NAME: ____

ASTRONOMY NOTES

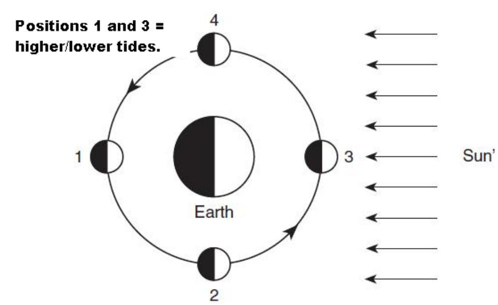
Log onto YouTube and search for **jocrisci** channel.

EARTH MOTIONS (Video 10.1)

1. Define rotation, how long it takes, which direction it happens, the proof it happens, and the result.
2. Define revolution, how long it takes, which direction it happens, the proof it happens, and the result.
3. Given the altitude of Polaris at a particular location, you should be able to determine the latitude.

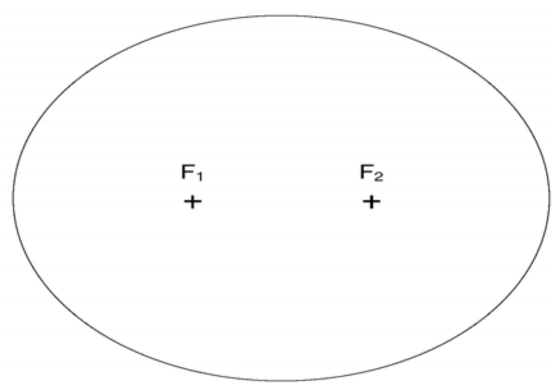
THE MOON (Video 10.2)

1. You must know the moons period of rotation and revolution.
2. You must know what causes the Moon to pass through phases and identify the phase based on the relative positions of the Earth, Moon, and Sun.
3. You must be able to discuss the cause of ocean tides on Earth.
4. At what position on the diagram is a lunar eclipse? Solar?



ECCENTRICITY (Videos 10.3, 10.4, 10.5 ESRT 1b part on eccentricity & 15b)

1. You must be able to calculate the eccentricity of a planets orbit, and compare the eccentricity of the Earth's orbit with the other planets in our solar system.
2. You must be able to discuss how orbital velocity, period of revolution, apparent diameter and gravitational attraction change with an objects distance from the body it is orbiting.
   a. On the diagram to the right, label one of the foci the sun. Put a dot on the orbit where the planet will have its greatest orbital velocity.
   b. Calculate the eccentricity of the planets orbit based on the image above. (Show all work)
   c. Compare the eccentricity of the planets orbit with the eccentricity of Mars.
   d. Place an X on the orbit where the planet is going fastest around the sun.



THE UNIVERSE (Videos 10.6 & 10.7 ESRT 15a)

1. You must be able to explain the Earth's position in the solar system and the Sun's position in the Milky Way Galaxy.
2. You must be able to explain the concept of a light year.
3. Using the HR diagram (ESRT page 15), you must be able to discuss the major type of stars and their life history.
4. Know the difference between geocentric and heliocentric models of our solar system.

Astronomy Facts

Video 10.1

1. Two proofs that the earth rotates / Coriolis Effect and Foucault's Pendulum
2. The earth rotates / west to east, 15 degrees per hour, in 24 hours or one day
3. The earth revolves / counterclockwise, 1 degree per day, in 365 ¼ days or one year
4. Revolution causes / different constellation to be visible at different times of the year
5. The altitude of Polaris equals / the latitude of the observer (Use ESRT for Cities in NYS)
6. Stars around Polaris make / counterclockwise circles, Polaris stays still (North star) (Pole Star)
7. Celestial objects (sun, moon, planets) rise in the / east and set in the west due to earth's rotation

Video 10.2

8. The moon has phases because / it revolves around the Earth, in one month or 29.5 days (½ the moon is always lit)
9. We always see the same side of the moon / it rotates and revolves at the same rate (27.3 days)
10. A new moon occurs when / the moon is between the earth and the sun SME (all dark from Earth)
11. A full moon occurs when / the earth is between the sun and the moon SEM (all bright from Earth)
12. Tides are caused by the / moons gravitational pull b/c close to earth (also the sun's but far away)
13. When the Earth, Moon, and Sun are in a line a / spring tide occurs (most extreme – new and full)
14. When the Moon and Sun are working against each other we get / neap tides (less extreme - half)
15. A solar eclipse happens when / the moon is between the earth and the sun and it blocks out the sun (NEW MOON PHASE ALWAYS!)
16. A lunar eclipse happens when / the Earth is between the sun and the moon and the shadow hits the moon (FULL MOON PHASE ALWAYS!)
17. Eclipses don't happen every month because / the moon's orbit is tilted

10.3 ESRT 15b

18. Inner four planets are / rocky (Terrestrial), more dense, smaller diameters, faster revolutions
19. Outer four planets are / gas giants (Jovian), less dense, larger diameters, slower revolutions
20. Heliocentric model / Sun centered, planet revolve in elliptical orbits, sun at one focus
21. Geocentric model / Earth centered, wrong model, planets and sun revolve around earth

10.4 & 10.5 ESRT 1b & 15a

22. The earth's orbit is / extremely round, almost perfect, but it is slightly elliptical
23. **Eccentricity is a measure of / how oval or elliptical the orbit is (highest =1, line) (lowest=0, perfect circle)**
24. The two factors affecting the force of gravity on an object are / mass and distance (closer = more)
25. As a planet gets closer to the sun or a star / the faster it orbits (further = slower)
26. When an object is close it looks / bigger (has a large apparent diameter) (farther = smaller)
27. The Sun is a regular star, produces energy converting / Hydrogen into Helium by Nuclear Fusion

Vids 10.6 & 10.7

28. Age of universe is approximately / 13.7 billion years old, solar system is only / 4.6 billion
29. Two proofs of the Big Bang Theory and the universe is expanding / cosmic background radiation and the red shift caused by the Doppler effect
30. Your universal address from smallest to largest / Earth, solar system, Milky Way galaxy, and the Universe

THE EARTH MOTIONS

	Rotation	**Revolution**
Definition		
What is the direction of movement?		
How long does it take?		
What is the rate?		
Result of the motion		
How can you prove this motion?	Two Ways:	

Earth's Motions

Fact(s) to memorize: 1 - 7

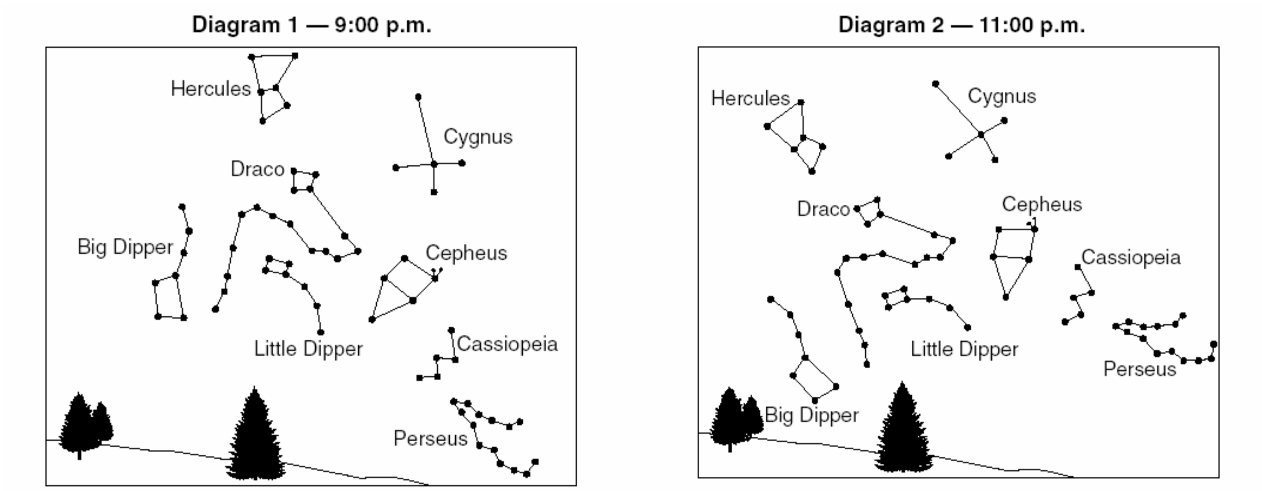
How long is one rotation of Earth? ___________________

How long is one revolution of Earth? ___________________

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

Rising and setting of the sun: ___________________________
Rising and setting of the moon: ___________________________
The seasons: ___________________________
Changing Constellations: ___________________________
Movement of Stars through the sky: ___________________________

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



How many degrees did the stars move from diagram 1 to diagram 2? ___________________

How can you find Polaris?____

What hemisphere must you be in if you can see these constellations? Why?

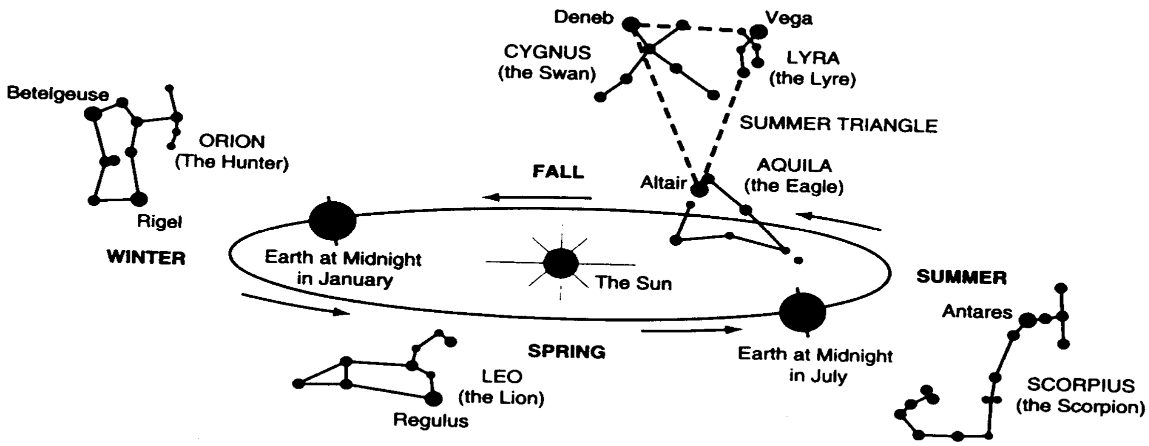
____

____

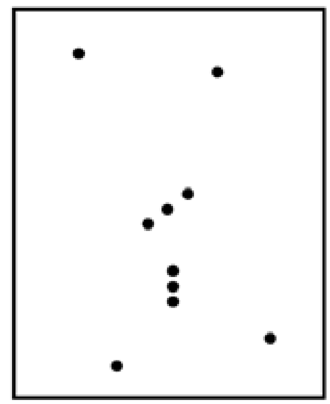
What direction must you be looking? ______________________

Do the stars appear to move clockwise or counterclockwise? _________________________________

What causes them to appear to move at all?____



1. The diagram to the right represents the major stars of the constellation Orion, as viewed by an observer in New York State.



   Which statement best explains why Orion can be observed from New York State on December 21 but not on June 21?

   (1) Orion has an eccentric orbit around Earth.
   (2) Orion has an eccentric orbit around the Sun.
   (3) Earth revolves around the Sun.
   (4) Earth rotates on its axis.

2. Which event is a direct result of Earth's revolution?
   (1) the apparent deflection of winds
   (2) the changing of the Moon phases
   (3) the seasonal changes in constellations viewed in the night sky
   (4) the daily rising and setting of the Sun

3. A Foucault pendulum appears to change its direction of swing due to the
   (1) tilt of Earth's axis
   (2) spin of Earth on its axis
   (3) deflection of Earth's planetary winds
   (4) movement of Earth in its orbit around the Sun

4. Predictable changes in the direction of swing of a Foucault pendulum provide evidence that
   (1) Earth is tilted on its axis
   (2) Earth's orbit is slightly elliptical
   (3) Earth rotates on its axis
   (4) Earth's magnetic poles reverse over time

5. The apparent shift in the direction of swing of a the motion of a Foucault pendulum provides evidence of
   (1) the Sun's rotation
   (2) the Sun's revolution
   (3) Earth's rotation
   (4) Earth's revolution

6. The apparent change in direction of a swinging Foucault pendulum is the result of the
(1) rotation of Earth
(2) tilt of Earth's axis
(3) revolution of Earth
(4) shape of Earth's orbit

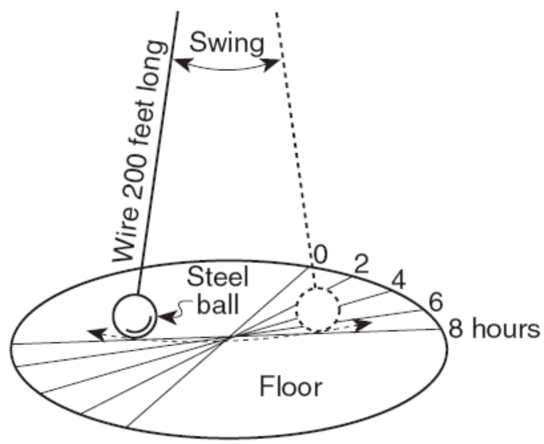
7. Foucault pendulum is caused by Earth's
(1) revolution
(2) spherical shape
(3) rotation
(4) tilted axis

8. The best evidence that Earth spins on its axis is provided by
(1) variations in atmospheric density
(2) apparent shifts in the swing of a Foucault pendulum
(3) changes in the position of sunspots on the Sun
(4) eclipses of the Moon

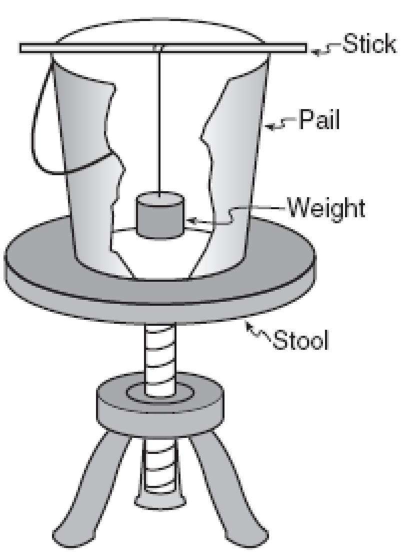
9. The diagram below represents a Foucault pendulum swinging freely for 8 hours.

The Foucault pendulum appears to gradually change its direction of swing due to Earth's

(1) orbit around the Sun
(2) tilted axis
(3) curved surface
(4) spin on its axis



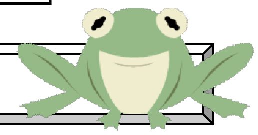
10. The diagram below shows the equipment used to demonstrate a Foucault pendulum



In the demonstration, a student swings the weight hanging in the pail and then spins the stool. The stool represents

(1) the revolving Earth
(2) the rotating Earth
(3) the Coriolis effect
(4) convection currents

Fact(s) to memorize: 8 - 11



Satellites

Satellite – ____

____

Earth is a satellite of the ____________.

The moon is a satellite of ____________.

Why do the distances between the sun and earth change? ________________________

____

Phases of the Moon

1) The apparent shape of the moon depends on the changing positions of the ________, ____________ and _______________.

2) How long does it take the moon to revolve around the Earth?_________________

3) One complete orbit of the moon around the Earth takes about ______ days.

4) A complete cycle the moon's phases takes _________ days.

5) Explain why there is a 2 ½ day difference between the revolution of the moon and the amount of time it takes to complete all of its phases.

____

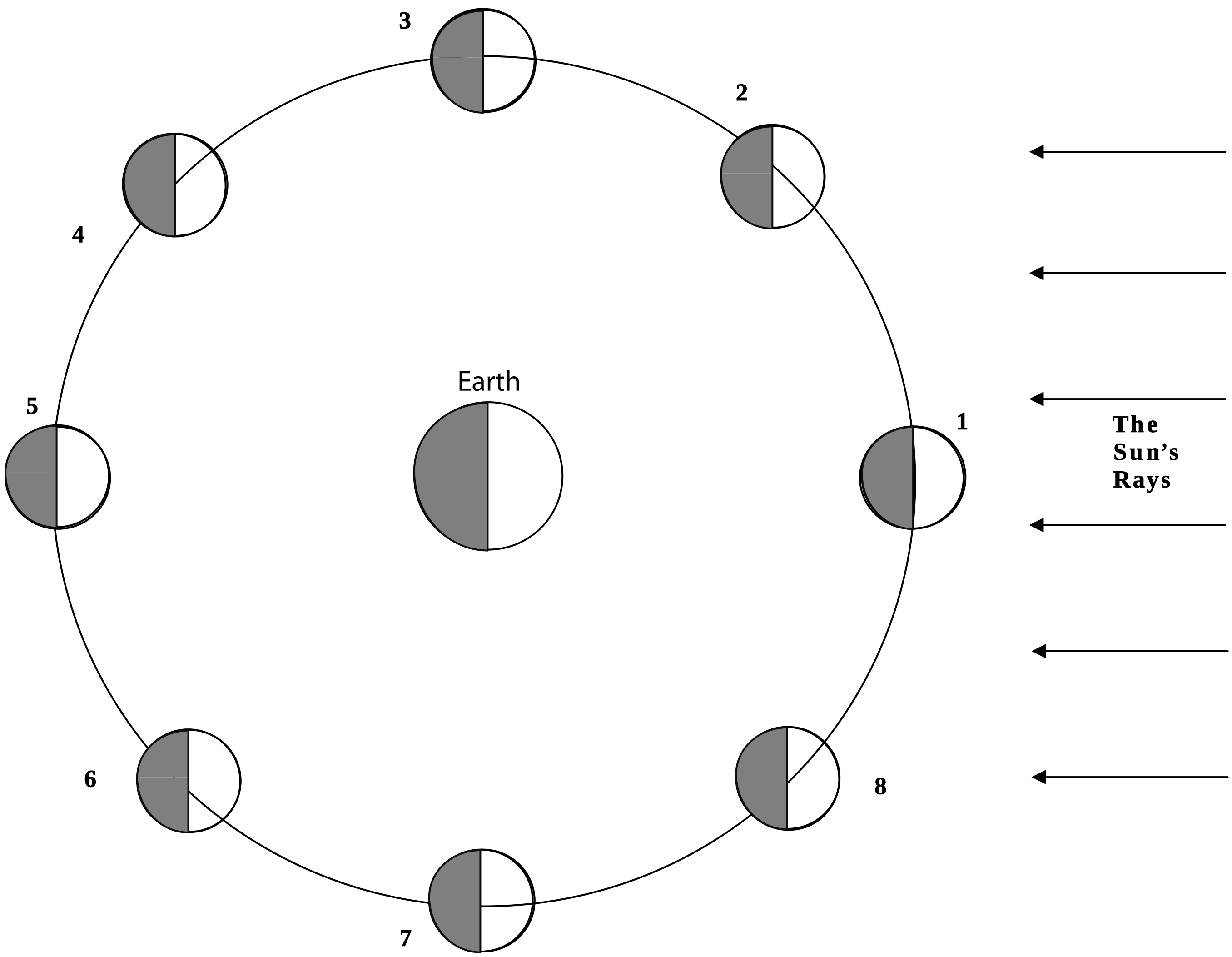
____

____

____

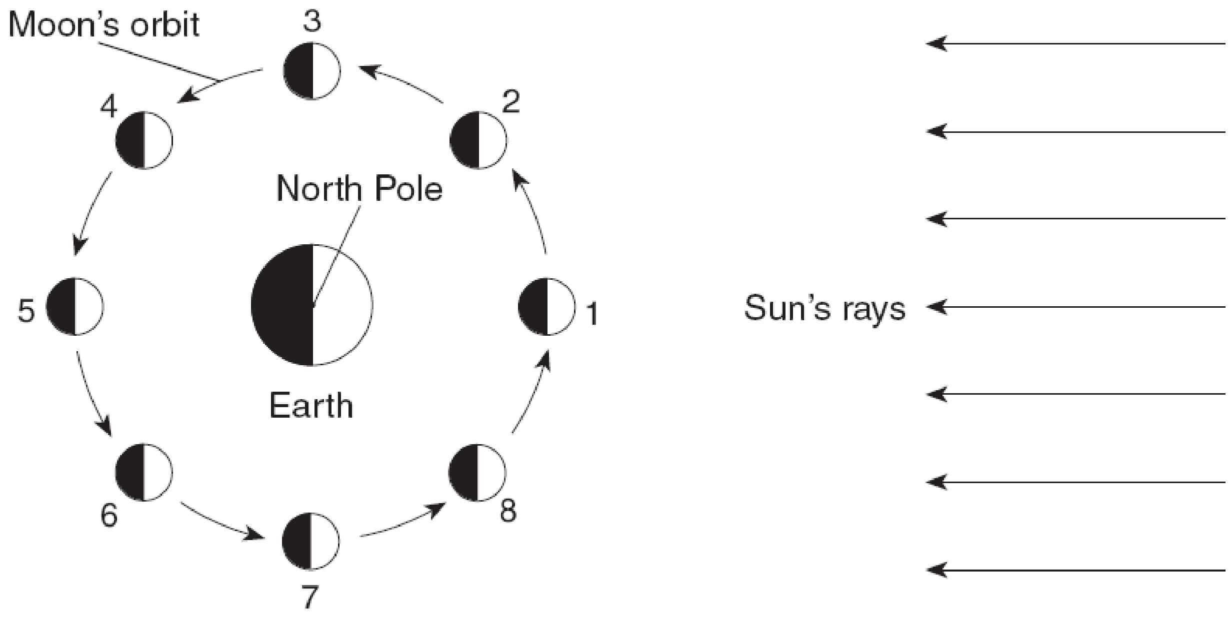
____

Know this Diagram!



1	5
2	6
3	7
4	8

Base your answers to questions 1 through 5 on the diagram below, which represents the Moon orbiting Earth as viewed from space above the North Pole. The Moon is shown at eight different positions in its orbit.



(Not drawn to scale)

Key

- Lighted, visible part of the Moon
- Dark, invisible part of the Moon

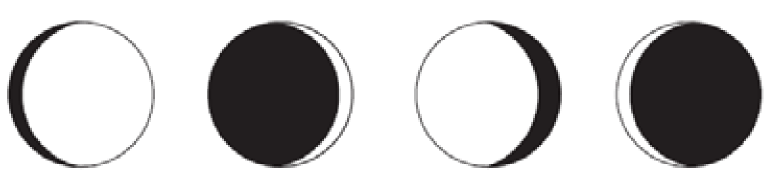
1. The approximate time required for the Moon to move from position 3 to position 7 is
   (1) 1 hour (2) 3 months (3) 2 weeks (4) 4 days

2. As the Moon changes location from position 2 to position 6, the visible portion of the Moon as observed from Earth
   (1) decreases, only
   (2) increases, only
   (3) decreases, then increases
   (4) increases, then decreases

3. Which motion causes the Moon to show phases when viewed from Earth?
   (1) rotation of Earth
   (3) revolution of Earth
   (3) rotation of the Sun
   (4) revolution of the Moon

4. Which device when placed on the Moon would provide evidence of Moon rotation?
   (1) Foucault pendulum (2) thermometer (3) seismograph (4) wind vane

5. When the Moon is in position 2, which phase would be visible to an observer in New York State?



(1) (2) (3) (4)

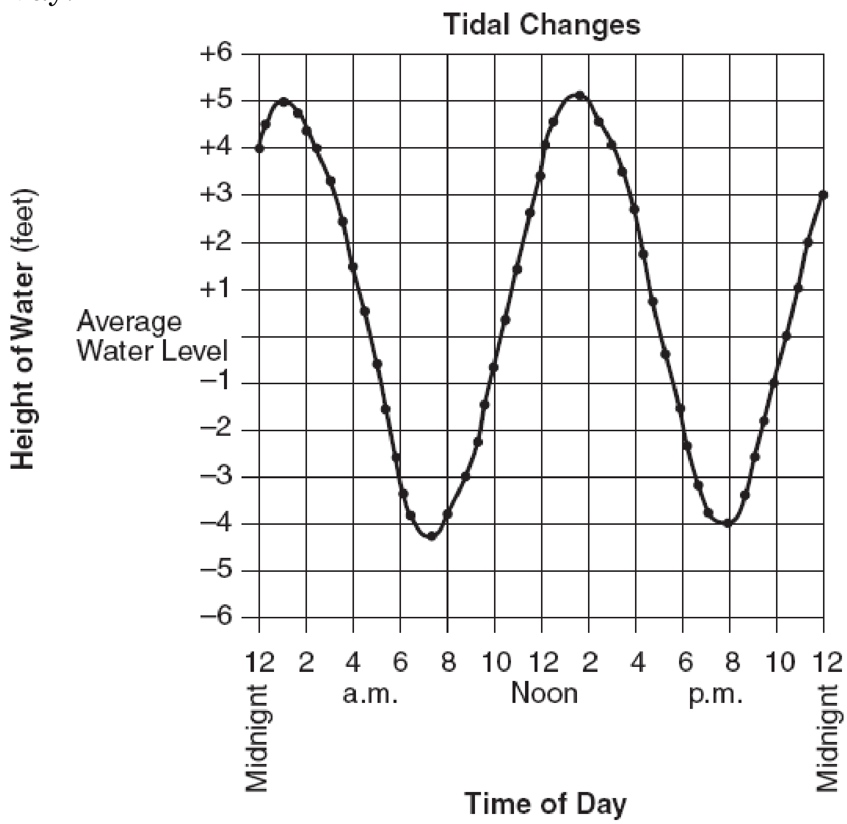
Fact(s) to memorize: 12 - 14

Tides

Spring Tide:	Neap Tide

Key	
E = Earth	H = High tide
M = Moon	L = Low tide

Base your answers to questions 1 and 3 on the graph below. The graph shows the recorded change in water level (ocean tides) at a coastal city in the northeastern United States during 1 day.



1. Which inference about tides is best made from this graph?
   (1) The hourly rate of tidal change is always the same.
   (2) The rate of tidal change is greatest at high tide.
   (3) The tidal change is a random event.
   (4) The tidal change is cyclic.

2. According to the pattern shown on the graph, the next high tide will occur on the following day at approximately
   (1) 12:30 a.m. (2) 3:15 a.m. (3) 2:00 a.m. (4) 4:00 a.m.

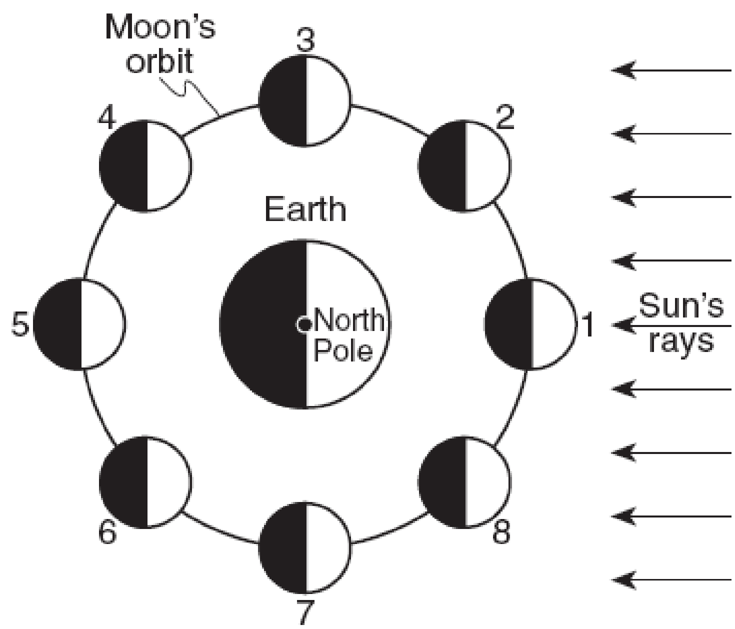
---

3. The cyclic rise and fall of ocean tides on Earth is primarily caused by Earth's rotation and the
   (1) temperature differences in ocean currents
   (2) revolution of Earth around the Sun
   (3) direction of Earth's planetary winds
   (4) gravitational attraction of the Moon and the Sun

4. Which description of change is most closely associated with ocean tides and moon phases?
(1) cyclic and predictable
(2) cyclic and unpredictable
(3) noncyclic and predictable
(4) noncyclic and unpredictable

5. Ocean tides are best described as
(1) unpredictable and cyclic
(2) predictable and cyclic
(3) unpredictable and noncyclic
(4) predictable and noncyclic

6. The diagram below shows the Moon orbiting Earth, as viewed from space above Earth's North Pole. The Moon is shown at eight positions in its orbit.

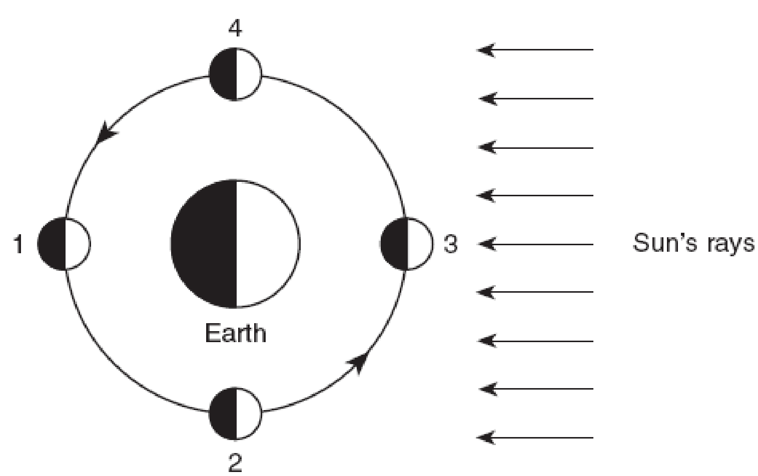


(Not drawn to scale)

Spring ocean tides occur when the difference in height between high tide and low tide is greatest. At which two positions of the Moon will spring tides occur on Earth?
(1) 1 and 5 (2) 3 and 7 (3) 2 and 6 (4) 4 and 8

7. The diagram below represents the Sun's rays striking Earth and the Moon. Numbers 1 through 4 represent positions of the Moon in its orbit around Earth.
The highest tides on Earth occur when the Moon is in positions

(1) 1 and 3
(2) 2 and 4
(3) 3 and 2
(4) 4 and 1



(Not drawn to scale)

Fact(s) to memorize: 15 - 17

Eclipses

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

SOLAR ECLIPSE	LUNAR ECLIPSE

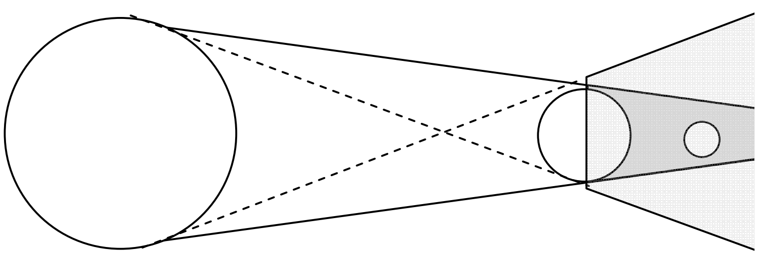
In order to have a solar eclipse, what phase must the moon be in? ______________________________

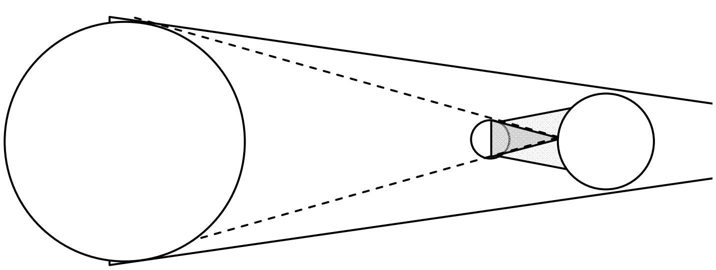
In order to have a lunar eclipse, what phase must the moon be in? ______________________________

Why don't we have solar and lunar eclipses every month? ______________________________

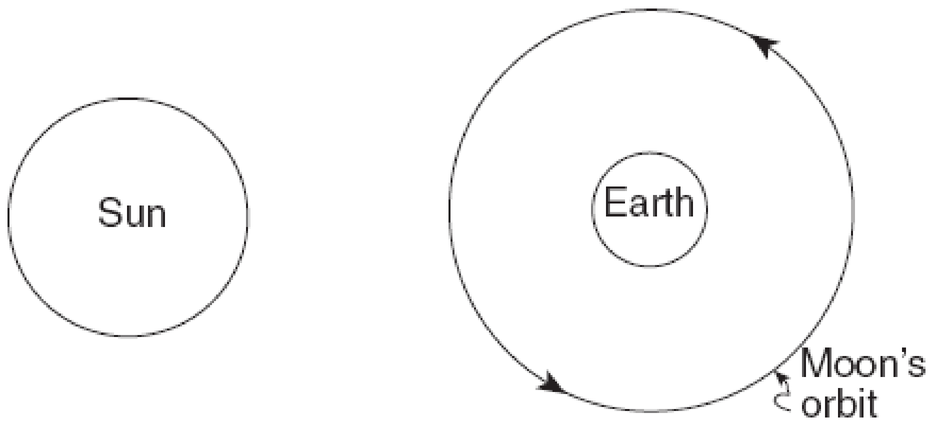
____

____





Base your answers to questions 1 through 3 on the diagram below and on your knowledge of Earth science. The diagram shows the Sun, Earth, and the Moon's orbit around Earth as viewed from space.



(Not drawn to scale)

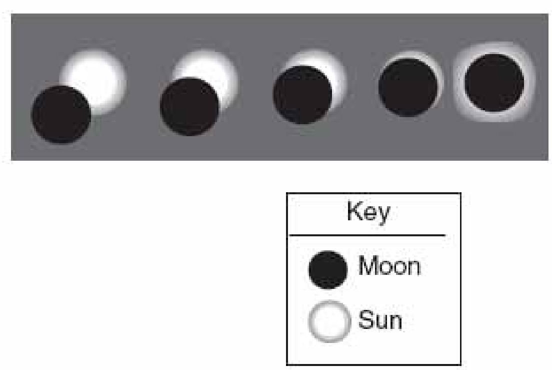
1. On the diagram provided *above,* draw a circle of approximately this size ◯ to represent the Moon's position in its orbit when a solar eclipse is viewed from Earth.

2. Approximately how many complete revolutions does the Moon make around Earth each month?

3. Explain why solar eclipses do not occur every time the Moon revolves around Earth.

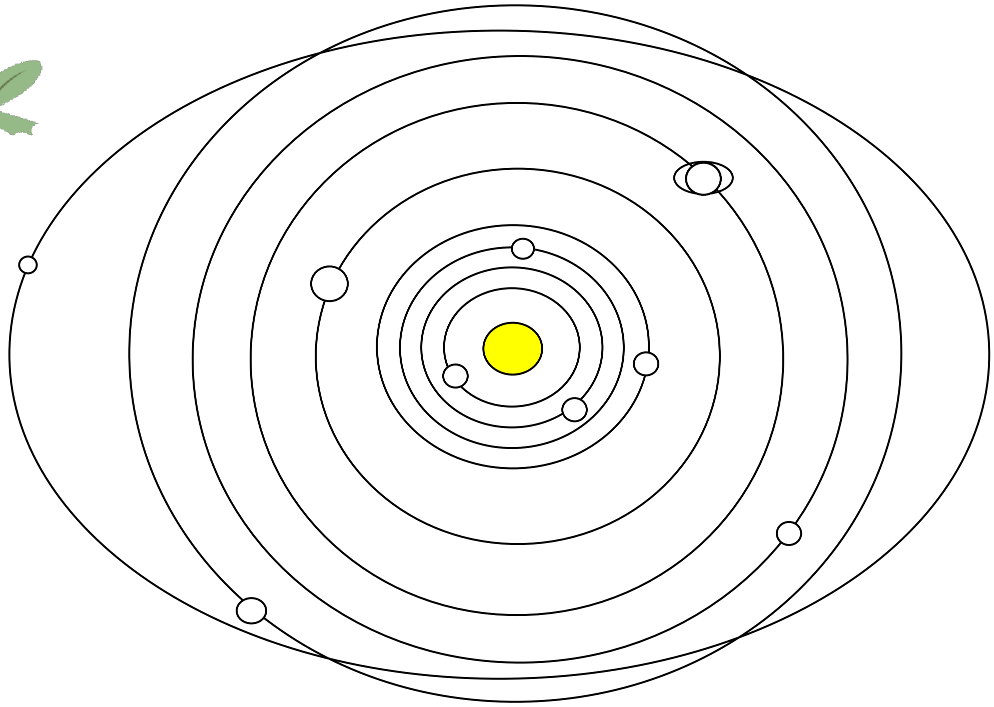
4. What is represented by the diagram below?

(1) changing phases of the Sun
(2) changing phases of the Moon
(3) stages in an eclipse of the Sun
(4) stages in an eclipse of the Moon



Our Solar System

Fact(s) to memorize: 18 & 19



Terrestrial Planets ______________________________

examples ______________________________

Jovian Planets ______________________________

examples ______________________________

Asteroid belt ______________________________

____

____

____

meteor ______________________________

____

____

meteorite ______________________________

Comets ______________________________

____

____

Solar System Questions

Base your answers to questions 1 and 2 on the data table to the right, which shows information about the four largest asteroids found in our solar system.

Data Table

Name	Average Diameter (kilometers)	Period of Revolution (years)
Ceres	848.4	4.60
Pallas	498.1	4.61
Juno	247.0	4.36
Vesta	468.3	3.63

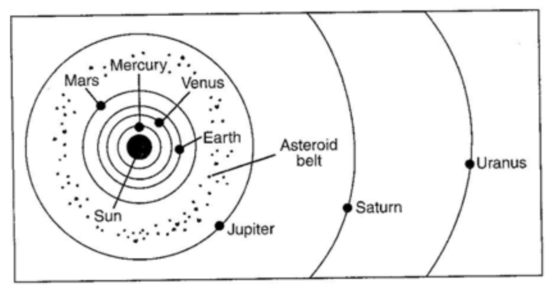
1. The asteroids shown in the data table are located between the orbits of:

   (1) Venus and Earth (2) Earth and Mars
   (3) Mars and Jupiter (4) Jupiter and Saturn

2. Compared to the diameter of Earths Moon, the diameter of Ceres is about

   (1) one-fourth of the Moon's diameter (3) twice the diameter of the Moon
   (2) one-half of the Moon's diameter (4) four times the diameter of the Moon

The diagram to the right shows a portion of the solar system.

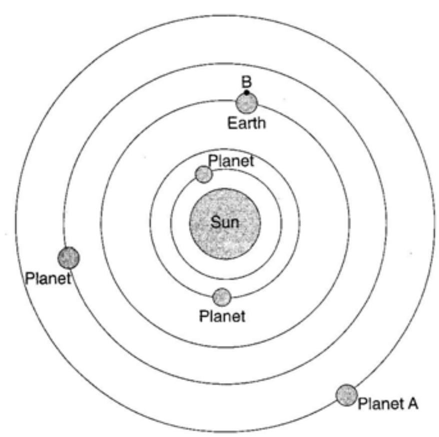


(Not drawn to scale)

3. What is the average distance, in millions of kilometers, from the Sun to the asteroid belt?

   (1) 129 (3) 503
   (2) 189 (4) 857

Base your answers to questions 4 and 5 on the diagram to the right which shows the heliocentric model of a part of our solar system. The planets closest to the Sun are shown. Point B is a location on Earth's equator.

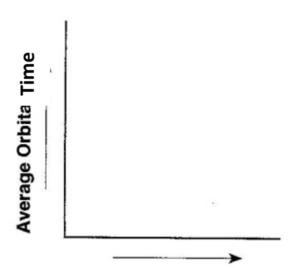


(Not drawn to scale)

4. State the name of planet A.

5. Explain why location B experiences both day and night in a 24-hour period.

6. On the graph to the right, draw a line to indicate the general relationship between a planet's average distance from the Sun and its orbital time.



7. Compared to the terrestrial planets, the Jovian planets are

(1) smaller and have lower densities (3) smaller and have greater densities
(2) larger and have lower densities (4) larger and have greater densities

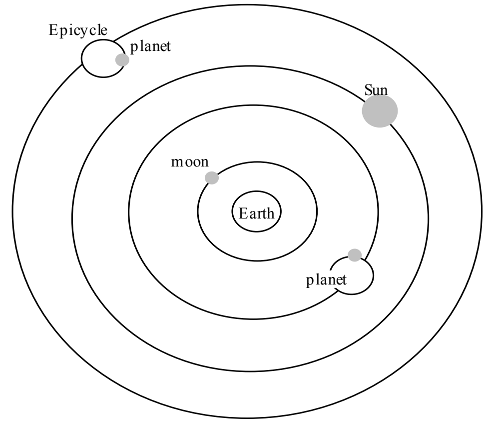
Fact(s) to memorize: 20 & 21

Solar System Models

Geocentric Model: ________________________________

Explained the following:

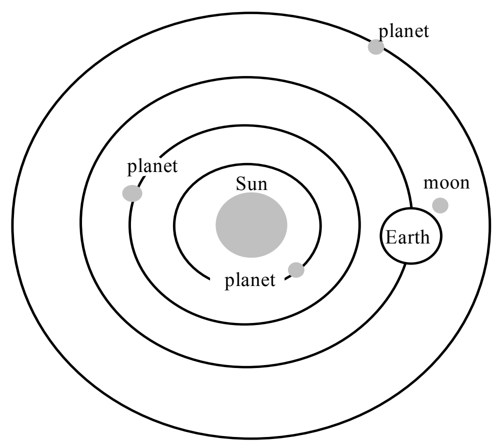
Did not easily explain the following:



Geocentric Model

Heliocentric Model: ________________________________

Explained the following:



Heliocentric Model

Copernicus, Brahe, Kepler, Galileo and other scientists in the 16^{th} and 17^{th} centuries supported this model. This is the model we use today.

Fact(s) to memorize: 22 - 26

Shape of Orbit

The planets move in ellipses with the Sun at one focus

Shape of Earth's orbit: ____

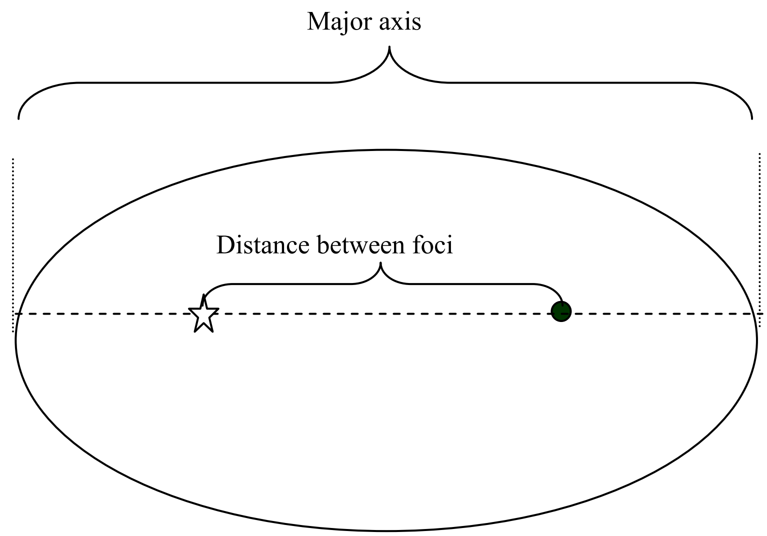
____

Eccentricity ____

____

Formula: ____

Determine the eccentricity of the ellipse to the right:



1) A circle has an eccentricity of __________, and is least eccentric.

2) The more oval an ellipse is the __________ eccentric it is.

The Force of Gravity

1) Gravity ____

2) Gravity depends on two things: __________ and ______________________

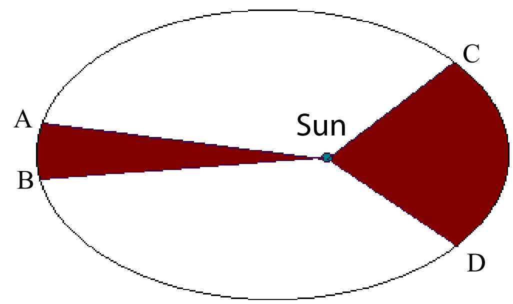
3) The larger the mass, the ____________________ the gravitational attraction.

4) The closer objects are together, the __________________ the attraction.

Fact(s) to memorize: 22 - 26

Planet Velocities

The line joining the Sun and a planet sweeps out equal areas in equal intervals of time



1. Between which two letters is the orbital speed the slowest? ________________
2. Between which two letters is the orbital speed the fastest? ________________

3. What happens to the speed of the planet as it travels from C to A then to D

____

4. The speed of a planet depends upon its distance from the __________.

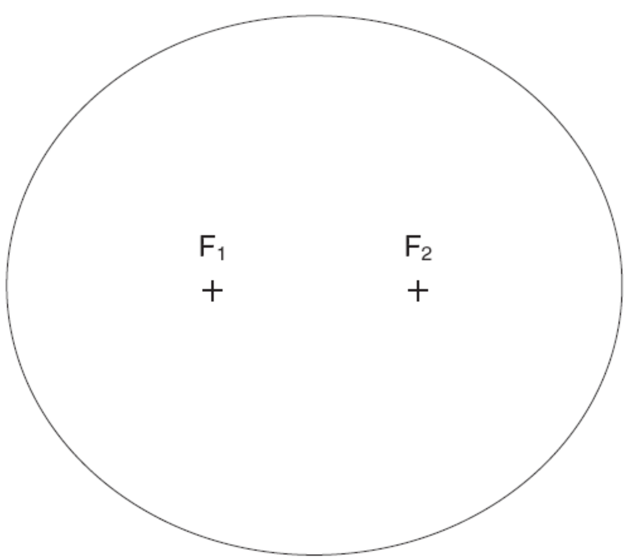
Distance of planets with respect to the Sun

Perihelion ____

Aphelion ____

The square of the time (T^2) of revolution of a planet divided by the cube of its mean distance (R^3) from the Sun gives a number that is the same for all the planets

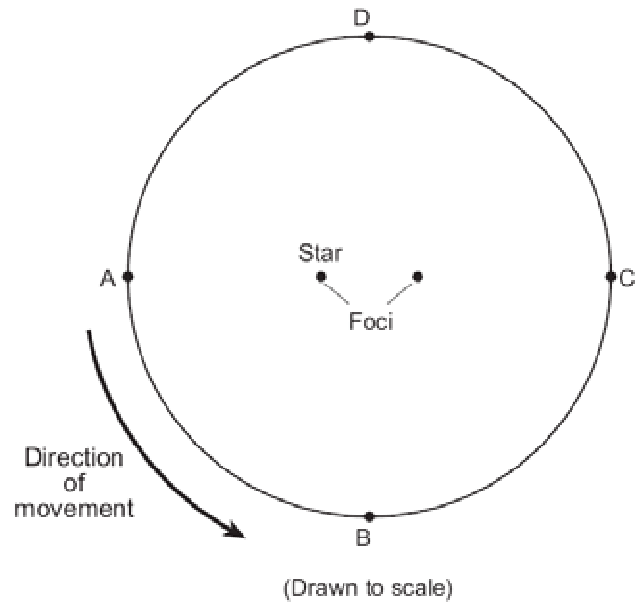
Base your answers to questions 1 and 2 on the diagram of the ellipse below.



1. Calculate the eccentricity of the ellipse to the *nearest thousandth*.

2. State how the eccentricity of the given ellipse compares to the eccentricity of the orbit of Mars.

Base your answers to questions 3 through 5 on the diagram below, which represents the elliptical orbit of a planet traveling around a star. Points *A, B, C,* and *D* are four positions of this planet in its orbit.



3. The calculated eccentricity of this orbit is approximately

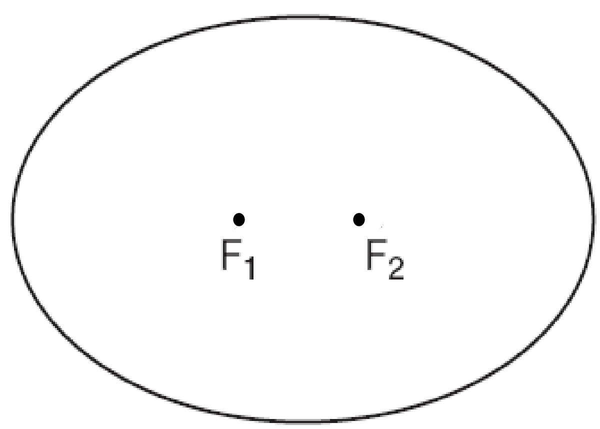
   (1) 0.1 (2) 0.2 (3) 0.3 (4) 0.4

4. The gravitational attraction between the star and the planet will be greatest at position
   (1) A (2) B (3) C (4) D

5. As the planet revolves in orbit from position A to position D, the orbital velocity will
   (1) continually decrease
   (2) continually increase
   (3) decrease, then increase
   (4) increase, then decrease

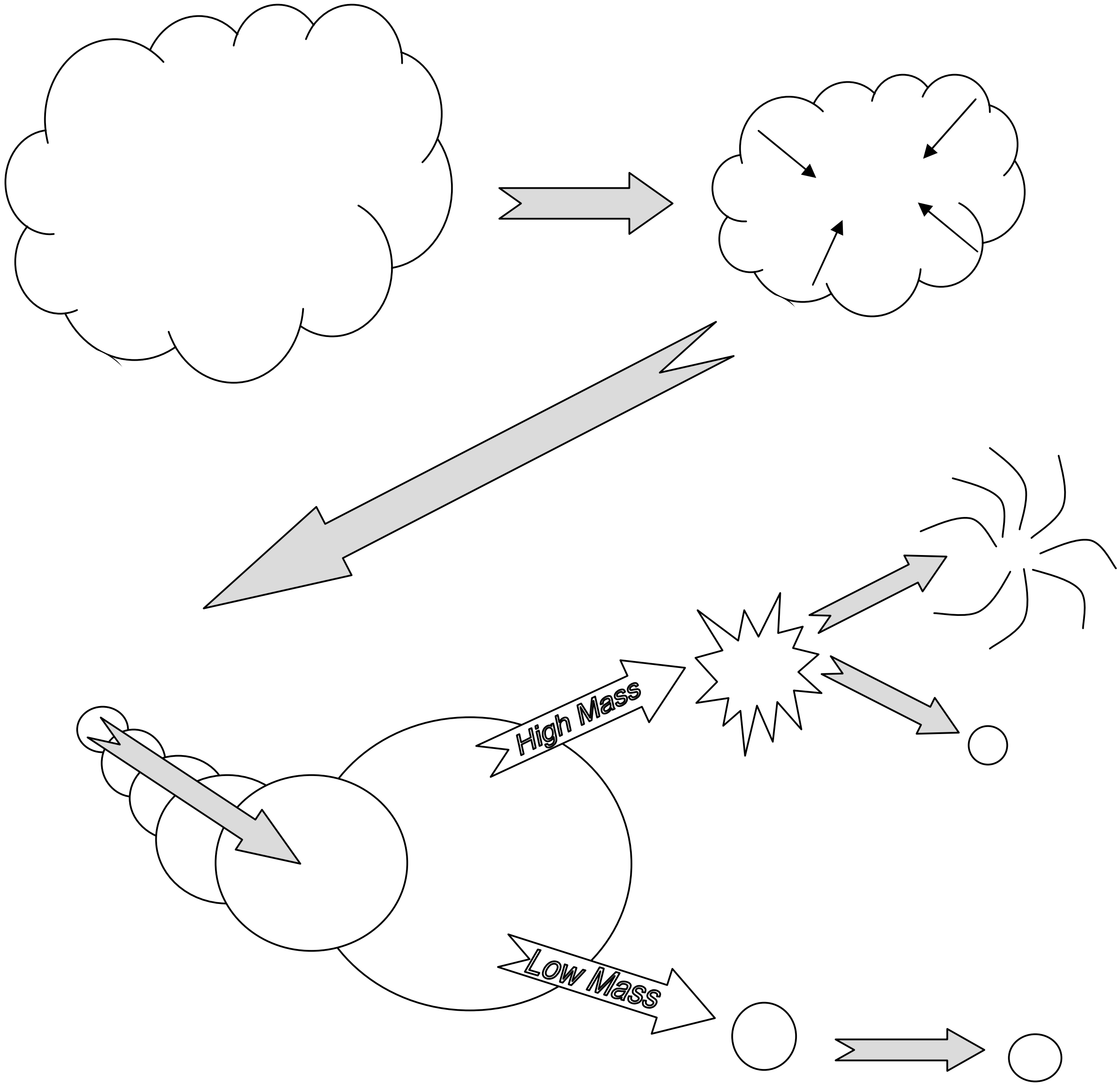
6. The diagram below is a constructed ellipse. *F*1 and *F*2 are the foci of the ellipse.

   The eccentricity of this constructed ellipse is closest to the eccentricity of the orbit of which planet?
   (1) Mercury (3) Saturn
   (2) Earth (4) Neptune



7. Which planet has an orbit with an eccentricity most similar to the eccentricity of the Moon's orbit around Earth?
   (1) Earth (2) Pluto (3) Jupiter (4) Saturn

A Star is Born



Star formation: ____

____

____

____

____

____

____

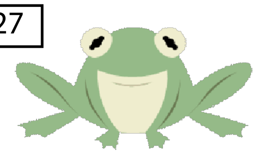
____

____

____

Stars

Fact(s) to memorize: 27



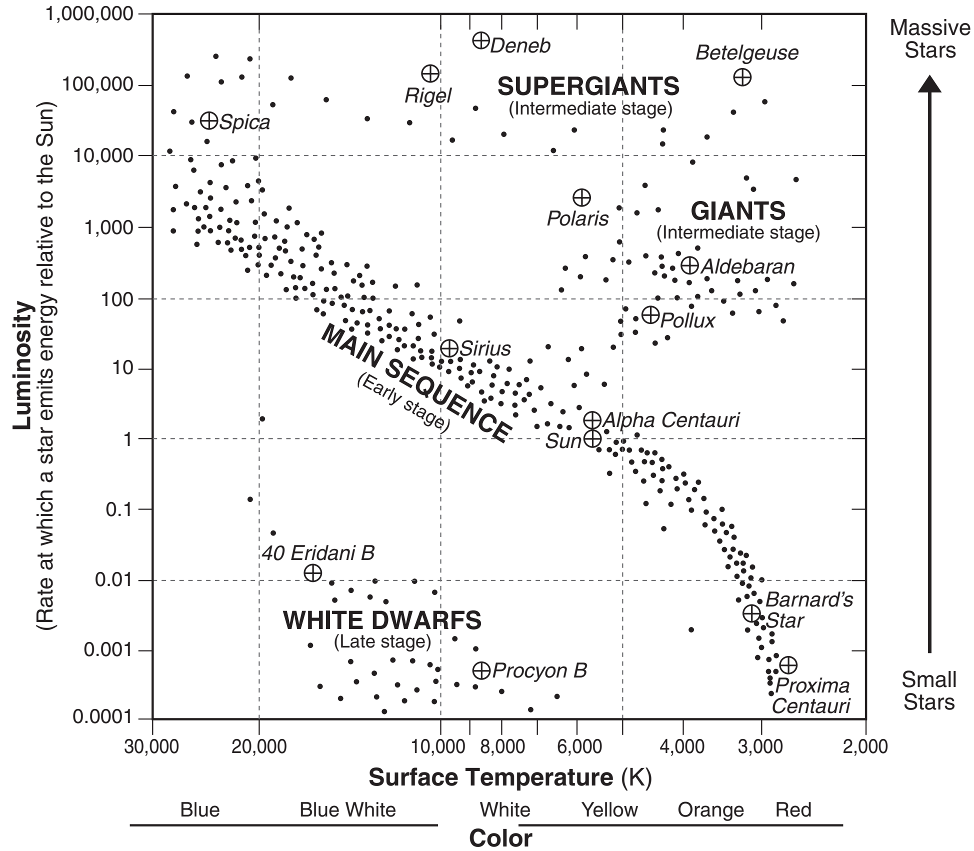
What are the main classifications of stars?

What two characteristics are used to classify stars?

______________________ **and** ______________________

Characteristics of Stars

(Name in italics refers to star represented by a ⊕.)
(Stages indicate the general sequence of star development.)



What type of star is our Sun classified as? ______________________ **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? __________
The star Rigel is located in the constellation Orion. What color is it? ______________

How do stars generate their energy?______________________________

Refer to the ESRT's pg 15 "Luminosity and Temperature of Stars" Diagram:

1. Within what area on the diagram is the Sun located? ______________________
2. Name the star that has a similar temperature and luminosity as the Sun

   ____
3. What does Polaris and the Sun have in common? ______________________
4. What is the name of the hottest star located on the Diagram? ______________
5. Which star has the same luminosity as Alpha Centauri? ______________________
6. Name a Supergiant ______________________
7. Name a White Dwarf ______________________
8. What color star is Betelgeuse? ______________________
9. Which process combines lighter elements into heavier elements and produces energy within the Sun and other stars?

   (1) fusion (3) conduction (2) insolation (4) radioactive decay
10. Which star has a surface temperature most similar to the surface temperature of Alpha Centauri?

    (1) Polaris (3) Procyon B (2) Betelgeuse (4) Sirius
11. Compared to the luminosity and surface temperature of red main sequence stars, blue supergiants are

    (1) less luminous and have a lower surface temperature

    (2) less luminous and have a higher surface temperature

    (3) more luminous and have a lower surface temperature

    (4) more luminous and have a higher surface temperature

Sunspots - ____

____

What happens when they occur? ______________________________

____

____

Speed of light - ____

____

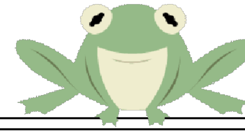
Light year - ____

Write of the stages in a stars life cycle (general sequence of star developement)?

____

____

Facts to memorize: 28 - 30



Galaxy

Galaxy - ____

____

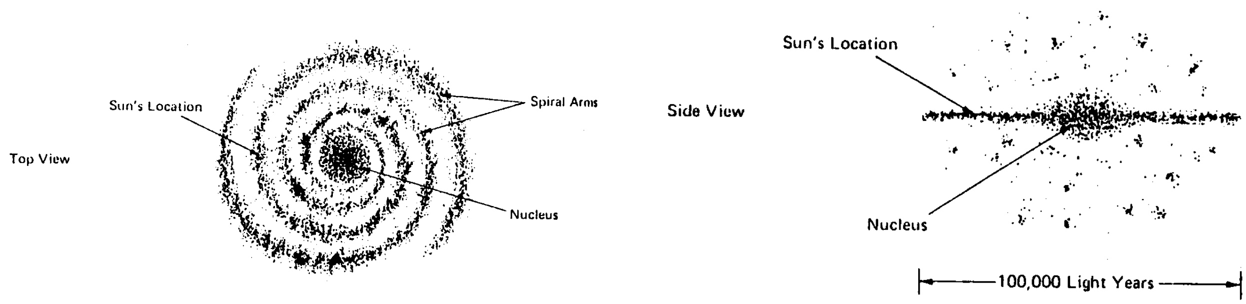
____

What is the name of our galaxy? ______________________________

What kind of a galaxy do we live in? ______________________________

Where is our solar system located within the galaxy ______________________

____



The Universe

The Universe ____

____

Big Bang Theory ____

____

____

evidence ____

____

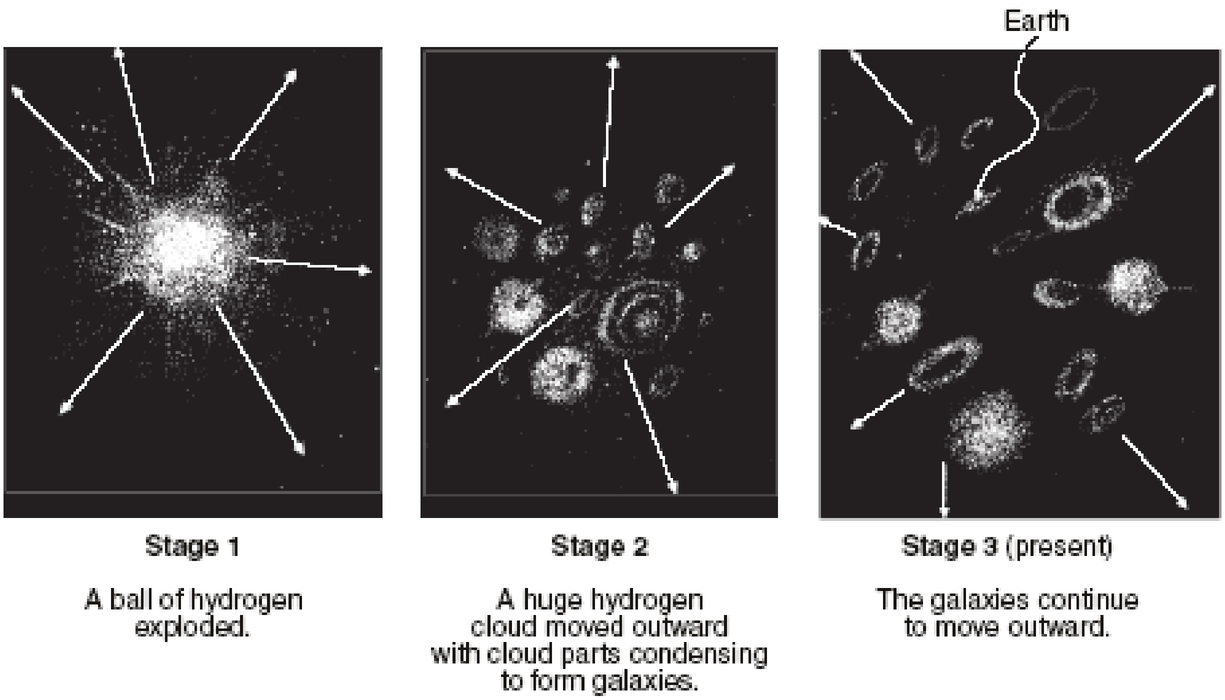
____

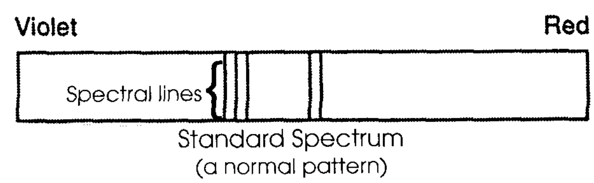
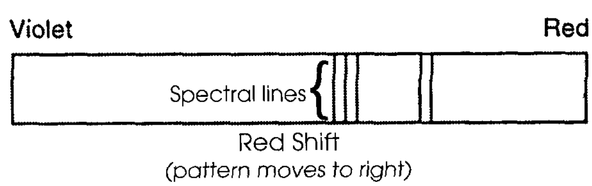
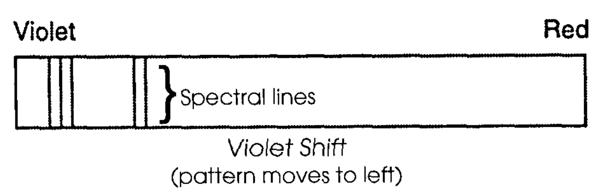
Put these items in order of size: **galaxy** **solar system** **universe**

____

Largest **Smallest**

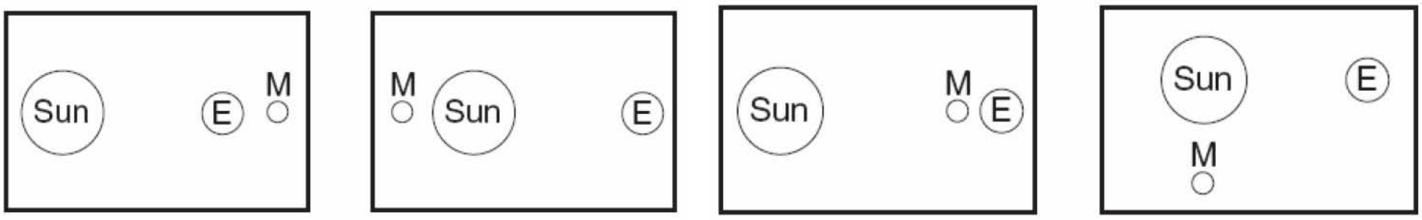
The diagram below illustrates three stages of a current theory of the formation of the universe.



Spectral lines	
red shift:	
blue shift:	

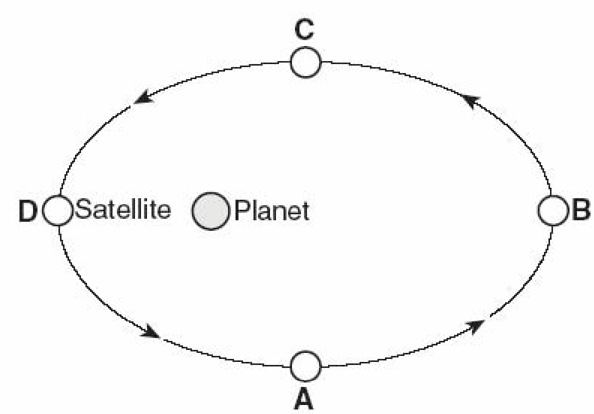
Astronomy Review

Use the following four pictures to answer questions 1-4.



1. Put an X through the pictures that are NOT possible.
2. Circle the picture that could be a lunar eclipse.
3. Triangle the picture that could be a solar eclipse.
4. Why does a solar or lunar eclipse NOT happen every month?

Use the following picture to answer questions 5-10.



(Not drawn to scale)

5. Which location is the satellite traveling the fastest?

6. Why is the satellite moving fastest there?

7. If the planet was the Earth, name that satellite.

8. How long will it take that satellite to revolve around the Earth?

9. Name the shape the satellite makes around the planet.

10. What happens to your velocity as you travel from point C to point A?

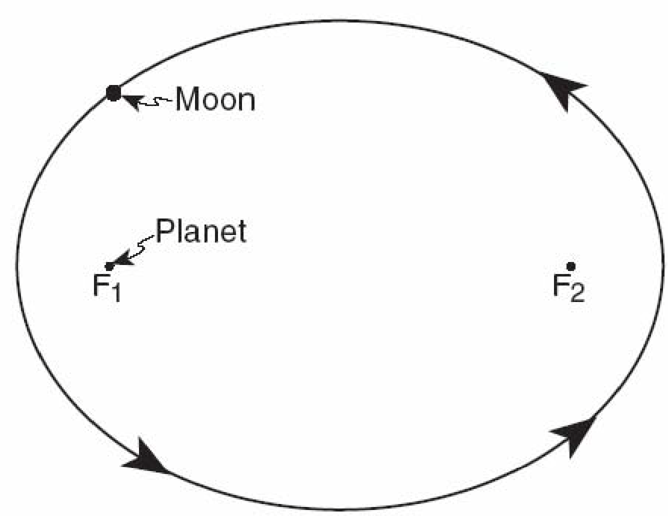
Use the picture below to answer questions 11-12.

11. What is the eccentricity of the following ellipse?
(Round to the thousandths)

Formula

Substitute

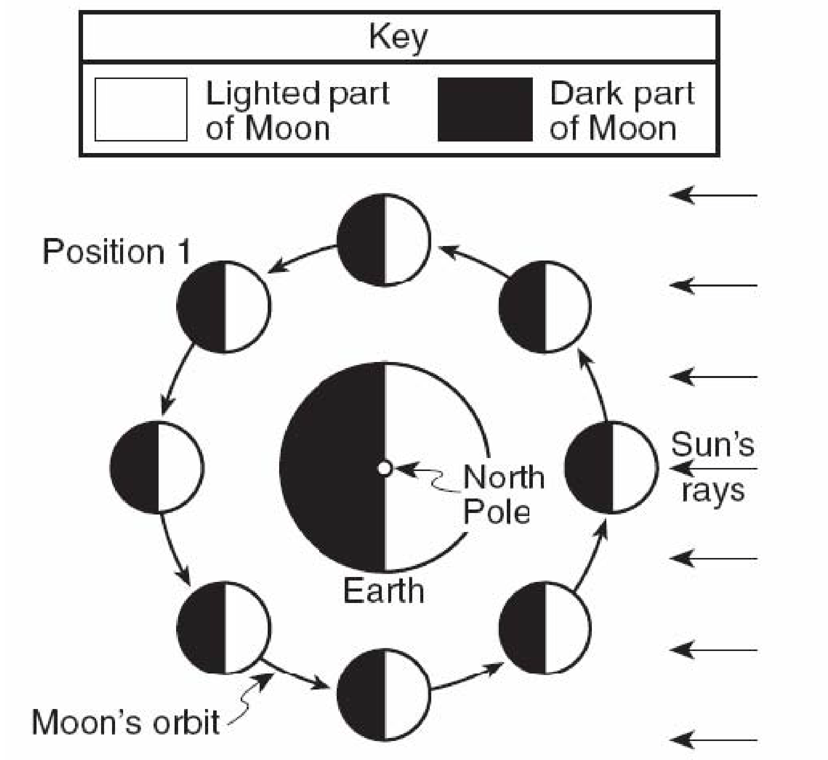
Solve



(Drawn to scale)

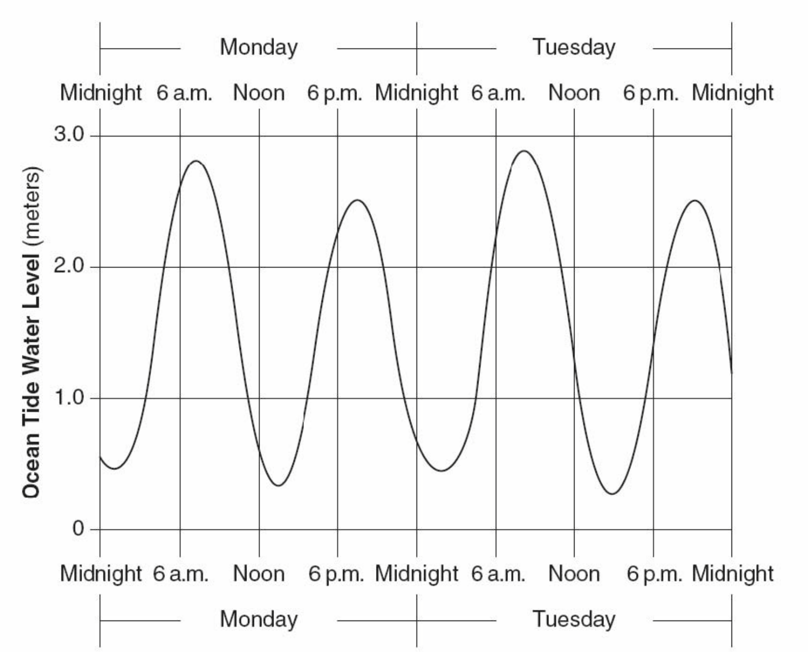
12. How does the eccentricity of this diagram compare to all of the planets in our solar system.

Use the picture to the right to answer questions 13-18.



13. Label the position of the new moon with an N.
14. Label the position of the full moon with an F.
15. Label the third quarter moon with a 3.
16. Put a square around the solar eclipse moon picture.
17. Put a triangle around the lunar eclipse moon picture.
18. What happens to the lit portion of the moon we see from position N to position F?

Use the picture below to answer questions 19-21.

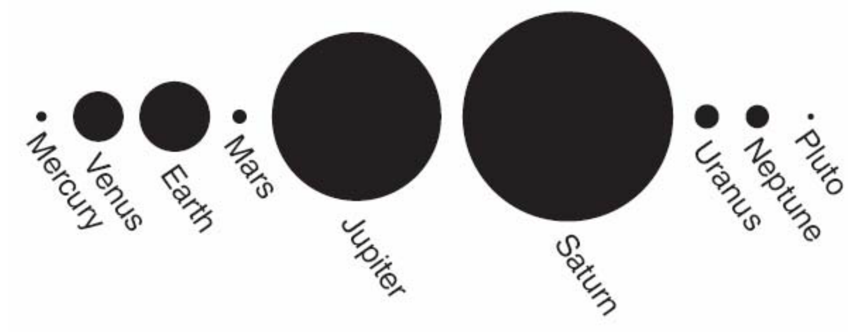


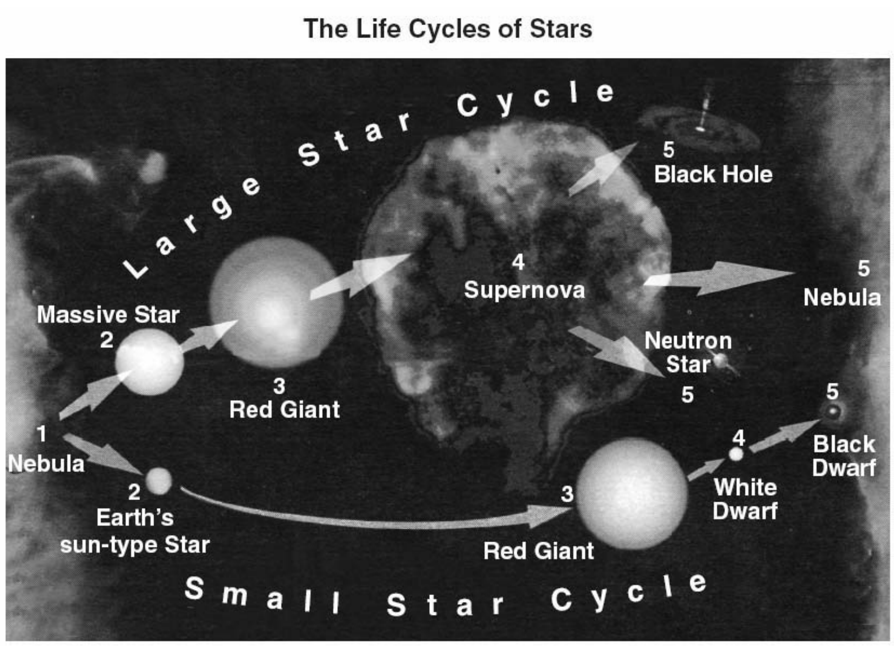
19. What causes the tides to rise and fall on a daily basis?
20. What time and day should the next LOW tide occur?
21. What should the Ocean Tide Water level be on the next HIGH tide?

22. Name at least two things wrong with this picture.

•

•



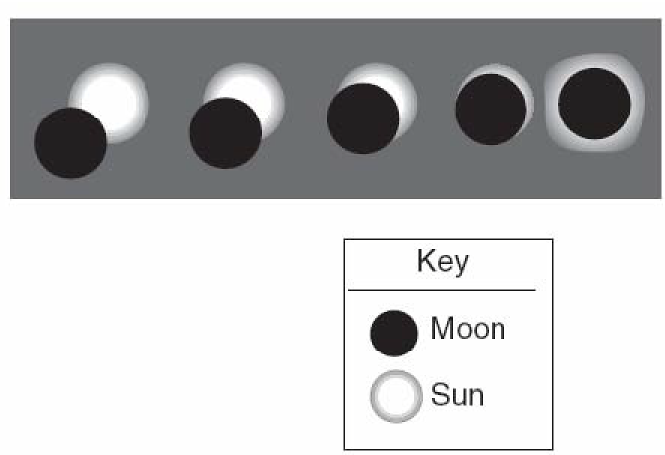


23. Describe the star cycle of a star like the Earth's sun?

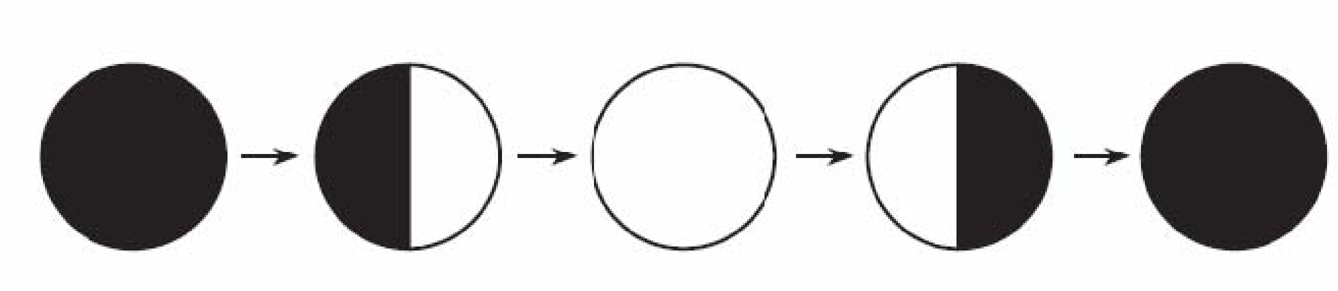
24. What do stars like the Earth's Sun originate from?

25. What could happen to a massive star?

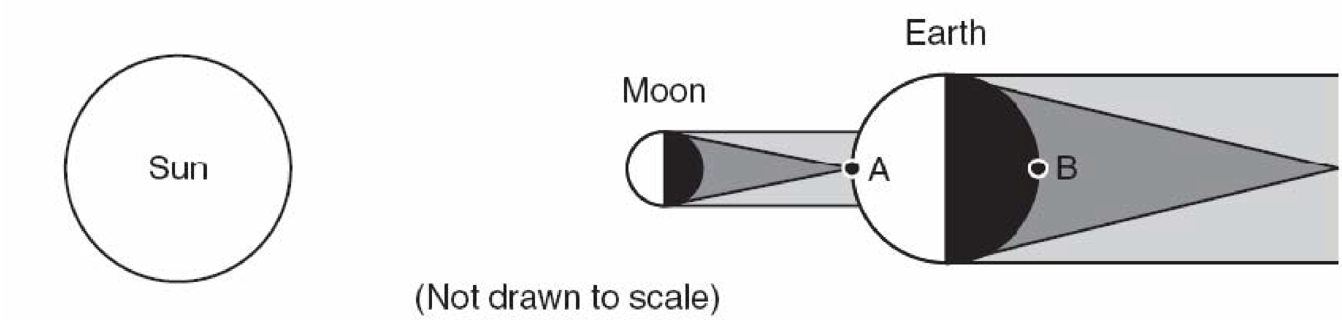
26. What is happening in this picture?



27. Label the moon phases in the diagram.



Use the following diagram to answer questions 28-30.

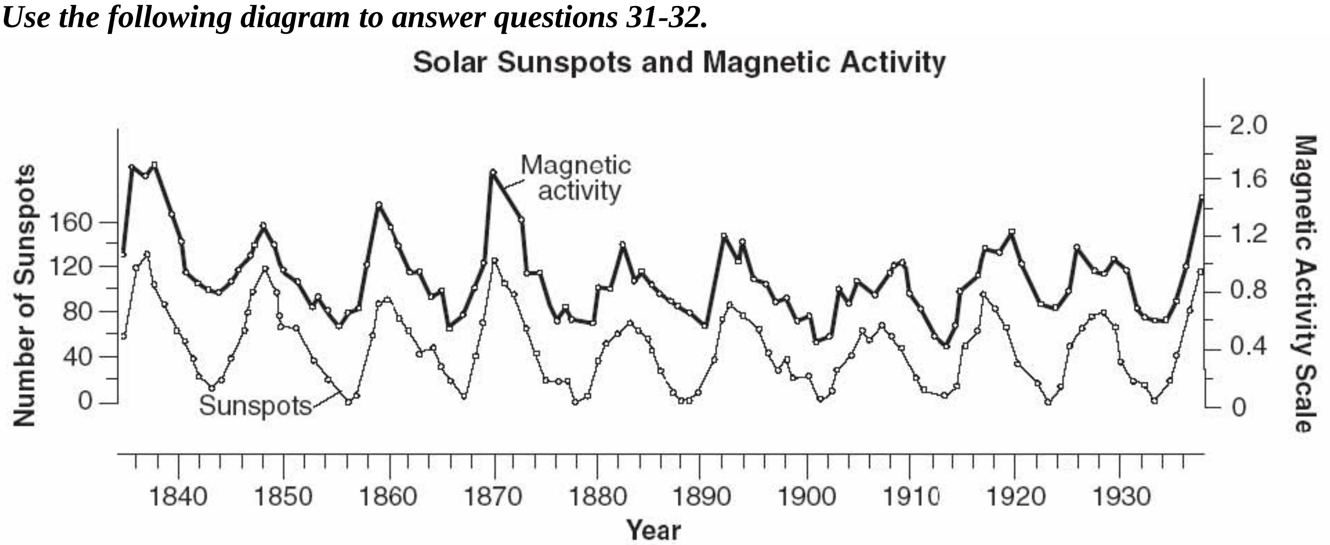


28. What time is it at location B?

29. What is location A experiencing?

30. What phase of the moon is shown in the diagram?

Use the following diagram to answer questions 31-32.

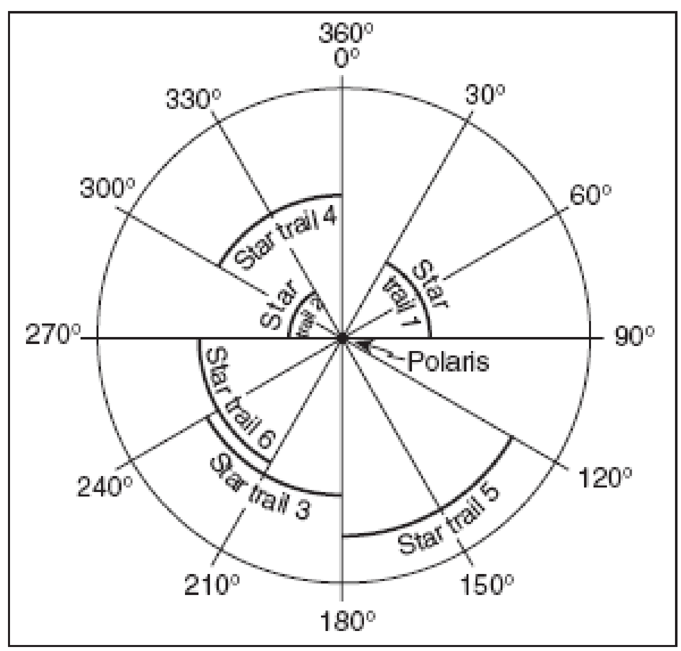


31. What is the relationship between sunspots and magnetic activity?

32. Describe this graph.

33. The diagram below represents the shape of the Milky Way Galaxy. The Milky Way Galaxy is best described as
(1) elliptical (2) circular (3) irregular (4) spiral

34. A camera was placed outside at night and pointed directly at *Polaris* and several other stars. The lens was kept open and a time-exposure photograph was taken. The diagram below represents that photograph of *Polaris* and star trails, with an angular protractor to measure apparent motion.



How many hours was the lens kept open to create the star trails in this photograph?
(1) 1 hour (3) 3 hours
(2) 6 hours (4) 4 hours