



**Q. HOW IS THE
MOON LIKE A DOLLAR?**

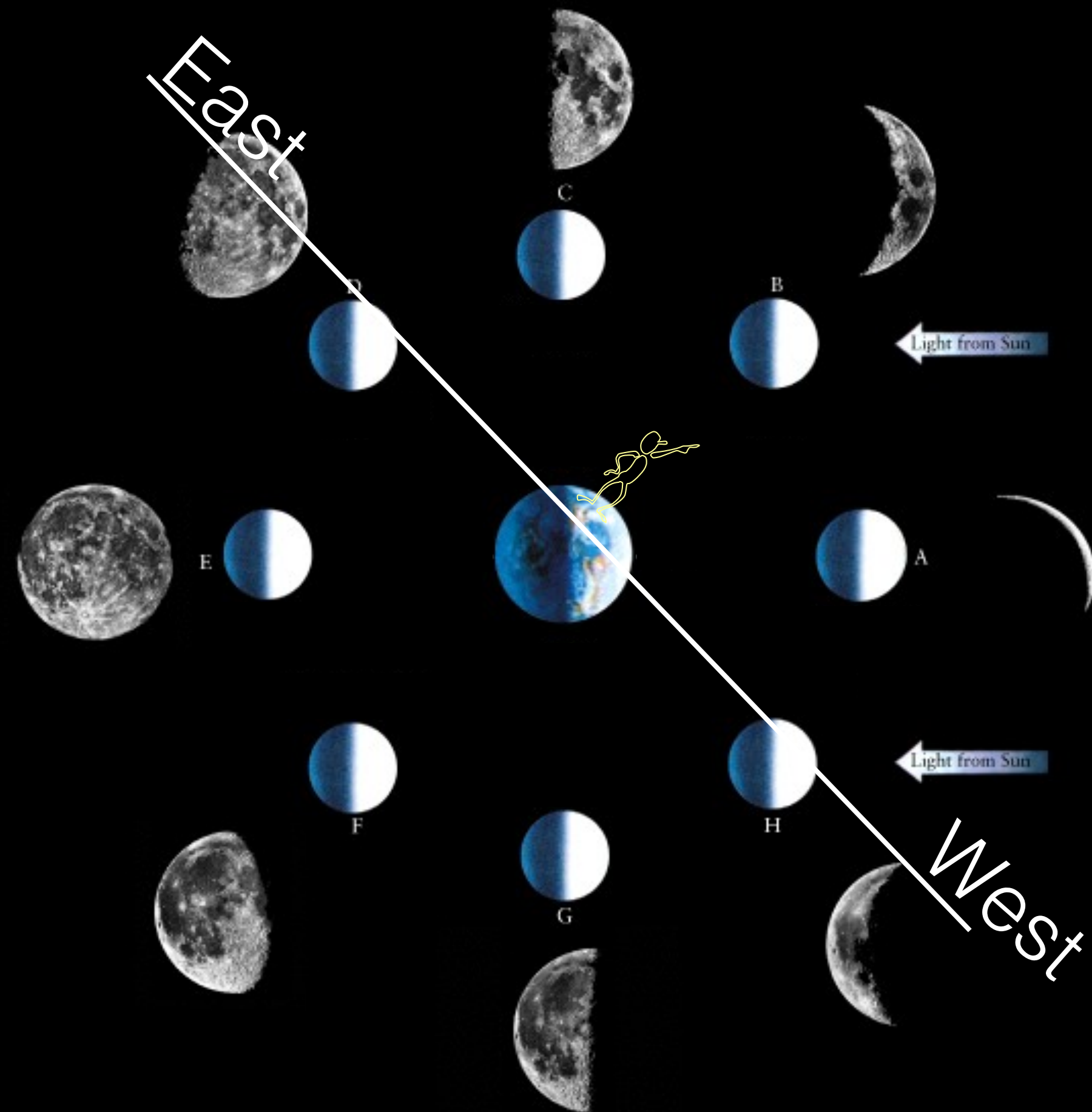
**A. BOTH HAVE
FOUR QUARTERS!**



Moonrise and set times depend on lunar phase

Phase	Rise	Highest Point	Set
New	6 a.m.	Noon	6 p.m.
1st Quarter	12 Noon	6 p.m.	Midnight
Full	6 p.m.	12 Midnight	6 a.m.
3rd Quarter	Midnight	6 a.m.	Noon

Phases of the Moon

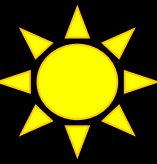
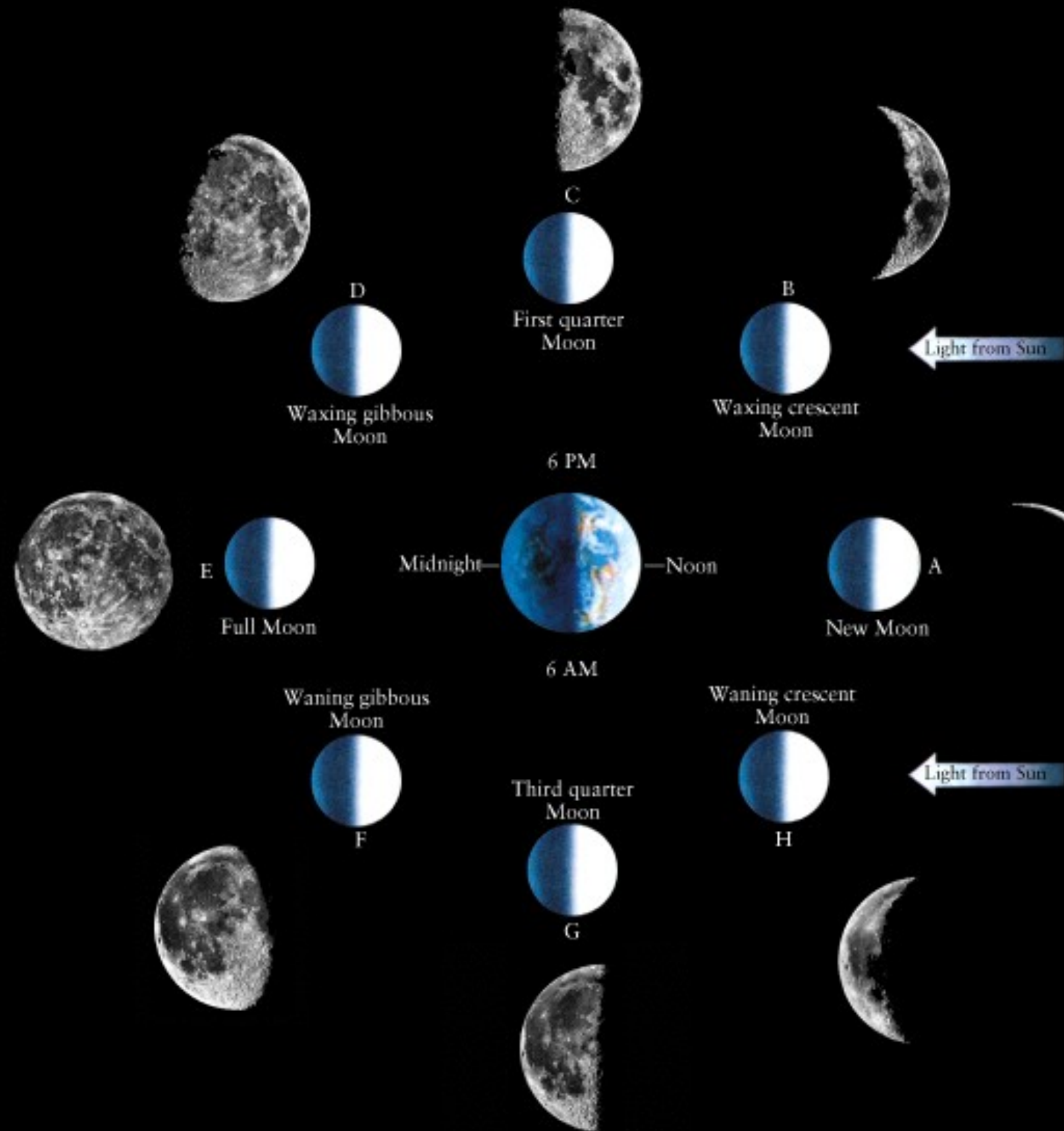


What time is it
when the
waxing
crescent
moon is
highest in the
sky? When
does it first
rise? When
does it set?



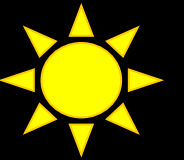
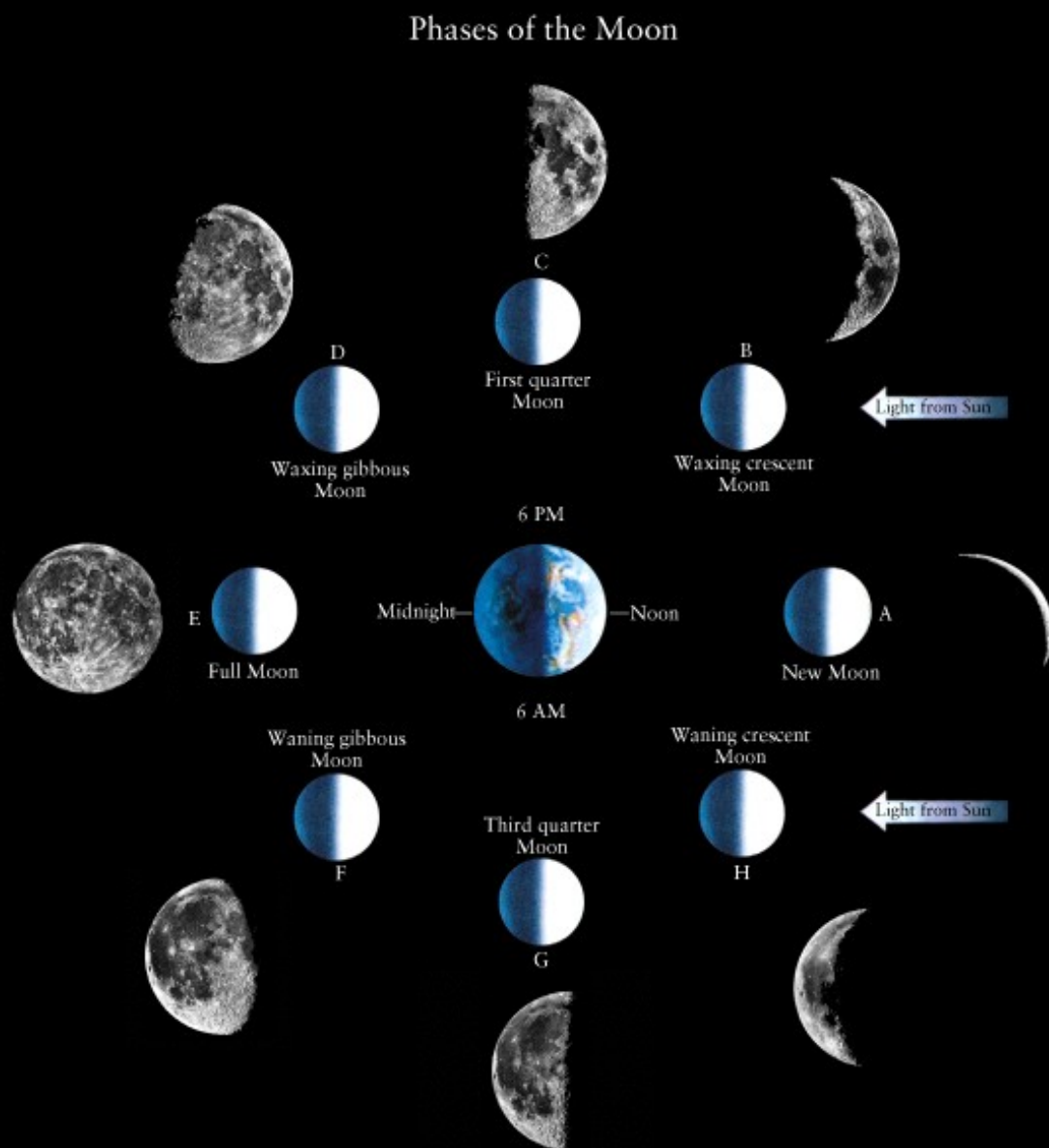
Phases of the Moon

Imagine the moon phase is highest in the sky at 9pm. What phase will the moon be in three weeks after today?



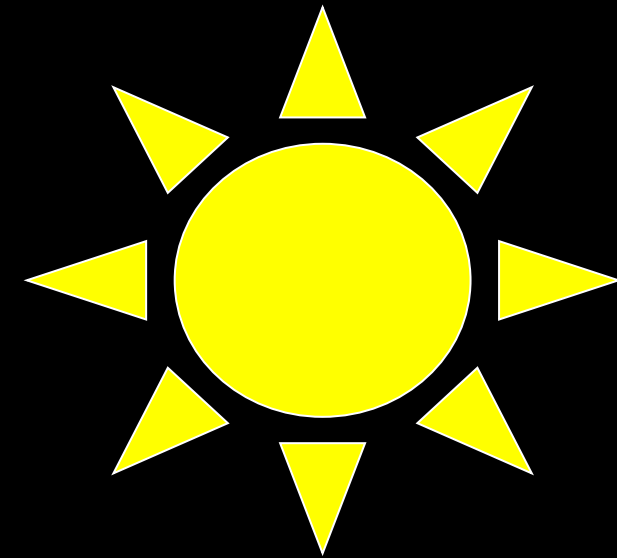
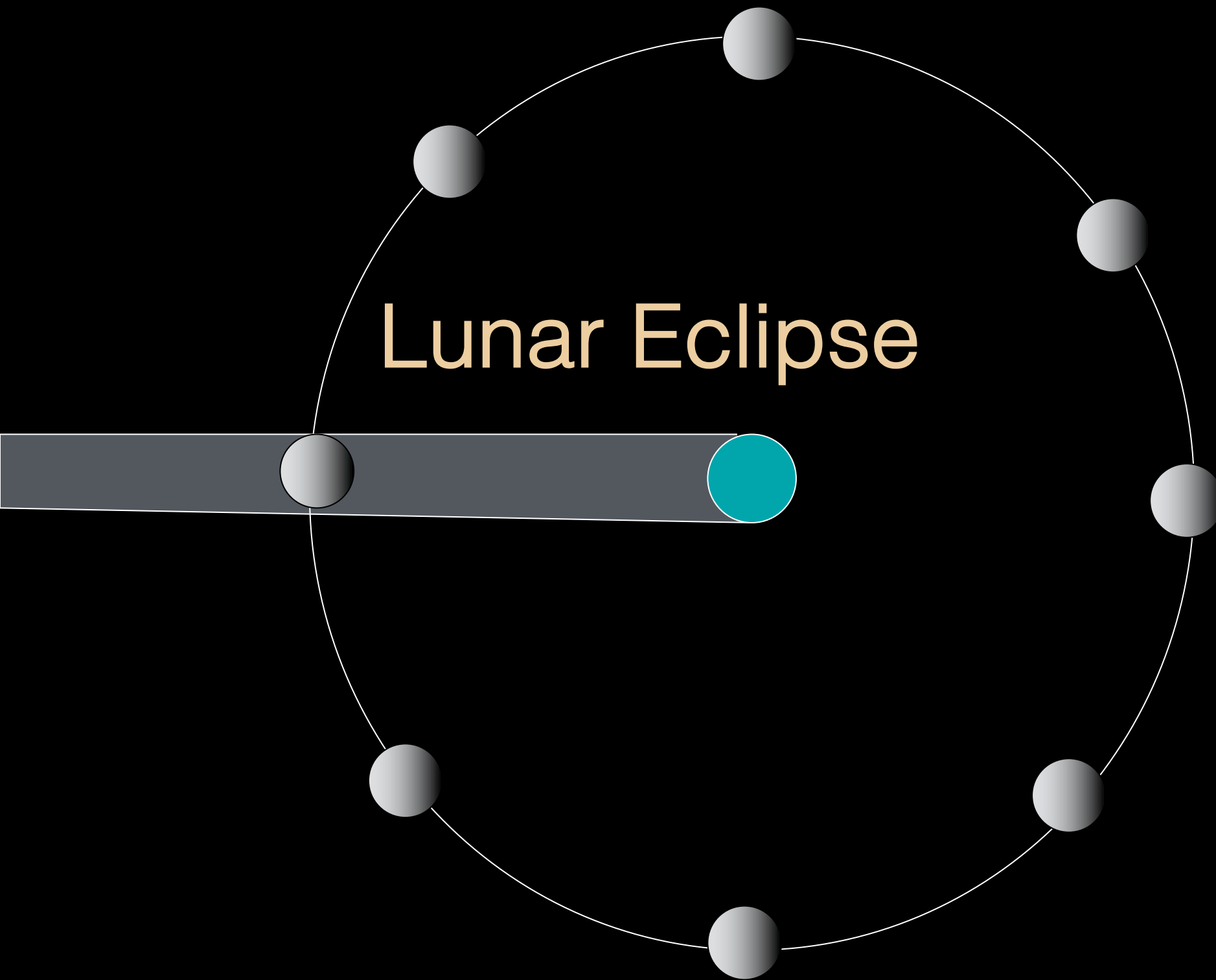
In each phase of the Moon, how much of the Moon is lit up by the Sun?

Half the Moon is always lit by the Sun



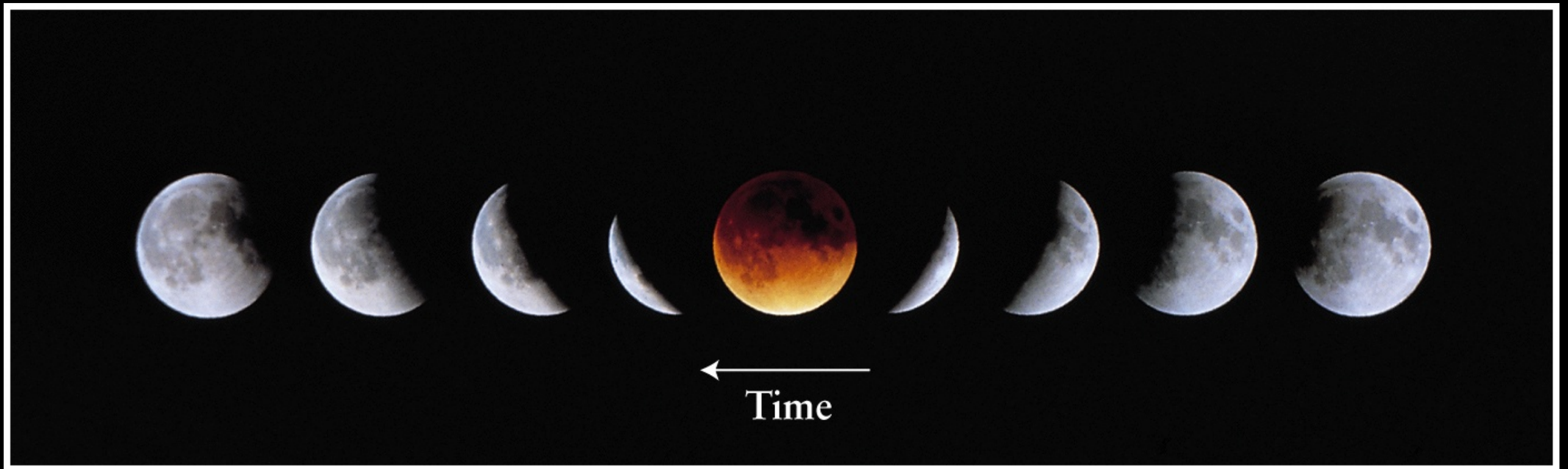
Except . . .

When the Earth's shadow hits the Moon we have a...



Lunar Eclipse

- When Earth blocks most of the sunlight from illuminating the Moons surface for several hours when in the full moon phase



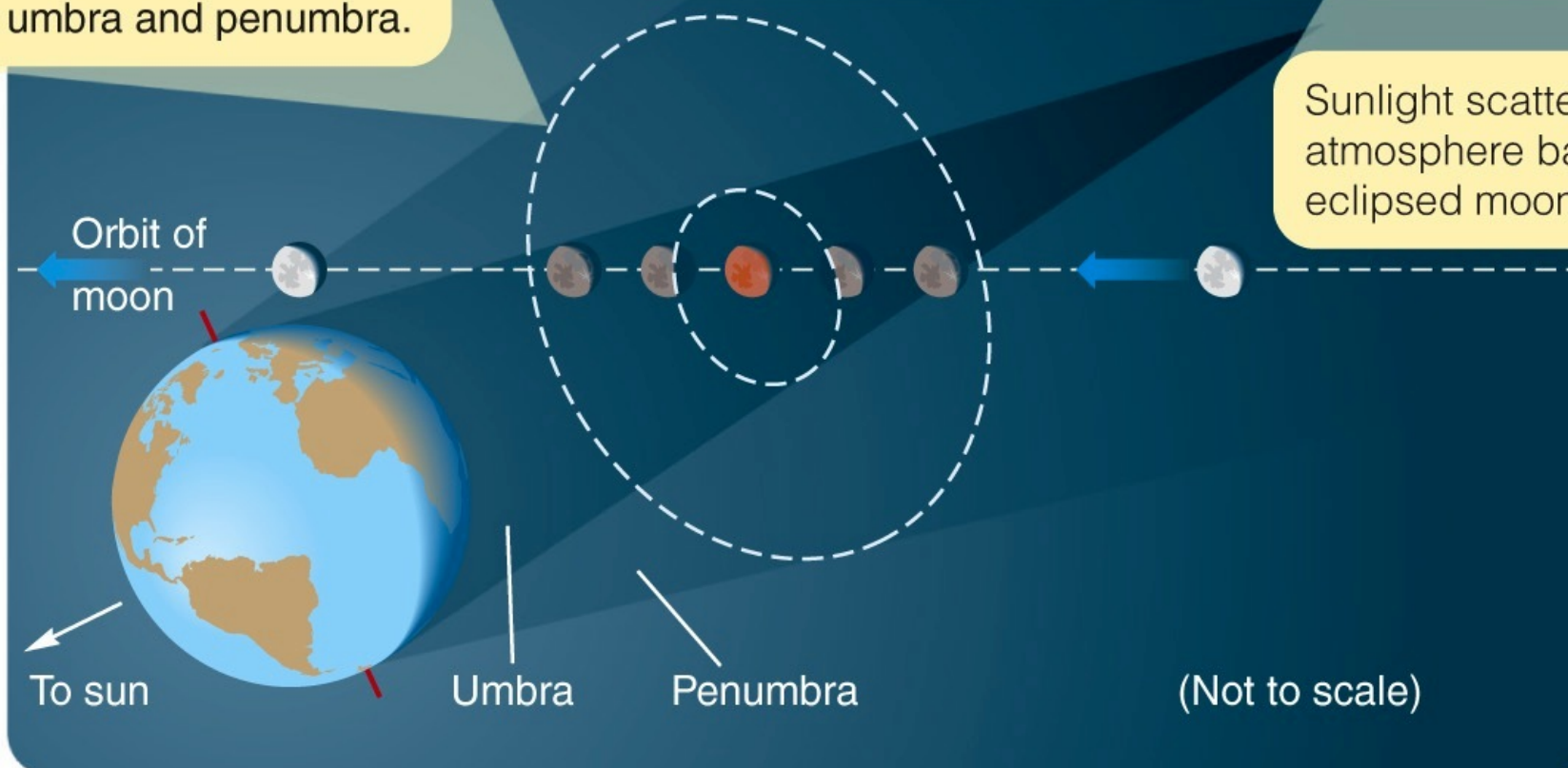
- Question: why does the moon appear red??

Lunar eclipse

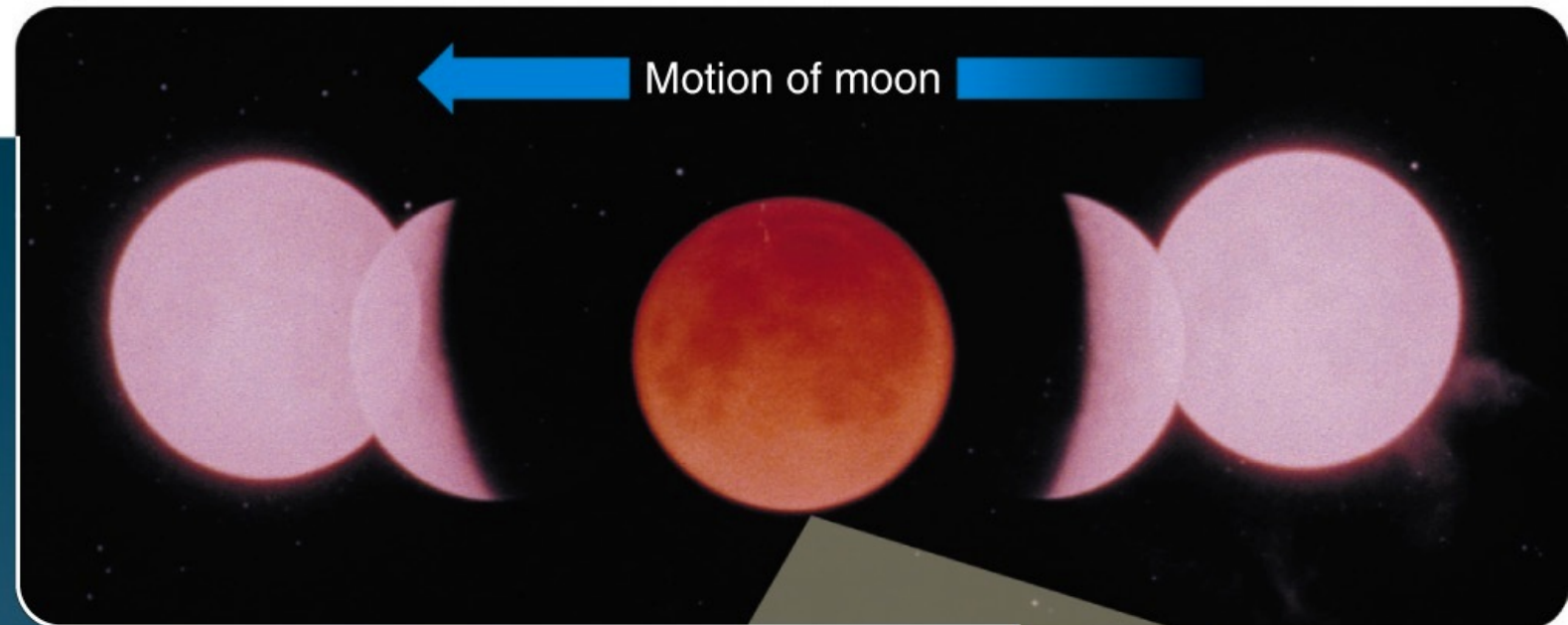
a

During a total lunar eclipse, the moon takes a number of hours to move through Earth's shadow.

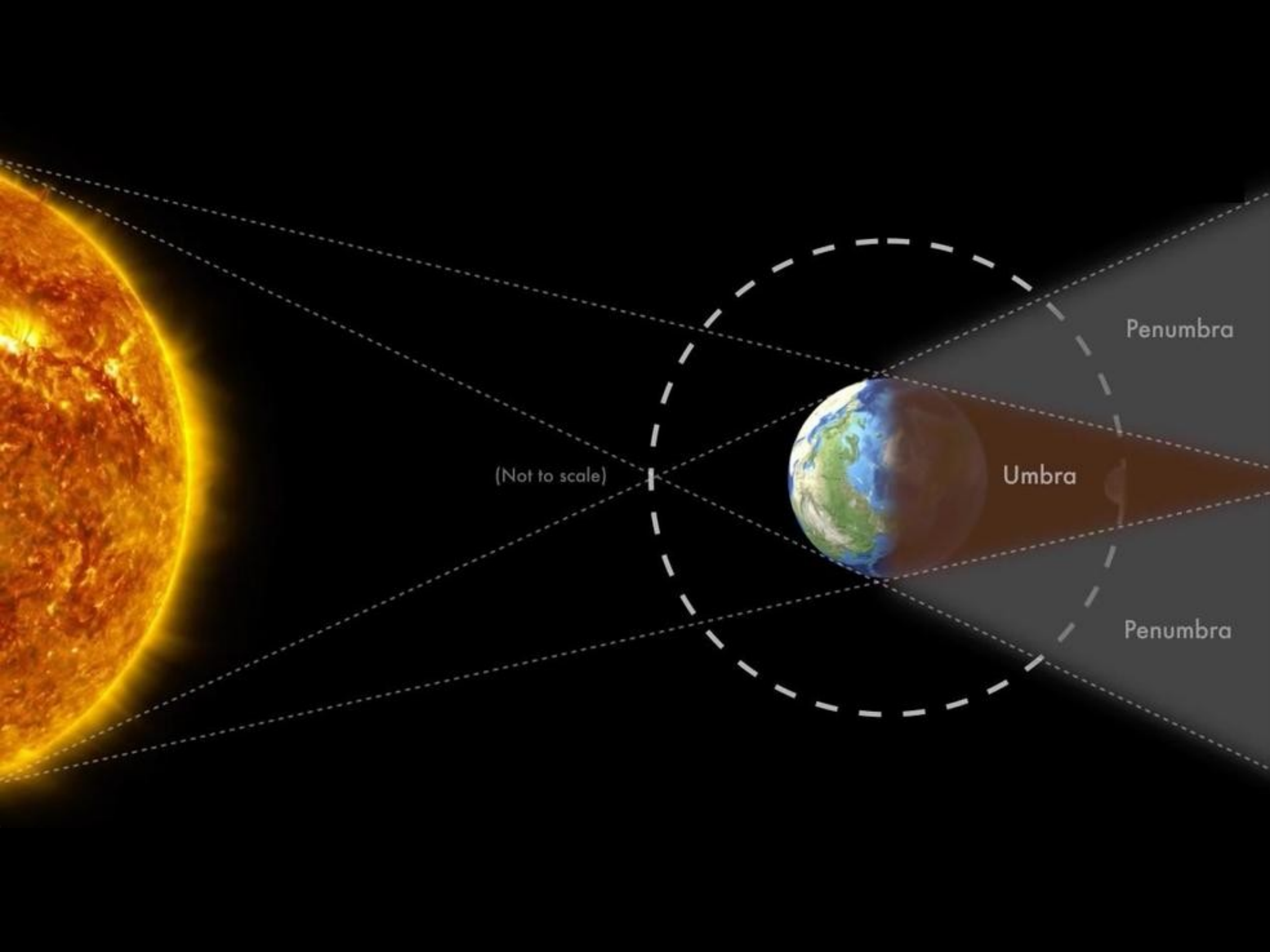
A cross section of Earth's shadow shows the umbra and penumbra.



b



Sunlight scattered from Earth's atmosphere bathes the totally eclipsed moon in a coppery glow.



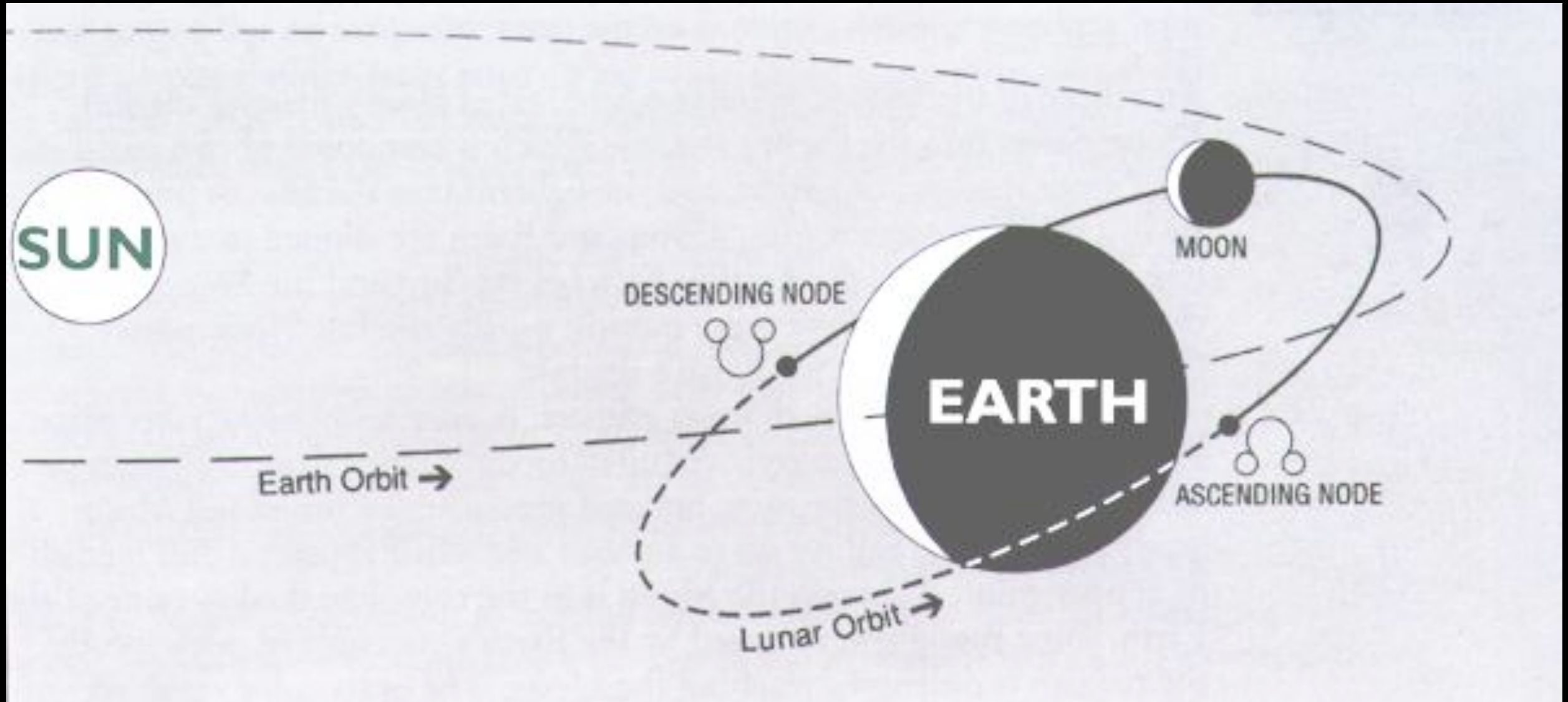
(Not to scale)

Penumbra

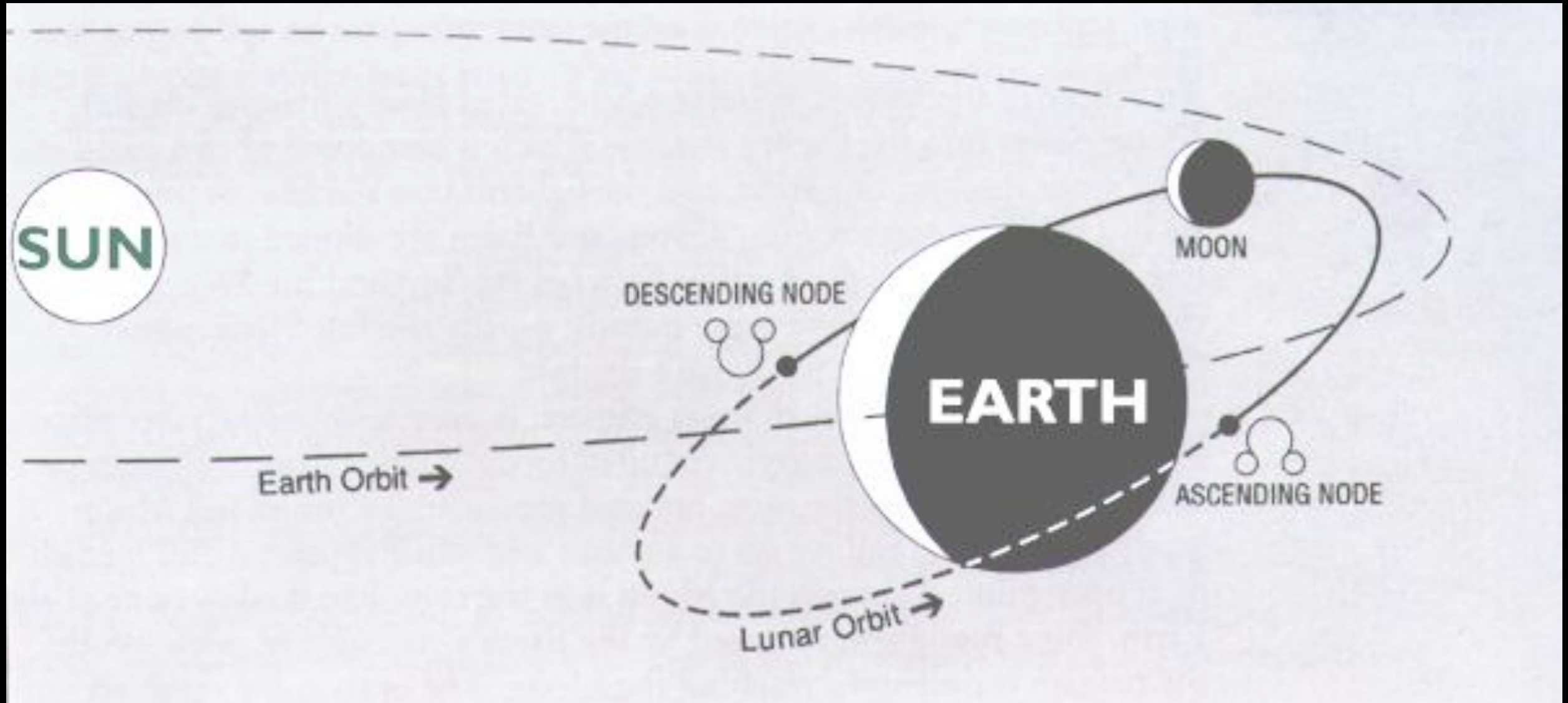
Umbra

Penumbra

Why do we not have eclipses every month?

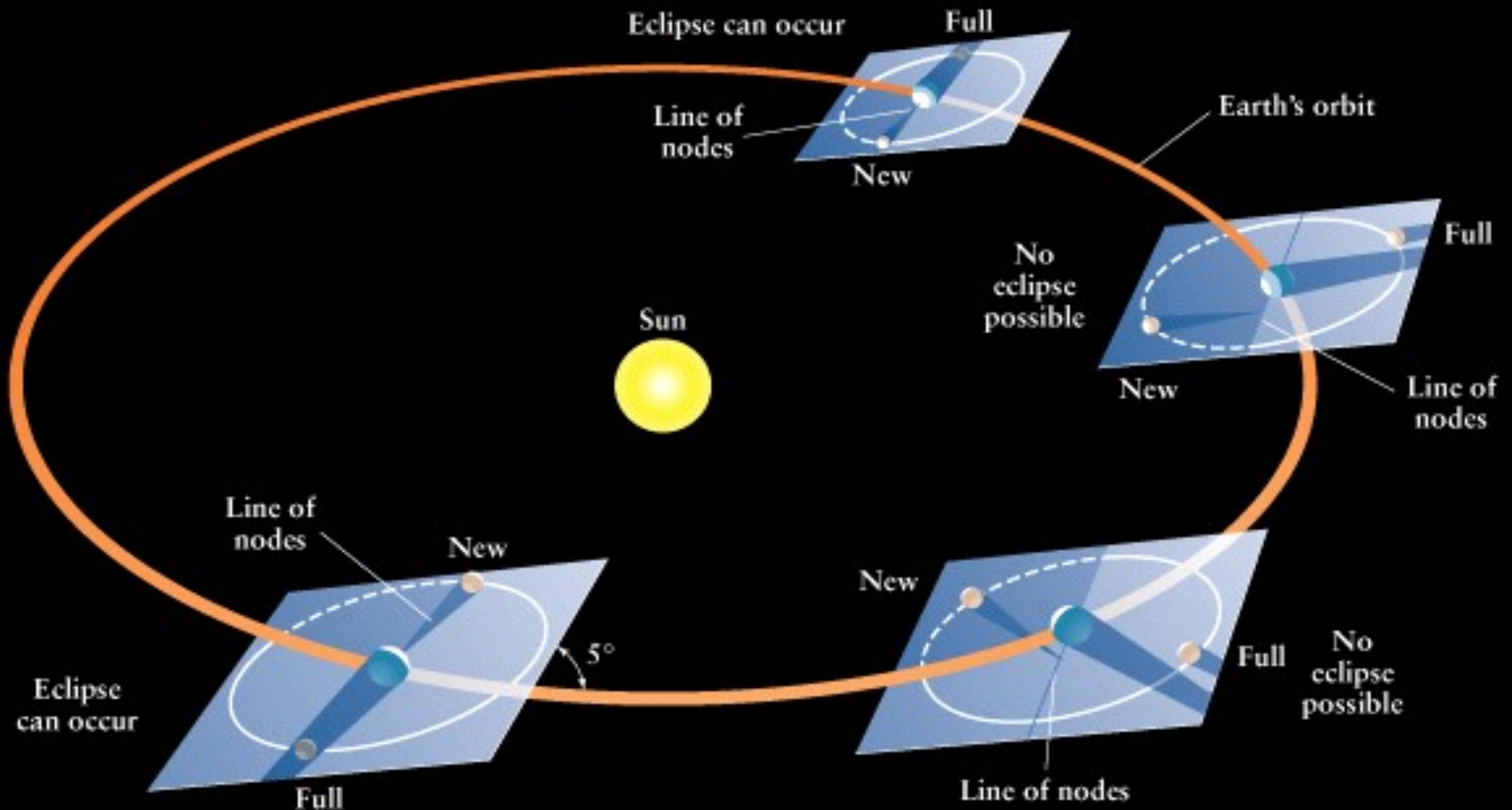


Why do we not have eclipses every month?



The moon's orbit is tilted 5° to the Earth/Sun orbital plane

Eclipses occur **ONLY** when the Moon crosses the plane of Earth's orbit around the Sun **AND ONLY** during the **NEW** or **FULL** phases



Phases of the Moon



How many phases shown in the picture at the right will the Moon go through in one day?

How long does it take the Earth to complete one rotation? How far will the Moon have moved?

How long does it take the Moon to complete one orbit? How many of the phases will the Moon have gone through in this time?

How much of the Moon's total surface is illuminated when it is in the New Phase? Full Phase?

How much of the illuminated surface of the Moon is visible from Earth when it is in the First Quarter Phase, Full Phase?

What time is it when the Waxing Gibbous Phase is highest in the sky, Rising? Setting? What phase will it be in one week later....