

SPACE VOLCANOES

A stroll around a volcano on Earth is no picnic, but what about volcanoes elsewhere in the solar system, or even further away! Your task is to manage the journey from Mercury all the way to Proxima Centauri b, our nearest exoplanet. Will you be faster than your opponents? This journey requires cleverness, skill, and luck!

All you need is a six-sided die, a timer (or maybe minute-long hourglass or just counting), and the same number of game pieces as players.

Go to the start and set off to discover space volcanoes...



VOLCANIC GASES Magma contains many gases that create bubbles near the surface, "pushing" the magma out – causing a huge explosion that propels you two spaces forward!



LIQUID MAGMA Magma is very liquid here. So no explosions happen here, the lava only seeps to the surface and slowly carries you one space back. If it carries you to a space that also has liquid magma, its effects apply there, as well.

There is no other celestial body in the solar system with such intense volcanic activity as Jupiter's moon, Io. It has hundreds of active volcanoes! The unbelievable volcanic activity on Io is propelled by tidal forces since Io is literally "kneaded" by the gravitation of Jupiter and of two of its other moons. You will definitely warm up on Io; do five squats and move forward one space.

The highest mountain in the solar system is found on Mars – the giant volcano, Olympus Mons. It is likely that it still had volcanic activity until quite recently. Numerous mud volcanoes have also been active on Mars. An interesting fact is that the sped-out mud on Mars could behave similarly to how pahoehoe lava, found on Iceland or in Hawaii, behaves here on Earth. And one such lava flow is now taking you two spaces forward!

The Moon "seas" are expansive lava fields that came into existence more than three billion years ago. However, the Moon still had active volcanoes even at least a billion years later. Since the Moon's gravitation "pulls" the Earth, it has been hypothesised that the Moon influences the timing of some volcanic eruptions. This hypothesis is still subject to passionate scientific debate. Simply put, the Moon has a huge influence on the Earth – but do you know the origin of the Moon? Is it a captured celestial body, did it originate after one or more bodies crashed into our prehistoric Earth, or did it form by spontaneously separating from the materials of the evolving Earth? The correct answer (found at the bottom of the page) will move you one space forward.

You find yourself on Venus. This red-hot "Earth's sister" has hundreds of volcanoes and judging by the warm areas observed by the Venus Express probe, some might be erupting even today. We find volcanic fields here and types of volcanoes we do not even have on Earth – the enormous heat and high pressure on Venus's surface allow lava to flow longer and further. This also allows you to move further – throw the die one more time and move ahead the number of spaces it shows!

The wide plains of Mercury are probably of volcanic origin, and the MESSENGER probe also discovered possible shield volcanoes (like in Hawaii here on Earth), but they have probably been extinct for over three billion years. Can you imitate "inert" Mercury and stand still on one leg for a minute? Yes? Super, move forward! If not, sit out the next round.

Europa is also kneaded by tides, thanks to which its ocean has water in liquid form under its icy surface, and maybe, even hydrothermal vents spouting hot water on the ocean's floor. Maybe it also has cryovolcanoes on its surface – geysers spouting water that immediately freezes into space. Try to "freeze" for a minute, not even blinking. If you can do this, throw the die and "freeze" your opponent; you can move one or more game pieces back by the number of spaces you throw.

Every time it orbits around Saturn, Enceladus spurts enormous geysers of water from its inner ocean in space. Their frozen crystals of ice even form one of Saturn's rings. You, too, will orbit around this gigantic planet – and you won't play the next round.

Voyager 2 detected probable geysers on Neptune's largest moon, Triton. Did you know that Triton orbits opposite direction to which Neptune rotates about its axis? In the very distant future, it is probable that tidal forces will rip it apart, and so, instead of an erupting moon, Neptune will temporarily have a large ring. But what material are the Triton geysers made of? Is it lava, ice water, or primarily nitrogen? If you answered correctly, copy the example of the "backwards" orbiting of Triton and move any player two spaces back (the correct answer can be checked at the bottom of the page).

Even dwarf planets ever-so-far from the Sun can have volcanoes! The New Horizons probe discovered a possible cryovolcano on Pluto. Do you know what the area of the solar system that surrounds Pluto and other frozen planets is called? Is it the Oort cloud, or the Kuiper belt? The correct answer will move you forward three spaces (check your answer at the bottom of the page).

Does the nearest planet of another star also have volcanoes? Proxima b is just a little bit heavier than the Earth, and it is possible that it also has volcanoes. Perhaps the James Webb Space Telescope can give us a hint – you see, it can detect volcanic gases in an atmosphere, that is, if a planet has one. But what distance must light from Proxima travel to reach us? Is it 3.4 light years, 4.2 light years, or 6.8 light years? If you answer correctly (the correct answer can be found at the bottom of the page), move forward two spaces.



Illustrations: Karolína Kuterová / Concept: Petr Brož and Marek Machek / Game design and texts: Julie Nekolná Nováková / The game is part of the comics When the Earth Melts. The Tale of a Volcano. / Licence CC BY-SA 4.0, 2022 GFU and Karolína Kuterová / www.igasczkomik

The planets and moons are not shown to scale, otherwise some would not even fit on the board and others would be scarcely visible.

Moon: Created by materials thrown into space after a protoplanet or more celestial bodies crashed into prehistoric Earth. Triton: The Triton geysers are made up of a mixture consisting primarily of nitrogen and carbon monoxide. Pluto: The Kuiper belt. Proxima Centauri b: The correct answer is 4.2 light years.

