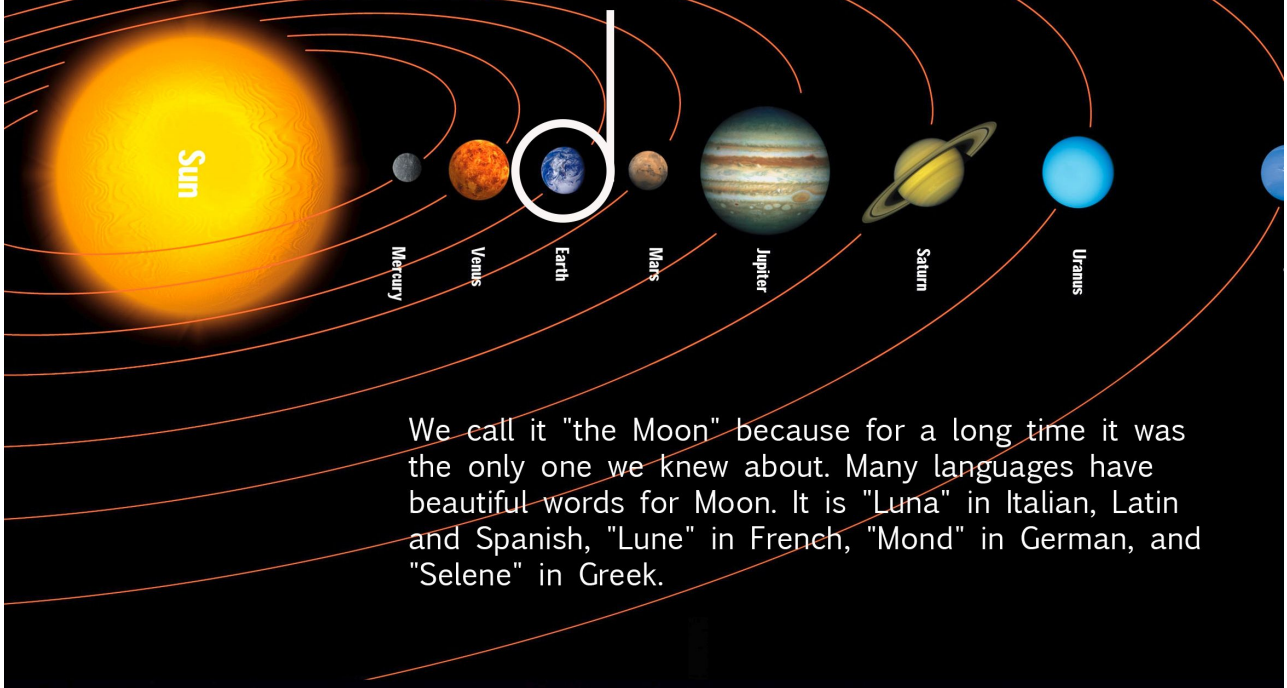
At first, Eris looked like it was larger than Pluto. This triggered a debate in the scientific community that led to the International Astronomical Union's decision in 2006 to clarify the definition of a planet. Pluto, Eris and other similar objects are now classified as dwarf planets.



Space Facts / Laurine Moreau

OUR MOON

Most of the planets in our solar system have moons. Earth has one moon. It is the only object human beings have ever visited beyond Earth.



We call it "the Moon" because for a long time it was the only one we knew about. Many languages have beautiful words for Moon. It is "Luna" in Italian, Latin and Spanish, "Lune" in French, "Mond" in German, and "Selene" in Greek.

VISITING THE MOON

The Moon has a very thin atmosphere. Humans need spacesuits to breathe on the Moon.

Astronauts brought back 842 pounds (382 kilograms) of rocks and dirt from the Moon. We are still studying them!

The first humans landed on the Moon on July 20, 1969. During the next three years, 12 American astronauts walked on the Moon. We have not been back since.

WHAT IS THE MOON LIKE?

Our Moon is like a desert. It has plains, mountains, and valleys. It also has many craters, which are holes created when space rocks hit the surface. There is no air to breathe on the Moon.

The Moon travels around the Earth. Scientists think the Moon was formed long, long ago when Earth crashed into an object the size of Mars.

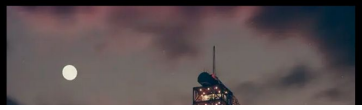
We always see the same side of the Moon from Earth. You have to go into space to see the other side.

The Moon is less than a third the width of Earth. If Earth were the size of a nickel, the Moon would be about as big as a coffee bean.

Moon

The Moon is farther away from Earth than most people realize. The Moon is an average of 238,855 miles (384,400 kilometers) away. This image shows the Earth and the Moon to scale.

Earth



WHY HAVEN'T WE BEEN BACK?

Sending humans to the Moon is expensive. In

Sending humans to the Moon is expensive. In order to get there, astronauts must be safely launched at a speed fast enough to break free of the force of gravity from the Earth. They must wear special protective gear and bring their own air, water and food. And then, unlike a robotic mission, the astronauts must be safely brought back to Earth.

COULD THERE BE LIFE?

Unlike some of the other places we might look for life in the Solar System, humans have been to the Moon. But they found no evidence of life.

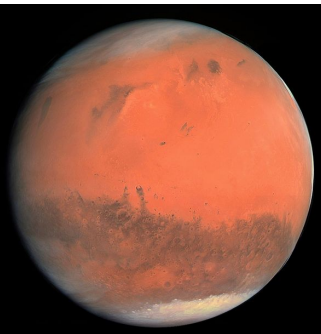
Maybe in the future, humans could live on the Moon. The Moon has a solid surface to walk on, and it has water ice that humans could melt. But some people question the morality of sending people to live on the Moon, especially when we should be putting our efforts into protecting the only planet we know that can actually sustain life: Earth. What do you think?

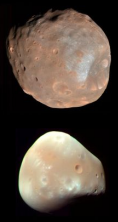
EARTHRISE

This famous photo was taken on December 24, 1968 from the Apollo 8 spacecraft. “Oh, my God! Look at that picture over there! Here’s the Earth coming up. Wow, is that pretty!” said astronaut William Anders when he saw the Earth through the window.

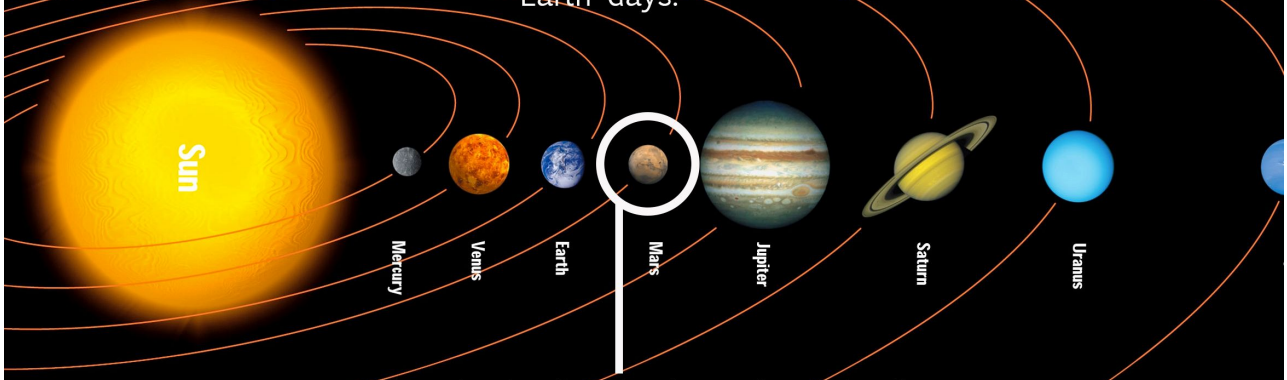
This photo was the first full-color view of our planet from off of it. This photo has been credited with launching the environmental movement, because it helped human beings recognize how special and fragile our living world really is, floating alone in what appears to be a cold and lifeless Universe

MARS



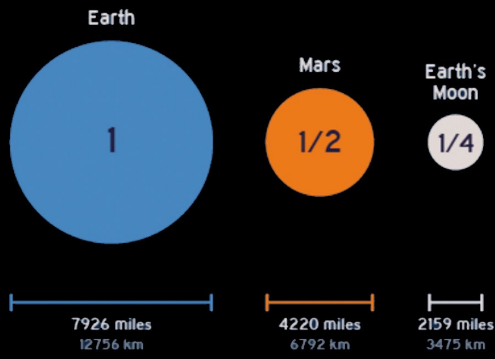


Mars goes around the Sun in 687 Earth days.



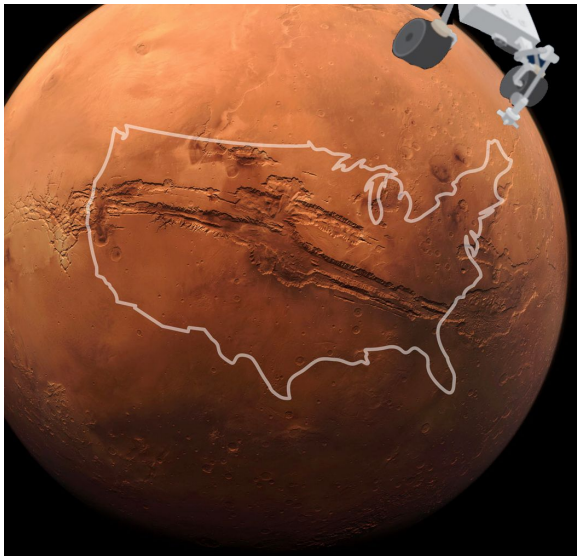
Mars is the fourth planet from the Sun. Mars orbits the Sun at an average distance of about 228 million km (142 million miles).

Like its fellow rocky planets, Mercury, Venus and Earth, Mars has a central core, a rocky mantle and a solid crust.



With a radius of 2,106 miles (3,390 kilometers), Mars is about half the size of Earth. If Earth were the size of a nickel, Mars would be about as big as a raspberry.

Several missions have visited this planet, from flybys and orbiters to rovers on the surface. The first true Mars mission success was the Mariner 4 flyby in 1965.



A large canyon system called Valles Marineris is long enough to stretch from California to New York—more than 3,000 miles (4,800 kilometers). This Martian canyon is 200 miles (320 kilometers) at its widest and 4.3 miles (7 kilometers) at its deepest. That's about 10 times the size of Earth's Grand Canyon.

WHAT'S THE WEATHER LIKE?

Mars has a thin atmosphere made up mostly of carbon dioxide, nitrogen and argon gases. To our eyes, the sky would be hazy and red because of suspended dust instead of the familiar blue tint we see on Earth. Mars' sparse atmosphere doesn't offer much protection from impacts by such objects as meteorites, asteroids and comets.

The temperature on Mars can be as high as 70 degrees Fahrenheit (20 degrees Celsius) or as low as about -225 degrees Fahrenheit (-153 degrees Celsius).

Occasionally, winds on Mars are strong enough to create dust storms that cover much of the planet. After such storms, it can be months before all of the dust settles.

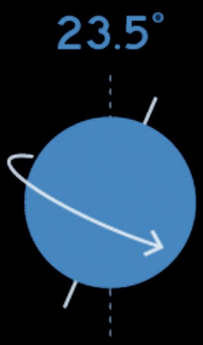
THE RED PLANET

The reason Mars looks reddish is due to oxidization—or rusting—of iron in the rocks, soil, and dust of Mars. This dust gets kicked up into the atmosphere and from a distance makes the planet appear mostly red.

Recorded observations of Mars date as far back as the era of ancient Egypt over 4,000 years ago, when they charted the planet's movements in the sky. Mars was named by the ancient Romans for their god of war because its reddish color was reminiscent of blood. Other civilizations also named the planet for this attribute; for example, the Egyptians called it "Her Desher," meaning "the red one."

SEASONS

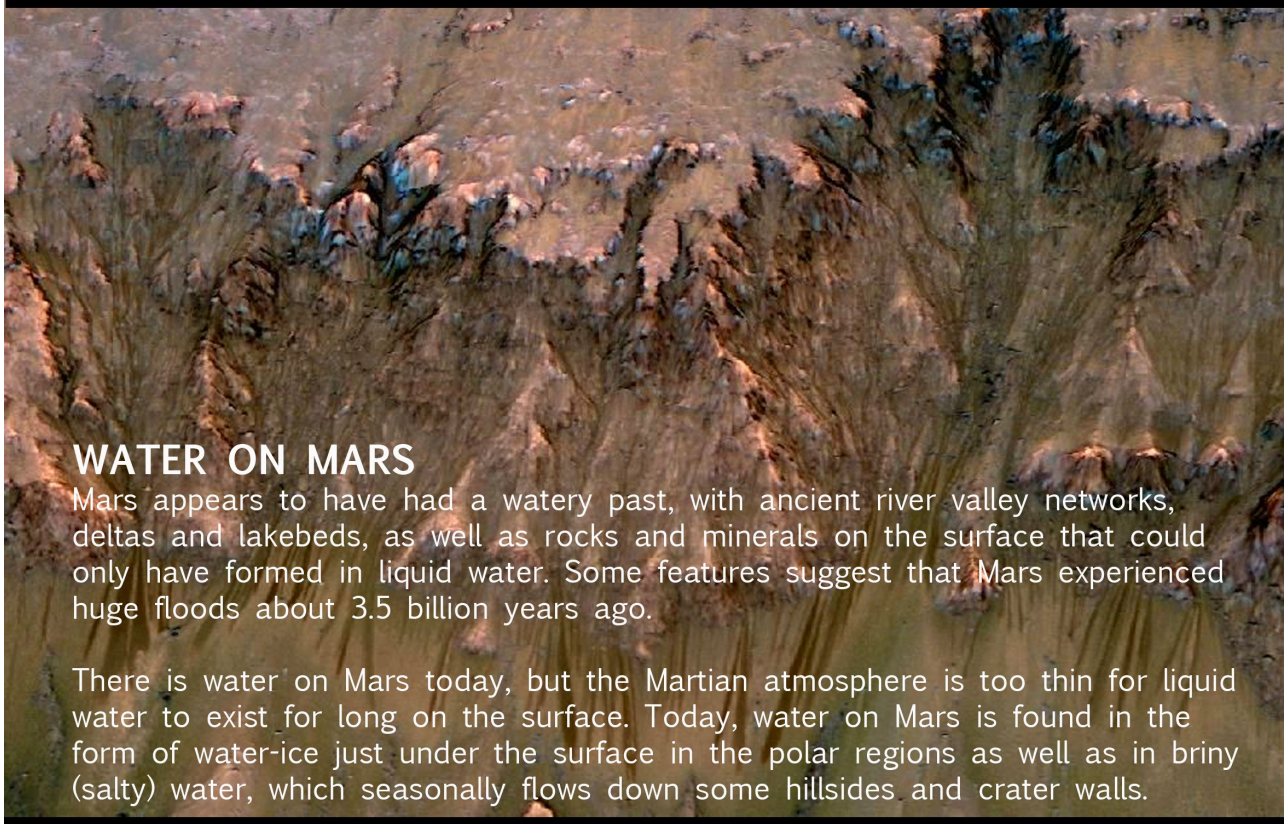
SEASONS



Mars' axis of rotation is tilted 25 degrees with respect to the plane of its orbit around the Sun. This is another similarity with Earth, which has an axial tilt of 23.4 degrees. Like Earth, Mars has distinct seasons, but they last longer than seasons here on Earth since Mars takes longer to orbit the Sun (because it's farther away).

SPIN

Just like Earth, Mars spins on its axis, creating patterns of dark and light called days. One day on Mars takes a little over 24 hours.



WATER ON MARS

Mars appears to have had a watery past, with ancient river valley networks, deltas and lakebeds, as well as rocks and minerals on the surface that could only have formed in liquid water. Some features suggest that Mars experienced huge floods about 3.5 billion years ago.

There is water on Mars today, but the Martian atmosphere is too thin for liquid water to exist for long on the surface. Today, water on Mars is found in the form of water-ice just under the surface in the polar regions as well as in briny (salty) water, which seasonally flows down some hillsides and crater walls.

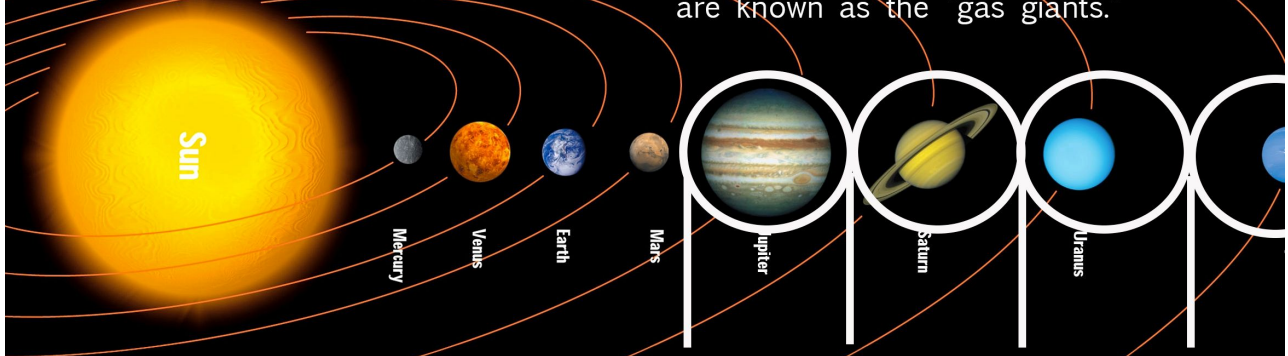
COULD THERE BE LIFE?

Scientists don't expect to find living things currently thriving on Mars. Instead, they're looking for signs of life that existed long ago, when Mars was warmer and covered with water.

GAS GIANTS

JUPITER
SATURN
URANUS
NEPTUNE

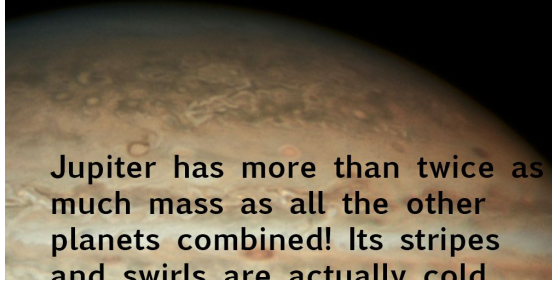
Jupter, Saturn, Uranus, and Neptune are known as the “gas giants.”



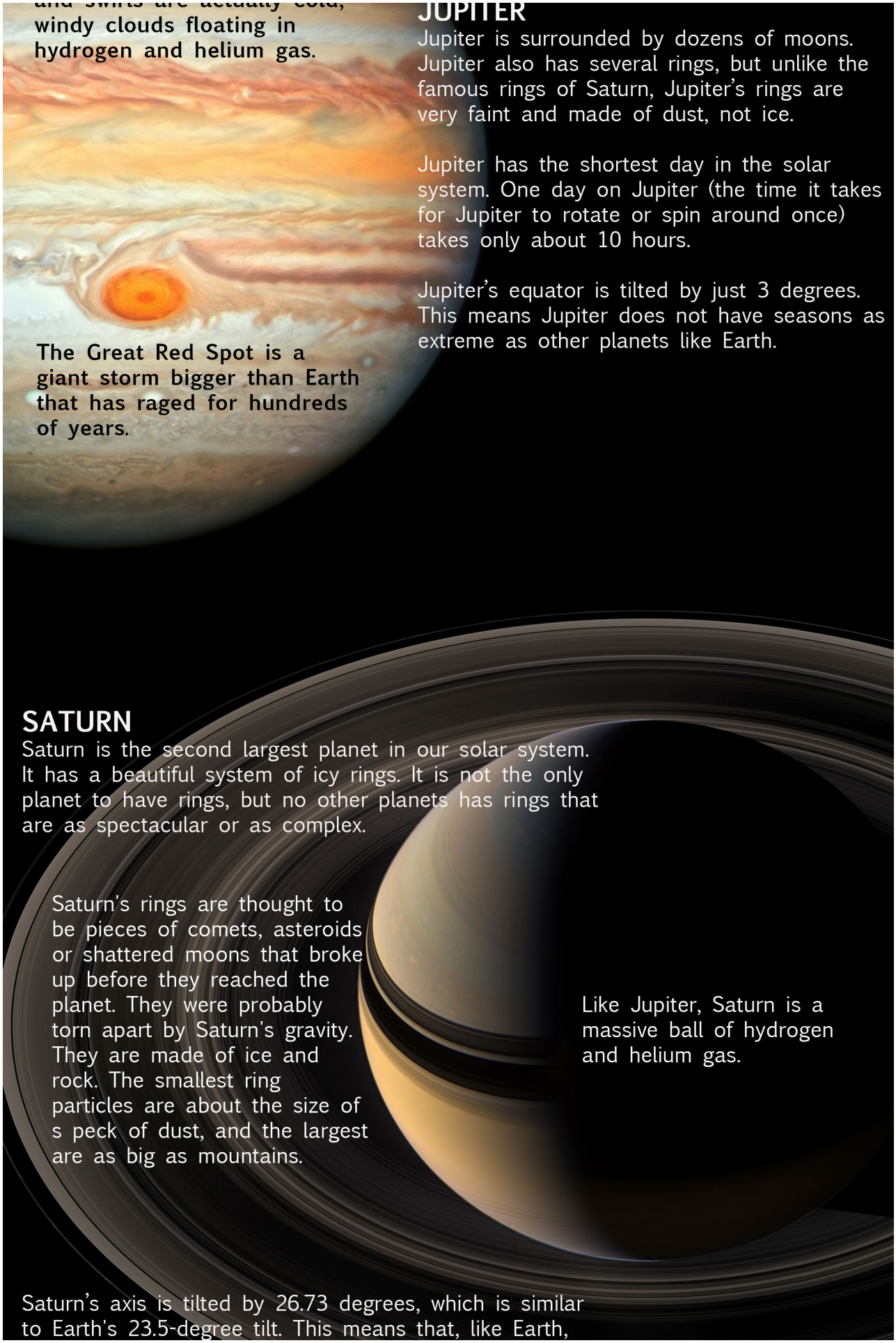
The four gas giants don’t have hard surfaces that you can walk on. They are mostly swirling gases and liquids. The extreme pressures and temperatures deep inside the gas giants would crush and melt anything trying to fly into these planets.

HOW BIG ARE THE GIANTS?

Jupiter is the biggest planet in the Solar System. You could fit 1321 Earths inside of Jupiter. Neptune is the smallest Gas Giant in our Solar System, but you could still fit 58 Earths inside.



Jupiter has more than twice as much mass as all the other planets combined! Its stripes and swirls are actually cold



windy clouds floating in hydrogen and helium gas.

The Great Red Spot is a giant storm bigger than Earth that has raged for hundreds of years.

JUPITER

Jupiter is surrounded by dozens of moons. Jupiter also has several rings, but unlike the famous rings of Saturn, Jupiter's rings are very faint and made of dust, not ice.

Jupiter has the shortest day in the solar system. One day on Jupiter (the time it takes for Jupiter to rotate or spin around once) takes only about 10 hours.

Jupiter's equator is tilted by just 3 degrees. This means Jupiter does not have seasons as extreme as other planets like Earth.

SATURN

Saturn is the second largest planet in our solar system. It has a beautiful system of icy rings. It is not the only planet to have rings, but no other planets has rings that are as spectacular or as complex.

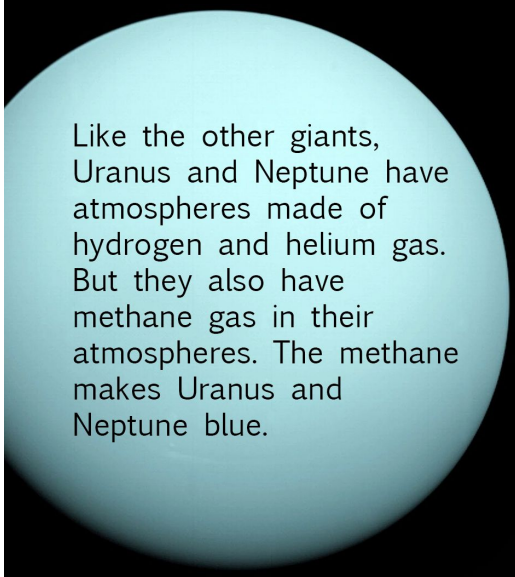
Saturn's rings are thought to be pieces of comets, asteroids or shattered moons that broke up before they reached the planet. They were probably torn apart by Saturn's gravity. They are made of ice and rock. The smallest ring particles are about the size of s peck of dust, and the largest are as big as mountains.

Like Jupiter, Saturn is a massive ball of hydrogen and helium gas.

Saturn's axis is tilted by 26.73 degrees, which is similar to Earth's 23.5-degree tilt. This means that, like Earth,

Saturn experiences seasons.

Uranus has 27 known moons, and a faint ring system.

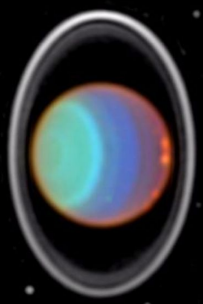


Like the other giants, Uranus and Neptune have atmospheres made of hydrogen and helium gas. But they also have methane gas in their atmospheres. The methane makes Uranus and Neptune blue.

URANUS

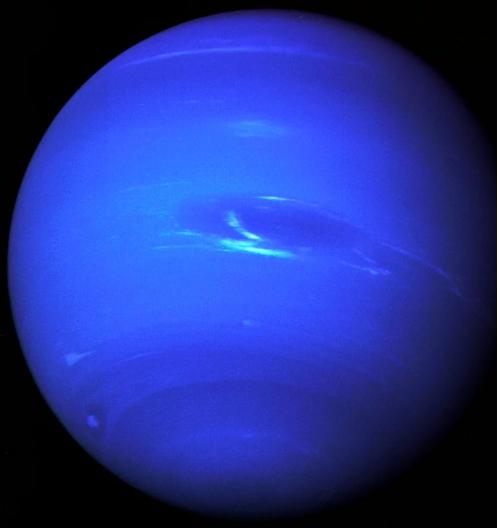
While Mercury, Venus, Mars, Jupiter and Saturn are easily visible in the sky with just your eyes, Uranus was first planet found with the help of a telescope, in 1781.

Uranus is sometimes called the sideways planets, because it rotates on its side. This is probably due to a collision in the early history of the Solar System that knocked it sideway



NEPTUNE

Dark, cold and windy, ice giant Neptune is the eighth and most distant planet in our solar system. Neptune takes about 165 Earth years to orbit the sun (a Neptunian year).



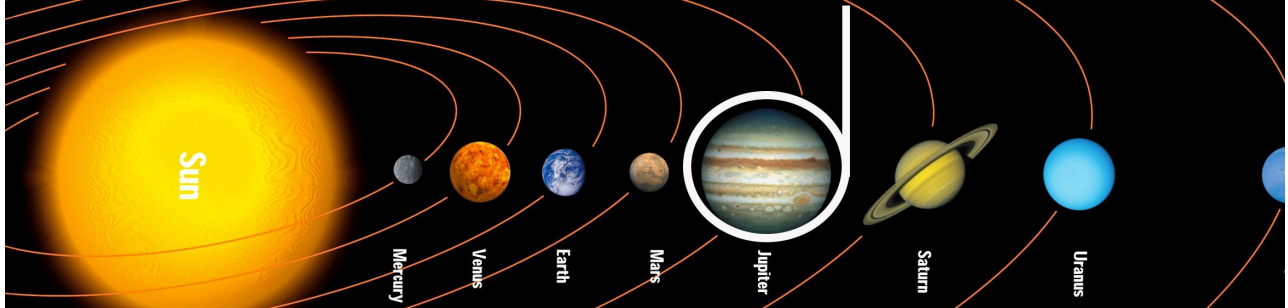
Neptune has 14 known moons and a faint ring system.

COULD THERE BE LIFE?

The environment on the gas giants is probably not conducive to life as we know it. The temperatures, pressures and materials that characterize these planets are most likely too extreme and volatile for organisms to adapt to.

JUPITER'S MOONS

Jupiter has dozens of moons. The most famous are the four "Galilean Moons": Io, Europa, Ganymede and Callisto.

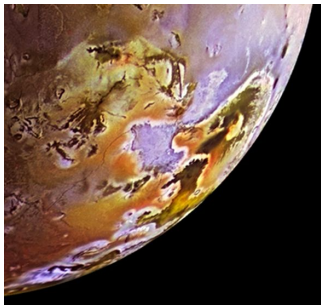


The Galiliean Moons are called moons because they go around a planet. If these moons broke free of Jupiter's gravity and began to orbit the Sun, we would call them planets.

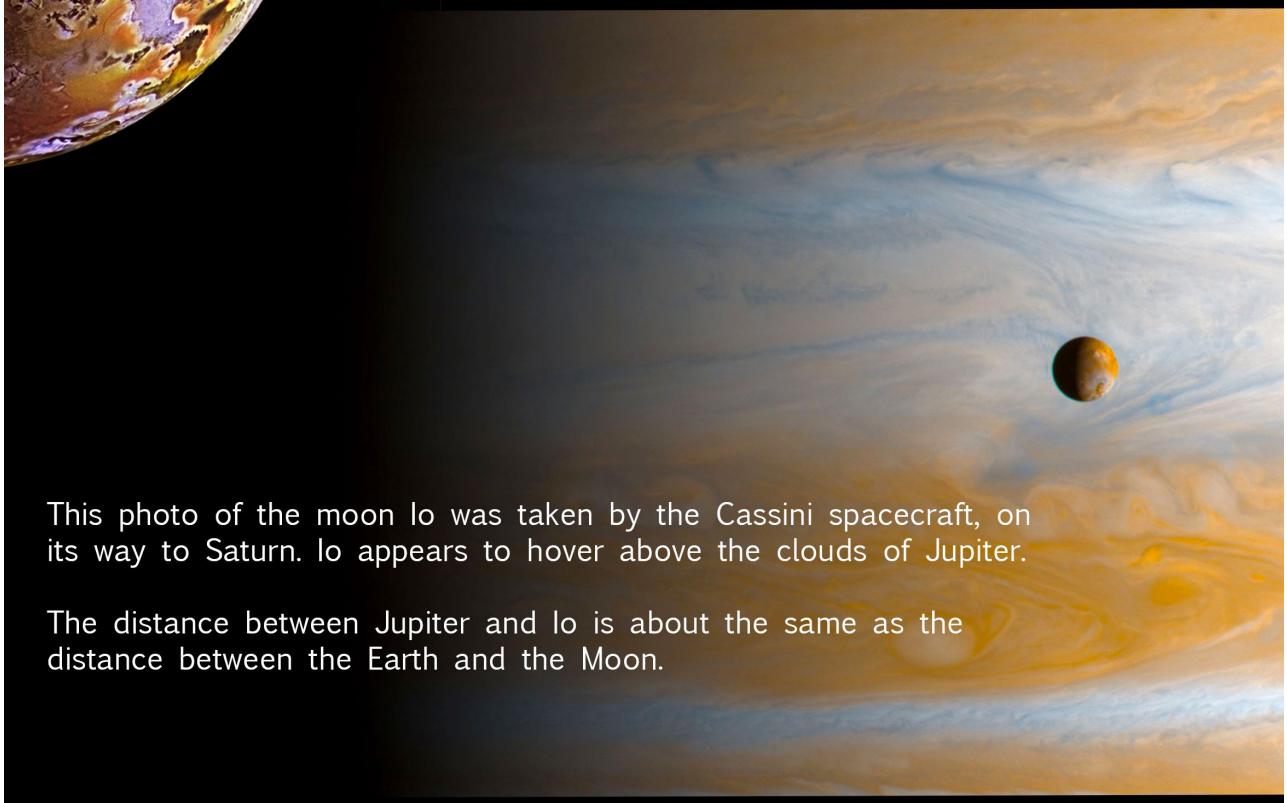
Galileo Galilei discovered these four moons in 1610. You can see them easily with a small telescope. This photo (at right) was taken with a simple backyard telescope attached to a digital camera!

IO

Io is covered in volcanoes. Sulfur from the volcanoes make the surface colorful. Io is very close to Jupiter, and Jupiter is the largest planet in the Solar System. This means that the gravity force pairs



between them are HUGE. The pull of gravity s so trong that no water can stay on Io's surface.



This photo of the moon Io was taken by the Cassini spacecraft, on its way to Saturn. Io appears to hover above the clouds of Jupiter.

The distance between Jupiter and Io is about the same as the distance between the Earth and the Moon.

EUROPA

Europa's surface is mostly water ice. But undereneath there may be an ocean of liquid water! The evidence suggests that Europa has twice as much water as Earth.

Europa has an oxygen atmosphere that is too thin for humans to breathe. But even so, Europa is one of the best places in the solar system to seek life. This is because it has liquid water, energy and the right chemical elements.

On Earth, we find life wherever we find water. We have found animals in freezing water under ice, and in boiling hot water near deep sea vents. We have even

found life like this tardigrade in boiling, acidic lakes on the peaks of the highest mountain ranges on Earth!

If something can live in these extreme conditions on Earth, could there be life swimming in the oceans of Europa?

GANYMEDE

Ganymede is the largest moon in the solar system. It is more than twice as big as our Moon. It is even larger than the planet Mercury! It is also the only moon known to have its own magnetic field. A magnetic field is good for life as we know it, because it protects life forms from dangerous radiation from the Sun.

CALLISTO

Callisto's surface has a lot of craters. This shows us that in the early Solar System, Callisto with a lot of rocks flying through space. The Earth probably also had a lot of collisions in the early Solar System. But wind, flowing water, and the dramatic impact of life over time has washed away the evidence of these impacts on our planet.