

## Top four keys to mastering Moon phases

Why does the Moon seem to change its shape every night? Why can I see the Moon in the daytime?

The answer to both questions is the same. It's that the Moon is a world in space, just as Earth is. Like Earth, the Moon is always half illuminated by the Sun; the round globe of the Moon has a day side and a night side. From our earthly vantage point, as the Moon orbits around Earth, we see varying fractions of its day and night sides.

These are the changing phases of the moon.

And the moon is in the daytime sky about half the time. It's just that it is sometimes so near the Sun we don't notice it. How can you understand moon phases? Here are four things to remember:

1. When you see the Moon, think of the whereabouts of the Sun. After all, it's the Sun that's illuminating and creating the dayside of the Moon. Moon phases depend on where the moon is with respect to the Sun in space. For example, do you see which Moon phase is being shown in the illustration above? The answer is, it's a full Moon. The Moon, Earth and Sun are aligned with Earth in the middle. The Moon's fully illuminated half – its dayside – faces Earth's night side.

2. The Moon rises in the east and sets in the west, each and every day. It has to. The daily rising and setting of all celestial objects is due to Earth's continuous daily spin beneath the sky.

3. The Moon takes about a month to orbit the Earth. Although the Moon rises in the east and sets in the west each day, it is also slowly moving eastwards in the sky in front of the fixed stars due to its own motion in orbit around Earth.

The Moon's eastward, orbital motion is about 12-13 degrees each day, as it completes one complete orbit in about one month. This can be noticed easily from one night to the next.

4. The Moon's orbital motion is toward the east. Each day the Earth has to rotate about 50 minutes longer to bring you around to where the Moon is in space. Thus the Moon rises, on average, about 50 minutes later each day. For the two weeks between new and full moon the later and later rising times of the Moon cause our companion world to appear in a different part of the sky at each nightfall. Then after full Moon you'll find the Moon rising later and later at night.



Artist's concept of the Moon, Earth and Sun aligned in space.



Moon phase composite via Fred Espenak (note Northern View)  
Top line: Waxing Crescent and First Quarter. Middle line: Waxing Gibbous and Full Moon and Waning Gibbous. Bottom line: Last Quarter and Waning Crescent. New Moon not shown.



The Moon's orbital motion carries it about 13 degrees eastward in our sky every 24 hours (12.8 hours x 28 days = 360 degrees)

A handy rule of thumb to know whether the Moon is in an ascending or descending (waxing or waning) phase of its monthly cycle, is to note which side of the Moon circle is illuminated (faces the Sun). In the Southern Hemisphere if the left side is illuminated, then the Moon cycle is ascending (like starting to write a small letter "a"). If the other (right) side is illuminated, then the Moon is in the descending phase. In the Northern Hemisphere the display is reversed (see the Moon phase composite by Fred Espenak above).

AK, with EarthSky and Wikipedia Notes