

# PHASES OF THE MOON

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----- **Interactive Physics Simulation** -----

To visit this simulation :

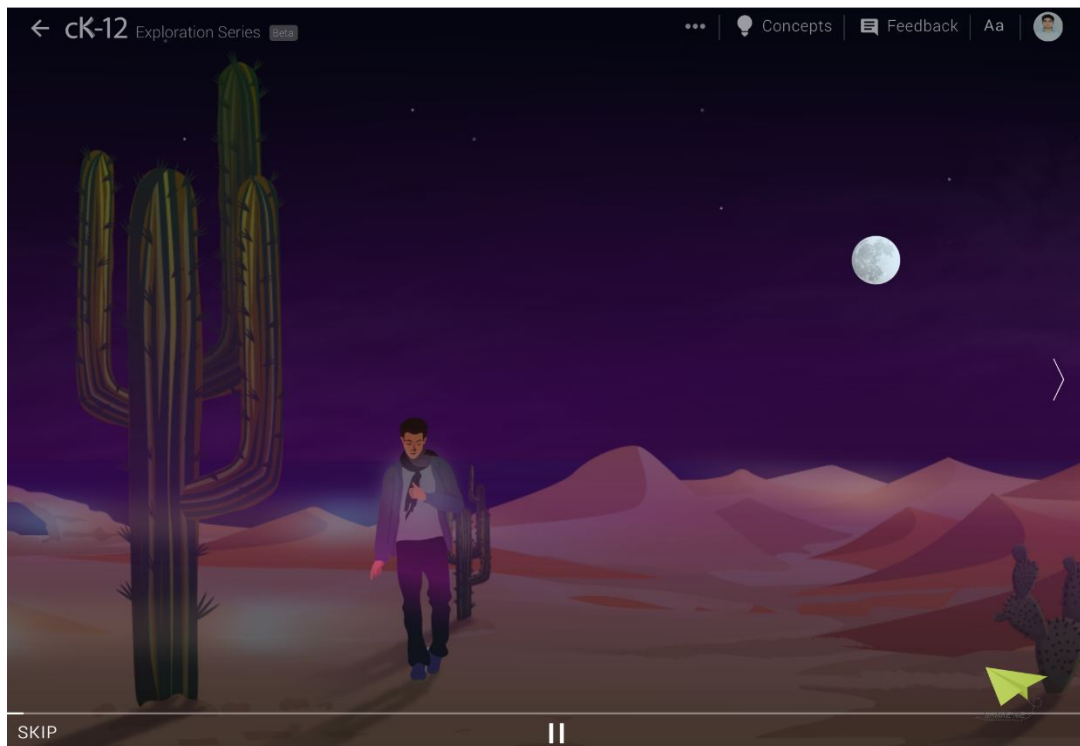
<http://interactives.ck12.org/simulations/physics/phases-of-the-moon/app/>



## Intriguing Question

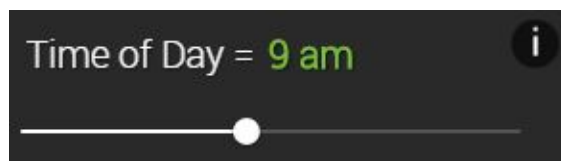
Can you tell time just by looking at the Moon?

## Illustrative Video

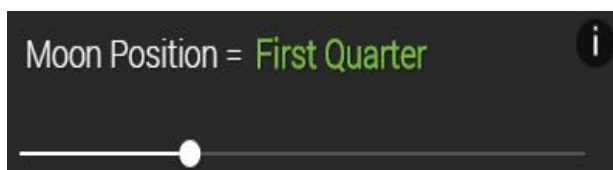


We often think of the Moon as a nighttime visitor. Is the Moon ever visible in the daytime? Why does the Moon appear to cycle through phases? The Moon orbits the Earth at a great distance - about thirty Earth diameters. The Moon takes about four weeks to orbit - which means it covers 90 degrees ( $\pi/2$  radians) every 7 days. Its angular speed is about  $13^\circ$  per day, or roughly  $\frac{1}{2}$  of a degree per hour. Half of the Earth faces the Moon at any time - only from here can the Moon be seen. How does this look from Earth? Let's explore how to use the Moon like a clock.

## Interactive Simulation



**Time of Day** - This slider allows you to adjust the local time of day - in essence, it rotates the Earth over its 24 hour period. Over a single day, the moon moves a bit in its orbit (roughly 13 degrees) but the greater change in its position in the sky has to do with the rotation of the Earth itself.



**Moon Position** - This slider allows you to adjust the position of the Moon in its orbit. We allow you to choose from 8 different positions, each corresponding to a 45 degrees shift in position. Because the Moon takes roughly 4 weeks to orbit the Earth, each of these positions is separated by about half a week in actual time.

## Interpreting Results



Which moon phase rises at approximately 9 AM? *(Be sure to set the time of day to 9AM)*




At approximately what time of day does the Waning Gibbous moon set? *(Be sure to set the moon phase slider to Waning Gibbous)*




At approximately what time of day does the full moon rise? *(Be sure to set the phase slider to FULL)*

## Challenge ME!

 What time does the first quarter moon rise?

 What time does the waning gibbous moon set?

 If you see a waxing crescent moon at its highest point in the sky, what time is it?

## Need Help?

Check out the Phases of the Moon Walkthrough video at: <https://youtu.be/CJBUmB8wYR8>

## Interesting Questions

### **Why isn't every full moon a lunar eclipse?**

If the moon orbited in the same imaginary plane in which the Earth orbits the Sun (known as the ECLIPTIC plane) then every full moon would be an eclipse. Instead, the Moon orbits in a plane that is tilted with respect to the ecliptic plane by about 5 degrees. This means the Moon only passes through the Earth's shadow very rarely. It is a common misconception to think that the Moon's phases are due to the Earth's shadow - beware!

### **Who can see a lunar eclipse?**

Everybody who can see the full moon as it passes through the Earth's shadow can see a lunar eclipse. This means most of the folks on the night-time side of the Earth can see it. This is one reason you are much more likely to see a lunar eclipse than a solar one. When the moon casts a shadow on the Earth - known as a solar eclipse - the shadow is quite small, and only those on the Earth in that shadow can see the eclipse. These are therefore much rarer from the point of view of an observer.

### **Why are solar eclipses so short?**

The Moon is smaller than the Earth, and so casts a smaller shadow than the Earth does. This means the Moon's shadow only takes up a fraction of the Earth's surface. If you aren't in this shadow, you don't see the eclipse. The Moon is moving with some angular speed through the sky, so this shadow is racing across the surface of the Earth. The Earth is rotating, too, with some angular speed that will tend to move you out of the shadow.

### **Are the moon's orbits getting longer or shorter?**

Yes! The moon interacts with the layer of water on the Earth causing a tidal bulge. The tidal bulge tugs on the moon, speeding it up. The faster moon moves outwards to a higher radius. This happens VERY slowly - you won't notice it in your lifetime!

**Physics Concepts** | [Click on the link below to learn more.](#)

 Angular Speed - <http://www.ck12.org/physics/Angular-Speed>

 Circular Motion - <http://www.ck12.org/physics/Circular-Motion>

