Phases and Eclipses

Earth & Moon Comparison

Size Ratio

Diameter of the Earth = 12,746 km

Diameter of the Moon = 3,476 km

Diameter of Styrofoam Earth = 5 inch

Diameter of Styrofoam Moon = ? inch

---------- = ----------

Answer = _____ inch

Distance Ratio

Diameter of the Earth = 12,746 km

Earth-Moon Distance = 384,400 km

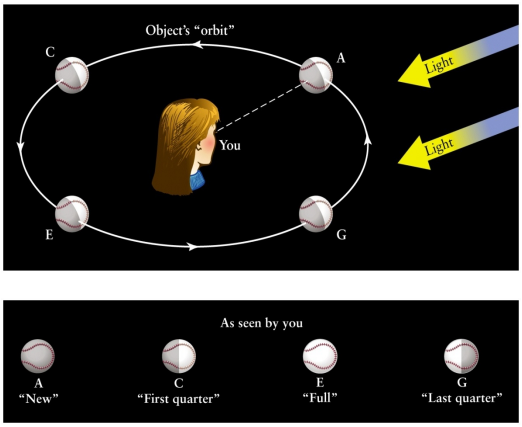
Diameter of Styrofoam Earth = 5 inch

Styrofoam Earth-Moon Distance = ? inch

---------- = ----------

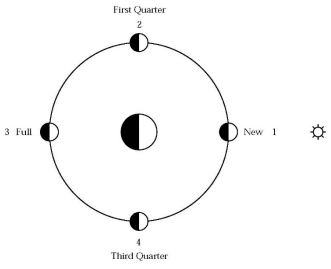
Answer = _____ inch = _____ feet

Shadows = Phases



Phases of the Moon

View from High Above
the Earth's North Pole



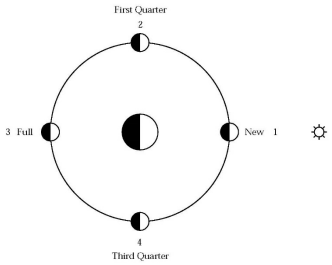
Phase depends only on the orientation of the Moon to the Earth and Sun.

It does not matter what time of day it is.

For example, the Moon is Full at position 3 whether it is noon or midnight on the Earth.

Angles of the Moon

View from High Above
the Earth's North Pole

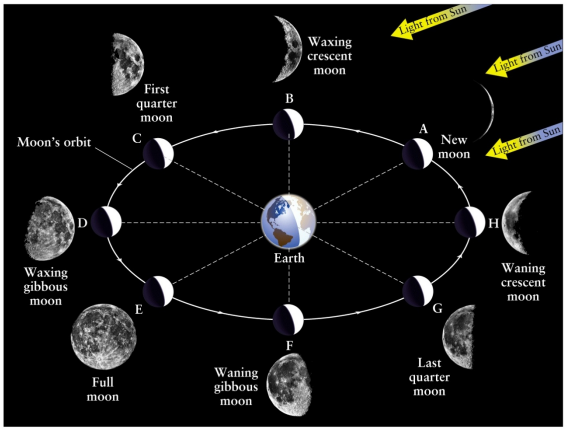


1. What is the angle from New Moon to First Quarter Moon?

2. If it takes 7.5 days to go from New Moon to First Quarter Moon, how many days does it take to go from New Moon to Third Quarter Moon?

3. The time from New Moon to New Moon is about 29.5 days. What else is about this long?

All Lunar Phases



Phases − Check Yourself

Use Figure 2 to answer Questions 4–7.

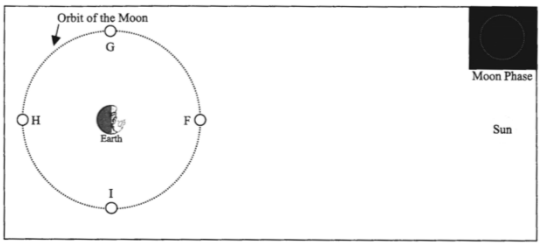


Figure 2

4) Which Moon position (F–I) best corresponds with the Moon phase shown in the upper-right corner of Figure 2?

Enter the letter of your choice: _____

Check Yourself

How much of the *entire* Moon's surface is illuminated by the Sun during New Moon?

a) None of the surface is illuminated.
b) Less than half of the surface is illuminated.
c) Half of the surface is illuminated.
d) More than half of the surface is illuminated.
e) All of the surface is illuminated.

How much of the Moon's illuminated surface is visible *from Earth* during New Moon?

a) None of the Moon's surface (visible from the Earth) is illuminated.
b) Less than half of the Moon's surface (visible from the Earth) is illuminated.
c) Half of the Moon's surface (visible from the Earth) is illuminated.
d) More than half of the Moon's surface (visible from the Earth) is illuminated.
e) All of the Moon's surface (visible from the Earth) is illuminated.

Time − Think About It

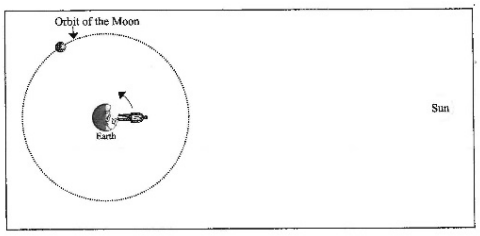
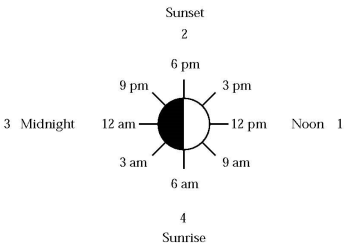


Figure 1

6) What time is it for the person shown in Figure 1?

Circle one: 6 A.M (sunrise) 12 P.M. (noon) 6 P.M. (sunset) 12 A.M (midnight)

Times of Day



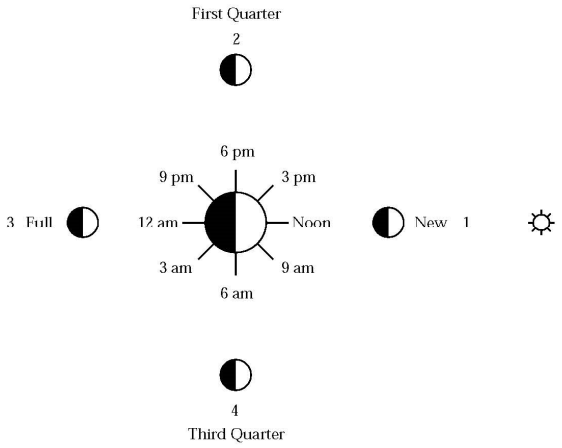
☼

The time of day depends solely on the altitude of the Sun.

The Moon plays no role in establishing the time.

For example, it can be midnight, and the phase of the Moon can be anything.

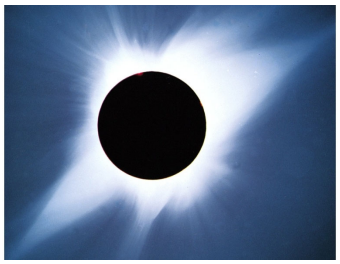
Phases & Times



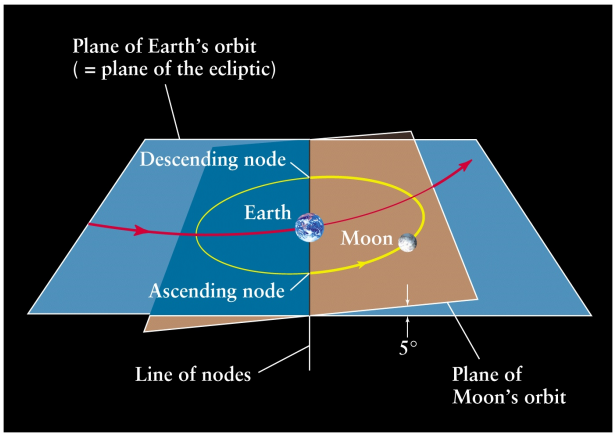
Eclipses

Lunar

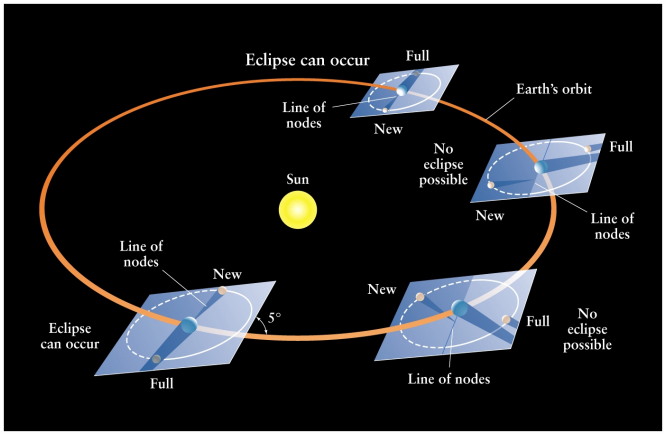
Solar



Inclination of Moon's Orbit



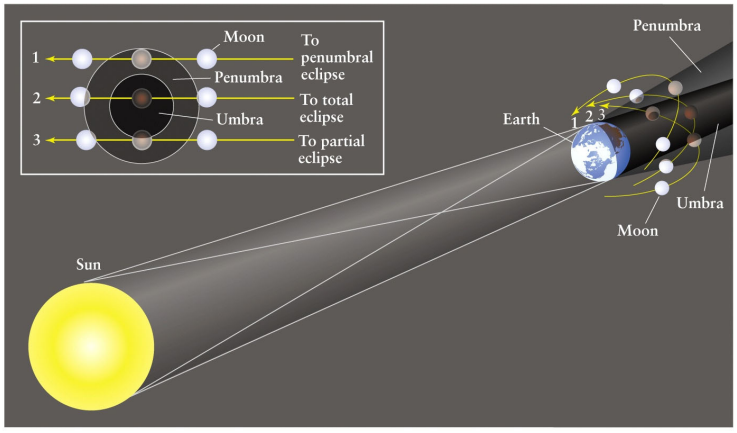
Conditions for Eclipses



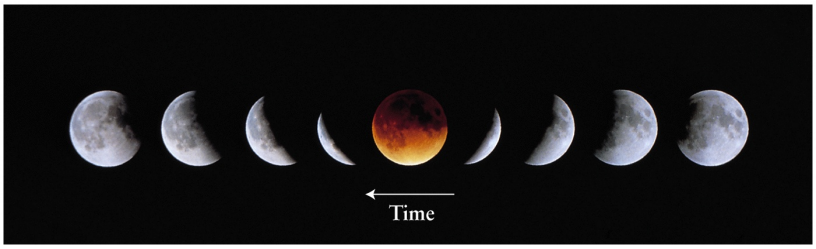
Eclipse Side View

Diameter of the Earth = 12,746 km	5 inches
Earth-Moon Distance = 384,400 km	12.5 feet
Diameter of the Moon = 3,476 km	1.25 inches
Earth's Shadow (1°)	2.5 inches
Moon's Highest Offset (5°)	13 inches

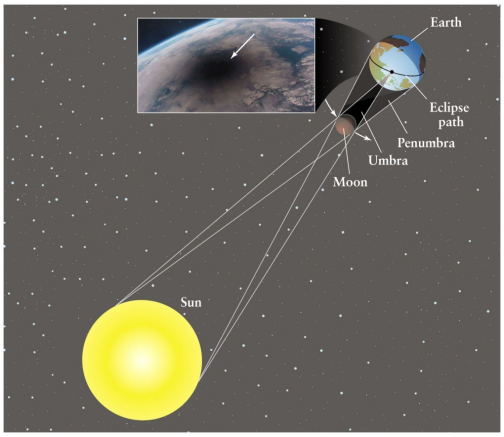
Geometry of Lunar Eclipses



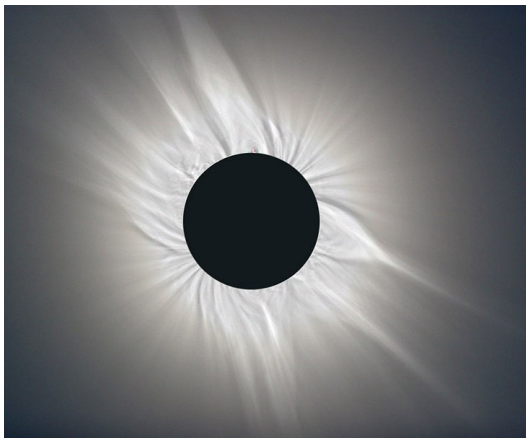
A Total Lunar Eclipse



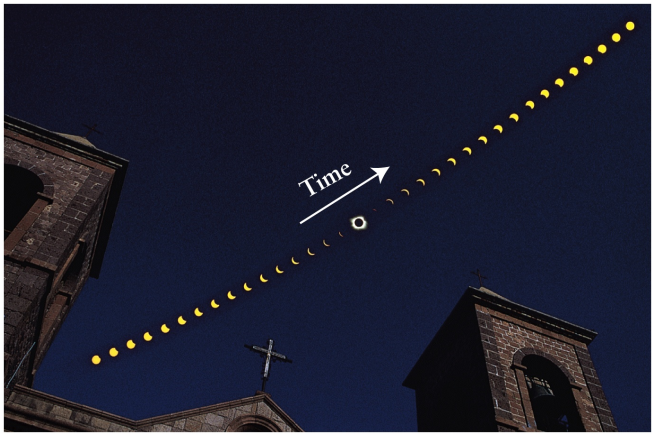
Geometry of Solar Eclipses



A Total Solar Eclipse

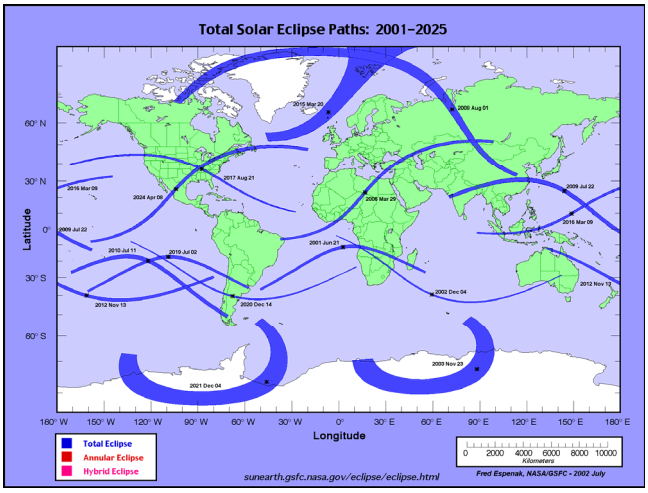


A Total Solar Eclipse

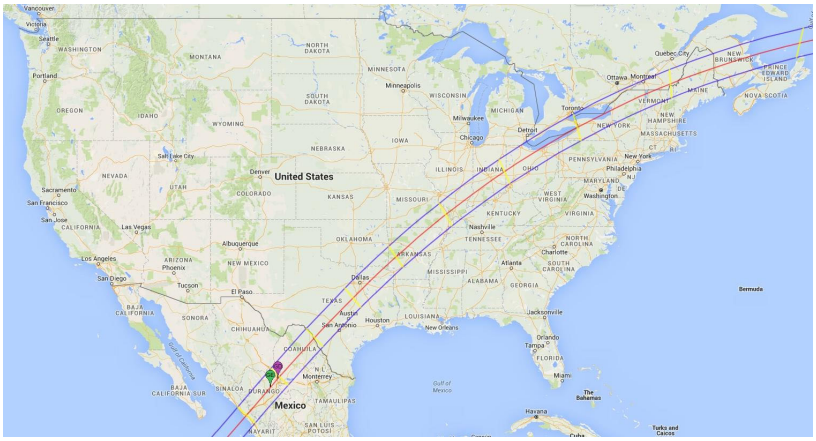


An Annular Solar Eclipse

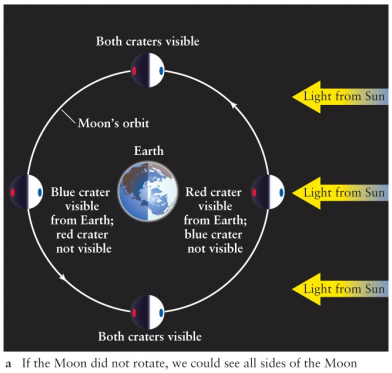
Eclipse Paths



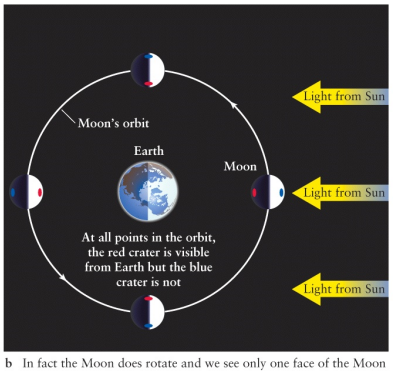
Eclipse Paths



Moon's Rotation

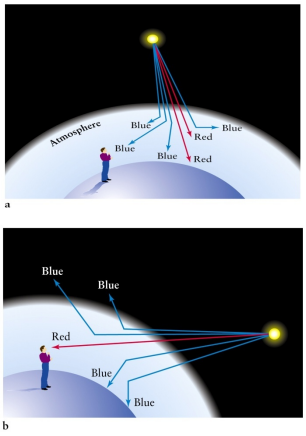


a If the Moon did not rotate, we could see all sides of the Moon

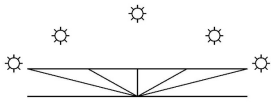


b In fact the Moon does rotate and we see only one face of the Moon

Why is the Moon Red Sometimes?



Only Red light passes through a thick atmospheric path, i.e., when the Moon is low.



Why is the Moon Large Sometimes?

Optical Illusion?

Eye works differently depending on the viewing angle?

Ground items give a frame of reference?

Other hypotheses?

How to test whether or not it is bigger near the horizon?