

## *"Sandy, Pepper & The Eclipse"*

&

## *"Moonwitch"*

# Teacher's Guide

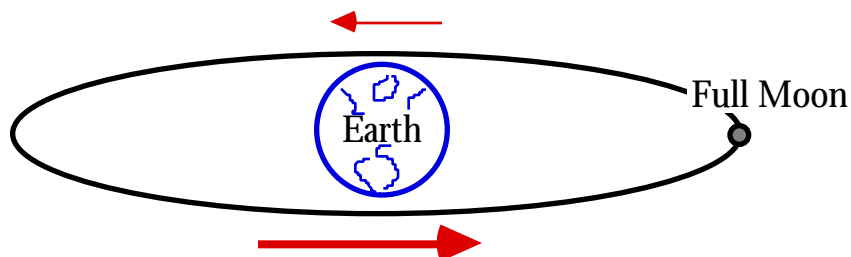
"Sandy, Pepper & The Eclipse" is a 20 minute planetarium program that covers: the causes of eclipses, how to safely view them, the different types of eclipses, and it dispels many common misconceptions about eclipses. It presents this material in a unique way that is both fun and educational to younger students. The show is presented from the viewpoint of two dogs: Sandy --a very knowledgeable golden retriever, and Pepper--a young and very naive beagle. Children will enjoy the friendly banter between these two interesting characters.

"MoonWitch" is another 20 minute planetarium program that covers more general knowledge concerning the Moon. Phases will be thoroughly discussed, as will the Moon's motions through the sky, why the Moon seems to follow you, why the Moon looks bigger near the horizon, some moon lore, features on the Moon, and the Apollo missions too. This program begins with children Trick-or-treating on Halloween, which of course features an eerie (but not scary-we hope) moon in the sky.

The school presentation will include both of these presentations with a star and constellation point-out between the two mini-shows. The full combined presentation will last for about one hour.

## One Month = One Moonth!

**From Full Moon to Full Moon = 29 Days and 12 hours.**



# The Face of the Moon

## Maria or Seas:

Mare Australe.....The Southern Sea  
 Mare Crisium.....The Sea of Crises  
 Mare Fecunditatis.....The Sea of Fertility  
 Mare Frigoris.....The Sea of Cold  
 Mare Humorum.....The Sea of Humors  
 Mare Imbrium.....The Sea of Showers  
 Mare Marginis.....The Sea of Margins  
 Mare Nectaris.....The Sea of Nectar  
 Mare Nubium.....The Sea of Cloud  
 Oceanus Procellarum.....The Ocean of Storms  
 Mare Serenitatis.....The Sea of Serenity  
 Mare Tranquillitatis.....The Sea of Tranquility  
 Mare Vaporum.....The Sea of Vapours

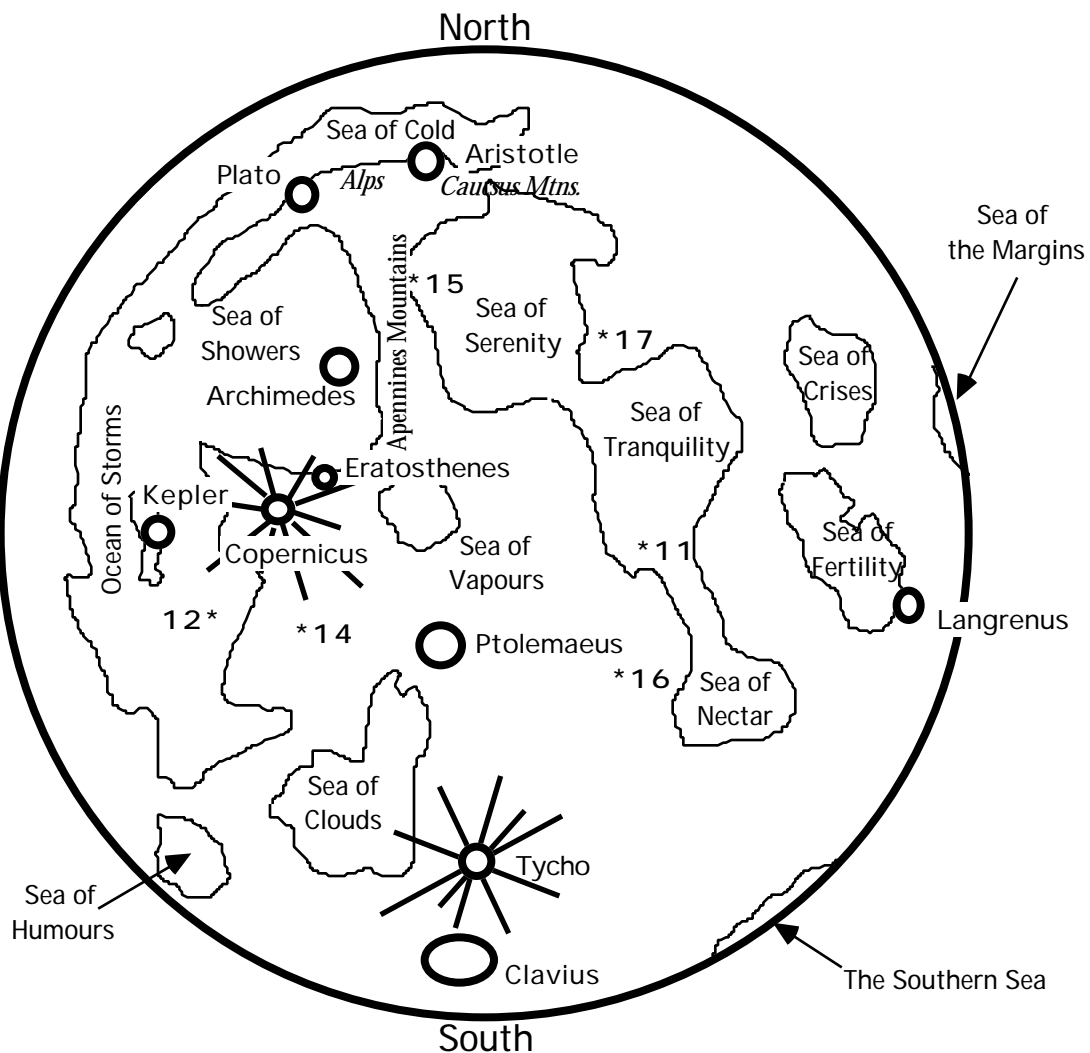
## Craters:

Archimede  
 Aristotle  
 Clavius  
 Copernicus  
 Eratosthenes  
 Kepler  
 Langrenus  
 Plato  
 Ptolemaeus

## Mountains Ranges

*Alps*  
*Apennines*  
*Caucasus*

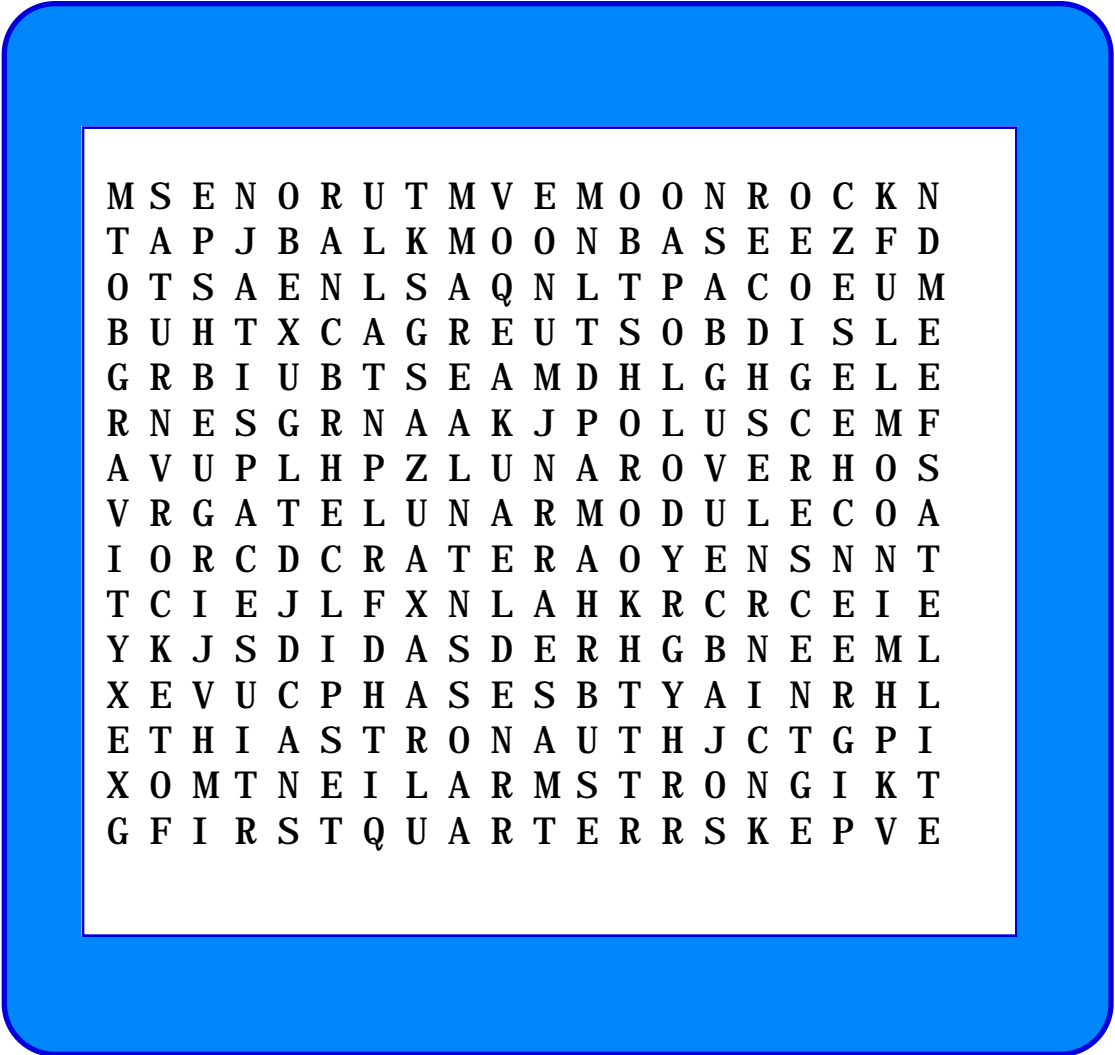
\* Apollo Landing Sites



## Lunar Word Prospecting

Find the lunar words hidden in the puzzle below. The words may be found either horizontally, vertically, or diagonally.

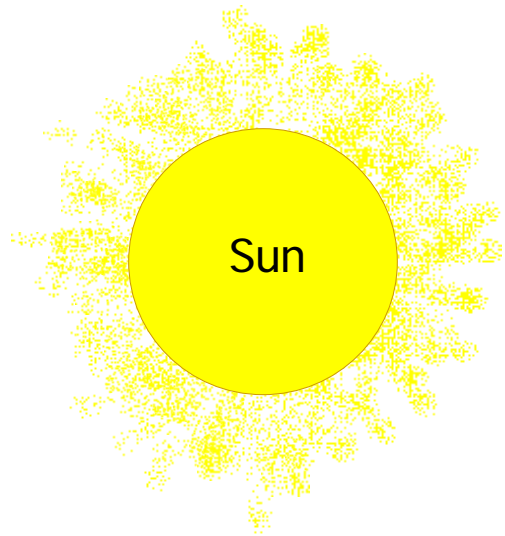
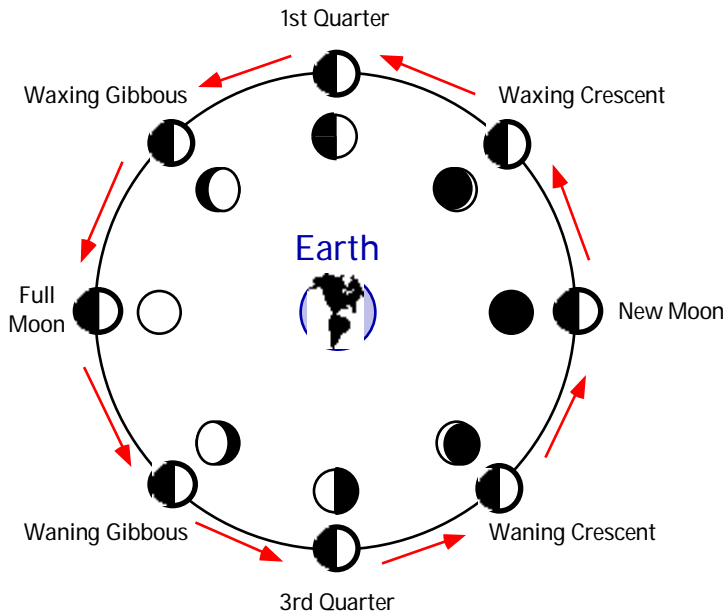
Moonbase Mare Highlands Luna Lunar Module Apollo Phases  
Crescent Rover Eclipse Saturn V Rocket Neil Armstrong Sea  
Crater Ejecta Month NASA Spacesuit Gravity Moonrock  
Earth Satellite First Quarter Astronaut Full Moon Orbit



M S E N O R U T M V E M O O N R O C K N  
T A P J B A L K M O O N B A S E E Z F D  
O T S A E N L S A Q N L T P A C O E U M  
B U H T X C A G R E U T S O B D I S L E  
G R B I U B T S E A M D H L G H G E L E  
R N E S G R N A A K J P O L U S C E M F  
A V U P L H P Z L U N A R O V E R H O S  
V R G A T E L U N A R M O D U L E C O A  
I O R C D C R A T E R A O Y E N S N N T  
T C I E J L F X N L A H K R C R C E I E  
Y K J S D I D A S D E R H G B N E E M L  
X E V U C P H A S E S B T Y A I N R H L  
E T H I A S T R O N A U T H J C T G P I  
X O M T N E I L A R M S T R O N G I K T  
G F I R S T Q U A R T E R R S K E P V E

# The Phases of the Moon

The circles within the orbit show what the Moon looks like from Earth at that phase.  
*Waxing* means “getting bigger.” *Waning* means “getting smaller.”



1. What phase comes after a “1st Quarter Moon”? \_\_\_\_\_
2. What fruit most commonly resembles a Crescent Moon? \_\_\_\_\_
3. If the Moon is “waxing” is its phase getting: BIGGER or SMALLER ?
4. What phase comes just after the Full Moon? \_\_\_\_\_
5. What does the Moon look like at the “New Moon Phase”? \_\_\_\_\_
6. Is a “Waning Crescent” getting: BIGGER or SMALLER ?
7. Which phase of the Moon reflects the most light towards Earth? \_\_\_\_\_
8. What is the common unit of time that relates to one full set of phases? \_\_\_\_\_

## BIBLIOGRAPHY

### Books:

- Cortright, Edgar, Editor, *Apollo Expeditions to the Moon*. Washington D.C.: NASA, 1975.
- Gallant, Roy, *Our Universe*. Washington D.C.: The National Geographic Society, 1986.
- Hadley & Hadley, *Legends of the Sun and Moon*. New York: Cambridge University Press, 1983.
- Hockey, Thomas A., *The Book of the Moon*. New York: Prentice Hall Press, 1986.
- Mullane, Mike, *Do Your Ears Pop in Space?* New York: John Wiley & Sons, 1997.
- Pogue, William, *How Do You Go To The Bathroom in Space?* New York: Tom Doherty Associates, 1985.
- Reynolds & Sweetsir, *Observe Eclipses*. Washington D.C.: Astronomical League, 1995.
- Rükl, Antonín, *Atlas of the Moon*. Waukesha, WI: Kalmbach Publishing Co., 1990.

### Videos:

- Out of This World: The Apollo Moon Landings*. Finely-Holiday Film Corp. 1993.
- Apollo 13*. MCA-Universal Home Video, A Ron Howard Film, 1995.

### Web Sites:

- Apollo 25 Years Later: <http://nssdc.gsfc.nasa.gov/planetary/lunar/apollo11.html>
- Apollo Lunar Surface Journal: <http://www.hq.nasa.gov/alsj/frame.html>
- Nine Planets: <http://seds.lpl.arizona.edu/nineplanets/nineplanets/nineplanets.html>
- Lunar Prospector: <http://lunar.arc.nasa.gov/>
- Clementine Image Library: <http://www.nrl.navy.mil/clementine/clib/>
- Solar Eclipse Stories: [http://live.exploratorium.edu/eclipse/alt\\_index.html](http://live.exploratorium.edu/eclipse/alt_index.html)
- A NASA search engine for all NASA sites: <http://www.nasa.gov/search/>
- NASA's Home Page: <http://www.nasa.gov/>
- Teacher's Guide to the Moon: <http://lunar.arc.nasa.gov/education/tg/teach1.html>



## Astronaut Footprints

The astronauts left many footprints on the surface of the Moon. This picture is of the first step taken on the Moon's surface. Notice how sharp and clean the edges are. It looks like Neil Armstrong just made that print (actually he had when the picture was taken!), but if we were to go back there today, the footprint would look exactly the same.

Why would it look just the same after more than thirty years? Do footprints on the Earth last for thirty years or more? Why?

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## WORDS AND NAMES TO LEARN AND UNDERSTAND:

**APOLLO MISSION:** The name given to the series of spacecraft that made the voyages to the Moon in the late 1960's and early 1970's.

**NEIL ARMSTRONG:** The first person to walk on the Moon on July 20, 1969.

**ECLIPSE:** A phenomena that occurs when the Moon goes directly in front of the Sun. For this to happen the Sun, Moon, and Earth must be in an exact straight line. If the Moon is in the middle, it blocks the Sun's light and creates a SOLAR ECLIPSE. If the Earth is in the middle, Earth blocks the Sun's light from hitting the Moon and creates a LUNAR ECLIPSE. The Sun is never in the middle of this line-up!

**HIGHLANDS:** The area on the Moon's surface that appears white from the Earth. It is made up of hills, mountains, valleys, craters, and generally rugged terrain. The rocks in the highlands are much older than the rocks in the *maria*.

**LUNAR PROSPECTOR:** A space probe that was launched on January 6, 1998. It initially orbited the Moon at an altitude of just 60 miles. It was designed to study the geology of the Moon. It *discovered water-ice deep* in craters near the Moon's poles. This discovery might one day enable people to more easily build a moonbase and live there.

**MARIA:** The plural term for MARE. The mare on the Moon are what appear as dark areas on the Moon's surface. They are not craters, they are level areas created by ancient lava flows. The term "*mare*" actually means "ocean" or "sea" because hundreds of years ago that's what many people thought the dark areas on the mMoon were--lunar oceans.

**PHASES:** The various appearances of the lit side of the Moon as it orbits the Earth. The Moon goes through one complete set of phases for each orbit around the Earth. The phases of the Moon listed in order are: *New Moon, Waxing Crescent, First Quarter, Waxing Gibbous, Full Moon, Waning Gibbous, Third Quarter, Waning Crescent, New Moon.*

**SATURN V ROCKET:** The largest rocket ever built by the United States. It was used to launch the *Apollo* spacecraft to the Moon. It stood 365 feet tall, nearly 200 feet taller than the Space Shuttle!

**WAXING:** To get bigger. The phases of the Moon that get bigger from night to night are said to be the waxing phases. Waxing Crescent, 1st Quarter, Waxing Gibbous.

**WANING:** To get smaller. The phases of the Moon that get smaller from night to night are said to be the waning phases. Waning Gibbous, 3rd Quarter, Waning Crescent.

## 20 QUESTIONS:

1. Why does the Moon change *phases* or shape?
2. How long does it take the Moon to go through one complete set of phases (full Moon to full Moon)?
3. What three objects in space must line up perfectly for an eclipse to happen?
4. What keeps the Moon in orbit around the Earth?
5. What makes craters?
6. Why is looking directly at an eclipse dangerous to your eyes?
7. Does the Moon have gravity?
8. Why does the Moon have more craters than the Earth?
9. How many astronauts have walked on the Moon?
10. Who was the first to step on the Moon?
11. What were his words as he first stepped on the Moon?
12. Who was the second man on the Moon?
13. What are the two different types of eclipses?
14. Does the Moon really follow you when you ride in the car?
15. Where was water-ice found on the Moon's surface in 1998?
16. Why is finding water on the Moon important?
17. Is the Moon really bigger when it is low in the sky than when it is high in the sky?
18. List the Moon's major *phases* in order from *new moon* to *new moon*.
19. What is the "Man in the Moon"?
20. Why are the astronaut's footprints still on the Moon today, even though they were made in 1969?

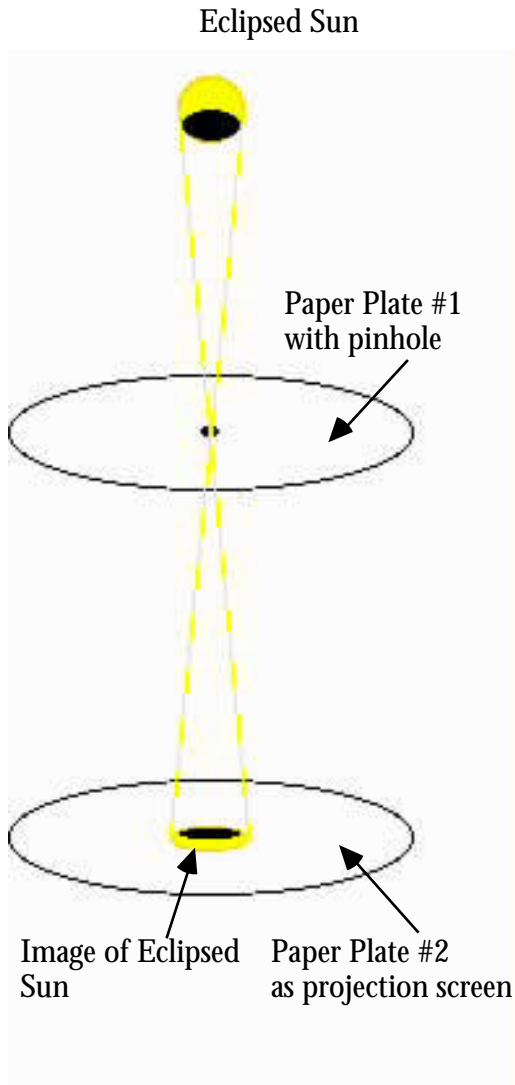


ANSWERS TO 20 QUESTIONS:      ? ? ? ? ? ? ? ?      ! ! ! ! ! ! ! !

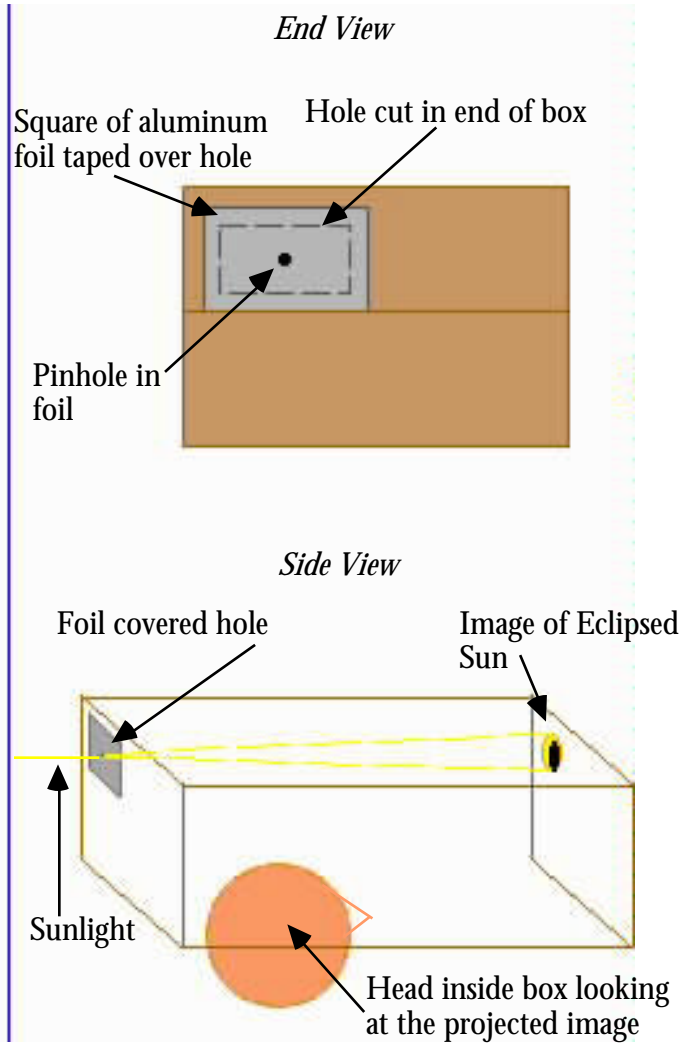
1. The Moon changes shape because of two things. First, the sun only lights up half the Moon at a time--the half that faces the Sun. Second, the Moon revolves around the Earth, this makes us see different parts of the sunlit areas of the Moon's surface.
2. 29.5 days.
3. The Sun, Moon, and Earth must be in a straight line for an eclipse to occur.
4. Gravity.
5. Meteoroids, which are rocks that hit planets and moons. They can be very large (miles in diameter) or very small (specks of dust).
6. Looking at an eclipse is dangerous because whenever you look towards the Sun it can quickly damage your eyes. You can even go blind. NEVER LOOK AT THE SUN!
7. Yes, the Moon has less gravity than Earth, but it does have gravity. The Moon's gravity is 1/6th the gravity of Earth. To find what you would weigh on the Moon simply divide your weight by six.
8. The Moon has no air or weather. On Earth most meteorites are burned up falling through the air due to friction. Even if they do last until they hit the ground and create a crater, the Earth's weather eventually erodes the crater away. On the Moon with neither air nor weather, no meteors burn up, they all hit the surface, and the only thing to destroy old craters is the impact of a new one on top of the old one.
9. 12 astronauts have walked on the Moon's surface.
10. Neil Armstrong.
11. "One small step for man, one giant leap for mankind."
12. Buzz Aldrin.
13. Solar Eclipses and Lunar Eclipses.
14. No. The Moon following you in your car or as you walk is simply an illusion.
15. Evidence of water was recently discovered frozen deep in craters at both the north and south poles of the Moon. There may be as much as six-billion metric tons of water ice in these two regions. This was discovered by the *Lunar Prospector Probe*.
16. Finding water on the Moon is very important for possible future moon stations or even colonies, because it means that water would not have to be brought there from earth which is very expensive. Water is needed not only for people, plants, and animals to live, but it can also be used for rocket fuel for launching space ships to other planets.
17. No. The Moon is the same size in the sky no matter where it is. It often looks bigger when it is down low because it is near the horizon which gives us something to compare it to, but its apparent increased size is an illusion.
18. New Moon, Waxing Crescent, First Quarter, Waxing Gibbous, Full Moon, Waning Gibbous, Third Quarter, Waning Crescent, New Moon.
19. The "Man in the Moon" is not a real man. Some people look at the Moon and say that the dark features that can be seen there (the maria or seas) form the shape of a man's face. Think of it as a "moon constellation". There are many other such imaginary moon constellations: an ant, an old woman knitting, two frogs, a little girl jumping rope, a soldier, a teddy bear, even Wilma Flintstone!
20. The astronauts footprints will forever be on the Moon because there is no air, wind, rain, or weather of any kind to wear it away. The only things that might destroy the footprints would be if a meteoroid should hit the Moon in the same spot as a footprint, or if we go back to the moon and mess them up!

# Two Safe Ways to View An Eclipse of the Sun

## Paper Plate Projection



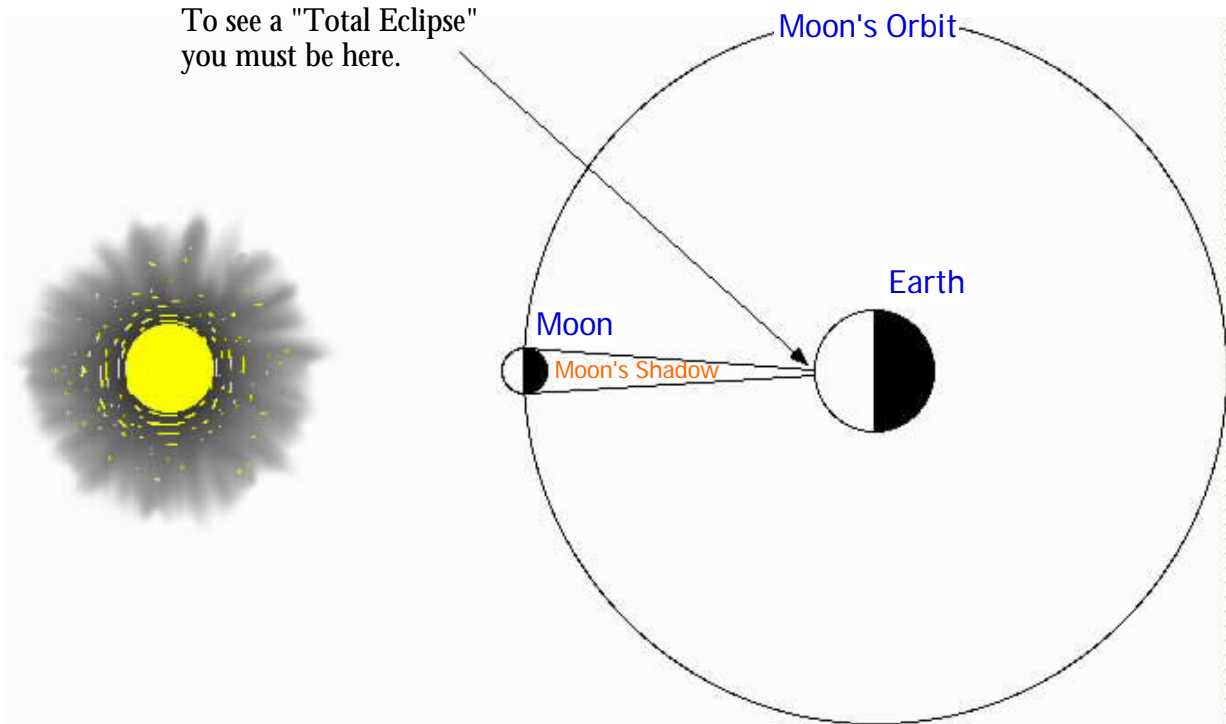
## Box Projection



Remember: **NEVER LOOK DIRECTLY AT THE SUN.**  
It can hurt your eyes in seconds!

## Eclipses and How they Work :

### Solar Eclipse



### Lunar Eclipse

