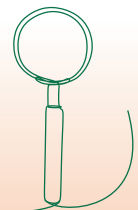




Images of the moon during a lunar eclipse.
The full moon passes into Earth's shadow and appears dark red.

WHY IT MATTERS

- A lunar eclipse is a spectacular natural phenomenon.
- Lunar eclipses allow a glimpse into the fascinating universe outside of Earth.



DID YOU KNOW? A lunar eclipse can last as long as three hours and 45 minutes.

For as long as humans have walked the earth, we have looked up and seen the familiar sight of the moon. It takes center stage in our night sky, dominating the heavens as it transitions from a thin sliver to a full circle and back again. This bright marvel has captivated and charmed people for centuries, with myths and theories about the moon taking root over the passage of time.

Today, we know that Earth is not the only planet with a moon—scientists believe that Jupiter has 79 of them! But our moon is called “the Moon” because this was the only moon we knew about for centuries. Our moon is an ever-present detail of our lives, compelling us to explore it further.

THE MOON AND ITS ORBIT

Although it appears as our brightest natural night-light, the moon does not create any light itself. The shining surface of the moon is simply a reflection of the sun’s light. It is essentially a more glamorous version of a workman’s reflective jacket, relying on the sun’s light to bounce off of it and make it glow. Sunlight reaches the moon’s desolate, rocky landscape and lights whatever surface it touches. Since we only see the lit side of the moon, we can sometimes see a banana-shaped moon, sometimes a full round moon, and—once a month—no moon. Standing on Earth, we only ever see one side of the moon, leaving the other “dark side” of the moon a mystery for centuries, until in recent years when space exploration allowed us a view.



An astronaut (left) stands next to a boulder on the moon's rocky surface.

The moon is more than just a decorative skylight; it affects Earth in various ways. As we know, Earth completes one **orbit**¹ around the sun every year, and the moon takes approximately one month to orbit Earth. As a result, the positions of Earth and the moon relative to the sun change constantly. This cycle is the reason we see the moon as having different shapes. Interestingly, how the moon appears in the sky also depends on where we are standing on Earth, though generally, on the same night, everyone will see the same shape of the moon. Today we might all see a crescent, but people in Canada, Argentina, and Australia will see the moon slightly differently.

These complex and brilliant orbiting patterns of both Earth and the moon give us our days and seasons, keep our planet at the right temperature, and much more. But what happens when something out of the ordinary occurs? When Earth is directly between the sun and the moon, it blocks the sunlight from reaching the moon’s surface, causing a shadow on the moon known as a **lunar eclipse**.² Lunar eclipses can only happen during a full moon.

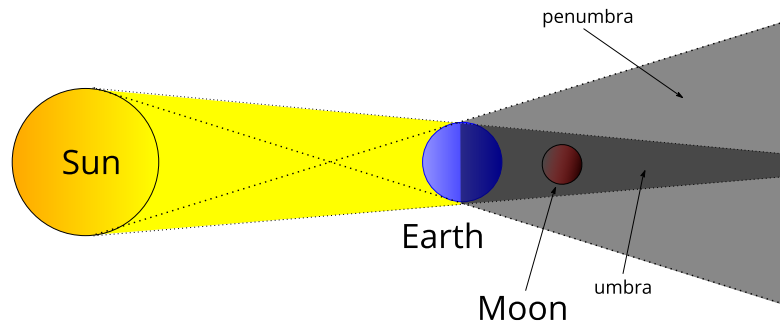
¹ **orbit** – move in a circular path around a star or planet

² **lunar eclipse** – a natural phenomenon where the moon darkens as it moves into Earth’s shadow

UMBRA AND PENUMBRA

Looking at the diagram of a lunar eclipse, you will notice that light from the sun shines on Earth, creating a shadow on the side that faces away from the sun. The dark shadow directly behind Earth, where almost no sunlight reaches, is called the umbra. The penumbra is the lighter shadow that spreads farther than the umbra. Most of us do not realize when the moon moves into the penumbra; it simply appears slightly darker than usual.

A partial eclipse occurs when the moon, Earth, and sun do not directly **align**.³ The moon moves into Earth's shadow but does not fully enter the umbra, as it does not travel directly behind Earth. The moon is partially in the umbra and partially in the penumbra. When that occurs, Earth's shadow gradually covers part of the moon, making it look like the moon is slowly disappearing.



This diagram shows the moon, directly behind Earth, in Earth's shadow. The shadow blocks all sunlight from reaching the moon. Notice the two types of shadows—the umbra and the penumbra. Credit: FSogumo, Wikimedia

If you are lucky, you may catch the rarer red moon. This occurs during a total lunar eclipse. Total eclipses start like partial eclipses. The moon begins to move behind Earth, and you see Earth's shadow creeping across the moon. It looks like a bite has been taken out of the moon. Then the moon moves entirely behind Earth, fully in the umbra. Because it is in shadow, the moon appears to be dark red. But why isn't it completely dark?

Sunlight is comprised of a **spectrum**⁴ of colors. During a lunar eclipse, Earth's **atmosphere**⁵ splits the sunlight, forming what looks like a rainbow. The colors of light are scattered, and the red rays reach around Earth in the direction of the umbra. This red light hits the moon and makes it look red, a powerful and intriguing sight.

But why do we not have a lunar eclipse once a month? The intricate steps of the orbits prevent the moon, Earth, and the sun from always lining up. However, if you are intrigued by this phenomenon, rest assured that you will likely see a lunar eclipse in your lifetime. Lunar eclipses happen a couple of times a year, but you need to be in the right place on Earth to be able to see one.

MYTHS ABOUT LUNAR ECLIPSES

A lunar eclipse is an exciting spectacle for all ages, but people did not always feel this way. The scientific reason for lunar eclipses was not known, and humans tend to be afraid of the unknown. Many people desperately tried to understand this “supernatural” phenomenon, which changed their comforting, familiar night sky. Some thought a black jaguar crept across the surface of the moon and attacked it, turning it red with blood. The Chinese believed that a mythical dragon was eating the moon.

3 **align** – line up

4 **spectrum** – range

5 **atmosphere** – layers of gases surrounding Earth

Whenever a lunar eclipse occurred, they would quickly make as much noise as possible to frighten the creature away. There are countless other myths about lunar eclipses from around the world.

There are also recorded instances where lunar eclipses were helpful. During one lunar eclipse, Greek astronomers saw the curve of Earth's shadow on the moon and used this to suggest that Earth was round, not flat.

After carefully studying the moon, astronomers were eventually able to predict when a lunar eclipse would happen. Lunar eclipse predictions helped Christopher Columbus in 1504. Columbus and his sailors had arrived in Jamaica, where indigenous tribes welcomed them and gave them food and drink. Soon, though, the **indigenous**⁶ people began to resent the intruding sailors. They refused to provide any more food. Columbus was looking through his astronomy charts and realized that a lunar eclipse was due to happen. He threatened to make the moon disappear if the tribesmen would not give him and his crew provisions. Just as predicted, the lunar eclipse began. The terrified tribes quickly offered to continue providing Columbus with food.

Ever present, the moon will continue to guide us during the dark nights. No longer feared, a lunar eclipse is a fascinating sight worth looking out for. Our intriguing moon that sometimes disappears is evidence of the immense and incredible space beyond our planet's skies.



*This picture of the moon was taken during a lunar eclipse in August 2007.
Credit: Peter Firminger from Wollombi, Australia, Wikimedia*



The red moon on January 21, 2019, during a total lunar eclipse

⁶ **indigenous** – original people living in a place or country

QUESTIONS



- The intricate steps of the orbits prevent the moon, Earth, and the sun from always lining up.*
As used in this sentence, “intricate” most nearly means

 - simple
 - elaborate
 - confused
 - current
- In which sentence is the word “spectrum” used correctly?**

 - It’s normal for your mood to spectrum based upon how many hours of sleep you received the night before.
 - People claim that you are either introverted or extraverted, but in reality, there is a wide spectrum of personalities within the two categories.
- Mark each statement as T (true) or F (false).**

_____ Columbus took advantage of a lunar eclipse to trick indigenous tribes into feeding his sailors.

_____ Lunar eclipses occur several times a year.

_____ The moon moves entirely into Earth’s umbra during a total lunar eclipse.

_____ Earth is the only planet that has a moon.
- Which of the following is not a true statement about lunar eclipses?**

 - During lunar eclipses, the Chinese Navy fired guns to scare off what they thought was a moon-eating dragon.
 - Lunar eclipses occur multiple times a year.
 - A partial lunar eclipse occurs when the moon moves into Earth’s umbra.
 - The red color that is seen during a lunar eclipse is caused by Earth’s atmosphere scattering light rays.



5. Look at the image featuring an astronaut on the moon. What can be inferred about the moon from this image that was not provided by the lesson?

- A. The image allows the reader to infer that the moon's surface isn't completely flat.
- B. The image allows the reader to infer that Neil Armstrong was the first astronaut on the moon.
- C. The image allows the reader to infer that Earth is visible from the moon's surface.
- D. The image allows the reader to infer that astronauts undergo intensive training to ensure that they use their equipment correctly.



6. What is the author's point of view regarding lunar eclipses?

- A. The author thinks that lunar eclipses are frightening.
- B. The author thinks that scientists do not understand what causes a lunar eclipse.
- C. The author thinks that lunar eclipses are thrilling events.
- D. The author thinks that lunar eclipses do not receive as much attention as they should.

7. Which choice provides the best evidence for the answer to the previous question?

- A. *There are countless other myths about lunar eclipses from around the world.*
- B. *A lunar eclipse is an exciting spectacle for all ages.*
- C. *Astronomers were eventually able to predict when a lunar eclipse would happen.*
- D. *But why do we not have a lunar eclipse once a month?*

8. Which detail in the lesson helps the author illustrate that lunar eclipses have been useful historically?

9. How did society's reaction to lunar eclipses change over time?

10. Imagine that you were researching lunar eclipses. What would you be most interested in studying?

