

Living on the Moon: Overview and Research Questions

Living on the Moon Overview

At night, surrounded by stars or clouds, the Moon looks distant and lifeless. However, it holds a place of unique beauty and dominance in the sky and has been inspiring humanity for eons. Dreamers of all kinds—including artists, science fiction writers, scientists, and engineers—have imagined a thriving city on the Moon, one with healthy people and a resourceful, sustainable ecosystem. The challenges of living on the Moon do not daunt them—though those challenges are sizeable! There’s no breathable atmosphere. In most places the temperature is either freezing cold or boiling hot. Human bodies weaken with gravity only 1/6 of that on Earth. On much of the Moon, night lasts for 14 days at a time. There are no plants or animals, no flowing water. Tiny meteorites crash into the Moon regularly. Solar radiation is constant and deadly. Dust that’s sharp as glass gets into every crevice.

Engineers and scientists are exploring solutions to the obstacles that make living on the Moon sound far-fetched. Frozen reservoirs of water are believed to exist at the Moon’s poles, deep inside craters. This water can be extracted, filtered with algae, and made drinkable. Lunar pioneers can eat the algae as well. They can breathe the oxygen produced during the process of extracting water. There are no trees or building materials as we know them, but regolith—lunar dirt and dust—can be heated into a strong, hard material for making buildings and roads. The Moon’s lava tubes could offer some protection from meteorites, making these places more inviting for building living quarters, and there is sunlight that can be harnessed for energy. New ideas are constantly being dreamed up and tested. A future lunar city is really going to happen!



The students’ challenge: Design a future lunar city and provide examples of how your city uses two Moon resources to keep your residents safe and healthy.

Research Questions

Life on the Moon will be quite different from life on Earth. It’s literally another world! Before you begin to design your city, you’ll start your research by learning about the Moon: its features, terrain, available resources, and unique hazards.

Lunar Features and Terrain

The Moon is 238,900 miles away from Earth. While we can only see one side of the Moon here on Earth, there is a lot more to explore.

- Does the Moon have an atmosphere? Is there oxygen or a way to make it?
- What is the Moon’s surface gravity? How does that compare to Earth’s? How will the Moon’s surface gravity affect humans living on the Moon?
- What are days and nights like on the Moon? How long is an average “day” in most places?
- Are there areas of the Moon that get more sunlight than others?
- What is the temperature on the Moon? What affects the Moon’s temperature? Are there places where the temperature is more stable than other areas?
- Terrain is a term for the natural features of the land. What types of terrain are found on the Moon?
- Like Earth, the Moon has an equator and a north and south pole, it also has different types of regions. What are the Moon’s regions? Where are they? How do they differ from each other in terms of temperature, amount of sunlight, and terrain?
- Does the Moon have a magnetic field? How would a magnetic field, or the lack of one, affect people’s lives?

Lunar Resources

Conditions may be challenging on the Moon, but certain abundant resources could make living there sustainable. And some might be valuable resources back on Earth! Below are a few resources to explore, but it is not a full list. What other resources does the Moon contain? As you research these resources ask how your future city's residents might use these lunar resources.

- **Sunlight** is strong and predictable on the Moon as there are no clouds to get in the way.
- **Water** can be found as ice in deep craters near the Moon's poles.
- **Key Elements** including oxygen, silicon, aluminum, iron, calcium, magnesium, hydrogen, and titanium are found in the surface layer of lunar dust, soil, and broken rock.
- **Geographic Features** such as lava tubes or craters might make good building locations.
- **Helium 3** is an isotope that some people think might be a good energy source.
- **Rare Earth Elements (REE)** may be used to manufacture many types of electronics.



Lunar Hazards

Moon dwellers will face serious hazards that we don't have on Earth and that our cities aren't built to withstand. Everything must be engineered to protect people from these hazards and that means thinking in a whole new way about how a city is planned and built.

- **Lunar dust** is mostly made of silicon dioxide glass with some particles of iron, calcium, and magnesium, that has been ground into a very fine powder over billions of years of being smashed by meteorites. How is lunar dust dangerous to humans?
- **Radiation** is energy that travels through space; solar radiation is energy emitted by the sun that travels to the Moon as well as Earth. Without a magnetosphere and with little atmosphere, the Moon offers no protection against solar radiation. Moon dwellers will have to be protected from solar flares and cosmic rays, two especially dangerous forms of radiation. Why is this radiation a hazard to your lunar residents?
- **A meteorite** is an object in space that hurtles into the surface of the Moon, Earth, or other planets. It can be as tiny as a grain of dust or it can be a massive rock weighing many tons. The Moon is bombarded by meteorites because it does not have the atmosphere to break them up before they hit the surface. Meteor strikes can create explosions of energy, as well as damaging micro impacts. What might protect people in a lunar city from meteor strikes?
- **Moonquakes** are known to rock the Moon. Tides, vibrations from meteorites smashing into the surface, and thermal quakes from the Moon's crust expanding in the morning sun are all pretty mild and harmless. A fourth kind, shallow moonquakes, can register 5.5 on the Richter scale and last for more than 10 minutes. What are the implications of these various moonquakes for a lunar city?