

Everything you wanted to know about the Moon

Haywards Heath & District Probuc Club



The Natural History Museum

The Natural History website ([HERE](#)) provides a valuable and interesting source of detail¹ about the Moon – see below. The Moon is Earth's most constant companion and the most accessible celestial object to find in the night sky. While it's a satellite of Earth, with a diameter of about 2,159 miles (3,475km), the Moon is larger than Pluto. Our Moon is about 27% the size of Earth – a much larger ratio (1:4) than any other moons in the galaxy to their planets.

Facts

- Equator circumference: 10,917 kilometres
- Radius: 1,737 kilometres
- The average distance from Earth: 384,400 kilometres
- Temperature: -173°C to 127°C
- Moon type: rocky
- Average orbital speed: 3,683km/h (1.02km/s)
- Year length: 27 days

How big is it?

The Moon is a little over a quarter the size of the Earth, with a circumference of 10,917km around the equator and a radius (the distance from the core of the Moon to the surface) of just 1,737km. In relation to Earth, the Moon is much larger than expected, which is thought to be due to how it was formed.

How cold is it?

There is almost no atmosphere on the Moon, which means it cannot trap heat or insulate the surface. In full sunshine, temperatures on the Moon reach 127°C - well above boiling point. There are 13 and a half days of high temperatures followed by 13 and a half days of darkness, and once the Sun goes down, the temperature at the bottom of craters can plummet to -173°C.

Is there water on the Moon?

Due to its tilt, some parts of the Moon's surface never see sunlight, allowing water ice to survive in some of its craters. When India's Chandrayaan-I lunar orbiter passed over the north pole of the Moon in 2009, it found more than 40 craters thought to contain water ice. This confirmed a finding from the previous year that saw water ice on the southern pole. In addition, the Moon has some water trapped in its rocks.

How far from Earth is the Moon?

The Moon is orbiting Earth at an average distance of 384,400 kilometres, meaning it would take over 17 days non-stop to fly there on a commercial plane. Its orbit is not perfectly circular but varies between 252,000 and 225,600 kilometres away. We tend to think it is closer than it actually is simply because it is the largest celestial object in the sky.

Is the Moon getting closer?

No. The Moon is gradually getting further away - every year, the Moon moves about four centimetres further away. This is because there is a small amount of friction between Earth and the tides, slowing our planet's rotation. As Earth's spin slows, the Moon is creeping away.



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How long is a day on the Moon?

It takes 27² days for the Moon to go around Earth and 27 days to rotate once on its axis. Because the Moon is orbiting Earth at the same rate at which it rotates itself, this means that the same side of the Moon always faces the Earth - this is known as synchronous rotation³.

Is there an atmosphere on the Moon?

For ages, scientists thought there was no atmosphere on the Moon, but recent studies have confirmed that this is not true. The very thin atmosphere, known as an exosphere, contains helium, argon, neon, ammonia, methane and carbon dioxide.

The Moon also contains sodium and potassium, which are not usually found as gases in the atmospheres of Earth, Venus or Mars. Where this atmosphere comes from is still not known. Some theories suggest that the solar winds and high energy particles are stripping material from the surface of the Moon, while others propose that evaporation of surface material might be involved or even meteor impacts. It could also be a combination of all of these effects.

Why are there so many impact craters on the Moon?

The thin atmosphere leaves very little to protect the Moon from asteroids. Early in the solar system's formation, all planets and moons were bombarded with rocks. The thin atmosphere on the Moon has meant that the impact craters have remained prominent - because the Moon has no weather, there is effectively no erosion on the celestial body.

What is the Moon made of?

Not cheese, for sure. Like Earth, the Moon can be divided into the crust, mantle and core. At its centre, the Moon has a solid iron core with a temperature between 1,327°C and 1,427°C - hot enough to create a surrounding molten liquid iron outer core, but not hot enough to warm the surface. The mantle which envelopes the core is roughly 1,000 kilometres thick. During the early history of the Moon, this layer was once liquid magma and the source of the intense volcanic activity that led to the formation of the lava plains on its surface. As the magma cooled down, this process stopped. All of this is encased in a crust made up mainly of a rock called anorthosite, which is rich in oxygen, silicon, calcium, and aluminium. The surface is coated with lunar regolith - a fine mix of dust, broken rock and material.

While Earth's regolith is formed by erosion and weather, on the Moon, it all comes from meteor impacts as the surface is blasted into fine pieces. In some places, this lunar regolith is just three metres deep, while in other parts, it has settled into drifts some 20 metres deep.

How does the Moon cause tides on Earth?

The gravitational pull of the Moon causes the water on the nearest side of Earth to bulge outwards, resulting in a high tide. Curiously, it also causes the water on the other side of the Earth to bulge outwards. This is because the Moon's gravity is not the only force acting on the planet's water, as Earth's own gravity also has to be taken into account. The resulting tidal force is stretching and squashing Earth, resulting in the water bulging on the two opposite sides of the planet. This is why we experience two high tides and two low tides on Earth every day.

² Other sources (for example, UniverseToday.com (here)) say that a day on the Moon lasts as long as 29.5 Earth days. In other words, if you were standing on the surface of the Moon, it would take 29.5 days for the Sun to move all the way across the sky and return to its original position again. However, as with all bodies in the Solar System, distinguishing between different types of days (based on different types of periods) is necessary.

³ Synchronous rotation is why some people call the side that never faces the planet the 'dark side' of the Moon. This is somewhat misleading, however: it is more correctly referred to as the far side of the Moon. As the Moon orbits the Earth, most of its surface is bathed in sunlight at some point.

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The Royal Museums Greenwich

The Royal Museums Greenwich website ([HERE](#))⁴ explains the names of full moons throughout the year. Blue moons, Harvest moons, Worm moons – you can find out more about the ancient names associated with the phases of the Moon - and what they mean.

What are the phases of the Moon?

When we look up at the Moon, we don't always see the same amount of its surface being lit up. This apparent change in the shape of the Moon is known as its 'phase'.

What causes the phases of the Moon?

The phases of the Moon are caused by the relative positions of the Moon, Sun and Earth. Because the Moon produces no visible light of its own, we can only see the parts of the Moon that are lit up by other objects. A small amount of light comes from distant stars and the reflection of light from the Earth (known as Earthshine). However, the main source of light for the Moon is the Sun. At almost all times, half of the Moon is being lit up by the Sun, but this need not be the half facing towards the Earth. The only exception is during a lunar eclipse. If the Moon is between the Earth and the Sun in its orbit, then the back side of the Moon is being lit up, and the side facing the Earth is in darkness. This is called a new Moon. If the Moon is on the other side of the Earth compared to the Sun, then the near side of the Moon will be fully lit up: a full Moon.

How many phases of the Moon are there?

The Moon goes through multiple stages of partial illumination during its different phases. These are the banana-shaped crescent Moon, the D-shaped quarter Moon and the almost complete gibbous Moon. Finally, each phase is also named after its position in the full 29.5-day cycle based on whether it is growing (waxing) or shrinking (waning).

The eight phases of the Moon in order are:

- New Moon
- Waxing Crescent Moon
- First-quarter Moon
- Waxing gibbous Moon
- Full Moon
- Waning gibbous Moon
- Last-quarter Moon
- Waning crescent Moon.

NOTE: Other sources put the number of phases as ten – see picture above.

The full, quarter and new Moons are all the instants in time when the Moon is exactly fully, half or not at all illuminated from our perspective on Earth. The crescent and gibbous Moons each last approximately a week.

Picture Credit: "Moon phases" by [MarkGregory007](#) is licensed under [CC BY-NC-SA 2.0](#)



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Moons with Other Names

Harvest Moon

The term "harvest moon" refers to the full, bright Moon that occurs closest to the start of the autumn equinox. The name dates to the time before electricity, when farmers depended on the Moon's light to harvest their crops late into the night. This is why the harvest moon can fall any time between September and October. The Equinox is when the Earth's equator is almost directly in line with the Sun's centre. It occurs twice a year - around late March (spring equinox) and late September (autumn equinox).

Blue Moon

A "blue moon" is an additional full Moon that appears in a subdivision of a year: either the third of four full moons in a season, or a second full moon in a month of the common calendar. The phrase in modern usage has nothing to do with the actual colour of the Moon, although a visually blue moon⁵ (the Moon appearing with a bluish tinge) may occur under certain atmospheric conditions.

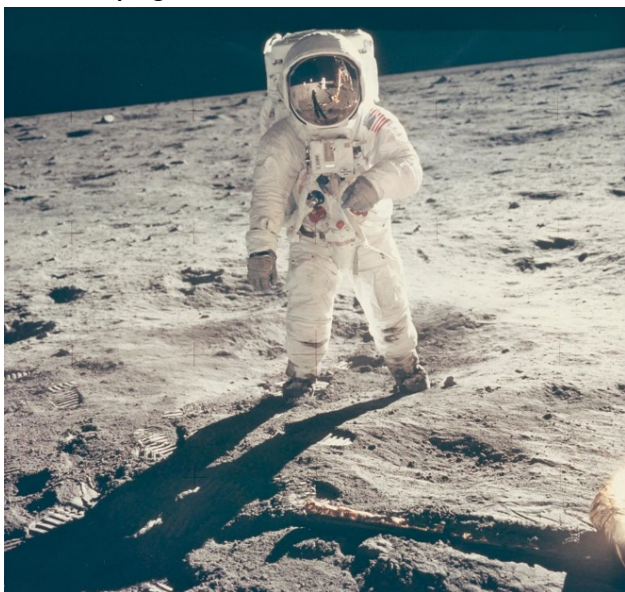
Super Blue Blood Moon

We know what a super moon is, but as a reminder, when the Full Moon or New Moon occurs during the Moon's closest approach to Earth (its perigee), it is often called a super moon. Super moon is not an official astronomical term - it was first coined by an astrologer, Richard Nolle⁶, in 1979.

A blue moon is what you call the second full Moon in one month. On average, they happen every two and a half years. But it's actually nothing to do with the Moon appearing blue! A blood moon is the name given for a view of the Moon during a total lunar eclipse. Because of the way light passes through the Earth's atmosphere during an eclipse, red light from the Sun is reflected onto it and gives it a reddish colour and the nickname blood moon.

Never Ending

The story doesn't end there as the Moon has multi-manifestations: there are Moons for specific harvests: Corn Moon, Barley Moon, Hay Moon, Grain Moon, Fruit Moon, Nut Moon, Blackberry Moon, Strawberry Moon. There are moons for killing: Buck Moon, Hunter's Moon, Hare Moon, Sturgeon Moon. There are Moons for growing things: Pink Moon (when the first spring flowers appear), Egg Moon, Budding Moon. There are Moons for more challenging times: Little Famine Moon, Big Famine Moon, Hungry Moon, Bony Moon, Dying Moon.



Men on the Moon

In 1969, three men on the Apollo 11 spacecraft successfully landed on the Moon. It was the first time that humankind had done so and was an event that caught the attention and imagination of the world. Since 1969, there have been other lunar landings – see the list ([HERE](#)) on Wikipedia,

Picture Credit: "Man on the moon, 20 July 1969" by Thomas Cizauskas is licensed under [CC PDM 1.0](#)

⁵ NOTE: Owing to the rarity of a blue moon, the term "blue moon" is used colloquially to mean a rare event, as in the phrase "once in a blue moon"

⁶ Richard Nolle defined it as 'a New or a Full Moon that occurs when the Moon is at or near (within 90% of) its closest approach to Earth in its orbit'. It is unclear why he chose the 90% cut off in his definition.

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Penguin Random House UK ([HERE](#)) have put together ten out-of-this-world facts about the first moon landing, and it's worth reading to remind ourselves of those gigantic steps towards space exploration. Here are some to whet your appetite:

- When Neil Armstrong landed the lunar module, only 30 seconds of fuel were left.
- While Neil Armstrong may have been the first man to set foot on the Moon, Buzz Aldrin was the first human to go to the toilet on the Moon, using a special tube in his spacesuit!
- A remarkable woman called Katherine Johnson carried out the calculations that made the mission to the Moon possible and got the astronauts home again. Her incredible achievement made it possible for other women and people of colour to follow in her footsteps, breaking down barriers of race and gender.

Sources and Further Information:

- <https://www.bbc.co.uk/newsround/41484454>
- <https://www.bbc.co.uk/newsround/42554508>
- <https://www.thesun.co.uk/tech/5232103/blue-moon-rare-what/>
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