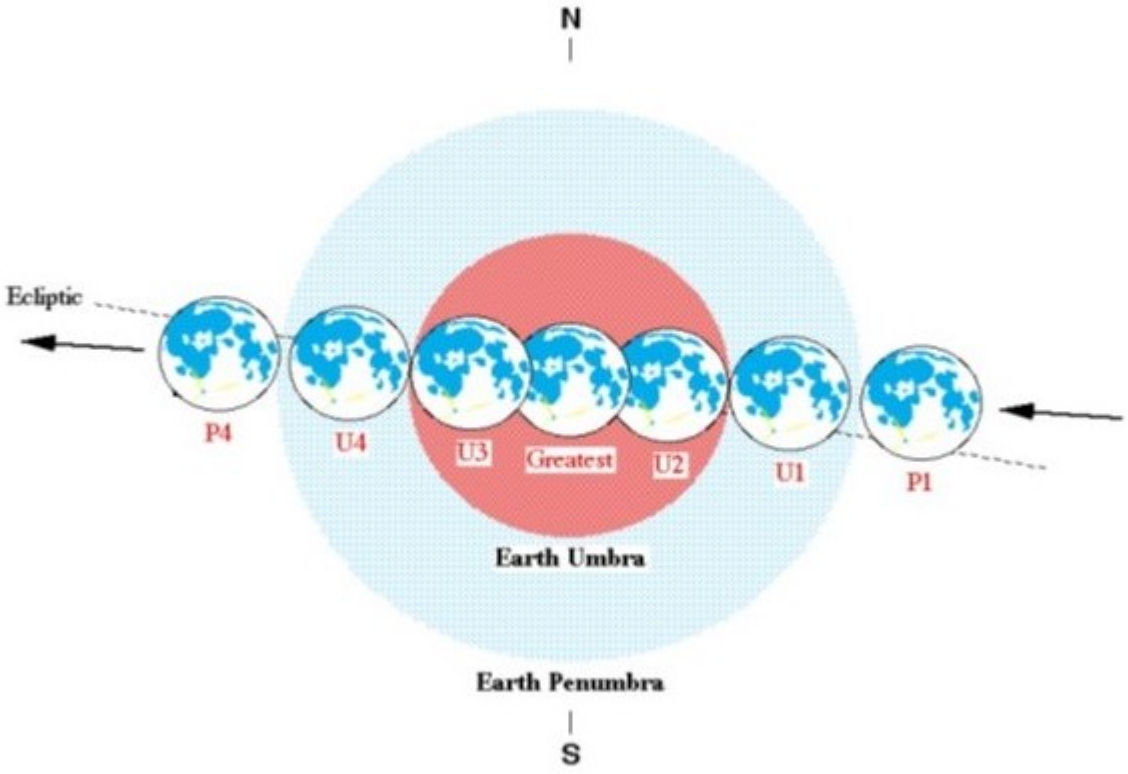
Lunar Eclipse Activity Worksheet

NASA data from the longest lunar eclipse of the last century: July 16^{th}, 2016



Eclipse Contacts

P1 = 10:46:38 UT
U1 = 11:57:17 UT
U2 = 13:02:05 UT
U3 = 14:49:06 UT
U4 = 15:53:55 UT
P4 = 17:04:31 UT

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Moon Diameter

1. How long does it take the moon to travel one moon-diameter (in minutes)?

2. How long does it take for the moon to travel through the Earth's umbra (in minutes)?

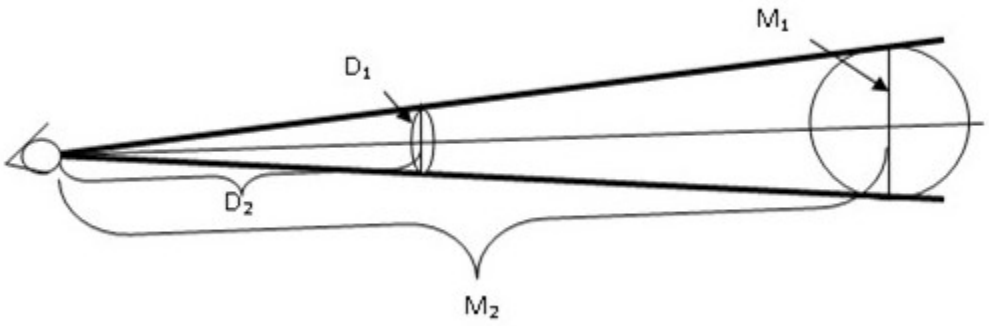
3. How long does it take for the moon to travel through the Earth's entire penumbra (in minutes)?

4. The actual diameter of the Earth is greater than the diameter of the umbra and smaller than the diameter of the penumbra. Use this fact to make a guess as to how long it takes the moon to travel one Earth-diameter.

5. What is the ratio of the Moon's diameter to the Earth's?

6. If the Earth's diameter is actually 7926 miles, what do you calculate the Moon's diameter to be?

Moon Distance



Holding up a coin so that it just covers the moon in our field of vision, we can estimate the distance to the moon. The similar triangles in the diagram give us that $\frac{M_2}{M_1} = \frac{D_2}{D_1}$. This means $M_2 = \frac{M_1 D_2}{D_1}$.

We calculated M_1 above. Now let's go outside (partner up) and measure D_1 and D_2.

$M_1 =$	$D_1 =$	$D_2 =$

Calculating M_2 we get.... | $M_2 =$ |

How good is your estimate???

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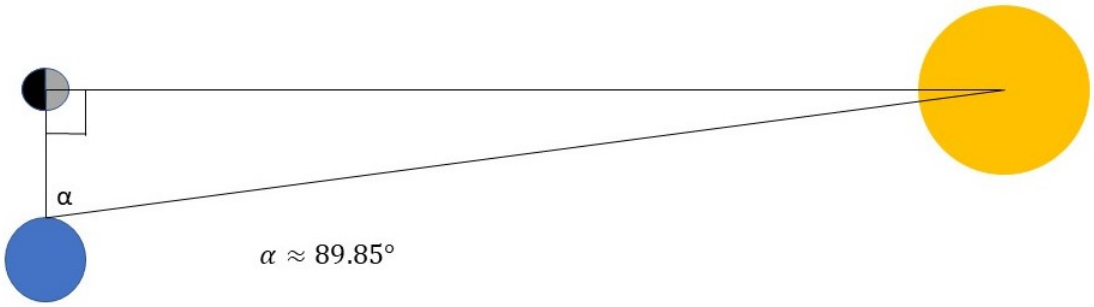
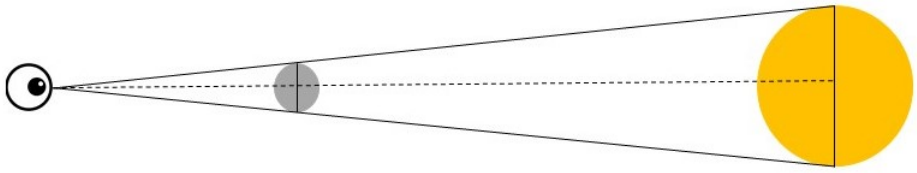
Sun Distance

When the moon is in half-phase the Earth, Moon, and Sun form a right triangle (with the moon at the right angle). Scientists have measured the Moon-Earth-Sun angle to be $\sim 89.85°$.



1. Notice that $\cos(\alpha) = \dfrac{\text{Earth-Moon distance}}{\text{Earth-Sun distance}}$.

   Calculate $\cos(89.85°)$ and use the Earth-Moon distance calculation that you did on the previous page to find the distance to the Sun.



2. During a total solar eclipse, the Moon just perfectly covers the sun in the sky. Use the geometry of similar triangles and the estimates from the previous page find the diameter of the Sun.

3. How good are your estimates???