**What Makes Earth Special Compared to Other Planets?**

By Clara Moskowitz, SPACE.com Assistant Managing Editor | July 8, 2008 07:00am ET



This image, taken while MESSENGER was 34,692 miles (55,831 kilometers) above Earth, shows the Galapagos Islands as tiny specks peeking through clouds. The line dividing day and night cuts through South America, with night about to fall on the western half of the continent. The large bright spot to the west of South America is the Sun’s light scattering off ocean waves.

*Credit: NASA/JHU/APL.*

**Earth is one special planet.**

It has liquid water, plate tectonics, and an atmosphere that shelters it from the worst of the sun's rays. But many scientists agree our planet's most special feature might just be us.

"It’s the only planet we know of that has life," said Alan Boss, a planet formation theorist at the Carnegie Institution of Washington in Washington, D.C.

Though other bodies in our solar system, such as Saturn's moon Titan, seem like they could have once been hospitable to some form of life, and scientists still have hope of eventually [digging up microbes beneath the surface of Mars](https://www.space.com/1880-crater-critters-mars-microbes-lurk.html), Earth is still the only world known to support life.

"So far, we haven't found it anywhere else," said Alex Wolszczan of Pennsylvania State University, who co-discovered the first planets beyond our solar system. He agreed that life was Earth's single most impressive characteristic.

None of this is a revelation, but understanding what's special about Earth is crucial for finding other planets out there and predicting what they might be like.

The fact that Earth hosts not just life, but intelligent life, makes it doubly unique. And the planet's intelligent life (humanity) has even developed rockets that enable travel beyond the planet, said Gregory Laughlin, astrophysicist and planet hunter at the University of California, Santa Cruz.

"During the last half century, the planet Earth has fashioned together tiny pieces of the metal in its crust, and has flung these delicately constructed objects to all of the other planets in the solar system," Laughlin said, adding that these achievements should be counted as an exemplary trait of our planet.

"From our *anthropocentric* viewpoint, we naturally separate ourselves from the planet that we live on, but if one adopts the point of view of an external observer, it is the 'planet' (taken as a whole) that has done these remarkable things," he told *SPACE.com*.

**Water World**

To enable life, this most special of attributes, planet Earth has [a number of ideal features](https://www.livescience.com/php/trivia/earthfacts/). It is unique among planets in our solar system for having water in its liquid form at the surface, in an amount conducive to life evolving.

"The most impressive attribute of the Earth is the existence and amount of liquid water on its surface," said Geoffrey Marcy, an astronomer at the University of California, Berkeley who has helped discover dozens of extrasolar planets. No one knows why Earth has the exact amount of water it does, which is relatively small considering that water molecules outnumber silicate molecules in the galaxy, he said.

"The Earth is remarkable for its precisely-tuned amount of water, not too much to cover the mountains, and not so little that it's a dry desert, as are Mars and Venus, our 'sister' planets," he said.

**Goldilocks planet**

Earth's water is also special in that it has remained liquid for so long. How has Earth been able to hold on to its oceans while those on other planets freeze or fry?

"Many details as to why Earth is the only planet with liquid water in our solar system need to be worked out," said Diana Valencia, a graduate student in Earth and Planetary Sciences at Harvard University. "Certainly the distance to the sun has made it possible. A planet much farther in would receive too much energy from the sun, and a planet too far out would quickly freeze."

Our planet's Goldilocks-like "just right" location in the solar system has helped, as has its system of plate tectonics, the slip-sliding movements of Earth's crust that are thought to have created the planet's towering mountain ranges and plummeting ocean depths.

"The fact that Earth has plate tectonics allows for the carbon-silicate cycle to operate over geological timescales," Valencia said. "With the carbon-silicate cycle, the levels of carbon in the atmosphere get regulated to keep the surface temperature around that of liquid water."

Plate tectonics and water are inextricably linked. Not only does plate tectonics enable liquid water to exist by way of regulating the temperature, but many scientists have argued water enables plate tectonics to happen.

"Without water the planet would be geologically dead," said Caltech's Mike Brown, discoverer of the newly reclassified "plutoid" object named Eris, which lies beyond Pluto in our solar system. "Water is what lubricates plate tectonics, which is what leads to the extreme difference between continents and seafloors, the large amount of earthquakes and volcanoes, fresh mountain-building. Venus has no water, no plate tectonics, no deep sea floor, no steep mountains, no continents, probably few earthquakes or volcanoes. A much less geologically interesting place!"

Another "just-right" aspect of Earth is its size: If it was much smaller, it wouldn't be able to hold on to our precious atmosphere, but much larger and it might be a gas giant too hot for life.

The presence of our big brother planet, Jupiter, farther out in the solar system blocking Earth from much of the incoming debris, has also helped Earth become a safe haven for life. Jupiter acts like a giant broom, sweeping the solar system of debris rocks as small as cars and as huge as moons that could snuff out life in one fatal blow. This protective effect was particularly helpful in the solar system's early years, when Earth still got pummeled but, scientists say, not nearly as bad as would have been the case without Jupiter.

**A friendly moon**

Life on Earth may also owe a debt to our nearest celestial neighbor, the moon.

Earth's moon stabilizes our planet's rotation, preventing drastic movements of the poles that could cause massive changes in climate that some scientists think could have doomed any chance for budding life to form or evolve.

The moon also helpfully pulls the ocean's tides, which scientists suggest might have been the perfect place for early life to begin evolving to survive on land.

Though Earth has the necessary ingredients for life, it's unclear whether the development of life here might have been a one-time fluke, or if it's something that happens pretty much everywhere the conditions are right.

**Rare Earth**

All of these features make Earth special among known planets near and far.

"You hear all the time how Earth-like Mars is, but if you were taken to Mars you wouldn’t feel happy there at all," said University of Washington astronomer Don Brownlee, author of the book "Rare Earth" (Springer, 2003). "It's not Earth-like. And Titan, when the [Huygens] probe landed, there was all this stuff in the media about how Earth-like it is. Earth-like? It is completely different. It has all this methane on the surface. Venus has about the same mass [as Earth], almost the same distance from the sun. But it’s a totally different place no oceans, no plate tectonics and it's not a place you would want to be."

So far, we haven't seen any planet outside the solar system come very close to Earth either.

Of the nearly 300 new worlds glimpsed elsewhere in the galaxy, most are "hot Jupiters," large planets that orbit close to their stars, on which life and liquid water are unlikely to exist.

"I doubt that in our galaxy typical stars have planets just like Earth around them," Brownlee said. "I'm sure there are lots of planets in the galaxy that are somewhat similar to Earth, but the idea that this is a typical planet is nonsensical."

Brownlee's view may be in the minority, however.

**Not-so-special Earth**

As our planet-hunting technology improves, many planet hunters expect to [find Earth's twin](https://www.space.com/5553-astronomers-verge-finding-earth-twin.html). The search has led scientists to debate whether Earth is really as special as we think it is.

"In the past 10 years, everything has been pointing in the direction of, 'Hey, the solar system, which we thought was unique, is not unique at all,'" said Alan Boss.

Boss and many other scientists think it's likely that [some form of life exists](https://www.space.com/5046-big-picture-astrobiology.html) on some of those countless other planets out there.

"Certainly there will be other planets that support life," he said. "I think life is actually quite common. I think we're going to find there are literally billions of them in the galaxy."

Use the article to answer the questions below.

**Earth is one special planet**

1. Name 4 reasons Earth is one special planet. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. What does anthropocentric mean? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Water World**

1. According to Geoffery Marcy, what is the most impressive attribute of Earth? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Goldilocks Planet**

1. Earth’s distance from the Sun helps to keep water in its liquid form. What would happen to water if Earth was too close to the Sun? What would happen to water if Earth was too far from the Sun? (You will need to make inferences). \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Identify 3 connections (how they work together) between water and plate tectonics.
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
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6. What would happen if Earth was too small? Too big? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. How did Jupiter make Earth a safe-haven for life? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**A Friendly Moon**

1. Identify 3 ways scientists believe the moon helps Earth.
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**Rare Earth**

1. How are Earth and Venus similar? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. How are Earth and Venus different? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. What is meant by a “hot Jupiter?” \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_