



## Southern Nevada Regional Professional Development Program

### *Phases of the Moon*

**INTRODUCTION** This activity may be used at any grade level. It helps if you send home a letter to parents describing the homework assignment.

#### **WHERE'S THE SCIENCE?**

The moon has always been a fascination to humans around the world. Many ancient calendars were based on the moon's cycles. The moon's phases are the changes in light and shadow we see from earth that move in a cycle over the face of the moon. One complete cycle takes about 29 ½ days called a lunation. During a cycle the moon travels through 8 basic phases. The **full moon** is when the whole moon appears lit. It lasts only one day, though it appears to be full for more. The **new moon** is when we can not see any light on the moon from earth so it seems to disappear. In between these two extremes the moon **waxes** (appears to grow larger) and **wanes** (appears to shrink). From a new moon, a **crescent** appears to light less than half the moon. When it waxes to half the moon lit, it is called the **First Quarter**. Anything larger than half the moon lit is called **gibbous**. A waxing, gibbous leads to the full moon. It then wanes back into a gibbous and continues to the **Last or Third Quarter** where the other half of the moon is lit. It wanes to a less than half crescent and into the new moon. This cycle repeats in a little less than most of our months. Every 3 years two full moons occur in one month. The second is called a Blue Moon. Since the moon is so precise and consistent with its cycle, almanacs posted the calendar initially for farmers to use. Today many different occupations use the lunar calendar to track time and seasons. The resources below can help you learn more about the moon phases, rising, and setting in our particular area.

#### **MATERIALS**

- 1 Notebook
- Local newspaper

#### **PROCEDURES**

1. Introduce this activity during the third quarter moon when it will be visible during the day. Your local newspaper should have the exact time.
2. Take the students outside and ask them to observe the sky and tell you what they see. Focus on the size and shape of the moon. Note the time and where the moon is in the sky-how high or low. Try to find a reference point, like the playground equipment or a tree for them to use each day. Also find the sun and see where it is in relation to the moon.
3. Return to class and have the students draw a picture of the moon in their moon notebook. They should also record the time and date of their observation.
4. Continue the moon notebook at school all week.
5. Students are to monitor the moon and record observations in the moon notebook all month. The moon appears to change slowly, especially near the full moon, so

observations made every other day will work. Try to record more than once a week, though.

Extension: Make a map of your playground and track how the moon and sun move across the sky. Record once a week at the same time in fall or spring (when you pick them up in the morning or release them at the end of the day), or go out many times in one day.

**Additional Resources:**

- \*[http://aa.usno.navy.mil/faq/docs/moon\\_phases.html](http://aa.usno.navy.mil/faq/docs/moon_phases.html) (help with moon rising, setting, and phases for teachers)
- \*<http://www.woodlands-junior.kent.sch.uk/time/moon/phases.html> (printable calendar for students to fill in plus a matching game for students)
- \*<http://worldwind.arc.nasa.gov/moon.html> (a very close look at the moon courtesy of NASA)
- \*<http://www.quia.com/jg/80593.html> (lots of reading and vocabulary enrichment games)

**Nevada State Standards:** E.2.B.2 Students know that the sun rises everyday, and that the Moon can rise during the day and/or the night. E.2.B.3 Students know the Sun and Moon appear to move across the sky. E.2.B.4 Students know the Moon appears to change shape over the course of a month.

NAME \_\_\_\_\_

MY MOON JOURNAL FOR THE MONTH OF \_\_\_\_\_

DATE:	TIME:	A PICTURE OF THE MOON	COMMENTS?
MONDAY	AM PM		<hr/> <hr/> <hr/>
TUESDAY	AM PM		<hr/> <hr/> <hr/>
WEDNESDAY	AM PM		<hr/> <hr/> <hr/>
THURSDAY	AM PM		<hr/> <hr/> <hr/>
FRIDAY	AM PM		<hr/> <hr/> <hr/>

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Date

Dear Parents,

As part of our science class this week, we are studying the phases of the moon. All week we will be looking at the moon at school and seeing how it changes. Since watching the moon takes a month to see the whole cycle, your help would be greatly appreciated. Help your child find the moon and fill in the chart below this weekend. We will share our findings in class on Monday. A new weekly chart will be handed out for your child to complete as homework.

This is a great opportunity to spend a few minutes with your child to see nature at work. If you would like more information on the moon to share with him/her, please feel free to contact me and I will send you the information I have. The library is a great place to find books at your child's level about moon as well.

Thank you again for your support and have fun moon watching!

Sincerely,

DATE: SATURDAY	TIME:	A PICTURE OF THE MOON	COMMENTS?
	AM PM		
SUNDAY			
	AM PM		



# Phases of the Moon and Percent of the Moon Illuminated

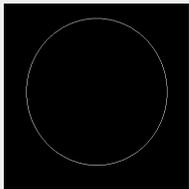
Note: For Moon phase information specific to a particular date, see [Dates of Primary Phases of the Moon, Complete Sun and Moon Data for One Day, Fraction of the Moon Illuminated, or What the Moon Looks Like Today in Data Services.](#)

From any location on the Earth, the Moon appears to be a circular disk which, at any specific time, is illuminated to some degree by direct sunlight. Like the Earth, the Moon is a sphere which is always half illuminated by the Sun, but as the Moon orbits the Earth we get to see more or less of the illuminated half. During each lunar orbit (a lunar

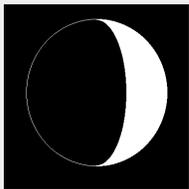


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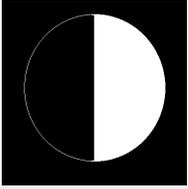
month), we see the Moon's appearance change from not visibly illuminated through partially illuminated to fully illuminated, then back through partially illuminated to not illuminated again. Although this cycle is a continuous process, there are eight distinct, traditionally recognized stages, called phases. The phases designate both the degree to which the Moon is illuminated and the geometric appearance of the illuminated part. These phases of the Moon, in the sequence of their occurrence (starting from New Moon), are listed below.



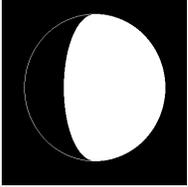
**New Moon** - The Moon's unilluminated side is facing the Earth. The Moon is not visible (except during a solar eclipse).



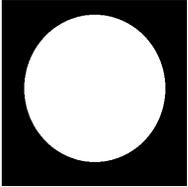
**Waxing Crescent** - The Moon appears to be partly but less than one-half illuminated by direct sunlight. The fraction of the Moon's disk that is illuminated is increasing.



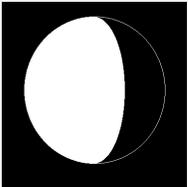
**First Quarter** - One-half of the Moon appears to be illuminated by direct sunlight. The fraction of the Moon's disk that is illuminated is increasing.



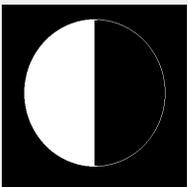
**Waxing Gibbous** - The Moon appears to be more than one-half but not fully illuminated by direct sunlight. The fraction of the Moon's disk that is illuminated is increasing.



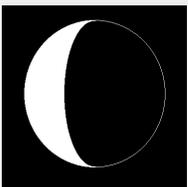
**Full Moon** - The Moon's illuminated side is facing the Earth. The Moon appears to be completely illuminated by direct sunlight.



**Waning Gibbous** - The Moon appears to be more than one-half but not fully illuminated by direct sunlight. The fraction of the Moon's disk that is illuminated is decreasing.



**Last Quarter** - One-half of the Moon appears to be illuminated by direct sunlight. The fraction of the Moon's disk that is illuminated is decreasing.



**Waning Crescent** - The Moon appears to be partly but less than one-half illuminated by direct sunlight. The fraction of the Moon's disk that is illuminated is decreasing.

Following waning crescent is New Moon, beginning a repetition of the complete phase cycle of 29.5 days average duration. The time in days counted from the time of New Moon is called the Moon's "age". Each complete cycle of phases is called a "lunation".

Because the cycle of the phases is shorter than most calendar months, the phase of the Moon at the very beginning of the month usually repeats at the very end of the month. When there are two Full Moons in a month (which occurs, on average, every 2.7 years), the second one is called a "Blue Moon". See the article "Once in a Blue Moon" for the story of how the usage of this term has evolved (Ref: Philip Hiscock, [Sky & Telescope](#), March 1999, pp. 52-55.).

The first time that the thin waxing crescent Moon is visible after New Moon (low in the evening sky just after sunset) marks the beginning of a month in the Islamic Calendar - see the FAQ [Crescent Moon Visibility and the Islamic Calendar](#).

Although Full Moon occurs each month at a specific date and time, the Moon's disk may appear to be full for several nights in a row if it is clear. This is because the percentage of the Moon's disk that appears illuminated changes very slowly around the time of Full Moon (also around New Moon, but the Moon is not visible at all then). The Moon may appear 100% illuminated only on the night closest to the time of exact Full Moon, but on the night before and night after will appear 97-99% illuminated; most people would not notice the difference. Even two days from Full Moon the Moon's disk is 93-97% illuminated.

New Moon, First Quarter, Full Moon, and Last Quarter phases are considered to be primary phases and their dates and times are published in almanacs and on calendars. (Click [here](#) for a list.) The two crescent and two gibbous phases are intermediate phases, each of which lasts for about a week between the primary phases, during which time the exact fraction of the Moon's disk that is illuminated gradually changes.

The phases of the Moon are related to (actually, caused by) the relative positions of the Moon and Sun in the sky. For example, New Moon occurs when the Sun and Moon are quite close together in the sky. Full Moon occurs when the Sun and Moon are at nearly opposite positions in the sky - which is why a Full Moon rises about the time of sunset, and sets about the time of sunrise, for most places on Earth. First and Last Quarters occur when the Sun and Moon are about 90 degrees apart in the sky. In fact, the two "half Moon" phases are called First Quarter and Last Quarter because they occur when the Moon is, respectively, one- and three-quarters of the way around the sky (i.e., along its orbit) from New Moon.

The relationship of the Moon's phase to its angular distance in the sky from the Sun allows us to establish very exact definitions of when the primary phases occur, independent of how they appear. Technically, the phases New Moon, First Quarter, Full Moon, and Last Quarter are defined to occur when the excess of the apparent ecliptic (celestial) longitude of the Moon over that of the Sun is 0, 90, 180, and 270 degrees, respectively. These definitions are used when the dates and times of the phases are computed for almanacs, calendars, etc. Because the difference between the ecliptic longitudes of the Moon and Sun is a monotonically and rapidly increasing quantity, the dates and times of the phases of the Moon computed this way are instantaneous and well defined.

The **percent of the Moon's surface illuminated** is a more refined, quantitative description of the Moon's appearance than is the phase. Considering the Moon as a circular disk, the ratio of the area illuminated by direct sunlight to its total area is the fraction of the Moon's surface illuminated; multiplied by 100, it is the percent illuminated. At New Moon the percent illuminated is 0; at First and Last Quarters it is 50%; and at Full Moon it is 100%. During the crescent phases the percent illuminated is between 0 and 50% and during gibbous phases it is between 50% and 100%.

For practical purposes, phases of the Moon and the percent of the Moon illuminated are independent of the location on the Earth from where the Moon is observed. That is, all the phases occur at the same time regardless of the observer's position.

## Lunation Movie

If you click on either of the two images on the right, you will see a time-lapse movie of the appearance of the Moon over one lunation. A lunation is a lunar month, during which time the Moon completely circles the Earth in its orbit. The complete cycle of phases is obvious. Two other effects can be easily seen. First, due to the elliptical shape of the Moon's orbit, the apparent size of the Moon's disk changes as its distance from Earth varies (the closest and farthest points do not always occur at the same phases, however). Second, although the Moon's near side directly faces the Earth on average, we get to view the Moon from slightly different angles as it orbits us. This effect, called libration, is caused partly by the tilt of the Moon's rotation axis with respect to its orbital plane and partly by the fact that the Moon's speed in its orbit varies but its rotation rate does not.

The movie is an animated GIF created by Antonio Cidadao from a sequence of still images taken during March and April 1998.

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[Small movie \(134k\)](#)



[Large movie \(493k\)](#)

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# The Phases of the Moon

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[More facts about the Moon](#)

## The Moon travels around the Earth.



The Moon travels around the Earth in a circle called an **orbit**. It takes the moon about 28 days to go one time around the Earth.

The Moon is about 250,000 miles (384,400 kilometers) from Earth and has a diameter of 2,000 miles ( 3,476 kilometers).

The Sun always lights up (illuminates) half of the Moon at one time.

The Moon is not a light source, it has no light of its own. We can only see the moon because it reflects light from the sun.

The Moon appears to change shape but what we are actually seeing is the Moon lit up by the light from the Sun in different ways on different days.



**Did you know?**

We always see the same side of the moon. The Moon always keeps the same side pointing towards us so we can never see the 'back' of the Moon from the Earth.

It takes the Moon 28 days to orbit the Earth.

The image on the right shows you what you would see if you looked at the moon tonight .



If it is black then it's a new moon.

[Click here for Phases of the Moon for each month during 2006](#)



## Why does the moon keep changing its shape ?

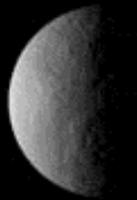
The bright part of the moon is the part that the sun is shining on. This is like daytime on earth. The dark part is in shadow, like night on earth.

As the moon moves around in its orbit, the sun shines on different parts of the moon.

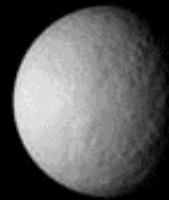
The images below show the different phases of the moon.



Waning crescent

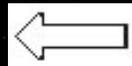


Third quarter  
(Last Quarter/Half Moon)

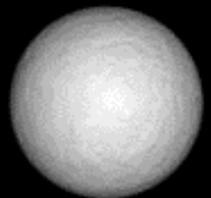
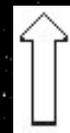


Waning gibbous

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Earth



New Moon



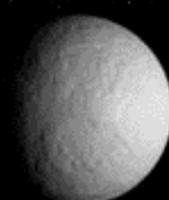
Full Moon



Waxing crescent



First quarter  
or Half Moon



Waxing gibbous

You are looking at the Moon as though you are looking up from the Earth.

### [Make you own Lunar Calendar](#)

Print out the Calendar and pictures of the different phases

### [Take the Moon Challenge](#)

Drag the Moons to their correct places in lunar cycles.

See a diagram of the different moon phases around the Earth

[Click here](#)

See an animation showing the different moon phases around the Earth

[Click here](#)

**New moon** is when the moon and the sun are on the same side of Earth. The **moon is between the sun and the Earth**. We see the side which is not lit, so the moon is dark.

**Gibbous moon** is between a full moon and a half moon, or between a half moon and a full moon.

**Quarter moon** is when the moon has completed one quarter of an orbit around the Earth from either the full or new moon. One quarter of the moon's surface is visible from Earth. Sometimes called half moon.

**Full moon** is when the **Earth is between the sun and the moon**.

 Full Moon	 New Moon
14 January 2006	29 January 2006
13 February 2006	28 February 2006
14 March 2006	29 March 2006
13 April 2006	27 April 2006
13 May 2006	27 May 2006
11 June 2006	25 June 2006
11 July 2006	25 July 2006
9 August 2006	23 August 2006
7 September 2006	22 September 2006
7 October 2006	22 October 2006

5 November 2006

20 November 2006

5 December 2006

20 December 2006

## The moon orbits the Earth

Remember **it takes the Moon 28 days to orbit the Earth.**

Click on the links below to see an animation illustrating the orbit of the moon around the Earth and the corresponding phases of the Moon as viewed from Earth.

### Animation 1

[Click here](#) and have a go at the activity to an animation of the moon going around the Earth showing the different phases. **Excellent!**

### Animation 2

#### Instructions

1. Wait for the animation to load.
2. Change the **point of view** to both.
3. Click on the **animate button** to **start the animation.**

[Click here to see the animation](#)

To find out why we have night and day [click here!](#)

## Glossary

**Orbit** - The path of the Moon around the Earth.

**Rotate** - The Earth spins around, like a top, about its axis once

**Waning** - Shrinking.

**Waxing** - Growing

**Gibbous** - Swollen on one side



## Explore the Solar System:

[Our Space Page](#)

[3D Virtual Moon Globe](#)

See the other side of the moon

[Solar System](#) - Allows you to watch a simulated solar system in motion and lets you control certain factors.

[Interactive Solar System](#) - See the position of the planets

[Click here for Phases of the Moon for each month during 2006](#)

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Junior School**

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# World Wind

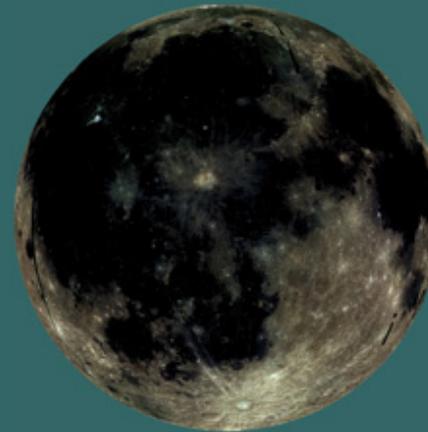
## Features

### Navigation

- Home
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- Contact Us

### NASA World Wind and The Moon

NASA World Wind version 1.3.3 (October 2005) now has the ability to browse Clementine moon data with full 3D terrain.



Three data sets are available; Clementine 40xx, Clementine 30xx, and the Shaded Relief map provided by the USGS. The first two were created using data processed by All three provide enough detail to see craters within craters. For more information regarding the Clementine mission see ([link](#))

The Clementine moon data is made possible with by a partnership between Frank Kuehnel of RIACS and the World Wind development group.

Back



## How to use moon data



There are two different ways to switch World Wind to display the moon. The first is a shortcut provided on the desktop labeled, World Wind Moon 1.3.



If World Wind is already running, you can switch to the moon using the menu bar.

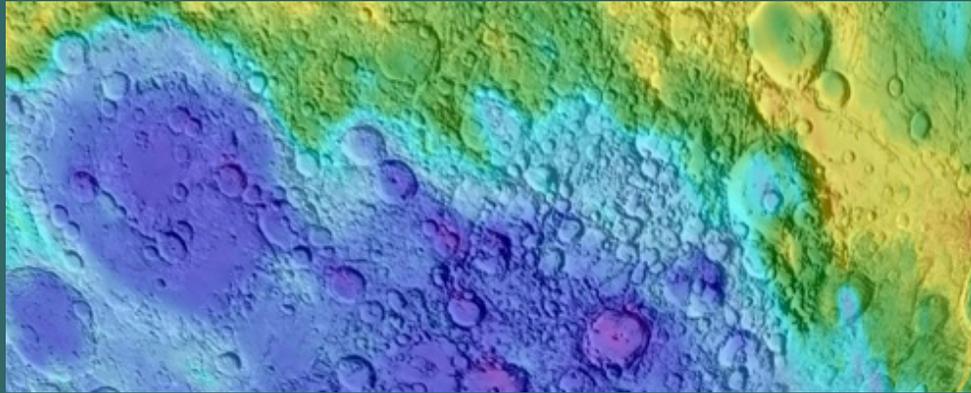
### Clementine 40xx



### Clementine 30xx



## USGS Shaded Relief



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World Wind is developed at NASA Ames Research Center by Chris Maxwell, Randy Kim, Tom Gaskins, Bruce Lam and project manager Patrick Hogan.

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Curator: Randolph Kim  
Responsible NASA Official: Patrick Hogan  
Last Updated: 10/25/2005

[Create your own activities](#) [go](#)[E-mail a friend](#)

## "Moon Phases" Games

These games contain vocabulary words related to the phases of the moon on third grade level.

### Tools

- [? Help](#)
- [Copy this to my account](#)
- [+ Add this to my class page](#)
- [Find other activities](#)
- [Start over](#)

See a [list of terms](#) used in these activities.

[Matching](#)[Flashcards \(Java / non-Java\)](#)[Concentration](#)

Activities created by: janicecox

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This activity was created by a Quia Web subscriber. To learn how to make your own, just like this, [click here](#).