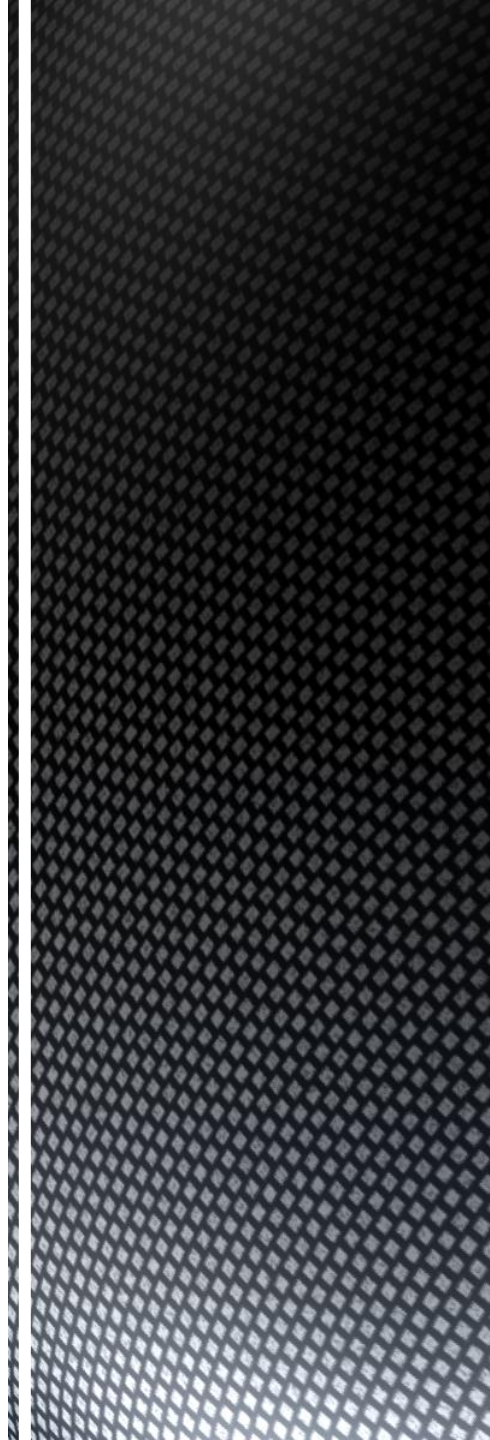


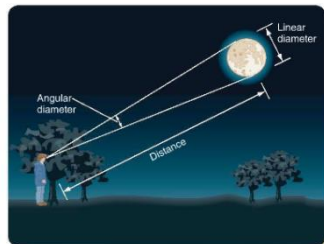
Solar & Lunar Eclipses



Eclipses

Angular Diameter and Distance

- The Moon has about the same _____ diameter as the Sun
 - Even though they are different sizes and distances away
- **Linear Diameter** – the _____ between an object's opposite sides
 - The further away an object is, the smaller the angular diameter
- The Moon's linear diameter = _____ km (2160 mi)



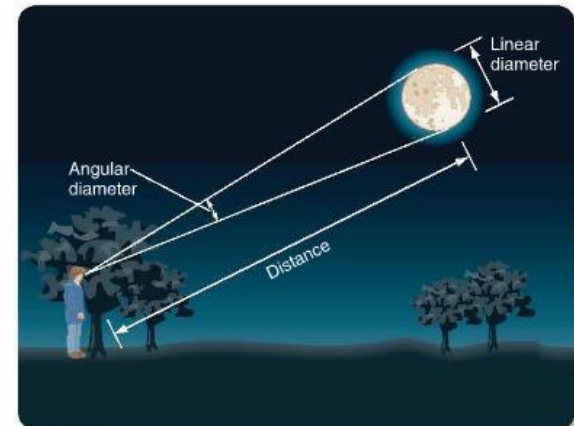
Eclipses

Angular Diameter and Distance

- **Small-Angle Formula** – how to find the angular of an object

$$\text{angular diameter (arc } \underline{\hspace{2cm}} \text{)} = \frac{\text{linear diameter}}{\underline{\hspace{2cm}}}$$

*The units for distance and linear diameter must be the same!



Eclipses

Angular Diameter and Distance

■ Ex: Moon:

angular diameter _____ km

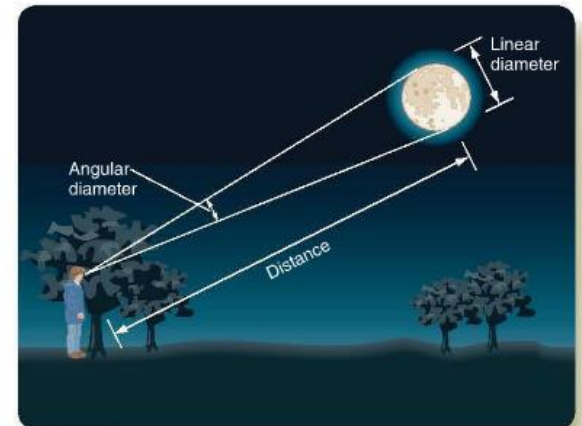
_____ = _____

_____ km

= _____ arc seconds

= _____ arc minutes

= _____ °



Eclipses

Angular Diameter and Distance

■ Ex: Sun:

angular diameter _____ km

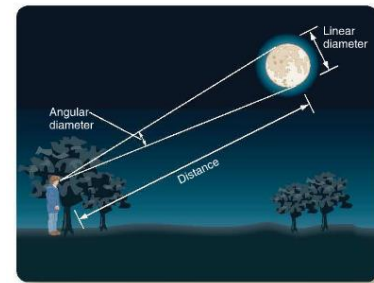
=

2.06×10^5 _____ km

= _____ arc seconds

= _____ arc minutes

= _____ ° ← same as the Moon



Eclipses

Angular Diameter and Distance

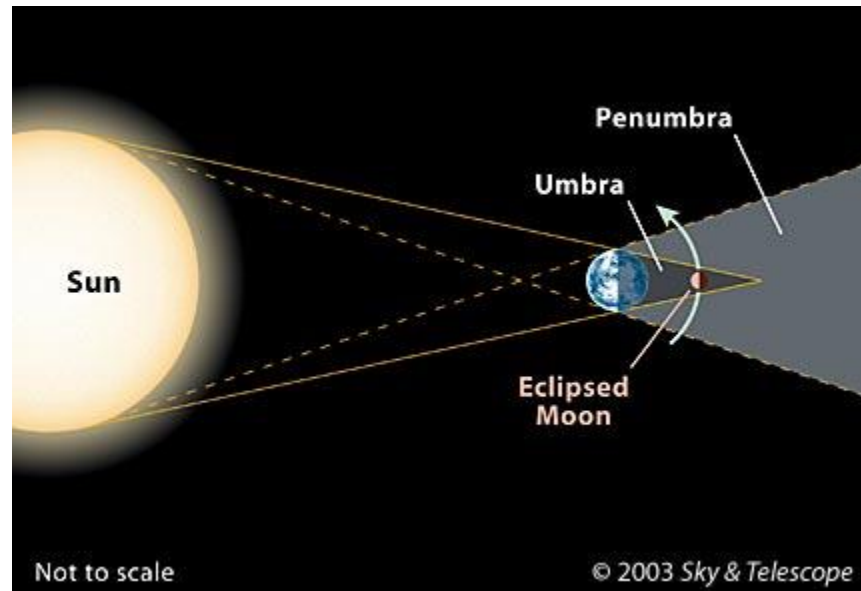
- **Apogee** – Moon's _____ point from Earth
 - Angular diameter = _____ % smaller
- **Perigee** – Moon's _____ point from Earth
 - Angular diameter = _____ % larger



Eclipses

Earth's Shadow

- The moon's _____ is only a few _____ off of Earth's orbit around the Sun
- The Earth's _____ points directly away from the Sun at the same level of Earth's orbit



Eclipses

Earth's Shadow

- **Lunar Eclipse** – can occur at a _____ Moon if the Moon's path carries it through the _____ of Earth
 - sunlight is cut off, and the Moon becomes dim temporarily

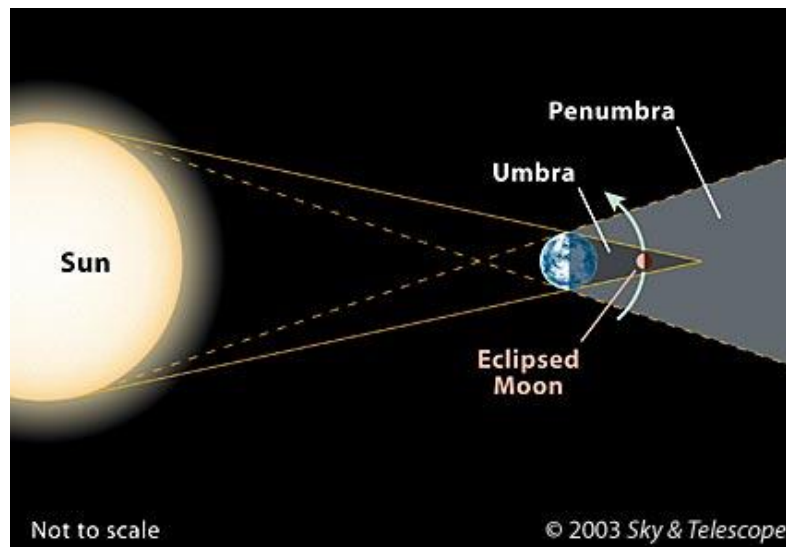


- These are _____ because the Moon usually is slightly north or south of Earth's shadow which is how we get a full Moon to be visible

Eclipses

Earth's Shadow

- **Umbra** – region of _____ shadow
 - The Sun is completely hidden from the Moon behind Earth
- **Penumbra** – _____ shadow
 - Part of the Sun would peek around the edge of Earth
 - Sunlight is dimmed here, but not diminished

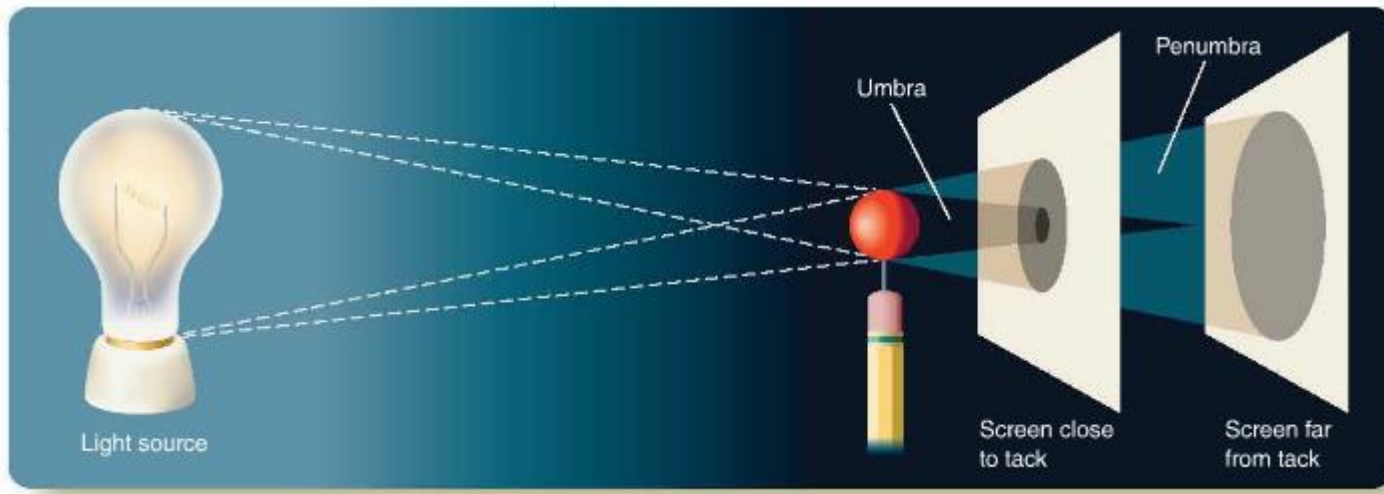


Eclipses

Earth's Shadow

■ Umbra & Penumbra

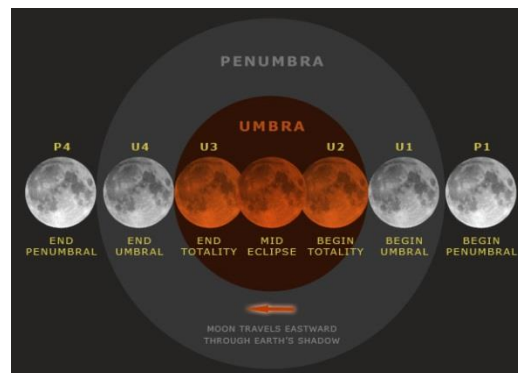
- The umbra is more than _____ longer than the distance to the Moon
- Points _____ from the Sun
- The shadow is plenty big enough to hide the _____ Moon, but only when it lines up correctly



Eclipses

Total Lunar Eclipse

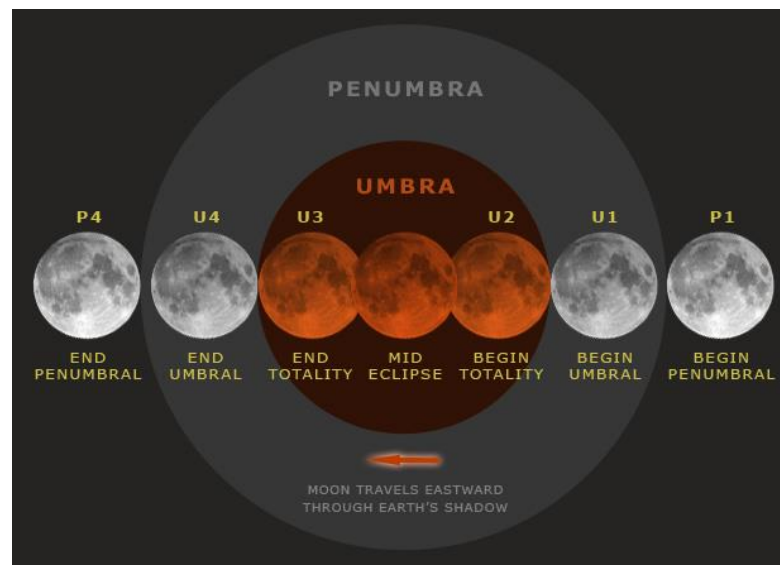
- **Total Lunar Eclipse** – Moon moves through the _____ and is completely covered by the umbra _____
- Moves into the penumbra and dims, then moves into the _____ and gets completely dark with an outer ring
- The Moon will NOT _____ completely because it receives some refracted (_____) light through the atmosphere



Eclipses

Total Lunar Eclipse

- **Totality**– the loss of the _____ sunlight on the Moon due to Earth being in the way
 - The sunlight beams around Earth and through it's atmosphere just like sunrises and sunsets causing a red glow to be casted on the Moon in the umbra
 - That _____ glow reflects off of the Moon and is what we see



Eclipses

Total Lunar Eclipse

- How _____ the eclipse is depends on several factors:
 - The _____ in Earth's atmosphere
 - _____ in the atmosphere from eruptions (volcanoes)
 - Darkest eclipse if the Moon falls directly in the center of the _____
- A total lunar eclipse can take up to 6 _____ in progress from start to finish



Eclipses

Partial and Penumbral Lunar Eclipses

- **Partial Lunar Eclipse** – Moon passes through the penumbra and only _____ of the umbra
 - Don't usually have the red glow like a total eclipse would
- **Penumbral Lunar Eclipse** – Moon passes through the _____ only
 - Tough to see because it's only partially dim
 - Looks very similar to a full Moon

<https://www.timeanddate.com/eclipse/north-america.html>

Eclipses

Solar Eclipses

- **Solar Eclipse** – when the Moon moves _____
Earth and the Sun
 - **Total Solar Eclipse** – when the Moon covers the disk of the Sun

 - **Partial Solar Eclipse** – when the Moon covers only _____ of the
Sun

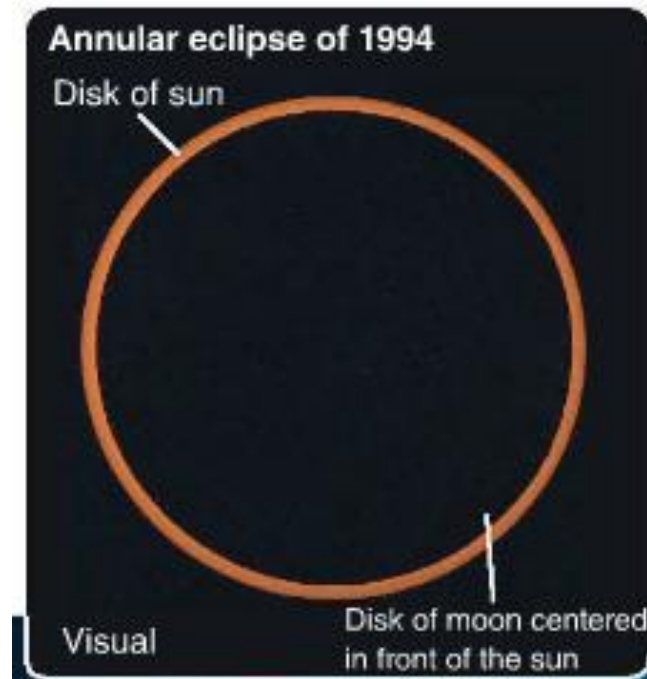
Both are _____ depending!



Eclipses

The Moon's Shadow

- **Annular Eclipse** – _____ eclipse where an annulus (ring) of light is visible around the disk of the Moon
 - The Moon's angular diameter is _____ than that of the Sun, causing the ring



Eclipses

The Moon's Shadow

- Totality during a solar eclipse only lasts about _____ minutes at most
 - Usually about 2 to 3 minutes



Observing an Eclipse

- *Caution!*
 - Even during an eclipse, the surface of the Sun is still able to be seen (either progressing in or out) causing harmful _____ to burn your eyes!

Eclipses

Conditions for an Eclipse

- **Eclipse Season** – when the Sun is _____ to the same spot in the sky as the Moon's _____
 - Eclipse season = about _____ days
 - Any new Moon during that time will produce a solar eclipse and any full Moon will encounter Earth's umbra and be eclipsed

