



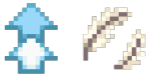


cat	Questions	Sciences of the Moon	Lunarcraft and Minecraft Specific Answers	Images
Terrain	Where is Lunarcraft world located on the Moon?	Lunarcraft consists of Theophilus crater located at the base of the rabbit's ear* and a part of Mare Nectaris, including the target landing point (SHIOLI crater) for the SLIM (Smart Lander for Investigating Moon). It launched on September 7, 2023. The topographic data by the KAGUYA (SELENE: The Selenological and Engineering Explorer) is adapted for Lunarcraft. *The Japanese have likened the blacker area on the Moon to a rabbit pounding rice cakes.	The Lunarcraft world is constructed in Minecraft by reducing an area of 5 degrees latitude and longitude (about 150 km square in actual distance) into about 1/75th scale, 2000 blocks square, and 100 blocks in elevation. Because of the equal scale in the direction of latitude, longitude, and altitude, steep slopes of nearly 45 degrees, etc. are the result. Asking experts in lunar geology for advice, we, the Lunarcraft team, have recreated the 64 blocks below the surface of the Moon based on supposition. Since this is a very small area of the Moon, the spherical nature of the Moon is not reproduced.	
	What are the highlands and mare of the Moon?	The Highlands are considered to originally be the Moon's early crust. They are composed of various sized craters, with a range of 3,000-meter mountains and valleys as well. When huge craters were formed, mare was the place where lava flowing from underground cooled and hardened to form basalts. As lava filled the small craters, creating a relatively level terrain. Most of maria, darker areas of rabbit shape, are on the Moon's face (the surface facing the Earth).	Try to dig through all the basalt of mare and see what happens!?	
	What is a central peak?	It is where the center of the crater has risen in reaction to the indentation created when the huge crater was formed. The mountain located in the back of the lunar base in Lunarcraft is the central peak. In some areas, it is conceivable that rocks deep below the ground were pushed up to the surface.	—	
	What is a lava tube?	When lava flows for a long distance, its surface cools and solidifies while the interior still flows. As the lava continues to flow, tubes can form inside. These tunnels are known as lava tubes. It is theorized that such tubes exist under the surface of the Moon. There are many lava tubes in places like Mt. Fuji and Hawaii on Earth. The bottoms of lava tubes are thought to be relatively even and traces of lava flowing out (ropy structures) in places, because lava runs through the tube, cools and sets. It is possible to prevent contact by cosmic rays or heat from the Sun, so lunar bases in these tubes might be constructed in the future!?	They are somewhere under the surface of the mare!	
	What is a vertical hole?	These are deep holes in the lunar surface. The vertical tubes on the Moon are believed to have resulted from lava ceilings becoming brittle over time or being impacted by meteorites, causing them to collapse and form openings. Such vertical holes are discovered by the observations by KAGUYA. Rock fragments, presumed to have been part of the ceiling, are scattered at the bottom of these vertical holes and are the entrances to the lava tubes. <a href="https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2017GL074998">https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2017GL074998</a>	There are 3 holes in the Lunarcraft. Look and see where they are. There is total darkness inside the tubes. Remember to take LED lights with you before you go in to explore!	
Minerals	What is the gray sand? Why are there 2 different colors of sand?	The surface of the Moon is covered with fine sand called regolith. The darker areas of a rabbit shape are called "mare (in Latin)", with a high basalt content (mare lunar regolith). The other lighter areas are called "terrae", with regolith rich in a plagioclase component (highland lunar regolith).	They are Minecraft Sand blocks (the light-colored ones: Highland regolith) and Gravel blocks (the dark-colored ones: Sea regolith) are used with modifications.	
	What is "regolith"?	Regolith is composed of fine sand (about as fine flour) from rocks and minerals that have been ravaged by meteorite impacts on the lunar surface or thermal changes by the Sun that collected on the lunar surface. Some scientists say lunar regolith is 2~3 m deep, with areas as deep as 15 meters. Due to fineness of the sand, scientists have come up with a variety of innovations including an ingenious design for the lunar rover's tires and keeping regolith from clinging to spacesuits, entering the lungs or gumming up machinery.	See above	
	What is "basalt"?	Basalt is solid rock formed from cooled lava which contains iron and magnesium. It is a heavy stone that is black in color. Basalts are mostly found in lava tubes of the rabbit shaped area, where lava cools and hardens. We have basalts on Earth too.	Basalt block in Minecraft has been used.	
	What is "anorthosite"?	Anorthosite is a rock containing a lot of a white mineral called plagioclase. The KAGUYA (SELENE) observation revealed that the crust of the Moon's highlands is made up of almost 100% pure plagioclase. This is something rarely seen on the Earth, and that is one of the mysteries of Moon's origin of the (its formation). <a href="https://www.nature.com/articles/nature08317">https://www.nature.com/articles/nature08317</a>	The Anorthosite (has more plagioclase than any rock on the Earth) block in the Minecraft has been modified into Anorthosite in the Lunarcraft.	
	What is green rock?	It is olivine. Olivine crystals are also known as evening emeralds or peridot gemstones. Because of its high density with much iron and magnesium, peridotite made from olivine makes up the mantle deep below the crust of the Earth and Moon. It is highly probable that peridotite deep below the ground was forced up by meteorite collisions and the like and ended up on the surface. The SLIM (project) is expected to make clear how the Moon formed and evolved by analyzing and comparing peridotite from the Moon surface with that of the Earth. Olivine has also been detected in the Itokawa rock brought back by the asteroid probe Hayabusa.	As emerald ore has been modified into Olivine, you can get emerald by digging with an iron pickaxe. A pickaxe enchanted by Silk Touch is bound to get the emerald as an olivine block.	
	What makes olivine green?	Due to the proportion of iron to magnesium, olivine crystals are a beautiful green color. Some are not green due to a different composition. It is a mystery why the main component of the massive mantle, which accounts for 60 ~ 80 percent of the whole volume of the Earth, has this olive-green color.	—	

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Minerals	What is "spinel"?	Spinel is a mineral that has a variety of colors such as red, purple, blue and so on. Spinel containing a lot of chromium looks red and known as a gemstone. A small amount of spinel is thought to be present at the bottom of the crust and the upper mantle of the Moon as well.	Spinel is distributed in the central hills and deep underground in Lunarcraft world. Redstone ore blocks in Minecraft are used as spinel. When you dig, you get Redstone Powder (this is a fictional substance on Lunarcraft).	
	Is there iron on the Moon?	The lunar mantle is thought to be composed mainly of iron and magnesium, similarly to Earth's. The existence of an iron core has also been theorized, although it is much smaller than Earth's. A mineral consisting of iron and titanium called ilmenite is observed on the lunar surface. In Minecraft, iron is made by burning iron ore, which is peculiar to the Earth with its water and living creatures. (Iron ore is formed when iron dissolved in seawater is oxidized by oxygen from plant photosynthesis and then precipitated). Iron ore cannot be on the Moon because the Moon is in a redox state with less oxygen than the Earth.	Iron blocks in Minecraft have been modified to Iron in Lunarcraft.	
	Is there ice on the Moon?	Yes, it is said that ice exists in the craters in the north and south poles of the Moon (or eternal darkness).	There is also ice hidden in a crater somewhere in Lunarcraft. Packed ice in Minecraft is modified into ice in Lunarcraft. The ice does not turn into water when illuminated with LED lights.	
	Is there water on the Moon?	There is no water on the Moon, which is different from on the Earth. It is necessary for humans to make the used water clean and use it again so as to live on the Moon, in addition to bringing water from the Earth. If you would like to learn, please visit to the following URLs. <ul style="list-style-type: none"> <li>Recycling Safe and Healthy Water  <a href="https://www.aero.jaxa.jp/eng/about/publications/magazine/pdf/en_sorasora_21.pdf">https://www.aero.jaxa.jp/eng/about/publications/magazine/pdf/en_sorasora_21.pdf</a></li> <li>JEM Water Recovery System(JWRS)  <a href="https://humans-in-space.jaxa.jp/en/biz-lab/experiment/facility/pm/jwrs/">https://humans-in-space.jaxa.jp/en/biz-lab/experiment/facility/pm/jwrs/</a></li> </ul>	In Minecraft, drinks are treated as one of foods. Since humans need water to live on the Moon, Lunarcraft team set up the water recovery system near the lunar base and the lunar farm.	
	Is there coal on the Moon like on Earth?	Since coal is a unique to the Earth where there are plants, coal can't exist on the Moon. It is necessary either to take all the fuel from the Earth or to produce energy on the Moon by some kind of solar power generation. How about studying on how to produce fuel using materials available on the Moon?	No matter how hard you dig through the Moon, Coal will not be found. All the fuel you have is in the chest in the Lander. If you use up Coal, maybe we can produce wood on the farm at the lunar base and use the furnace to make charcoal. (You can also make LED lights from charcoal)	
	What kind of minerals are on the Moon?	Most of what comprises the crust of the Moon is "anorthosite" and "basalt". (The surface is covered with regolith whose main constituent parts are those.) Anorthosite contains plagioclase, and basalt is rich in minerals as pyroxene and olivine.	Terrain for the Lunarcraft consists of "Regolith of Mare", "Regolith of highlands", "Anorthosite", "Basalt", "Ilmenite", "Olivine", and "Packed ice".	
Structures	Is there a motif of the lunar base in Lunarcraft?	As of 2023, a lunar base does not yet exist. We might realize a lunar base in the 2030s!?	The model reproduces a long, narrow residential building, a laboratory building, a hemispherical farm, fuel tanks, etc. Due to the characteristics of Minecraft, where each block is 1 m long, the model is a little larger to allow detailed shape expressions. Guess how many years it will be before this scale of the lunar base is realized!?	
	What kind of 3D models are there?	The list of the artifacts on the Moon: <a href="https://en.wikipedia.org/wiki/List_of_artificial_objects_on_the_Moon">https://en.wikipedia.org/wiki/List_of_artificial_objects_on_the_Moon</a> The positional relationship between the landing site and the terrain of Lunarcraft is based on the real.	A small-scale exploration lander SLIM (Smart Lander for Investigating Moon, launched on September 7, 2023), Lunar Polar Exploration Mission (LUPLEX, planned for the 2024 fiscal year), and the models of the Apollo Program are set somewhere. Please watch out for them! LUPLEX and the remains of Apollo Program are put on imaginary points.	
	Is the shape of lander different from an airplane or a rocket with a streamlined shape?	Since there is no air on the Moon, the lander does not need to be designed for air resistance or lift. We based the lander's design for carrying people and supplies between the space station and the lunar surface.	Due to the characteristics of Minecraft, where each block is 1 cubic meter, the lander is slightly larger to allow for detailed shape expression.	
	There are a lot of spacefood, right?	A variety of space foods have been developed. <a href="https://humans-in-space.jaxa.jp/en/life/food-in-space/japanese-food/">https://humans-in-space.jaxa.jp/en/life/food-in-space/japanese-food/</a> Since these are currently certified according to the standards for the operational conditions of the International Space Station, spacefoods based on new standards will be certified for the lunar surface. In the future it will be possible to grow vegetables on a farm on the lunar base! What do you think?	We the Lunarcraft team have created a new space food for the world of Minecraft. The foods you brought with you from Earth are all that is in the chest on the lander. If you eat it all up, you can grow vegetables in the farm of the space base.	
	What is this rover? How does it run? How fast?	It is a reproduction of the Apollo lunar vehicle. During Apollo 17, the maximum speed was about 18 km/h and the total distance covered was about 36 km. It used of a rechargeable battery.	You can get on the rover with a right-click, move forward with W-key, and steer with your mouse. You can get off by jumping with the space key. The speed is about the same as the speed of a Minecraft horse. It is a two-seater.	

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The Moon environment	Can the Earth and the stars be seen from the Moon?	Without air on the Moon, there are no blue skies even in daytime. In addition, the Sun, the Earth, and stars can be seen at the same time. Actually, as the Sun and the surface are so bright, stars in daytime can't be seen without straining your eyes. No air means that the twinkling of the stars can't be seen as well. Look up at the starry heavens if you're ever on the surface of the Moon.	To display the Moon and stars on the screen, you need to set Minecraft's video setting to display up to 20 chunks (20 × 16 blocks). That lets you see far into the distance. The operation might be slow depending on the device settings.	
	Are the positions of the Sun and the Earth fixed?	When viewed from the lunar surface, the Sun takes one month to circle the Moon. Since it is daytime for half a month and nighttime for half a month, one lunar day is about 30 times longer than on Earth. In addition, since the Moon always faces the same plane toward the Earth, the Earth continues to appear in almost the same position. Therefore, neither the Earth nor the Sun change relative positions much.	Due to Minecraft specifications, the position of the Sun is permanently fixed in Lunarcraft. (To avoid having a sunset sky at sunrise/sunset)	
	Although both the Earth and the Moon are at about the same distance from the Sun, why does the temperature of the surface of the Moon reach over 100°C or drop below -100°C?	As the Earth has an atmosphere and clouds, about 30% of the sunlight reaching the Earth is reflected into space. In addition, the atmosphere and oceans store heat, so even at night when there is no sunlight, the temperature is maintained at a level suitable for life. The Moon has none of this, so the temperature is harsh.	There is no concept of temperature in Minecraft world. So the Lunarcraft Team has configured to be equipped with a space suit.	
	Why is the Moon exposed to strong radiation?	The atmosphere and magnetosphere around the Earth provide protection from radiation from outer space (the Sun and deep space). As the Moon has none of these, it is said that the Moon is exposed to 200 times more radiation than Earth. The International Space Station is at an altitude of about 400 km and has no atmosphere, but is in the magnetosphere, so radiation is said to be 100 times higher than Earth. The Moon is an even harsher radiation environment than the ISS. Radiation cannot be completely blocked by space suits. On the other hand, it is said that radiation can be prevented at depths deeper than about 5 m beneath the Moon's surface. It is thought that a future lunar base could be constructed underground.	The concept of radiation does not exist in the world of Minecraft, however, studies should be implemented on how to protect astronauts from invisible cosmic radiation.	
Minecraft	The Lunarcraft world consists of how many blocks?	—	The total number of blocks reached 421 million and 280 thousand. Stacking 10 blocks per second takes a year but can be done in seconds with programming.	
	Why can we jump up higher and slower in Lunarcraft? What do the arrow and the feather at the top right of screen stand for?	The gravity of the Moon is 1/6 of that of Earth's, so jumps are higher and descents are slower.	The icon is always visible (it cannot be deleted) because it simulates a small gravity force using Minecraft's "Jump Boost" and "Slow Descent" status effects.	
	Show the collection of minerals and the tools we can use in Lunarcraft.	—	"Regolith of Mare", "Regolith of highlands", "Anorthosite", and "Basalt" can be dug even by hand. Try to dig others with the Iron Pickaxe. Follow the specifications of Minecraft on whether you can dig or not.	
	Are 3D models not visible unless close up?	—	Due to Minecraft specifications, 3D models can only be displayed as you come near.	
	Why is an LED light, not a torch available?	Torches can't burn because there's no atmosphere on the Moon. So, LED lights must be used.	A torch of Minecraft has been adjusted to the LED light for Lunarcraft.	
	A spacesuit won't be taken off...why?	You will perish without a spacesuit, as there is no air on the Moon.	Since the presence or absence of air cannot be reproduced in Minecraft, the space suit is set up to be worn at all times.	
	Can sounds be heard?	Since there is no air on the Moon, distant sounds cannot be heard. Since there is air inside the space suit, sounds (vibrations) coming directly through the space suit should be audible.	Sound cannot be muted in Minecraft, so there will be sound effects of opening doors and digging.	
	I would like to watch the lift-off from the Earth into space as well, please!	The international project Artemis Program, in which JAXA also participates, is underway with the aim of exploring the Moon in the 2030s. You will be able to watch the lift offs in the near future.	THE ARTEMIS MISSION LAUNCHES IN MINECRAFT <a href="https://www.minecraft.net/ja-jp/article/artemis-mission-dlc-minecraft">https://www.minecraft.net/ja-jp/article/artemis-mission-dlc-minecraft</a> If you like, Minecraft worlds related to the NASA-supervised Artemis Program are recommended. Visit to the URL above.	
I would like to post Lunarcraft playing movie on video sharing site, such as You Tube.	—	Regarding the use of Lunarcraft for public sharing, please note that you need to check the URL listed below.  · JAXA Space Education Center - About Space Education Materials <a href="https://edu.jaxa.jp/en/materialDB/contents/about/">https://edu.jaxa.jp/en/materialDB/contents/about/</a> · MINECRAFT Content Creation And Broadcasting Terms Of Use And Guidelines <a href="https://help.minecraft.net/hc/en-us/articles/4408934440589">https://help.minecraft.net/hc/en-us/articles/4408934440589</a>		