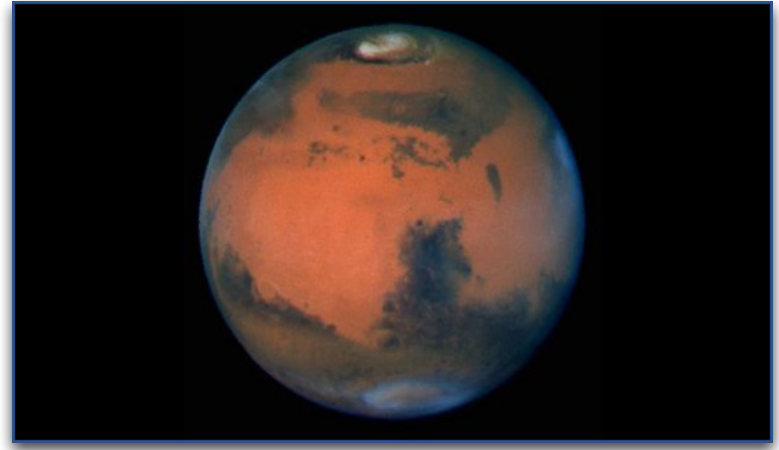


Mars

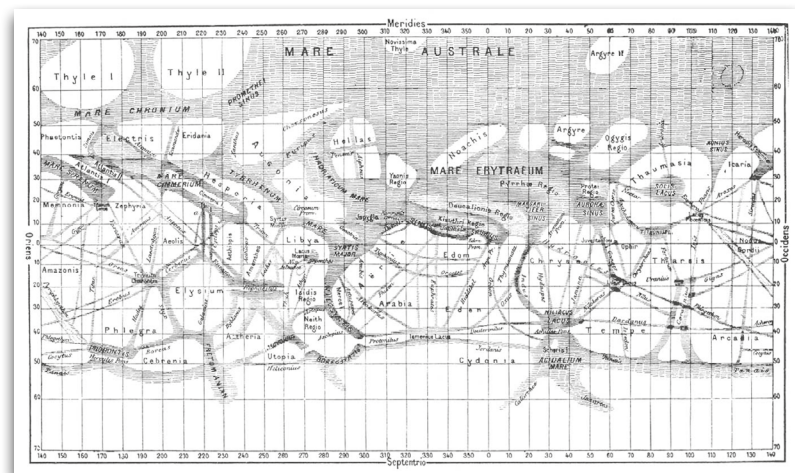
Mars, the 'red planet', is Earth's neighbour in the Solar System.

Mars' red colour makes it stand out in the night sky and if you know where and when to look, you can see it with the naked eye.

Because of this, humans have observed Mars since ancient times.



Mars
Credit: NASA/JPL



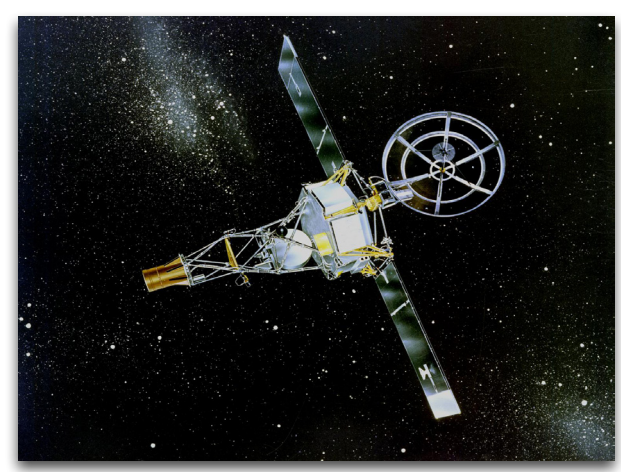
Giovanni Schiaparelli's map of Mars, compiled from 1877-1886

Astronomers in ancient Egypt recorded the movement of Mars across the sky more than 3500 years ago and ancient Chinese astronomers called it the 'fire star'.

In 1610, the Italian astronomer Galileo Galilei was the first person to look at Mars through a telescope and by the 1800s telescopes were powerful enough for astronomers to see features on the martian surface.

Since the 1960s humans have launched space missions to Mars and robotic rovers have explored its surface.

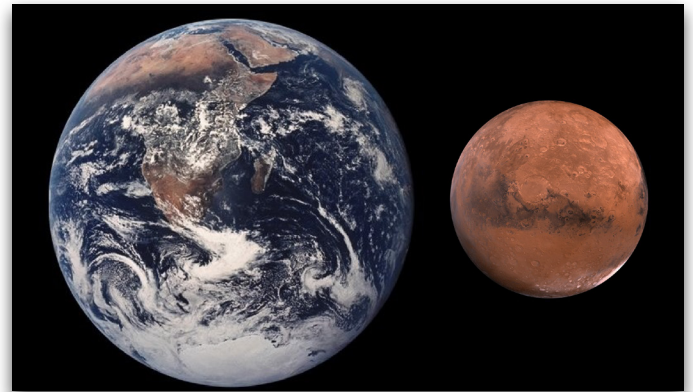
Why are we so interested in Mars?



Mariner 4
(Credit: NASA/JPL)

Mars: The facts

Mars is about half the diameter of the Earth. The distance between Earth and Mars varies from 55 million km to 401 million km, depending on where they are in their orbits.



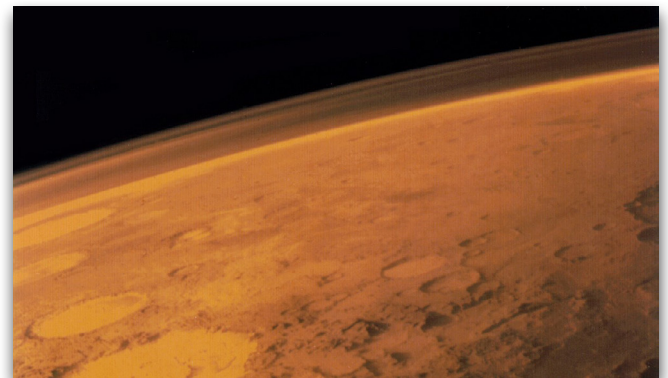
Earth and Mars

Mars' crust is mostly made of a rock called 'basalt'. Mars' red colour comes from a thin layer of iron oxide (a mineral called 'haematite') that covers the surface.



*Mars Surface as seen from the Pathfinder lander.
Credit: NASA/JPL*

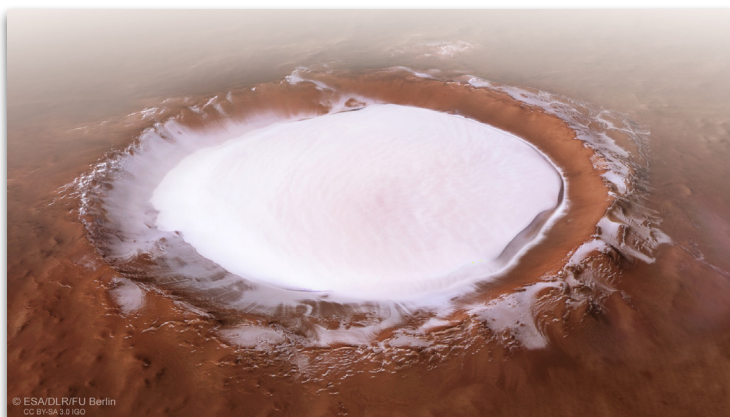
Mars' atmosphere is mostly carbon dioxide (96%), with small amounts of argon, nitrogen, oxygen and water and even smaller amounts of methane.



*Mars atmosphere
Credit: NASA*

There is no liquid water on the surface of Mars, but the polar ice caps are made of frozen water and carbon dioxide, and there may be lakes underneath.

There is evidence that there was liquid water on the surface of Mars until about 3.2 billion years ago. Mars has channels, valleys and gullies that look very similar to landscapes made by water on Earth.



*Ice at Korolev crater
(Credit: ESA/DLR/FU Berlin, CC BY-SA 3.0 IGO)*

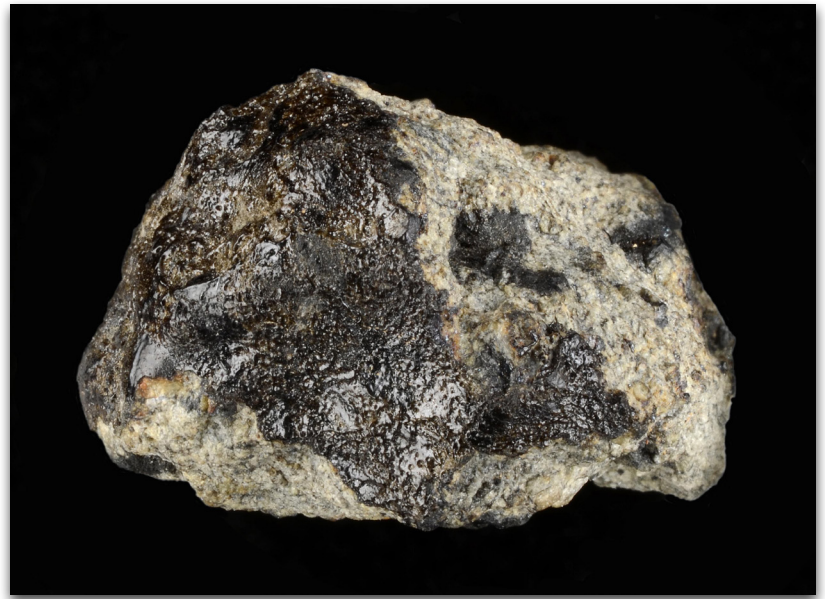


Exploring Mars from Earth

Some of what we know about Mars comes from investigating rocks that come from the planet's surface.

These rocks, called 'martian meteorites', are ejected from Mars when objects in the Solar System collide with it.

About 300 martian meteorites have been found on Earth and these tell us the kinds of rocks and minerals found on Mars. Some minerals even hold bubbles of gases trapped from the martian atmosphere. Comparing these gases to those detected by missions to Mars have proven the meteorites do come from the red planet.



*The Nakhla martian meteorite
(on loan to The Open University from the Natural History Museum) (Credit: Andy Tindle)*

Exploring Mars from Space

Although there hasn't been a crewed expedition to Mars (yet!) spacecraft have explored the planet and sent images and information back to Earth. The first spacecraft to explore Mars was NASA's *Mariner 4*, which flew past the planet in 1965.



*Nirgal Vallis, Mariner 9
(Credit: NASA/JPL-Caltech)*

In 1971, *Mariner 9* was the first spacecraft to orbit the planet. The photographs it sent back to Earth showed gigantic volcanoes, a massive canyon and ancient riverbeds.

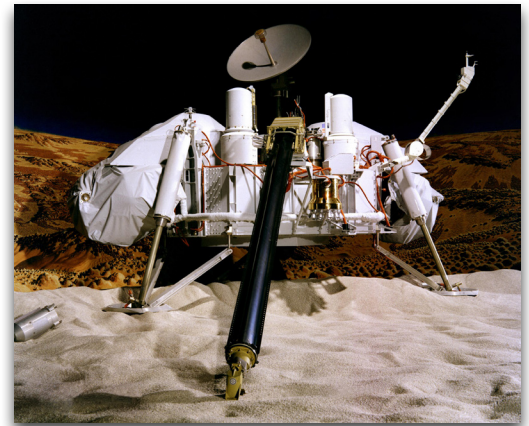
Other spacecraft have orbited Mars, including the European Space Agency's *Mars Express* (2003) and *ExoMars 2016* (2016) orbiters and the Indian Space Research Organisation's *Mangalyaan Mars Orbiter* (2014).

In 2021, both the Chinese National Space Administration's *Tianwen-1* orbiter and the UAE Space Agency's *Hope Probe* orbiter reached Mars.

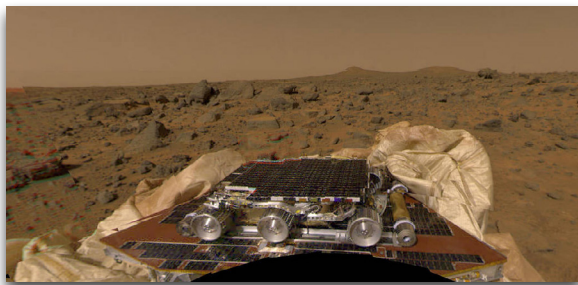
Landing on Mars

Two type of robotic spacecraft have landed on Mars: 'landers' and 'rovers'. Landers are stationary, with onboard specialist equipment to study Mars. Rovers can travel around the martian surface to study different areas of the red planet.

The first lander on Mars was the USSR's *Mars 3* (1971) but it lost contact seconds after landing. The first successfully completed lander mission was NASA's *Viking 1* (1976).



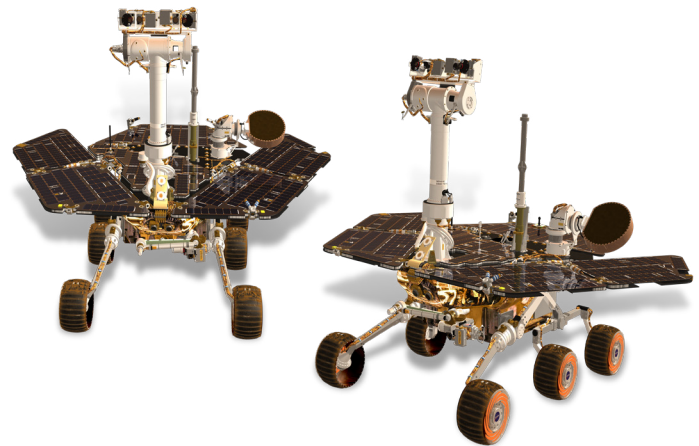
Viking 1
(Credit: NASA/JPL-Caltech/
University of Arizona)



Sojourner on Mars
(Credit: NASA)

In 1997, the first rover on Mars was *Sojourner*, which was delivered to Mars by NASA's *Pathfinder* mission. It operated for almost 84 Earth days, took 550 photographs, carried out more than 15 analyses of martian rocks and soil and gathered information on martian wind and weather patterns.

NASA's two Mars Exploration Rovers landed in 2004. *Spirit* explored Mars for over six Earth years. A camera on its robotic arm took the first microscope image of another planet. *Opportunity* operated for 15 Earth years, travelling 45 km across Mars. Both rovers collected information About Mars' geology, surface, weather and climate, including evidence that its surface had once been wet.



Spirit and Opportunity
(Credit: NASA/JPL-Caltech)

NASA's *Curiosity* rover, which landed in 2012, is still active. Its mission is to find out if Mars could ever have supported life and to study Mars' climate and geology.

In February 2021, the *Perseverance* rover landed on Mars. It will collect and store rock and soil samples that could be returned to Earth by a later mission. A helicopter, *Ingenuity*, will be the first spacecraft to try to fly on Mars.

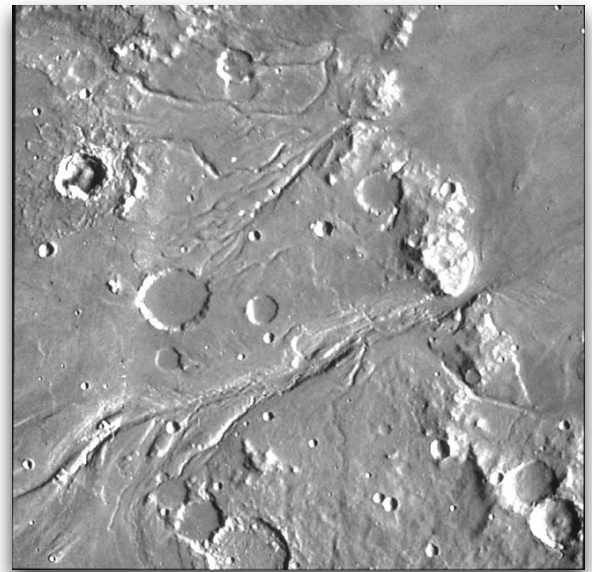
The *Tianwen-1* orbiter will deliver a rover and lander to the surface of Mars in summer 2021, to look for evidence of life, map the surface, analyse martian soil and study the atmosphere.

Is there life on Mars?

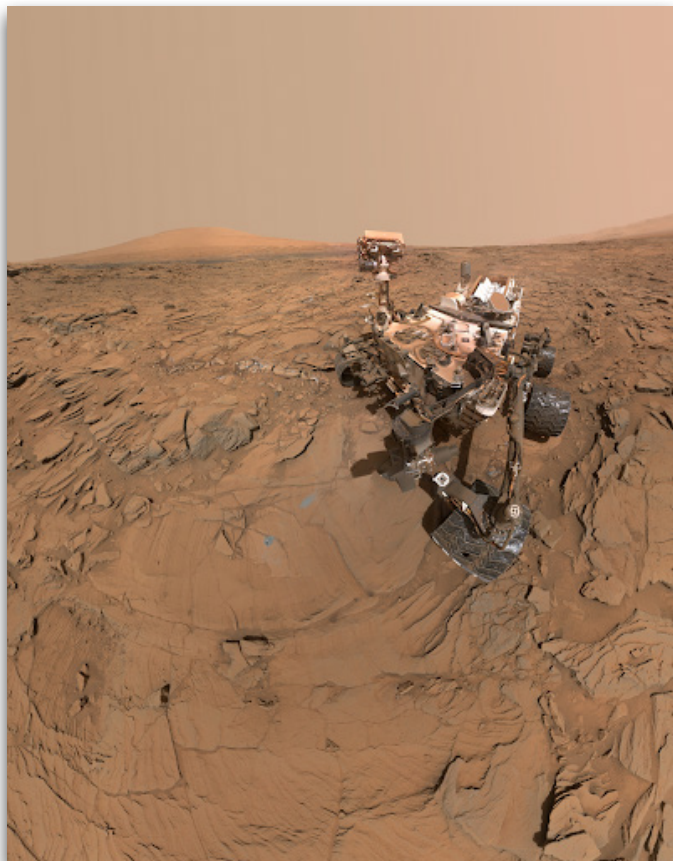
Several missions have the objective of looking for life on Mars, but researchers have not found any evidence of it now or in the past. But they keep looking! Our understanding of Mars changes all the time and the equipment on spacecraft improves, so they are capable of doing more detailed experiments.

But what are they looking for?

Water: Where there is water on Earth, there is almost always life. The geology of the martian surface and the shape of the landscape show there was once liquid water present. Today there may be liquid water underneath the polar ice caps.



*Northern Plains of Chryse Planitia
(Credit: NASA/JPL-Caltech)*



*NASA Curiosity Rover
(Credit: NASA/JPL-Caltech/MSSS)*

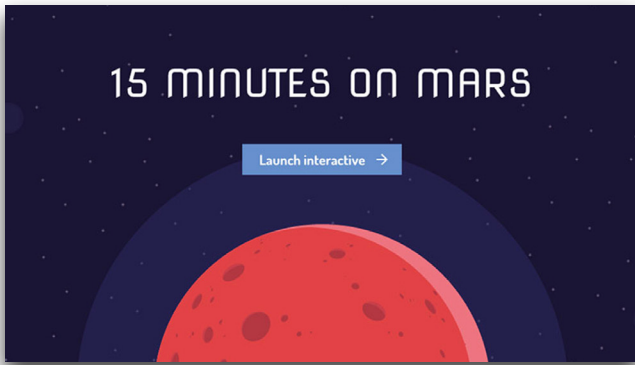
Signs of life: Missions, such as *Curiosity*, that are searching for life look for 'biosignatures' that indicate that life was once present. These include molecules, gases and minerals that are only made by life or in the presence of life.

One possible biosignature, methane gas, has been detected in Mars' atmosphere. However, methane can also be produced when hot water comes into contact with the mineral olivine which is often found in basalts that makes up the martian crust.

What kind of life do we expect?

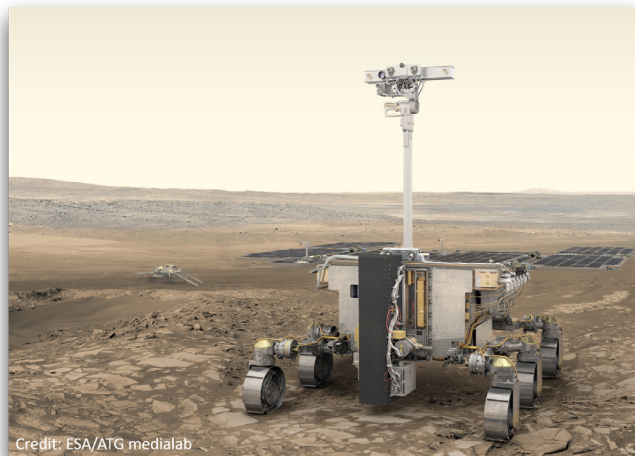
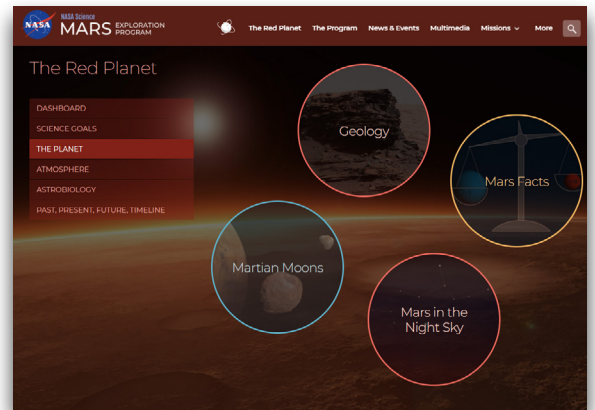
Life is found almost everywhere on Earth, including places where humans find it difficult or impossible to survive. Life on Mars might be 'extremophiles'. These are organisms that can survive in the extreme conditions of Mars (very cold, very salty and very dry). We use our knowledge of how these organisms survive on Earth to understand where life might be found on Mars.

Find out more:



[15 minutes on Mars](#): find out more about Mars, missions to the red planet and the possibility of life there.

The [NASA Science Mars Exploration program](#) is full of images, news, [games](#) and information about past, present and future NASA missions to Mars.



The [European Space Agency's](#) Mars exploration website includes news of current and upcoming missions.



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