

Name: **Key**

# **Astronomy NOTES**

## **OBJECTIVES**

**Correctly define:** asteroid, celestial object, comet, constellation, Doppler effect, eccentricity, eclipse, ellipse, focus, Foucault Pendulum, galaxy, geocentric model, heliocentric model, local time, luminosity, meteor, revolution, rotation, solar system, tides, universe

### **THE UNIVERSE:**

- State that the universe is approximately 10-20 billion years old.
- Explain the Big Bang Theory and give two pieces of evidence which support it.
- Explain the significance of the blue and red shifts.
- Correctly arrange by increasing/decreasing size: universe, galaxies, and solar system.

### **STARS:**

- Identify the main classifications of stars.
- Use the Luminosity & Temperature of Stars diagram on the ESRTs to identify the characteristics of specific stars in relation to Earth's sun.
- Explain the process by which stars generate their energy.

### **THE SOLAR SYSTEM:**

- Differentiate between asteroids, comets, and meteors.
- Identify the key characteristics of each of the planets by the use of the Solar System Data Table on the ESRTs
- Classify the planets as jovian or terrestrial and how those classifications compare with regard to average density, average size, and length of year.
- Calculate the eccentricity of an ellipse and identify the planets with the most and least circular orbits.
- Explain the difference between a heliocentric and geocentric model of the solar system.

## **EARTH'S MOTIONS:**

- Explain and demonstrate the difference between rotation and revolution.
- Be able to calculate the rate of rotation and the movement of celestial objects through the sky.
- Be able to explain the motion of Polaris in the sky as well as the motion of constellations.
- Provide evidence for the Earth's rotation---Focault Pendulum and Coriolis Effect specifically.
- Provide evidence for Earth's revolution---different constellations through the year, specifically

## **MOON:**

- Draw the eight phases of the moon.
- Explain that the phases of the moon are caused by the moon's revolution around the Earth.
- Explain that the tides are caused the by the gravitational attraction of the moon and the sun.
- Explain the difference between neap and spring tides and during which phases of the moon each occurs.
- Explain the difference between lunar and solar eclipses and during which phases of the moon each can occur.
- Explain why the moon rises 50 minutes later each day.

# Vocabulary

<b>Altitude</b>	
<b>Asteroid</b>	
<b>Celestial object</b>	
<b>Comet</b>	
<b>Constellation</b>	
<b>Coriolis Effect</b>	
<b>Doppler Effect</b>	
<b>Eccentricity</b>	
<b>Eclipse</b>	
<b>Ellipse</b>	
<b>Focus</b>	
<b>Foucault Pendulum</b>	
<b>Galaxy</b>	
<b>Geocentric Model</b>	
<b>Heliocentric Model</b>	
<b>Local Time</b>	
<b>Luminosity</b>	
<b>Meteor</b>	
<b>Revolution</b>	
<b>Rotation</b>	
<b>Solar System</b>	
<b>Tides</b>	
<b>Universe</b>	



# Stars

What are the main classifications of stars?

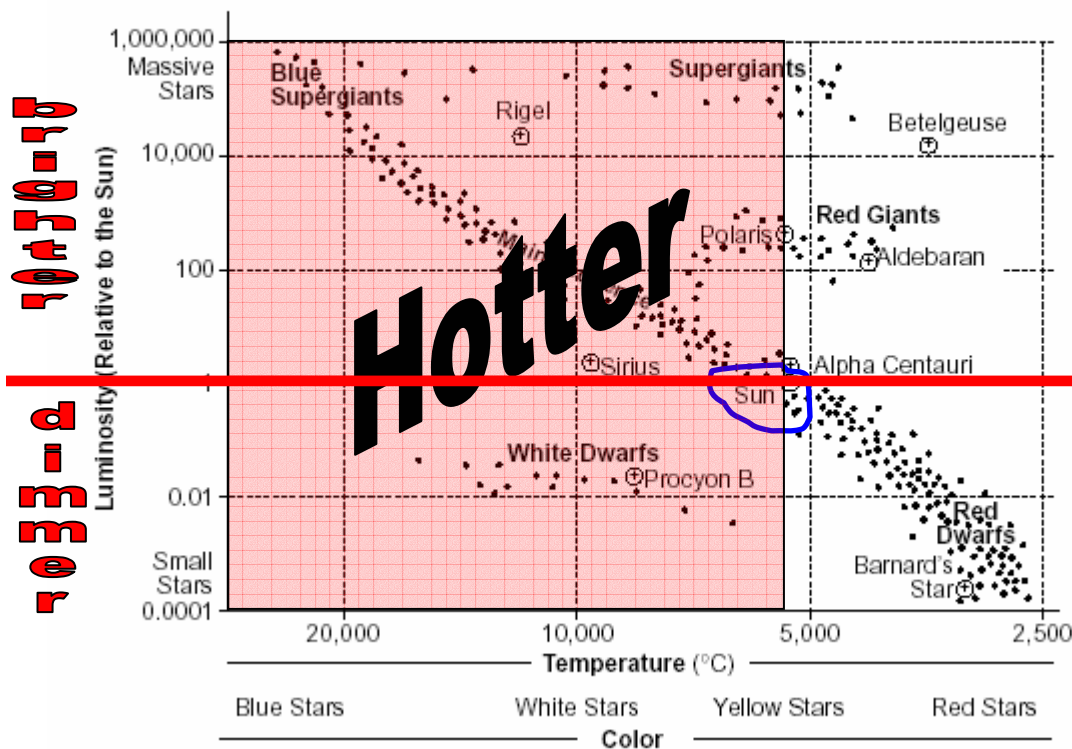
blue supergiants	red giants	main sequence
white dwarfs	red dwarfs	

What two characteristics are used to classify stars?

temperature And luminosity

Luminosity and Temperature of Stars

(Name in italics refers to star shown by a ⊕)



Luminosity is the brightness of stars compared to the brightness of our Sun as seen from the same distance from the observer.

What type of star is our Sun classified as? main sequence Circle where it is on the chart above.

Shade the chart where all of the stars are hotter than our sun.

Draw a line on the chart which separates those stars brighter than our sun and those less bright.

The star Betelgeuse is located in the constellation Orion. What color is it? red

The star Rigel is located in the constellation Orion. What color is it? blue

How do stars generate their energy? nuclear fusion

# Solar System

Explain the difference between

asteroids	comets	meteors
<p>rocky objects with round or irregular shapes</p> <p>lie in a belt between Mars &amp; Jupiter</p>	<p>“dirty snowballs”</p> <p>only visible when close to the sun</p> <p>have a tail</p>	<p>“shooting stars”</p>

Solar System Data

Object	Mean Distance from Sun (millions of km)	Period of Revolution	Period of Rotation	Eccentricity of Orbit	Equatorial Diameter (km)	Mass (Earth = 1)	Density (g/cm <sup>3</sup> )	Number of Moons
SUN	—	—	27 days	—	1,392,000	333,000.00	1.4	—
MERCURY	57.9	88 days	59 days	0.206	4,880	0.553	5.4	0
VENUS	108.2	224.7 days	243 days	0.007	12,104	0.815	5.2	0
EARTH	149.6	365.26 days	23 hr 56 min 4 sec	0.017	12,756	1.00	5.5	1
MARS	227.9	687 days	24 hr 37 min 23 sec	0.093	6,787	0.1074	3.9	2
JUPITER	778.3	11.86 years	9 hr 50 min 30 sec	0.048	142,800	317.896	1.3	16
SATURN	1,427	29.46 years	10 hr 14 min	0.056	120,000	95.185	0.7	18
URANUS	2,869	84.0 years	17 hr 14 min	0.047	51,800	14.537	1.2	21
NEPTUNE	4,496	164.8 years	16 hr	0.009	49,500	17.151	1.7	8
EARTH'S MOON	149.6 (0.386 from Earth)	27.3 days	27 days 8 hr	0.055	3,476	0.0123	3.3	—

## JOVIAN vs TERRESTRIAL:

Draw a line across the table between the terrestrial and jovian planets and label.

Which are more dense?	Jovian	terrestrial
Which have more moons?	Jovian	terrestrial
Which have longer periods of revolution?	Jovian	terrestrial
Which are larger in size on average?	Jovian	terrestrial

## ROTATION vs REVOLUTION:

Which planet has the longest day?	<u>Venus</u>
Which planet has the longest year?	<u>Neptune</u>

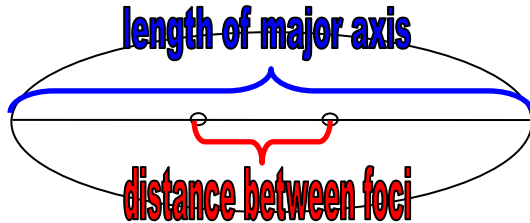
**ECCENTRICITY:**

How are the orbits of the planets described? “slightly eccentric ellipse”

Which planet has the least perfectly circular orbit? Mercury

Which planet has the most perfectly circular orbit? Venus

Calculate the eccentricity of the ellipse below:



Show All Work & Formulas Below

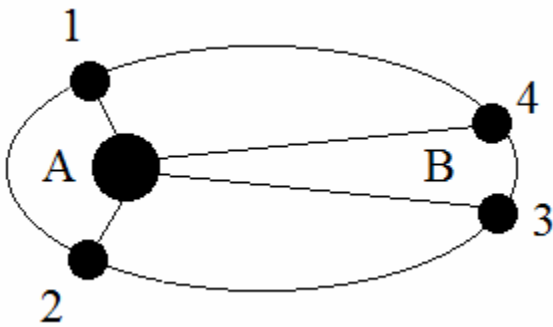
eccentricity =  $\frac{\text{distance between foci}}{\text{length of major axis}}$

=

When does a planet move fastest in its orbit? when it's closest to the sun

When does a planet move slowest in its orbit? when it's furthest from the sun

# Kepler's Second Law



If the time from 1 to 2 is the same as the time from 3 to 4, then the Area of A is the same as Area B.

Explain the difference between the geo- and helio-centric models of the solar system.

geocentric model	heliocentric model
<b>Earth-centered</b>	<b>Sun-centered</b>

# Earth's Motions

How long is one rotation of Earth? one day

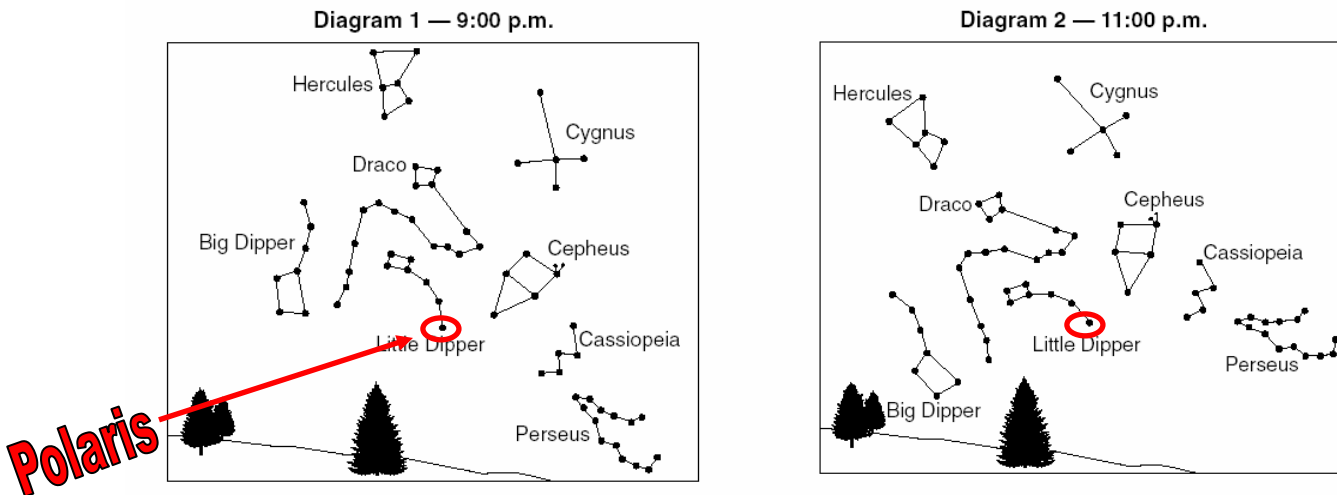
How long is one revolution of Earth? one year

For each of the following events state whether it is caused by the Earth's rotation or revolution:

Rising and setting of the sun:	<u>rotation</u>
Rising and setting of the moon:	<u>rotation</u>
The seasons:	<u>revolution</u>
Changing Constellations:	<u>revolution</u>
Movement of Stars through the sky:	<u>rotation</u>

Show how to calculate the Earth's rate of rotation in degrees per hour.

$$360^\circ \div 24 \text{ hours} = 15^\circ/\text{hour}$$



How many degrees did the stars move from diagram 1 to diagram 2? 30° (15°/hr x 2 hours)

How can you find Polaris? it's the only star that doesn't move

What hemisphere must you be in if you can see these constellations? Why? you must be in the Northern Hemisphere because Polaris can only be seen in the Northern Hemisphere

What direction must you be looking? North

Do the stars appear to move clockwise or counterclockwise? counter-clockwise

What causes them to appear to move at all? Earth's rotation



What evidence do we have that the Earth rotates?

<b>Focault Pendulum</b>	<b>Coriolis Effect</b>
<b>it appears to change direction 15° hour, but it only moves because the Earth is rotating under it</b>	<b>in the Northern Hemisphere, winds and currents are deflected to the right and in the Southern Hemisphere they are deflected to the left</b>

What evidence do we have that the Earth revolves?

<b>Changing Constellations</b>	<b>Parallax</b>
<b>This is the basis for the Zodiac. Only certain constellations are visible at different times of the year</b>	<b>stars appear to slightly change position because we are observing the stars from slightly different distances in space</b>

# The Moon

What are the bright white objects on the surface of the moon?

they are mostly craters from collisions with asteroids and meteors

What are there so many? the Moon has no atmosphere

Why is Earth not like this? erosion, weathering and our atmosphere



Astronomy

# Phases of the Moon

What causes the phases of the moon? the moon's revolution around the Earth

How long does one revolution of the moon take? 27 1/3 days One rotation? 27 1/3 days

What phenomenon does this explain? we only ever see one side of the moon

Why does the moon rise later each day? as the Earth rotates, the moon revolves and we have to move more in space to get the moon to the same exact spot in the sky



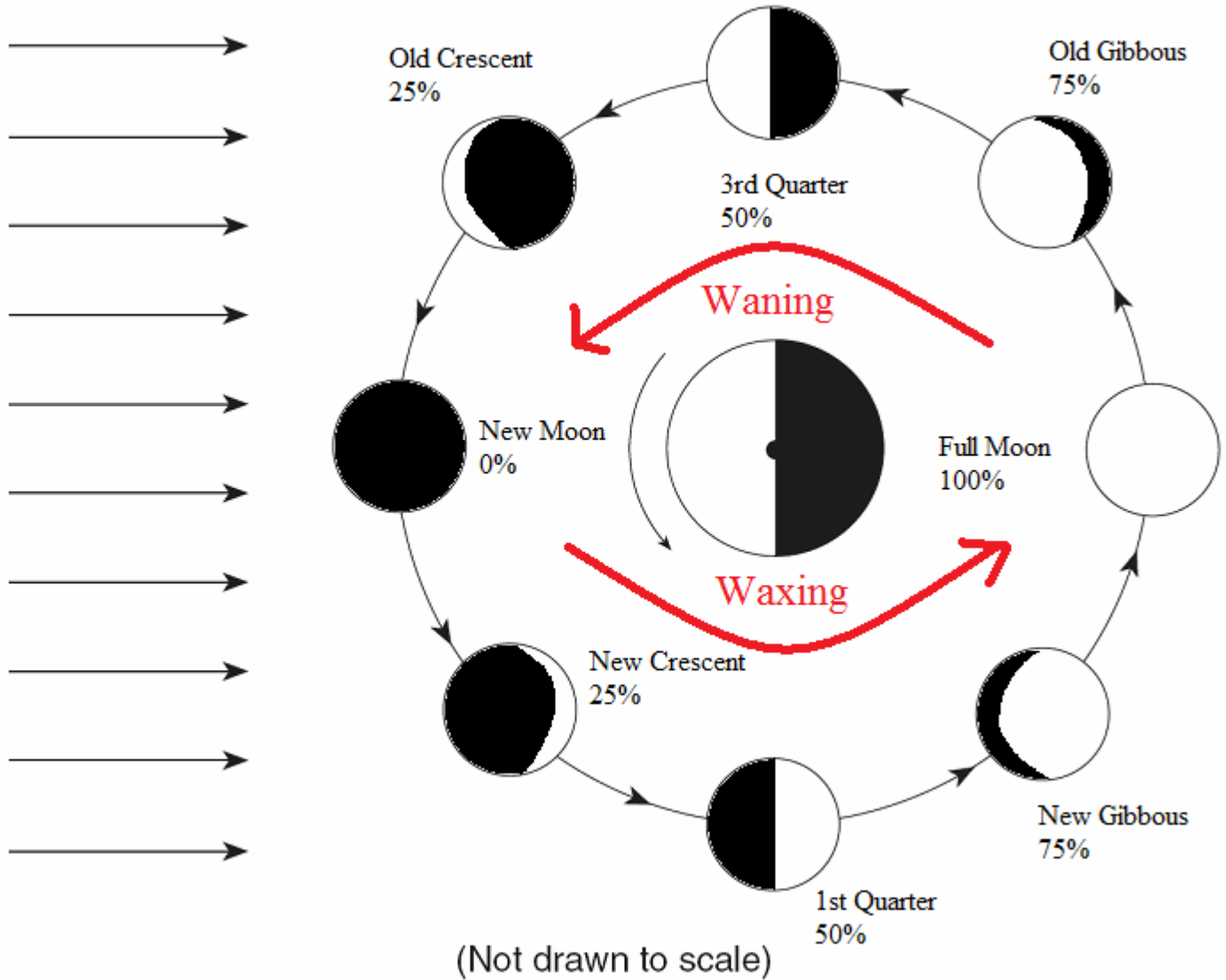
Approximate Times of Moonrise and Moonset		
	<b>moonrise</b>	<b>moonset</b>
new moon	06:00 AM	06:00 PM
waxing crescent	09:00 AM	09:00 PM
first quarter	12:00 PM	12:00 AM
waxing gibbous	03:00 PM	03:00 AM
full moon	06:00 PM	06:00 AM
waning gibbous	09:00 PM	09:00 AM
third quarter	12:00 AM	12:00 PM
waning crescent	03:00 AM	03:00 PM
new moon	06:00 AM	06:00 PM

Based on the chart above, approximately how many hours is the moon visible each day? 12

What do “waxing” and “waning” mean? waxing: more of the moon's surface can be seen; waning: less of the moon's surface can be seen

The phases of the moon are what type of event? cyclic

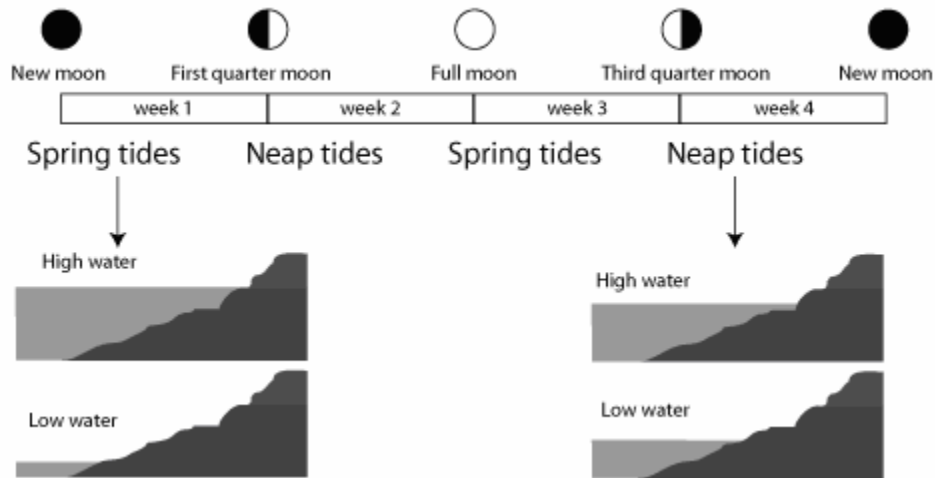
On the diagram below, write the name of each phase of the moon and the percentage visible. Finally, label appropriately where the moon is waxing and waning.



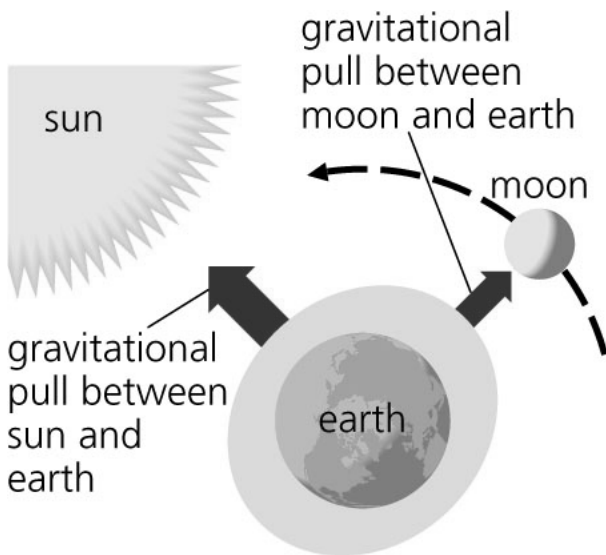
# The Tides

What causes the tides? the gravitational attraction of the moon and sun

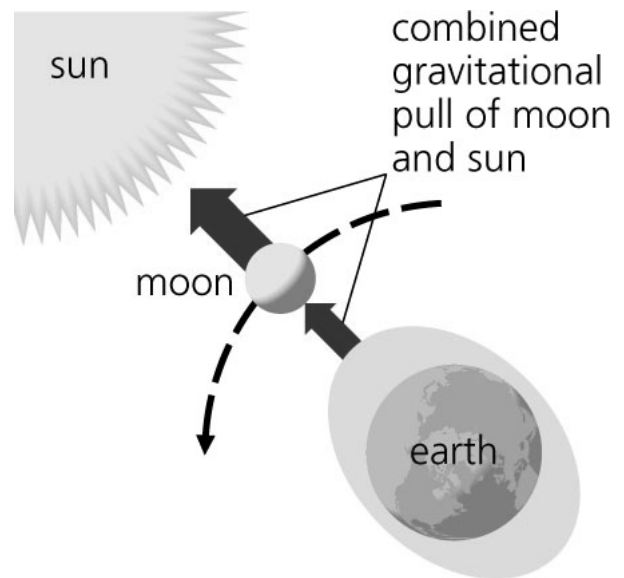
Based on the diagram below. Which types of tides have a larger range---neap or spring? Spring



## NEAP TIDES



## SPRING TIDES



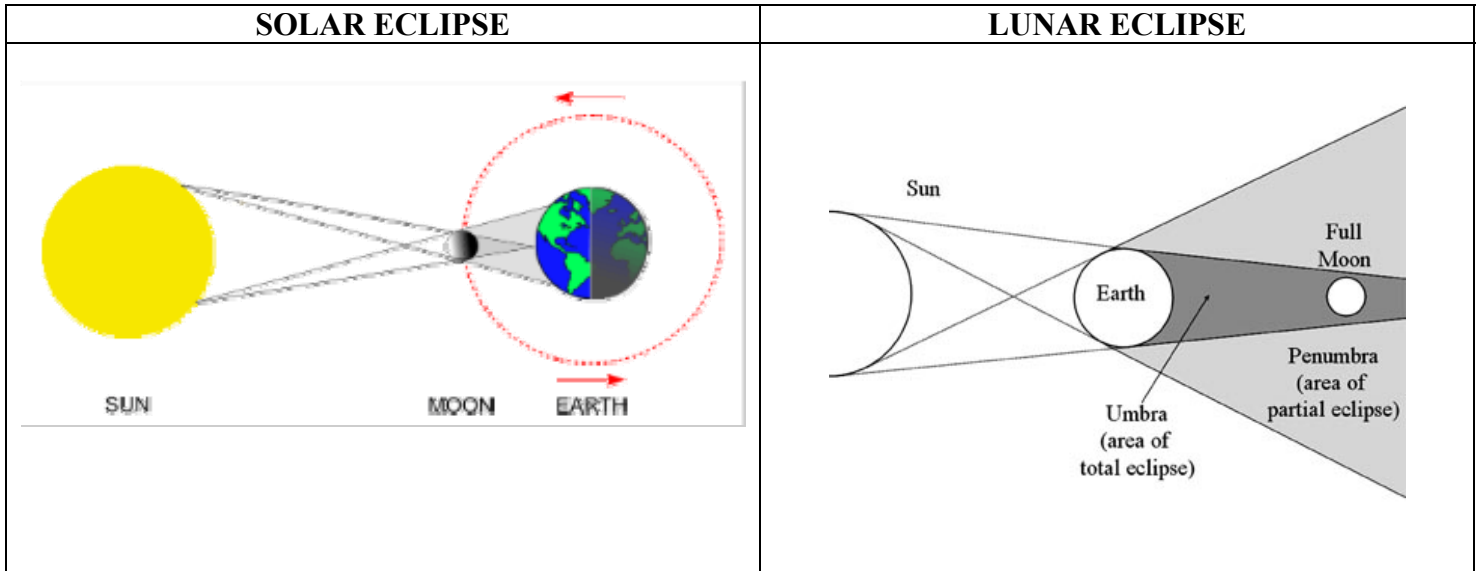
During which phases of the moon do neap tides occur? 1<sup>st</sup> and 3<sup>rd</sup> Quarters

During which phases of the moon do spring tides occur? New and Full Moons

Why are there not exactly 12 hours between each high or low tide? as the Earth rotates, the moon is revolving

# Eclipses

Draw the position of the Sun, Earth, and Moon in each diagram for a solar and lunar eclipse.



In order to have a solar eclipse, what phase must the moon be in?           **New Moon**          

In order to have a lunar eclipse, what phase must the moon be in?           **Full Moon**          

Why don't we have solar and lunar eclipses every month?           **the moon's orbit is tilted 5°**          

