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

\[ \text{Answer} = \frac{5}{?} \text{ inch} \]

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

\[ \text{Answer} = \frac{5}{?} \text{ inch} = \frac{5}{?} \text{ feet} \]
Shadows

Object is "white"

As seen by you
A "New"
B "First quarter"
C "Full"
D "Last quarter"

Phases of the Moon

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

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?

Check Yourself

How much of the entire Moon’s surface is illuminated by the Sun during this phase?

- 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 for this phase?

- a) None of the surface (visible from the Earth) is illuminated.
- b) Less than half of the surface (visible from the Earth) is illuminated.
- c) Half of the surface (visible from the Earth) is illuminated.
- d) More than half of the surface (visible from the Earth) is illuminated.
- e) All of the surface (visible from the Earth) is illuminated.
Time – Think About It

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

First Quarter

Third Quarter

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

Videos and Interactives

Interactive Exercises
(http://highered.mheducation.com/sites/007299181x/student_view0/interactives.html)

Seasons Interactive
Lunar Phases Interactive
Eclipse Interactive

"Physics Girl" describes Eclipses
Eclipse Paths
Moon’s Rotation

Why is the Moon Red Sometimes?

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