EARTH MOTIONS REVIEW:

A) Apparent motion

The seeming motion of one object due to the actual motion of second object

Example - Daily motion of Sun, Moon and stars (caused by earth's rotation)

B) Real motion

The actual motion of an object relative to another

Examples:

1) Revolution of Earth around Sun
2) Revolution of Moon around Earth
3) Rotation of Earth on axis

C) Geocentric model:

a) Earth at center
b) Sun, Moon, stars, and planets revolve around Earth
c) Because it cannot predict **planetary** motion, so the model fails.

D) Heliocentric model:

a) Sun at center of solar system
b) Earth and planets revolve around Sun
c) Sun is one of many stars
d) Model successfully predicts motions
e) The earth revolves around the Sun = 365 1/4 days
f) Th earth rotates on its axis = 24 hours

E) Lunar motion

a) Moon revolves around Earth
b) 1 revolution = 27 1/3 days
c) 1 complete set of Lunar phases = 29 1/2 days.
d) 1 lunar rotation = 1 set lunar phases so that same side of moon always faces Earth

F) Solar motion

a) Apparent motion (due to rotation of Earth) from east to west.
b) Rate = 15E/hr.
c) Apparent path in sky varies with seasons due to23.5E tilt of the Earth on its axis
d) The sun is never directly overhead in NYS.
"overhead" means that the sun's rays are perpendicular to the ground = 90E
Never overhead north of 23.5E N Lat or south of 23.5E S Lat.
e) Apparent diameter varies:
1) Largest = closest = Northern Hemis. winter
2) Smallest = farthest = Northern Hemis. summer
f) Solar noon = Sun's highest point in sky (zenith) for the day.

G) Seasons: (applies to northern hemisphere only)

a) Summer solstice: June 21st
1) First day of summer
2) Earth farthest from sun
3) Maximum duration of insolation
4) Sun at maximum yearly noon altitude
5) Sun overhead at noon at 23.5E N. Lat.

b) Autumnal equinox: September 23rd
1) First day of Autumn
2) Equal duration of day and night
3) Sun overhead at noon on equator
c) Winter solstice: December 21st
1) First day of winter
2) Earth closest to sun
3) Minimum duration of insolation
4) Sun at lowest yearly noon altitude
5) Sun overhead at noon at 23.5E S. latitude
d) Vernal (Spring) equinox: March 21st
1) First day of spring
2) Equal duration of day and night
3) Sun overhead at noon on equator

H) Earth's motions and time
a) Evidence for Earth's rotation:
1) Apparent motion of Sun, moon, and stars
2) Movement of surface features as seen from space
3) Coriolis effect: deflection of moving objects (winds, water) due to the rotation of Earth.
4) Motion of Foucault pendulum:
a) Appears to change direction of swing over 24 hours.
b) Actual direction doesn't change; Earth rotates beneath pendulum
b) Rotational speed:
1) Greatest at equator: 465 m/sec
2) Least at poles: 0 m/sec
3) 15E/hour everywhere
c) Time based on Earth motions:
1) 1 rotation = 1 day
2) 1 revolution = 1 year
d) As the distance between a planet and the sun increases, the period of revoliution increases.

I) The Geometry of Orbits
a) Ellipses and eccentricity:
1) Planets orbit sun (or star)
2) Moons orbit planet
3) All orbits are ellipses
4) An ellipse has 2 foci (The sun is at one focus of the earth's orbit)
5) eccentricity = "out of roundness"

$$e = \text{eccentricity} \qquad e = \frac{D \text{ (dist. between foci)}}{L \text{ (length of major axis)}}$$

6) Maximum e = 1 (a line)
7) Minimum e = 0 (a circle)
8) Orbital speed of a planet is inversely proportional to distance from

the sun.
a) close = fast (more Ke, less Pe)
b) far = slow (less Ke, more Pe)

9) Keppler's Law: equal swept area in equal time.

10) Keppler's Law: Period of revolution directly proportional to distance from sun.
a) close = short period (mercury year = 88 earth days)
b) far = long period (pluto year = 247.7 earth years)

SUMMARY

SUMMER* =	FAR =	SLOW =	WEAK GRAV =	SMALLEST APP DIAM =	LEAST Ke =	MOST Pe =	LONGEST DURATION OF INSOL. =	MOST DIRECT INSOL.

* For winter, just reverse everything.

> Luminosity: The brightness of a star as compared to our sun. Luminosity is INDEPENDENT of distance.

> The color of a star is an indication of it's temperature:
a) Red = cool
b)Yellows and whites = hotter
c) Blue = hottest

> Doppler effect:
Red shift = object moving AWAY
Blue shift = object moving closer

Need-2-Know
For "Earth in Space - Solar Motions" Unit

1) The important dates of the year: The equinoxes and solstices.
For each date know:
a) Which season begins
b) Altitude of sun in NYS at solar noon
c) Latitude at which sun is overhead at solar noon.
d) Location of earth in orbital diagram on given date.
e) Gravitational attraction between earth and sun (max or min)
f) Ke and Pe (max or min)
g) orbital velocity (fast or slow)
h) day/night hours
i) direction of sunrise/sunset for given location on specific dates
j) direction to face to see the noon sun

2) Be able to interpret celestial sphere diagrams. Given a diagram be able to tell
   a) At what location (latitude) and date was this diagram made.
   b) If there are several paths on one diagram, can you tell the date on which a given path was drawn.
   c) Maximum solar altitude for any path.
   d) Direction of a shadow cast by a vertical pole at noon.

3) Interpret orbital diagrams: Be able to tell
   a) eccentricity of orbit (e)
   b) season of the year for a given hemisphere at a given location
   c) orbital velocity (max or min) at a given point in the orbit
   d) Pe and Ke (max or min) for a given point in the orbit

4) Vocabulary:

a) duration	f) altitude	k) gravity
b) insolation	g) revolution	l) velocity
c) zenith	h) rotation	m) apparent motion
d) eccentricity	i) orbit	n) real motion
e) focus	j) ellipse	o) apparent diameter

5) Keppler's law: Equal swept area in equal time.
6) Relationship between "distance between foci" and eccentricity.
7) Max and Min possible eccentricity
8) Name of shape w/max eccentricity - name of shape w/min eccentricity
9) Be able to look at a diagram of the earth/moon system and understand the phase of the moon visible to an observer on the night side of the earth.
10) Answer questions about the length of a shadow.