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PLANET TYPE
Terrestrial

NUMBER OF MOONS
2

SIZE COMPARED TO EARTH
1.9x smaller

COURTESY OF NASA

A Viking Orbiter mosaic of the Valles Marineris hemisphere of Mars.

Mars at a Glance

Mars is no place for the faint-hearted. Arid, rocky, cold and apparently lifeless, the Red Planet offers few hospitalities. Fans of extreme sports can rejoice, however, for the Red Planet will challenge even the hardiest souls among us. Home to the largest volcano in the solar system, the deepest canyon and crazy weather and temperature patterns, Mars looms as the ultimate destination.

No planet fascinates more than Mars. Home for most of the movie industry's go-to aliens – and occasionally Matt Damon – Mars is the fourth-closest planet to the Sun. The Red Planet earned its nickname due to its appearance. This is created by iron minerals in the Martian soil that oxidize, or rust, causing the soil and atmosphere to appear a warm, red colour. In fact, Mars is a cold, desert world with a very thin atmosphere. It is also a dynamic planet, with seasons, polar ice caps, extinct volcanoes, vast canyons and extremes of weather.

Named after the Roman God of war, Mars is located at an average distance from the Sun of about 142 million miles (228 million km) or 1.52 AU. Similar to Earth, one day on Mars takes a little over 24 hours. A year in Martian time, however, during which it makes one complete orbit around the Sun, is 687 Earth days.

While Mars has no rings, it does have two moons, Phobos and Deimos. Mars also shares the distinction of being the only other planet in our solar system to have an atmosphere. The atmosphere on Mars is thinner than that of Earth's, and made up mostly of carbon dioxide, argon and nitrogen, as well as small amounts of oxygen and water vapour. A rocky planet, Mars' surface has been altered by volcanoes, impacts from debris, and fierce winds, as well as crustal movement and chemical reactions.

Various NASA missions have visited the planet, from flybys and orbiters, to rovers on the surface. The first successful mission to Mars was the Mariner 4 flyby, in 1965. Current NASA missions are determining Mars' potential for life, including the InSight lander, which arrived on the surface in November 2018. At this time, Mars' surface cannot support life as we know it. Yet learning about its history, from its past atmospheric composition and it water, provide clues to the fate of our own planet.

Mars Highlights

Polar Ice Caps

1 Mars is home to two permanent polar ice caps: Planum Boreum, at the northeern pole, and Planum Australe to the south.

Tharsis Montes

2 Towering above a vast, mountainous plateau stand some of Mars' most celebrated attractions, the largest volcanoes found anywhere in the solar system.

Olympus Mons

3 The undisputed champion of Martian volcanoes rises 25km above the planet's floor. Its 374m diameter is roughly equivalent to that of the US state of Arizona.

Valles Marineris

4 What started out, around 1 billion years ago, as just a small crack is today a canyon some 2500 miles long, 370 miles wide and 4 miles deep.

Hellas Planitia

5 A behemoth asteroid made this 1400-mile depression. It formed the vast plains of the Hellas basin, one of the largest visible impact craters on Mars.

Gale Crater

6 First observed in the 19th century by Walter Frederick Gale, subsequent observations of carved outflow channels have led to speculation that this area was once a lake..

ROTATIONAL VELOCITY
0.6 km/s

GRAVITY
0.375 that of Earth

TEMPERATURE AVERAGE
-81° F / -60° C

ATMOSPHERE
95.32% Carbon Dioxide, 2.7% Nitrogen

LENGTH OF YEAR
687 days

Getting There & Away

On average, Earth and Mars are 225 million km/140 million miles apart as they orbit the sun. The shortest distance between Earth and Mars, 54.6 million km/33.9 million miles, occurs every two years. In 1969, the Mariner 7 orbiter reached Mars in 128 days. The longest time taken by a probe, Viking 2 in 1975, was 333 days. The estimated time for manned flights is 250–300 days. Launches to Mars have to follow a parabolic trajectory in order to align with the planet's orbit.

Traveller Beware

During the trip to Mars, the Mars Science Laboratory and Curiosity encountered radiation levels that could pose potential health risks to human astronauts. Because Mars has no global magnetic field to deflect energetic particles, and its atmosphere is much thinner than Earth's, astronauts would get only minimal protection even on the surface of Mars.

COURTESY OF NASA

Gale Crater

Gale Crater

ABOUT 3.5 TO 4 BILLION YEARS AGO, meteors frequently crashed into Mars. These impacts created craters and mounds like Gale Crater, which has Aeolis Mons (Mt Sharp) in its center.

Satellite data shows ripple marks on the crater's surface, layered upon each other, indicating the previous flow of water. Curiosity data revealed veins in the rock indicative of past flows below ground. Today, Gale Crater is 96 miles (154km) in diameter. A large mountain, Mt Sharp, now stands in the middle of Gale Crater, but three billion years ago, the rim would have been higher and less eroded. Accumulation of sediments in lakes, deltas, streams and wind-blown deposits is proposed to have formed the layers making up the lower portion of the mountain. Curiosity's journey through Gale Crater's Hidden Valley and up the slopes of Mt Sharp have helped scientists understand whether Mars has ever offered environmental conditions favorable for microbial life. In its first year, on the crater floor at Yellowknife, the rover found evidence of ancient freshwater river and lake environments with all the main chemical ingredients for life and a possible energy source for life.

Sights

Mt Sharp / Aeolis Mons

1 The central peak of Gale Crater is a huge mound of sedimetary debris taxhat rises 5½km above the northern crater floor.

Peace Vallis

2 This outflow channel seems to have been carved by fluids – maybe water.

Bagnold Dune Field

3 The Bagnold Dune FIelds gave Curiosity a chance to investigate active, modern sedimentary processes.

Aeolis Palus

4 This plain between the northern wall of Gale Crater and the northern foothills of Aeolis Mons was found by Curiosity to have signs of easily accessible water in its history.

Yellowknife Bay

5 The sedimentary rocks here were exposed about 70 million years ago by removal of overlying layers due to erosion by the wind.

COURTESY OF NASA

A view from the "Kimberley" formation on Mars taken by NASA's Curiosity rover.

Olympus Mons

Mars is the site of Olympus Mons, the largest volcano and second-highest known mountain in the Solar System, and of Valles Marineris, one of the largest canyons in the Solar System. The smooth Borealis basin in the northern hemisphere covers 40% of the planet and may be a giant impact feature

Curiosity

Originally planned to last for two years, Curiosity's ability to keep going even n shaky terrain means the mission has been extended indefinitely. It has now extended to over 2,000 Martian sols (the Martian day), or over 2,100 earth days. Curiosity has since driven to the base of Mt Sharp, a layered mountain inside the crater, and inspected rock layers that grow progressively younger as the rover gains elevation.

Water

Liquid water cannot exist on the surface of Mars due to low atmospheric pressure, which is typically less than 1% of the Earth's, but the two polar ice caps appear to be made largely of water ice. In fact, the volume of water ice in the south polar ice cap, if melted, would be sufficient to cover the entire planetary surface to a depth of 11 meters (36 ft). In November 2016, NASA reported finding a large amount of underground ice in the Utopia Planitia region of Mars. The volume of water detected has been estimated to be equivalent to the volume of water in Lake Superior.

PLANET TYPE
Gas Giant

NUMBER OF MOONS
79

SIZE COMPARED TO EARTH
11x

COURTESY OF NASA

A rendering of Juno in orbit around Jupiter

Jupiter at a Glance

This gas giant is twice as large as all the other planets combined, a site of intense meteorological activity at the Great Red Spot and elsewhere, and the controlling force for nearly 80 distinctive moons.

When it comes to size, nowhere in the solar system compares to the ginormous, gargantuan gas giant of Jupiter. It's by far and away the biggest planet in our solar system: a whopping eleven times the size of Earth, more than twice as massive as all the other planets combined. To put that in perspective, if Earth were the size of a grape, Jupiter would be approximately the size of a basketball. That's big. First recorded by Babylonian astronomers in the 8th century, it's named after the King of the Gods – a fitting moniker for this most kingly of planets. Seen from afar, Jupiter is marked by distinct patterns of stripes and swirls, like a gigantic gobstopper floating in space. These stripes are actually cold, windy clouds of ammonia and water, floating in an atmospheric soup that's approximately nine-tenths hydrogen, one-tenth helium – pretty much the precise ingredients needed to make a star. In another parallel universe, Jupiter may perhaps have grown massive enough to ignite, and maybe even eclipse our Sun – but in this one, it remained stuck at mere planetary status.

Jupiter's most famous feature is its Great Red Spot, a storm of truly epic proportions – twice the size of Earth. Like many of Jupiter's storms, it's thought to have raged for hundreds of years. In 1979, the Voyager mission also discovered that Jupiter has its own ring system, but Jupiter's rings are very faint, and made of dust, not ice.

For some scientists, however, the most interesting things about Jupiter are the bodies in orbit around it: its many moons. At the last count, there were 79, more than any other planet in our solar system (the nearest contender, Saturn, only has a mere 62). Even more intriguingly, scientists believe that a few of them may have the atmospheric and chemical conditions necessary to support life. The main focus is currently on Europa, where there is evidence of a vast ocean hidden just beneath its icy crust – a prime location for possibly finding life. These satellites are terrestrial bodies, making them more closely related to Earth than to the gas giant which they orbit.

Jupiter Highlights

The Great Red Spot
1 This planet-sized monster makes our worst hurricane look like a storm in a teacup.

The Jovian Ring System
2 Jupiter is encircled by a system of three vast rings, thought to be made mainly of dust.

The Juno Mission
3 This pioneering probe arrived in 2016, and aims to unlock Jupiter's secrets.

Europa
4 Cold and icy though it may be, but this Jovian moon may perhaps be capable of supporting life.

Io
5 Unlike its icy sisters, this moon is a bubbling cauldron of volcanic activity. Io has a mantle composed at least partly of molten rock, and a solid rock crust coated by sulfur.

Callisto
6 Jupiter's second-largest moon is roughly the size of Mercury, and appears to be mainly a mixture of ice and rock.

Ganymede
7 Icy and pock-marked, this is the biggest moon discovered so far in our solar system. With its own internally generated magnetic field, it contains mysteries.

DISTANCE FROM THE SUN
778.3 million km

ONE-WAY LIGHT-TIME TO THE SUN
44.6 minutes

LENGTH OF DAY
9.9 hours

ATMOSPHERE
90% Hydrogen,
10% Helium

LENGTH OF YEAR
4333 Earth days

Getting There & Away

Jupiter orbits the Sun at a distance of around 778 million km, or 5.2 Astronomical Units (Earth is at one AU). Travelling at the speed of a jumbo jet, it would take around 100 years to reach it.

TIME ON JUPITER
Jupiter has the shortest day in the solar system. One day on Jupiter takes only about 10 hours (the time it takes for Jupiter to rotate or spin around once), and Jupiter makes a complete orbit around the Sun (a year in Jovian time) in about 12 Earth years (4333 Earth days).

Top Tip

On average, the surface of Jupiter is about twice as cold as the South Pole in the middle of winter – so you might want to pack a few extra warm garments.

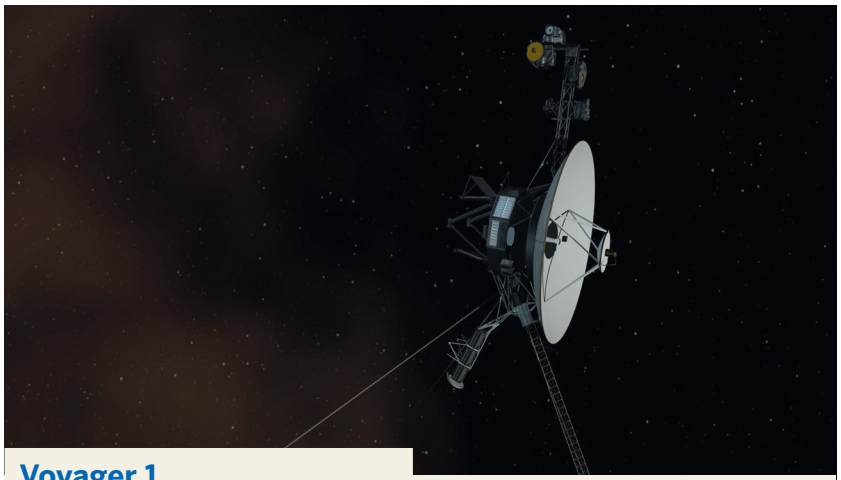
Space Exploration

Pioneer 10 and 11 and Voyager 1 and 2 were the first to fly by Jupiter in the 1970s. Since then we've sent Galileo to orbit the gas giant and drop a probe into its atmosphere. Cassini took detailed photos of Jupiter on its way to neighbouring Saturn, as did New Horizons on its quest for Pluto and the Kuiper Belt. Juno arrived in the Jovian system in July 2016 and is currently studying Jupiter from orbit.

Juno

LAUNCHED: AUGUST 5, 2011

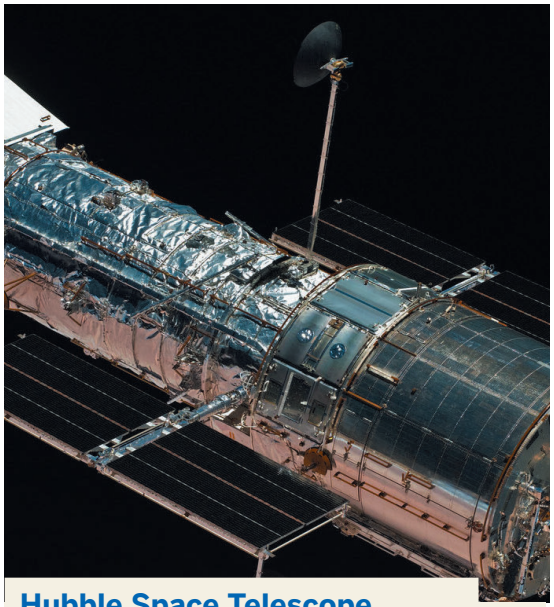
Early Juno science results have revealed Jupiter as a complex, gigantic, turbulent world, with Earth-sized polar cyclones in constant flux, plunging storm systems that travel deep into the heart of the gas giant, and a mammoth, lumpy magnetic field.



Voyager 1

LAUNCHED: SEPTEMBER 5, 1977

Voyager 1 successfully flew by both the Jupiter and Saturn systems before continuing out into the farthest most reaches of our solar system.



Hubble Space Telescope

LAUNCHD: APRIL 24, 1990

The Hubble Space Telescope was designed to provide clear and deep views of distant galaxies and stars and most of the planets in our solar system.

Voyager 2

LAUNCHED: AUGUST 20, 1977

Voyager 2 is the only spacecraft to study all four of the solar system's giant planets at close range.

Significant Events

1610
Galileo Galilei makes the first detailed observations of Jupiter.

1973
Pioneer 10 becomes the first spacecraft to cross the asteroid belt and fly past Jupiter.

1979
Voyager 1 and 2 discover Jupiter's faint rings, several new moons and volcanic activity on Io's surface.

1992
Ulysses swung by Jupiter on Feb. 8, 1992. The giant planet's gravity bent the spacecraft's flight path southward and away from the ecliptic plane, putting the probe into a final orbit that would take it over the sun's south and north poles.

1994
Astronomers observe as pieces of comet Shoemaker-Levy 9 collide with Jupiter's southern hemisphere.

1995-2003
The Galileo spacecraft drops a probe into Jupiter's atmosphere and conducts extended observations of Jupiter and its moons.