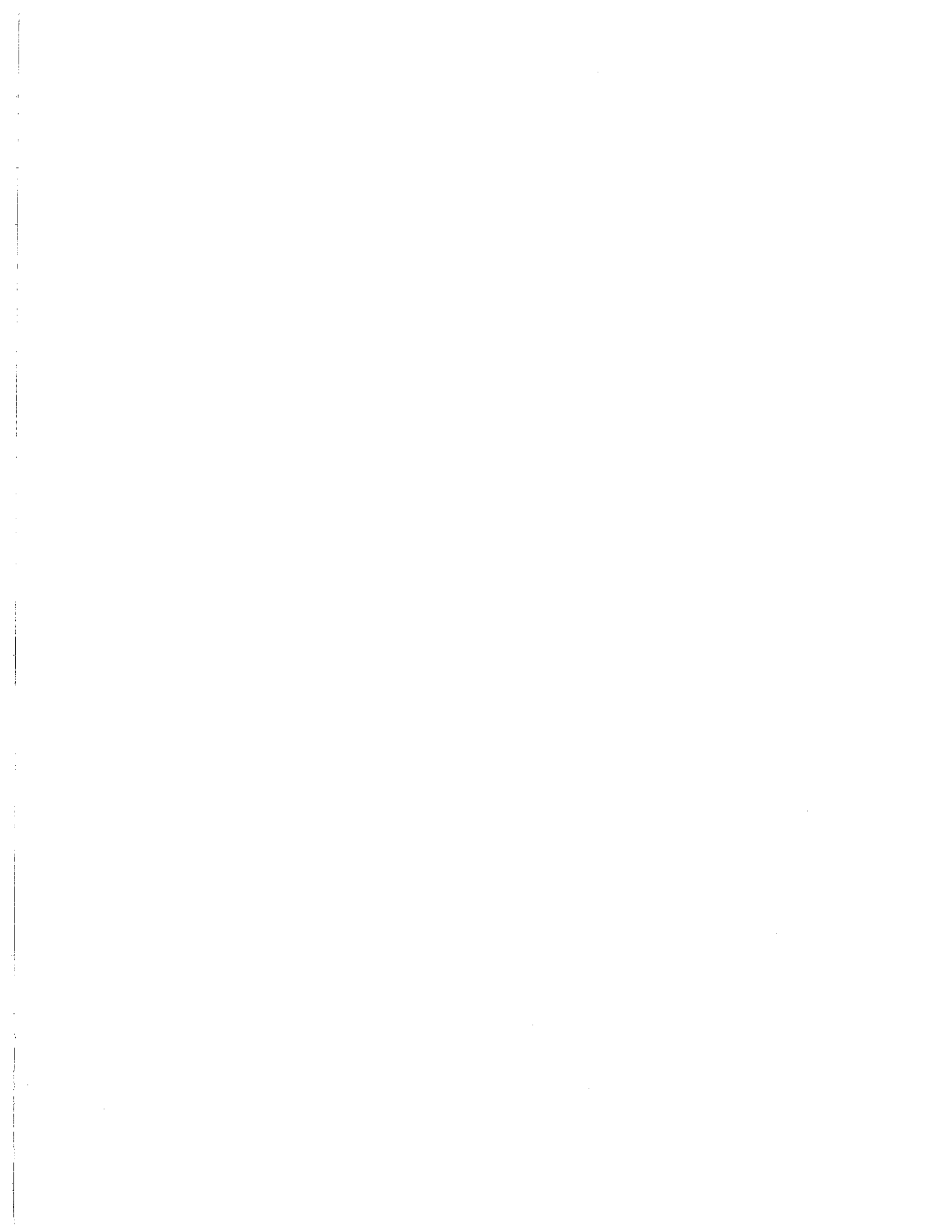


Astronomy



Warren Mott



Units Used in Astronomy

NAME OF UNIT	SYMBOL OR ABBREVIATION	DESCRIPTION AND METRIC (SI) EQUIVALENT UNITS
angstrom	Å	Measure of the wavelength of light. 1 Å = 10^{-10} m or 10^{-8} cm
astronomical unit	AU	Average Earth-Sun distance. 1 AU = 92.95582×10^6 mi 1 AU = 1.495979×10^{11} m
light-year	ly	Distance that light travels in one year. 1 ly = 6.3240×10^4 AU 1 ly = 5.9×10^{12} mi 1 ly = 9.46053×10^{15} m
parsec	pc	1 pc = 3.261633 ly 1 pc = 206,265 AU 1 pc = 3.085678×10^{16} m
kiloparsec	kpc	1,000 pc
megaparsec	Mpc	1,000,000 pc

Constants

Quantity	Value
astronomical unit (A.U.)	149,597,870.691 kilometers
light year (ly)	$9.460536207 \times 10^{12}$ km or 63,240 A.U.
parsec (pc)	$3.08567802 \times 10^{13}$ km or 206,265 A.U.
sidereal year	365.2564 days
Earth mass	5.9736×10^{24} kilograms
Sun mass	1.9891×10^{30} kg = 332,980 × Earth
mean Earth radius	6371 kilometers
Sun radius	6.96265×10^5 km = 109 × Earth
Sun luminosity	3.827×10^{26} watts
speed of light (c)	299,792.458 kilometers/second
gravitational constant (G)	6.6726×10^{-11} m ³ /(kg sec ²)



Main Sequence Star Properties

Color	Class	solar masses	solar diameters	Temperature	Prominent Lines
bluest	O	20 - 100	12 - 25	40,000	ionized helium
bluish	B	4 - 20	4 - 12	18,000	neutral helium, neutral hydrogen
blue-white	A	2 - 4	1.5 - 4	10,000	neutral hydrogen
white	F	1.05 - 2	1.1 - 1.5	7,000	neutral hydrogen, ionized calcium
yellow-white	G	0.8 - 1.05	0.85 - 1.1	5,500	neutral hydrogen, strongest ionized calcium
orange	K	0.5 - 0.8	0.6 - 0.85	4,000	neutral metals (calcium, iron), ionized calcium
red	M	0.08 - 0.5	0.1 - 0.6	3,000	molecules and neutral metals

The Brightest Stars

Name	Spectral Class	Apparent Magnitude	Absolute Magnitude	Distance (LY)
Sirius	A1	-1.47	1.4	8.7
Canopus	F0	-0.72	-3.1	98
Rigel Kentaurus	G2	-0.01	4.4	4.3
Arcturus	K2	-0.06	-0.3	36
Vega	A0	0.04	0.5	26.5
Capella	G8	0.05	-0.6	45
Rigel	B8	0.14	-7.1	900
Procyon	F5	0.37	2.7	11.3
Betelgeuse	M2	0.41	-5.6	520
Achernar	B3	0.51	-2.3	118
Hadar	B1	0.63	-5.2	490
Altair	A7	0.77	2.2	16.5
Aldebaran	K5	0.86	-0.7	68
Acryx	B2	0.86	-3.5	260
Spica	B1	0.90	-3.3	220
Antares	M1	0.91	-5.1	520
Fomalhaut	A3	0.92	2.0	22.6
Pollux	K0	1.15	1.0	35
Deneb	A2	1.16	-7.1	1600
Beta Crucis	B0.5	1.26	-4.6	490

The Nearest Stars

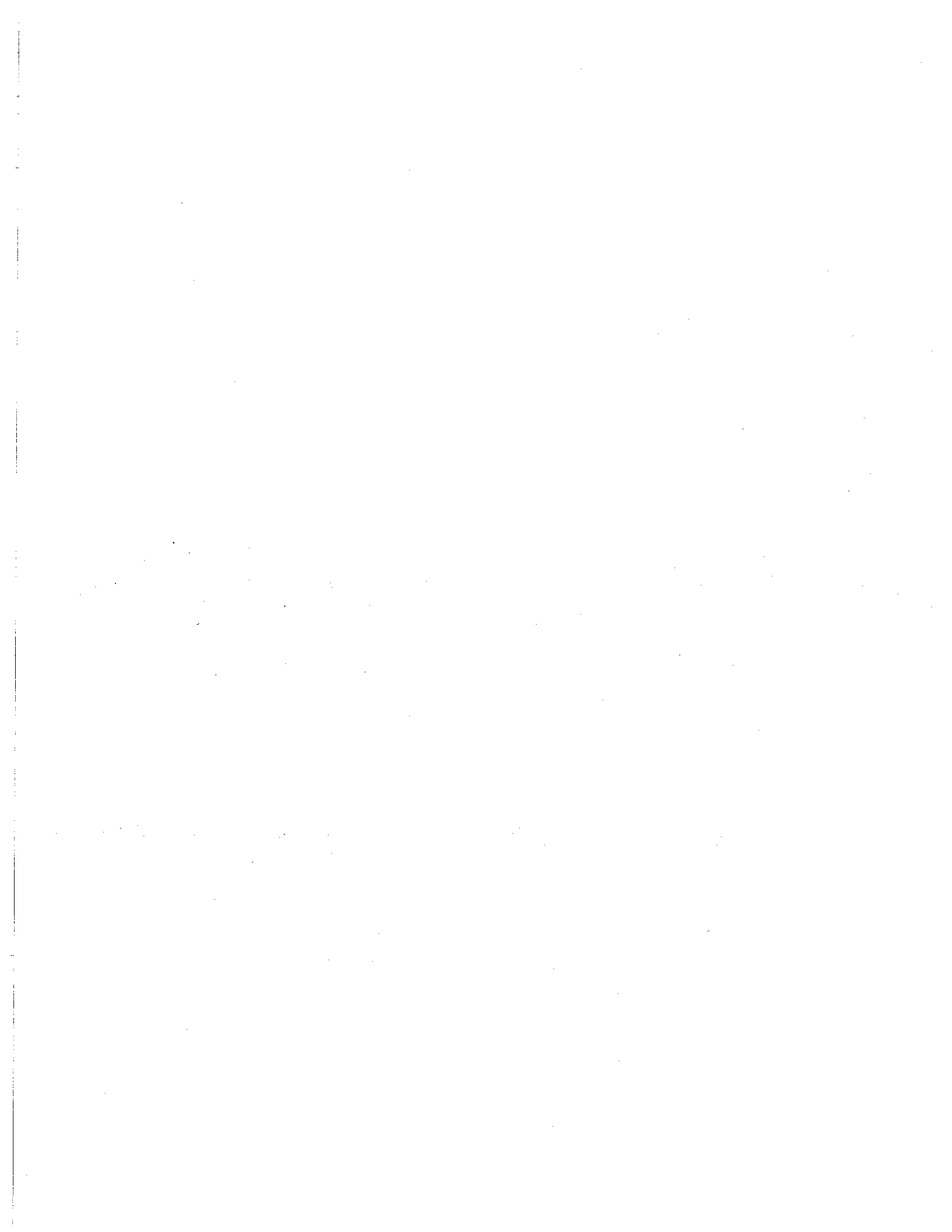
Name	Spectral Class	Apparent Magnitude	Absolute Magnitude	Distance (LY)
Sun	G2	-26.7	4.83	
Proxima Centauri	M5	11.05	15.45	4.28
α Cen A	G2	0.1	4.38	4.3
α Cen B	K5	1.5	5.76	4.3
Barnard's Star	M5	9.5	13.21	5.9
Wolf 359	M6	13.5	16.80	7.6
Lalande 21185	M2	7.5	10.42	8.1
Sirius A	A1	-1.5	1.41	8.6
Sirius B	White Dwarf	7.2	11.54	8.6
Luyten 726-8A	M5	12.5	15.27	8.9
Luyten 726-8B (UV Cet)	M6	13.0	15.8	8.9
Ross 154	M5	10.6	13.3	9.4
Ross 248	M6	12.2	14.8	10.3
ϵ Eri	K2	3.7	6.13	10.7
Luyten 789-6	M7	12.2	14.6	10.8
Ross 128	M5	11.1	13.5	10.8
61 Cyg A	K5	5.2	7.58	11.2
61 Cyg B	K7	6.0	8.39	11.2
ϵ Ind	K5	4.7	7.0	11.2
Procyon A	F5	0.3	2.64	11.4
Procyon B	White Dwarf	10.8	13.1	11.4
Σ 2398 A	M4	8.9	11.15	11.5
Σ 2398 B	M5	9.7	11.94	11.5
Groombridge 34 A	M1	8.1	10.32	11.6
Groombridge 34 B	M6	11.0	13.29	11.6
Lacaille 9352	M2	7.4	9.59	11.7
τ Ceti	G8	3.5	5.72	11.9
BD + 5° 1668	M5	9.8	11.98	12.2
L 752-32	M5	11.5	15.27	12.4
Lacaille 8760	M0	6.7	8.75	12.5
Kapteyn's Star	M0	8.8	10.85	12.7
Kruger 60 A	M3	9.7	11.87	12.8
Kruger 60 B	M4	11.2	13.3	12.8

Planets: Orbital Properties

Planet	distance (A.U.)	revolution	eccentricity	inclination (deg)
Mercury	0.387	87.969 d	0.2056	7.005
Venus	0.723	224.701 d	0.0068	3.3947
Earth	1.000	365.256 d	0.0167	0.0000
Mars	1.524	686.98 d	0.0934	1.851
Jupiter	5.203	11.862 y	0.0484	1.305
Saturn	9.537	29.457 y	0.0542	2.484
Uranus	19.191	84.011 y	0.0472	0.770
Neptune	30.069	164.79 y	0.0086	1.769

Planets: Physical Characteristics

Planet	Mass ($\times M_E$)	Diameter (km)	density (g/cm^3)	rotation	axis tilt (deg)	mag. field (\times Earth's)	Surface Gravity
Mercury	0.0553	4879	5.427	58.785 d	~ 0	0.0006	0.378
Venus	0.815	12,104	5.243	243.686 d	177.36	0.00	0.903
Earth	1.000	12,742	5.515	23.9345 h	23.45	1.000	1.00
Mars	0.107	6779	3.933	24.6229 h	25.19	0.00	0.379
Jupiter	317.83	139,822	1.326	9.9250 h	3.13	19,519	2.54
Saturn	95.159	116,464	0.687	10.656 h	26.73	578	1.16
Uranus	14.536	50,724	1.270	17.24 h	97.77	47.9	0.919
Neptune	17.147	49,244	1.638	16.11 h	28.32	27.0	1.19



UNIT 1

Astronomy Basics

History of Astronomy

Basic Concepts of Astronomy

Earth-Sun Relationship



Unit 1 Guided Notes

The 3 topics Unit 1 covers are:

- 1)
- 2)
- 3)

History of Astronomy

Vocab Words that go along with History of Astronomy:

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People cared about Astronomy in ancient times because it pertained to the following things in their everyday lives:

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Most facts about astronomy were actually known _____ of years ago, without the sophisticated tools we have today (i.e. telescopes and modern technology). However, they did use _____.

_____ is the study of astronomy in ancient civilizations.

*Some famous archeoastronomy sites are:

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*The end of archeoastronomy was in _____.

*After archeoastronomy, astronomers began keeping _____ or their discoveries and their reasoning.

Some of the earliest astronomers were (as we go through each astronomer, list one reason why he is important to the history of astronomy):

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Some things we knew about astronomy back then, but people didn't necessarily believe, were:

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We currently believe in the _____ model of the solar system.

The 3 theories on the formation of the Universe are:

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The _____ theory is the theory the universe began from a giant explosion and all the galaxies within the universe have expanded to where they are today.

The _____ theory is the theory that the universe was formed the way it is today and will remain unchanged over time.

The _____ theory is the theory that the universe was formed from electrically charged particles and magnetic phenomena.

Basic Concepts in Astronomy

Vocab words that go along with Basic Concepts in Astronomy are:

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The two units we use to measure distances in space are _____ & _____.
_____ is the average distance between the earth and the sun.

*It is equal to _____ km.

*We use it to measure distances _____ our solar system.

_____ is the distance light travels in one year.

*It is equal to _____ km.

*We use it to measure distances _____ our solar system, but within our galaxy.

_____ is a group of stars that forms a figure when put together.

*There are _____ constellations recognized by the International Astronomical Union.

* They were named thousands of years ago for _____ or _____.

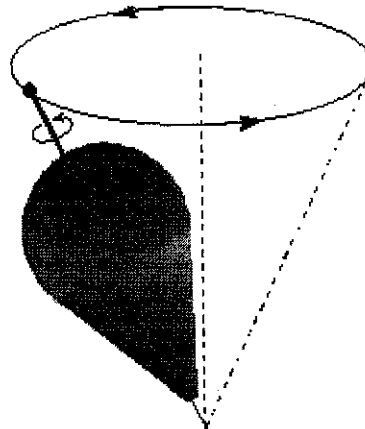
* _____ are popular, unofficial names for constellations.

_____ is the gradual movement of earth's axis overtime.

*Currently the earth is tilted _____ ° and is pointed at the _____.

*Every _____ years the earth's axis traces out an imaginary circle VERY slowly.

*During this shift, the tilt of the earth will point at _____, then _____ and finally _____.



Earth-Sun Relationship

Vocab words that go along with Earth-Sun Relationship are:

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_____ is the spherical representation of the earth.

* _____ is the imaginary line that separates the earth into a northern and southern hemisphere.

* _____ is the imaginary line that separates the earth into an eastern and western hemisphere.

* _____ are imaginary lines that measure distances north and south of the equator.

* _____ are imaginary lines that measure distances east and west of the prime meridian.

The earth moves in 2 ways.

*It _____, or spins around itself, every _____ hours.

*The imaginary line around which it spins is called its _____.

*It _____, or travels around the sun, every _____ days.

*Earth's _____ gives us day and night.

*Earth's _____ gives us the 4 seasons, but only because its axis is _____.

*Earth is actually closer to the sun in _____ and furthest in _____.

Earth's Seasons

The sun appears to shine directly at the _____, then shine directly at the _____, then back to the _____, then directly at the _____ and back to the _____ again. It repeats this cycle each year.

_____ is $23\frac{1}{2}^{\circ}$ N latitude. It is the furthest North the sun appears to ever shine directly. The sun shines here on _____.

_____ is $23\frac{1}{2}^{\circ}\text{S}$ latitude. It is the furthest South the sun appears to ever shine directly. The sun shines here on _____.

The summer solstice is the _____ day of summer.

*It is around _____ in the Northern Hemisphere and around _____ in the Southern Hemisphere.

*It is the _____ day of the year.

*It is the day your hemisphere is tilted _____.

The winter solstice is the _____ day of winter.

*It is around _____ in the Northern Hemisphere and around _____ in the Southern Hemisphere.

*It is the _____ day of the year.

*It is the day your hemisphere is tilted _____.

The autumnal equinox is the _____ day of fall.

*It is around _____ in the Northern Hemisphere and around _____ in the Southern Hemisphere.

*There is _____ hours of daylight and _____ hours of darkness.

*It is the day the sun is shining directly at the _____, but appears to be moving _____ (towards winter).

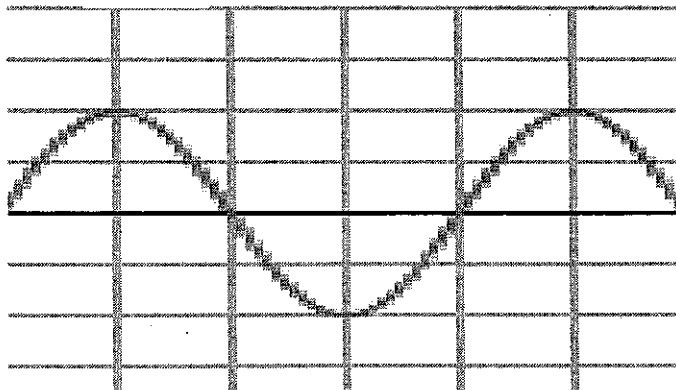
The vernal equinox is the _____ day of spring.

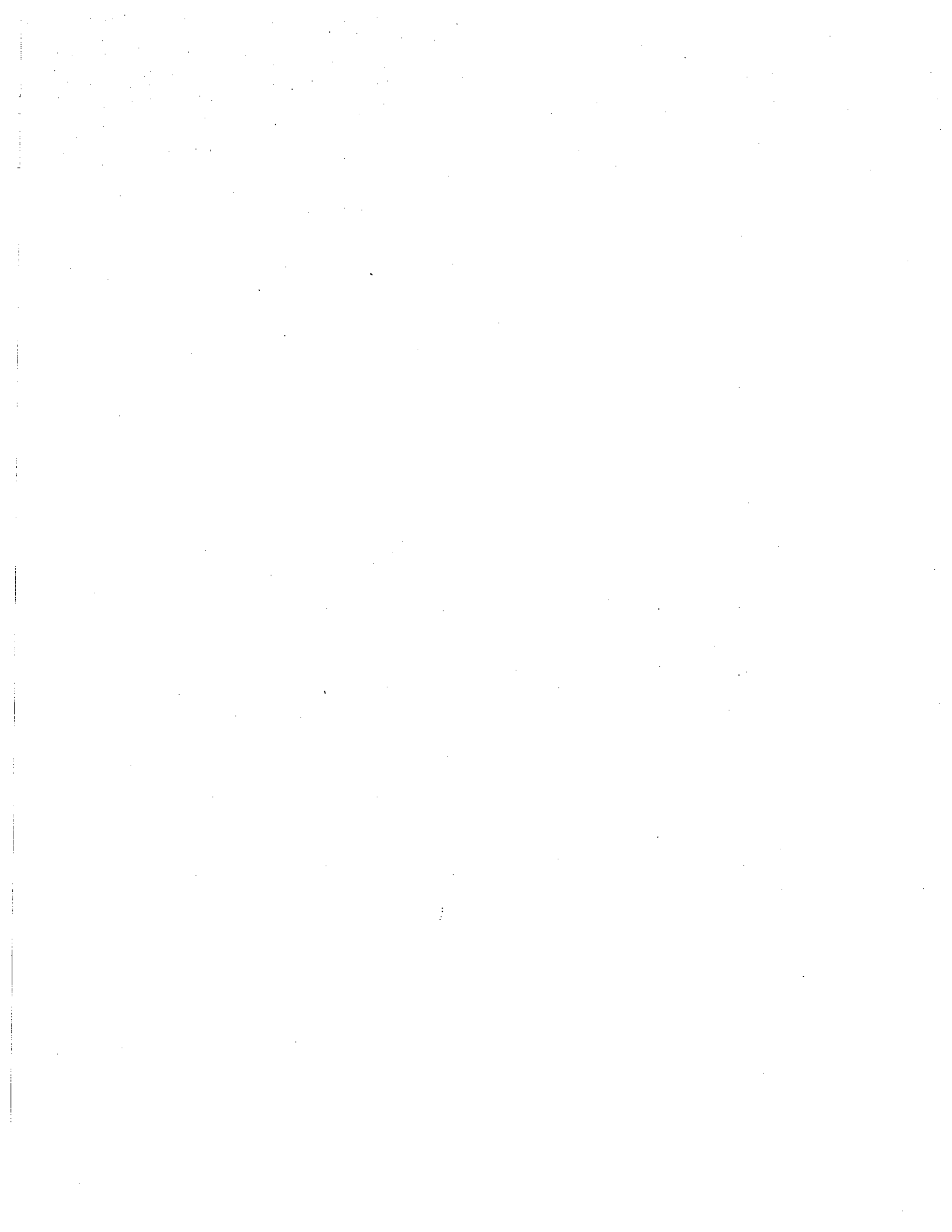
*It is around _____ in the Northern Hemisphere and around _____ in the Southern Hemisphere.

*There is _____ hours of daylight and _____ hours of darkness.

*It is the day the sun is shining directly at the _____, but appears to be moving _____ (towards summer).

The apparent altitude of the sun changes throughout the year in the following way.





UNIT 2

Motion of Celestial Bodies

Telescopes

Celestial Spheres/Constellations

Apparent Motion of the Stars

Motion of the Planets



Unit 2 Guided Notes

The 4 topics Unit 2 covers are:

- 1)
- 2)
- 3)
- 4)

Telescopes

The vocab words that go along with telescopes are:

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_____ invented the telescope in _____.

Galileo was the first to _____ in _____.

The 3 types of telescopes are:

- 1)
 - *There are two types or these....
 - a)
 - b)

- 2)
- 3)

_____ study visible light.

*One type is the _____ that uses mirrors to bounce light traveling through the telescope.

*The other type is the _____ that uses lenses to bend light and magnify the image.

_____ use a parabolic antenna and a receiver to study radio waves.

*This is a type of radiation that is usually not visible to the naked eye.

_____ travel out of earth's atmosphere to study all the different types or radiation that can not make it through earth's atmosphere.

*Two examples are _____ & _____.

*These are important because without them we couldn't study a great deal of radiation because it never makes it past earth's atmosphere!

Celestial Sphere & Constellations

Vocab words that go along with celestial sphere & constellations are:

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A _____ is an imaginary sphere surrounding the earth where the sun, moon and all the stars appear to be combined.

*You use _____ & _____ to locate on the celestial sphere.

- _____ measures angular distance north and south of the celestial equator.

- _____ measures distances eastward along the celestial equator from the vernal equinox.

*Constellations on the celestial sphere that are close enough to celestial pole, they are visible all year long are called _____.

- _____ are constellations that are visible from the North celestial pole all year long.

- _____ are constellations that are visible from the South celestial pole all year long.

*The _____ is the apparent path the sun traces out across the sky throughout the year.

*Along the _____ lie the 12 constellations of the _____.

- These 12 constellations are:

Apparent Motion of the Stars

Vocab words that go along with apparent motion of the stars are:

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_____ is the circular path a star appears to take each day.

_____ is the apparent shift of an object due to a change in the viewers position.

*Stars display this.

*As the earth moves around the sun, it changes our _____ of the stars. This causes the stars to display _____.

*We use this to determine _____ to stars.

*Stars that are further away display _____, while stars that are closer to us display _____.

Motion of the Planets

Vocab Words that go along with Motion of the Planets are:

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_____ is that amount of time it takes the earth to get back to its previous location. This lasts _____ hours, _____ minutes and _____ seconds.

*We use a _____ hour day though, because the earth not only revolves each day, but it _____.

Planets move relative to the _____ stars in the background.

* _____ motion is when planets move "normally" westward.

* _____ motion is when planets appear to move "backward" or eastward across the sky.

-The planets don't actually switch the direction they are moving in. Instead the orbit of _____ and _____ are _____ with each other.

_____ developed 3 laws for how the planets move around the sun.

*He did this by _____ & _____ of how the planets moved over many years.

*We are studying the first _____ laws.

*These laws apply to how ALL the planets (including earth) move around the sun and to how _____ move around their _____.

*Kepler's 1st Law of Planetary Motion is:

-Here is the picture that applies to Kepler's 1st Law:

-An _____ appears as a squashed circle. It is defined as closed loop where the _____ of the distances from 2 points (the _____) to every point on the line is constant.

-Kepler's 1st Law implies there are times during the year we are closer to the sun and other times we are further.

*We are closest to the sun in _____, or _____. We are _____ km from the sun at this time.

*We are furthest from the sun in _____, or _____. We are _____ km from the sun at this time.

*Kepler's 2nd Law of Planetary Motion is:

-Here is the picture that applies to Kepler's 2nd Law:

-When we are closer to the sun, we travel _____ than when we are further away!

-This is because the _____ increases when we are closer to our parent object.

-On average the earth travels _____.

UNIT 3

Satellites

Artificial Satellites

Natural Satellites

*Orbit of Our Moon

*Surface Features of Our Moon

*Origin of Our Moon



Unit 3 Guided Notes

The topics Unit 3 covers are:

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Artificial Satellites

Vocab Words that go along with Artificial Satellites:

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An _____ is a man-made object put into orbit around another object.

- They orbit things like _____, _____, _____, etc.
- They remain in orbit by _____.
- They include _____ of instruments.
- Each artificial satellite must include a _____ and a _____.

The 6 types of artificial satellites are (include a description of each one):

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-
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Natural Satellites

Vocab Words that go along with Natural Satellites are:

A Natural Satellite is _____

_____ It is _____. They remain in orbit due to a _____ exerted upon it by its parent object.

*The _____ is a natural satellite of the sun.

*All the _____ & _____ are natural satellites of the sun.

*The _____ is a natural satellite of the earth.

*Jupiter has _____ natural satellites in orbit around it.

Our Moon's Orbit

Vocab words that go along with "Our Moon's Orbit" are:

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The moon _____ around earth every _____ days.

The moon also _____ around itself every _____ days.

This means the moon has a _____.

-A Synchronous Orbit is when _____.

-The moon rotates at the _____ as it is revolves.

-This causes the moon to have a _____ and a _____.

-The _____ is the side of the moon that ALWAYS faces earth.

-The _____ is the side of the moon that NEVER faces earth.

-List some differences between the Near Side & the Far Side.

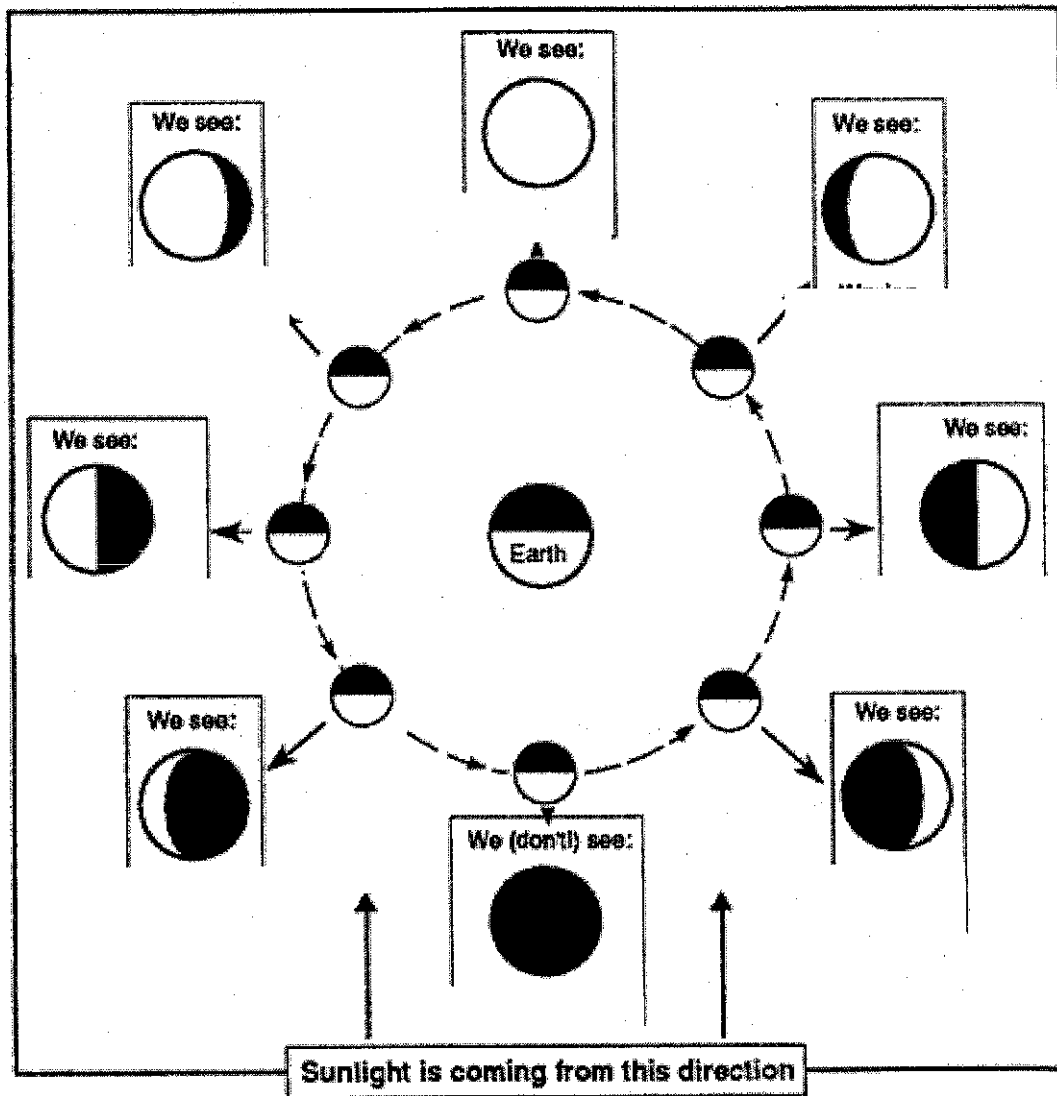
Moon Phases are _____

The moon is always _____ lit up.

-The phase we see in the night sky are _____

-The moon goes through ____ distinct phases during each _____ around earth:

- *
- *
- *
- *
- *
- *
- *
- *
- *



- _____ is when none of the lit up portion of the moon is facing earth.

- _____ is when all of the lit up portion of the moon is facing earth.

- _____ are the growing phases of the moon.

- _____ are the shrinking phases of the moon.

The moon's orbit is _____ from the earth's orbit.

- This means _____ & _____ will not occur each month.

- A solar eclipse is when _____
_____.

*The moon should be in _____ phase at this point.

*Here is the position of the sun, moon and earth when this occurs:

- A lunar eclipse is when _____
_____.

*The moon should be in _____ phase at this point.

*Here is the position of the sun, moon and earth when this occurs:

Our Moon's Surface Features

Vocab Words that go along with "Our Moon's Surface Features"

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When Galileo first looked at the moon he thought he was seeing _____ &
_____.

The surface features of the moon are _____ & _____.

*Maria are _____
_____.

*Highlands are _____
_____.

The moon is also covered in _____.

*Craters are _____
_____.

Origin of the Moon

There are many different theories on the origin of the moon. You will read about some of these in your reading booklet and in the "Geological History of the Moon" Lab.

UNIT 4

The Sun

Basic Sun Information

Energy Formation and Layer of the Sun

Surface Features of the Sun



Unit 4 Guided Notes

Unit 4 Covers

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-
-

Basic Sun Information

Vocab words that go along with "Basic Sun Information"

-

"Fun Sun Data"

Diameter	1,391,940km
Circumference	4,379,000
Radius	695,970km
Mass	1.989 x 10 ³⁰ kg
Temp. at Core	15,600,000 K \approx 15599727 °C
Temp. at Surface	6400 K \approx 6127 °C
Rotation Period	25 days in middle, 35 day near poles
Luminosity	3.85 x 10 ²⁶ watts - we use 1 on our HR diagram because we compare other stars to the sun!
Absolute Magnitude	4.83
Apparent Magnitude	-26.7
Spectral Class	G Type Star - means it is yellow!
Spectral Type	G2 V
Solar Constant	1400 watts/m ²

-The sun is an _____ star. It appears so big because _____

-We study the sun because....

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-
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-
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-The _____ is _____ at the center of our Solar System.

-The sun _____ around itself.

-The center rotates every _____.

-The areas near the poles rotate every _____.

-The sun is located on _____.

-The sun is made of _____, _____, and _____.

-Those other elements consist of _____ different elements.

-The sun is surrounded by a large _____, which causes _____.

-A magnetic field is _____.

-The uneven rotation of the sun causes the _____ to flip every _____.

-This means the Solar Cycle is _____, because it takes that long for the magnetic field to flip-flop to where it began.

Energy Formation & Layers of the Sun

Vocab words that go along with "Energy Formation & Layers of the Sun"

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-Energy is produced in the _____ of the sun.

-The process of energy production is called _____.

-Hydrogen Fusion is when _____.

-For this process to occur, there has to be _____, which the core of the sun has!

-The difference between "Fission" and "Fusion" is _____.

-The sun uses the _____ process!

-Draw a visual representation of Hydrogen Fusion

-During the Hydrogen Fusion process, a _____ is given off.

-A neutrino is _____

-The sun is made of _____ layers.

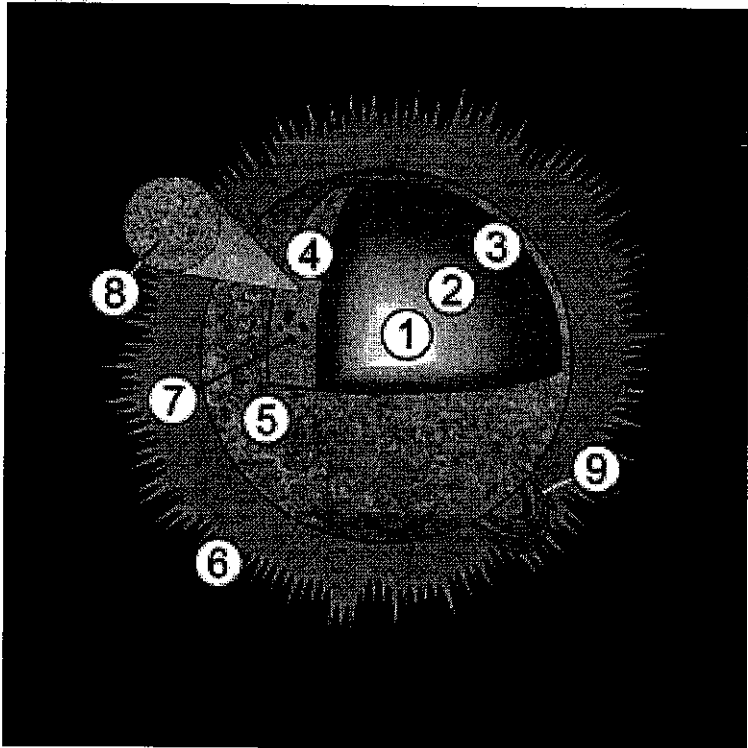
-The 3 layers of the sun's interior are:

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-The 3 layers of the sun's atmosphere are:

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-
-

-Each layer of the sun has _____ in energy production of the sun.



#1 is the _____

The core is _____

#2 is the _____

The radiation zone is _____

#3 is the _____

The convection zone is _____

#4 is the _____

The photosphere is _____

#5 is the _____

The chromosphere is _____

#6 is the _____

The corona is _____

-Each _____ of energy takes a different amount of time to reach the _____ from the _____

-A photon is _____

-On average it takes _____ for energy produced in the core to make it to the photosphere of the sun.

-Once the energy hits the photosphere, it takes _____ to reach earth.

Surface Features of the Sun

Vocab words that go along with "Surface Features of the Sun"

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-The solar wind is _____

-It does not actually effect earth in a large way because _____

-The entire photosphere is covered in _____

-Granulation is _____

-It is a result of _____ under the photosphere in the convection zone.

-_____ occur on the surface of the sun. Sometimes there are lots of them, sometimes there are not very many.

-A sunspot is _____

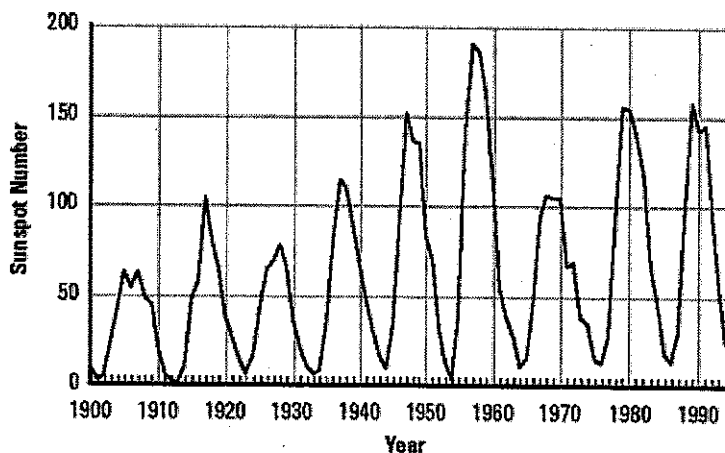
-They are cooler than their surroundings, but still about _____.

-Sunspots go through a _____. They reach a _____, fall down to a _____, then climb back up to a _____ again.

-This takes _____.

-This is directly related to the _____.

Sunspot Cycles 1900-1995



-Sometimes the interaction between _____ and the _____ of a sunspot causes a _____ on the sun's surface.

-If the ejecta is not traveling fast enough a _____ occurs.

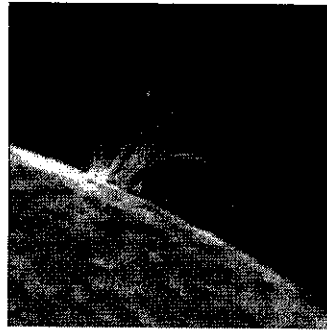
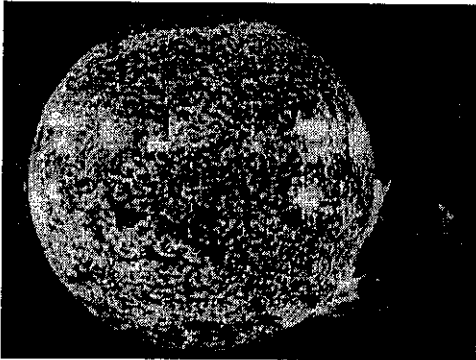
-A solar prominence is _____.

-On average they last for _____.

-If the ejecta is traveling fast enough a _____ occurs.

-A solar flare is _____.

-On average they last for _____.



This is a _____.

This is a _____.

-An increase in the amount of sunspots means an _____ in the number of _____ and _____.

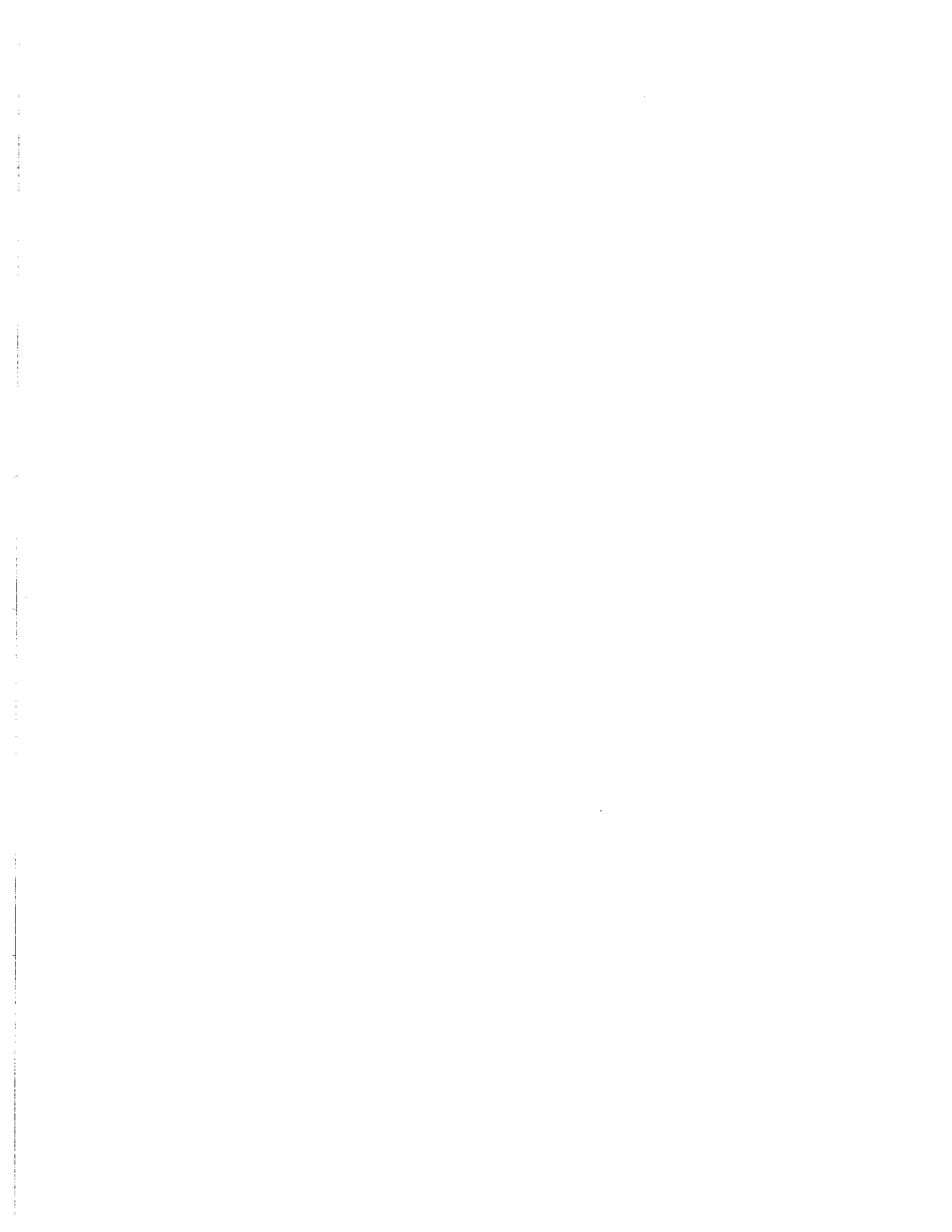
-It is important to follow the Sunspot Cycle because an increase in Solar Flares effects earth! They effect earth by

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UNIT 5

The Stars

Basic Star Information
Electromagnetic Spectrum
Spectral Analysis
Energy Production in Stars
Life Cycle of a Star
HR Diagram



Unit 5 Guided Notes

Unit 5 is _____

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Basic Star Info.

Vocab words for "Basic Star Info."

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A Star is _____

*Every star has different _____, _____, _____, _____, etc.

Most stars behave as _____

*A binary star is _____

*One example is _____ & _____

A star's _____, _____ & _____ are related.

*Spectral class is _____

-The list of spectral classes from hottest to coldest is _____

-O type stars are _____

-B type stars are _____

-A type stars are _____

-F type stars are _____

-G type stars are _____

-K type stars are _____

-M type stars are _____

A star's _____ & _____ are related.

*Luminosity is _____

-Luminosity is measured relative to _____.

-Stars with luminosity less than 1 produce _____ energy than the sun.

-Stars with luminosity more than 1 produce _____ energy than the sun.

*Absolute Magnitude is _____

-The lower the number for magnitude, the _____ the star.

-The sun's absolute magnitude is _____.

Absolute Magnitude and Apparent Magnitude are _____.

*Apparent Magnitude is _____

-Apparent magnitude is dependent on _____.

-The lower the magnitude the _____ the star.

-The sun's apparent magnitude is _____.

Parallax is _____

*Further stars have _____ parallax.

*Closer stars have _____ parallax.

*We can compare a stars apparent and absolute magnitude to determine _____.

-A close star will have an apparent magnitude _____ than its absolute magnitude.

-A far star will have an apparent magnitude _____ than its absolute magnitude.

Electromagnetic Spectrum

Vocab word for "Electromagnetic Spectrum"

The electromagnetic spectrum is _____

*The radiation is sorted into _____ different categories

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*The only types of radiation penetrating earth's atmosphere are _____ & _____.

*The only type of radiation that is actually visible to naked eye is _____.
-It is seen as a variation of the following colors, listed in order of _____ wavelength, _____ frequency & _____ energy.

* _____

Spectral Analysis

Vocab Words for "Spectral Analysis"

Spectral Analysis is _____

*Scientists look at the spectra of _____ and compare those to the spectra of _____ to determine what elements a star is made of.

*Scientists use _____ or _____ to study the spectra of the elements and the stars.

-A spectroscope _____

-A spectrometer _____

Energy Production in Stars

Vocab Words for "Energy Production in Stars"

Energy production in a star is the same as energy production in _____ because _____ is a star!

*It is produced through _____ occurring in the _____ of the star.

-Hydrogen Fusion is _____

The energy is given off as _____.

*A photon is _____

*Each photon takes a _____ path throughout the star.

Life Cycle of a Star

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On average a star lives for about _____ years.

During this _____ years a star goes through _____ in its life.

A star will spend most of its life in the _____ because _____

The final stage of a star's life is determined _____. It is dependent upon the star's _____ & _____.

*Star's are classified in the 3 ways

- _____ stars -
- _____ stars -
- _____ stars -

*The final stage of a stars life is either _____, _____ or _____.

Every star begins its life in a _____.

*A nebula is _____

The nebula then develops at _____.

*A protostar is _____

-Some protostars never get hot enough, or are not large enough for _____ to begin. A protostar in which fusion never begins is called a _____.

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If the protostar is large enough and hot enough, _____ will begin. The star will enter the _____ phase of its life.

*The main sequence is _____

*At this stage the star will _____ into _____ & _____ until it begins to run out of _____.

*Our sun is currently a Main Sequence star.

*Stars spend _____ of their lives in the Main Sequence.

When the star runs out of _____ to fuse, it is going to enter the last stages of its life.

*The final stages of a stars life depend upon the _____ & _____ of the star.

Sun-Sized Stars - _____

*As a sun-sized star runs out of hydrogen, it is left with _____.

*The star will move into _____ phase at this point.

-The giants are _____

-The giants fuse the _____ in the core.

-Helium is a _____ element to fuse. To compensate for this, the outer layer's of the star begin _____.

-This cause the star to become _____.

*Eventually the star will become completely unstable and run out of _____.

-At this point, the expanded outer layers will be shed in a _____ called a _____.

*Once the outer layers are shed, we are left with remnants of the _____ of the star.

-The core is composed of _____ at this point.

-We call this stage _____.

*The white dwarfs are _____

*At this point, the star is not large enough to fuse the carbon, so it will begin _____.

-It cools down to a _____.

*A black dwarf is _____

-This is the final stage of a sun-sized star's life!

Huge Stars - _____

*As a huge star runs out of hydrogen, it is left with _____

*The star will move into _____ phase at this point.

-The supergiants are _____

-The super giants fuse the _____ in the core.

-Helium is a _____ element to fuse. To compensate for this, the outer layer's of the star begin _____

-This cause the star to become _____

***THESE STARS ARE LARGER & BRIGHTER THAN GIANTS!**

*Eventually the star will become completely unstable and run out of _____

-At this point the star will _____ in a _____

-A supernova is _____

*Once the star explodes we are left with _____

-A neutron star is _____

-This is the final stage of a huge star's life!

Massive Stars - _____

*As a massive star runs out of hydrogen, it is left with _____

*The star will move into _____ phase at this point.

-The supergiants are _____

-The super giants fuse the _____ in the core.

-Helium is a _____ element to fuse. To compensate for this, the outer layer's of the star begin _____

-This cause the star to become _____

***THESE STARS ARE LARGER & BRIGHTER THAN GIANTS!**

*Eventually the star will become completely unstable and run out of _____

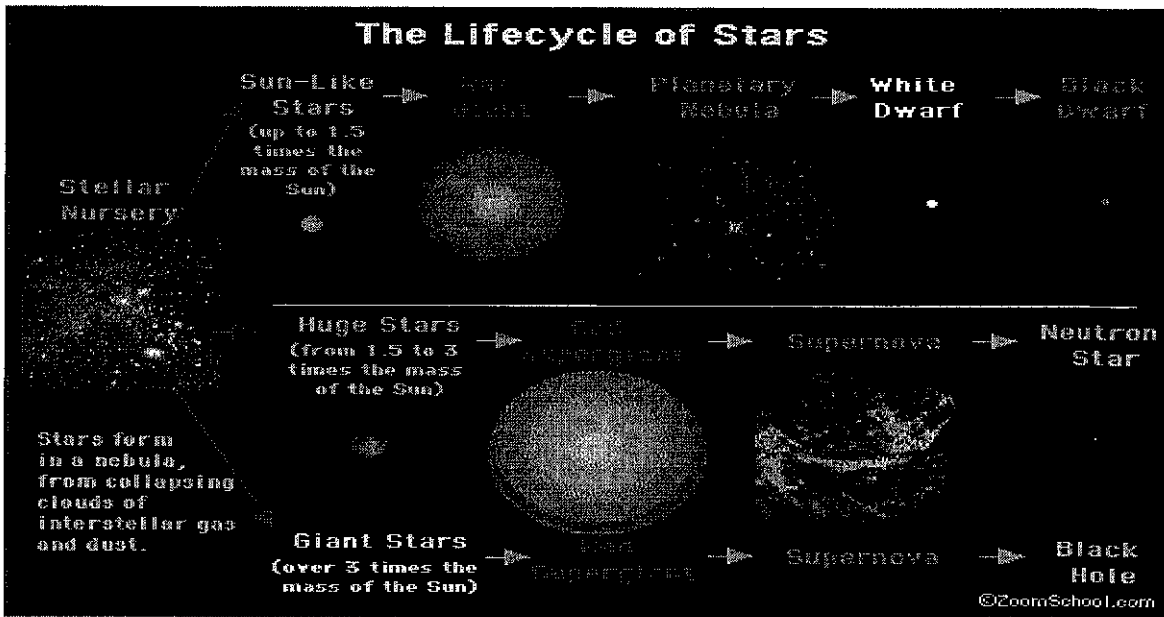
-At this point the star will _____ in a _____

-A supernova is _____

*A massive star is large enough that _____ is so powerful, everything gets _____ into this area of space.

-A black hole is _____

-This is the final stage of a massive star's life!



HR Diagram

Vocab Words for "HR Diagram"

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_____ & _____ developed the Hertzsprung Russell Diagram, or HR Diagram.

*The HR Diagram is _____

-Hertzsprung and Russell originally did this with _____.

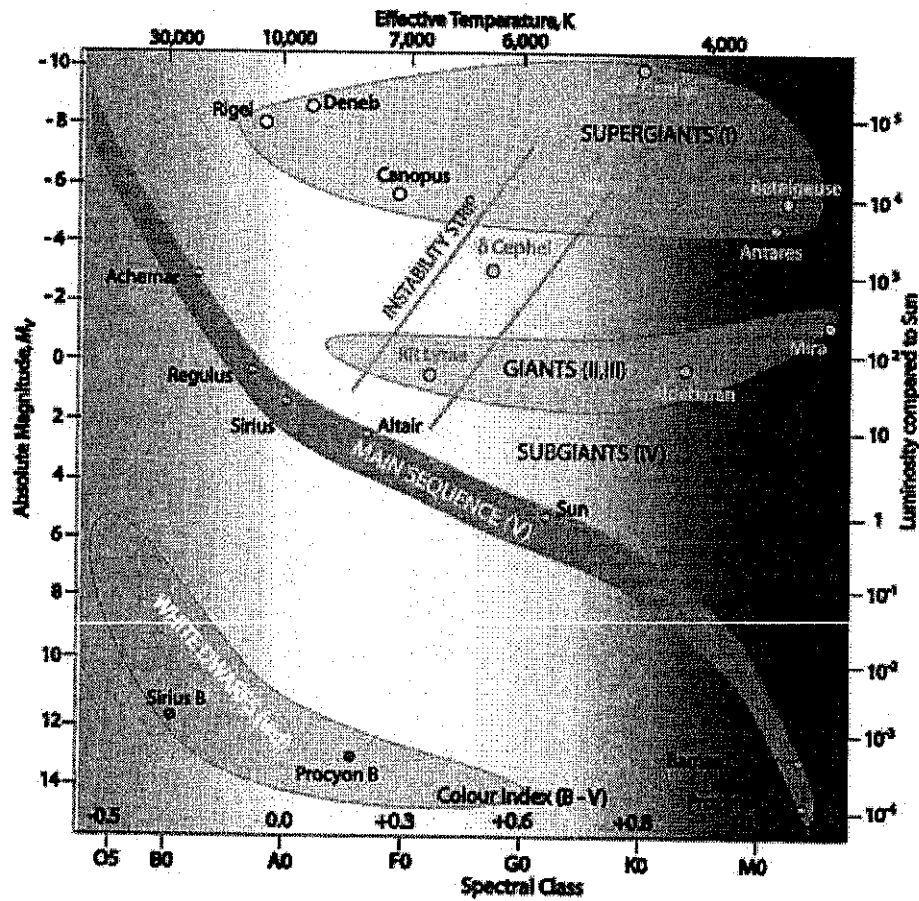
-Since technology has advanced we have been able to chart other stars and link _____, _____ & _____ to the HR Diagram.

Hertzsprung and Russell grouped the stars in the HR Diagram into _____ categories, with similar characteristics.

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-The categories also tell us about _____ or the _____ of the star.

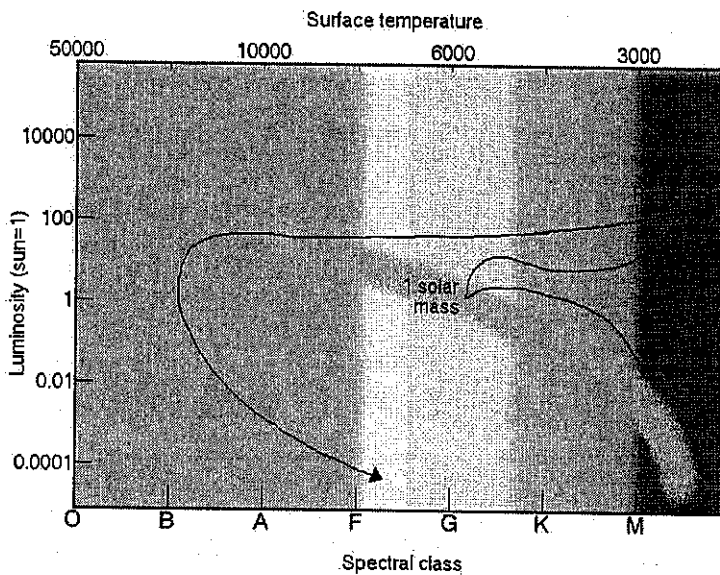
Hertzsprung-Russell Diagram



-We have defined all of these categories previously, except Subgiants.
 *Subgiants are _____

The HR Diagram is sometimes called an _____ because it shows some of the _____ of star's lives on it.

The evolution of the sun along the HR Diagram is below.



UNIT 6

Galaxies

Basic Galaxy Information

Types of Galaxies

*Traits of the Milky Way/Spiral Galaxy

Red Shift & Hubble's Law



Unit 6 Guided Notes

Unit 6 is _____

- _____
- _____
* _____

Basic Galaxy Info.

Vocab words for "Basic Galaxy Info."

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A Galaxy is _____

*We live in the _____ galaxy!

Galaxies behave as a _____.

*A gravitational lens is _____

Our galaxy is currently an _____.

*An active galaxy is _____

-It may be _____ in number of stars.

-It may be performing _____.

-It may contain _____.

Galaxies sometimes perform what is called _____.

*Galactic Cannibalism is _____

Galaxies may also contain a special type of star, a _____ or _____ star.

*A pulsating or variable star is a _____

Types of Galaxies

Vocab Words for "Types of Galaxies"

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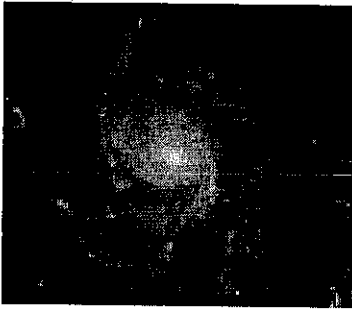
A Spiral Galaxy is _____

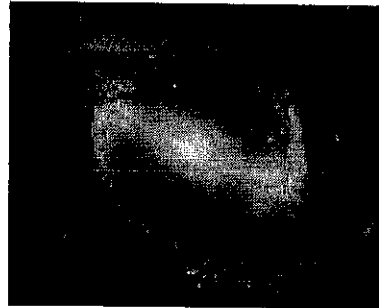
*A special type of Spiral Galaxy is a _____

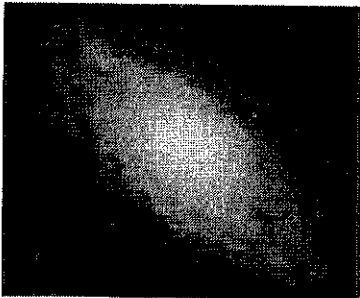
-In a Barred Spiral Galaxy, _____

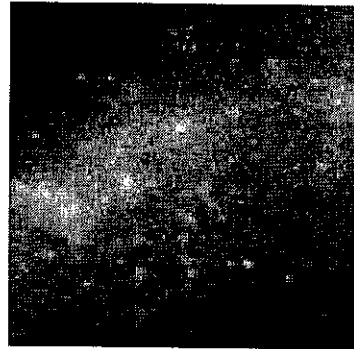
An Elliptical Galaxy is _____

An Irregular Galaxy is _____









Characteristics of the Milky Way (Spiral) Galaxies

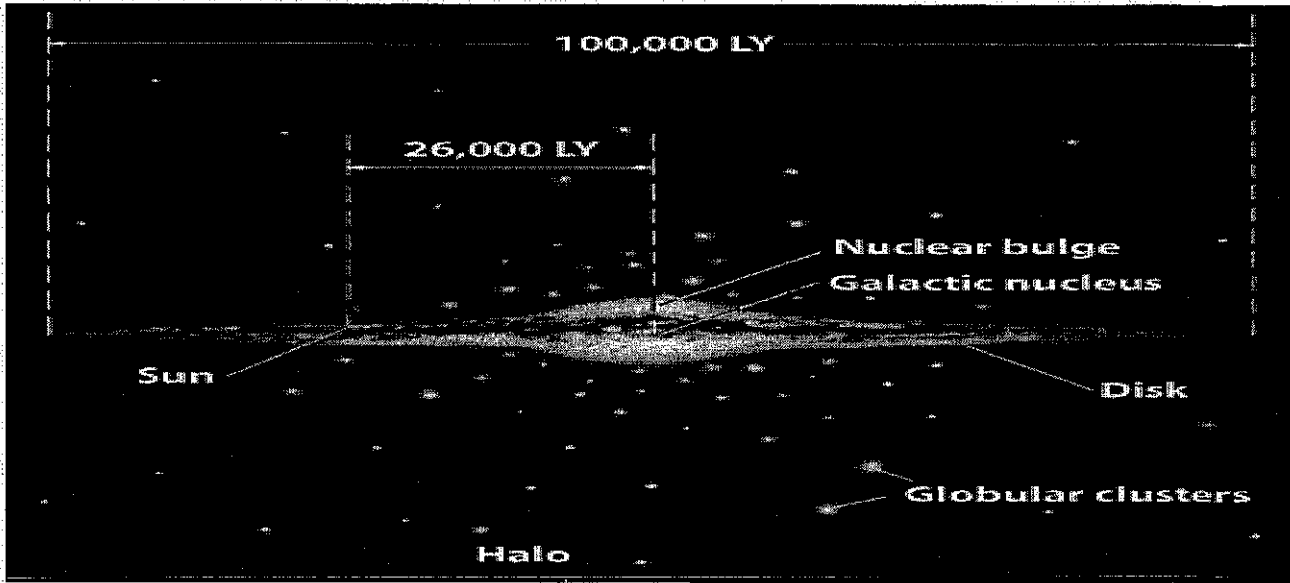
*Vocab Words for "Characteristics of the Milky Way (Spiral) Galaxies"

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*The _____ is a Spiral Galaxy, so we know a lot about Spiral Galaxies!

*We know they contain...

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*The Galactic Bulge is _____

*The Galactic Disk is _____

*The Spiral Arm is _____

*The Globular Cluster is _____

*The Galactic Halo is _____

*The Milky Way is part of a cluster of galaxies called the _____

-The Local Group is _____

-Two of these nearby galaxies are:

- 1.
- 2.

Red Shift & Hubble's Law

Vocab Words for "Red Shift & Hubble's Law"

All the galaxies put together make up the _____.

Red Shift is _____

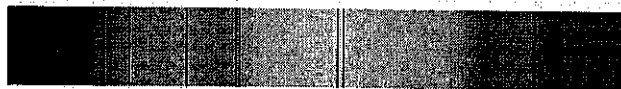
*The idea that galaxies are _____.

Red shift does not mean _____.

*It means Doppler Effect is occurring and _____ and _____ are shifting towards the _____ of the visible light spectrum.



moving toward you: blueshift



at rest



moving away from you: redshift

Hubble's Law takes _____ one step further.

*Hubble's Law states _____

-It can be demonstrated by the equation $V = H_0 D$, where V is _____, H_0 is _____ and D is _____.

*For our purposes, we assume H_0 is _____.

_____ causes the galaxies to accelerate as they move outward.

*Dark Matter is _____. We know it is there, because it does have a _____ that is causing the galaxies to accelerate.

UNIT 7

Our Solar System

Planets

*Inner and Outer Planets

Dwarf Planets

Smaller Solar System Bodies



Unit 7 Guided Notes

Unit 7 is _____

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- _____
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Planets

Vocab words for "Planets"

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A Planet is _____

- 1) _____
- 2) _____
- 3) _____

There are _____ planets in Our Solar System.

They are _____ & _____

The Inner Planets are _____

They are _____ & _____

The Outer Planets are _____

They are _____ & _____

The _____ separates the Inner Planets from the Outer Planets.

Terrestrial Planets	Gas Giants
* _____	* _____

List each of the Planets in order and something significant about each....

1)

2)

3)

4)

5)

6)

7)

8)

There are _____ known moons in our Solar System.

*The largest moon in the Solar System is _____. It is a moon of _____.

Dwarf Planets

Vocab Word for "Dwarf Planets"

A Dwarf Planet is _____

- 1) _____
- 2) _____
- 3) _____

In 2006 astronomers discovered the dwarf planet _____, which is larger than _____.

At this point, they came up with a new _____ of the word planet.

Since Pluto is in the middle of the _____, it does not _____ and is no longer considered a planet.

Other Dwarf Planets in our Solar System include _____ & _____.

Smaller Solar System Bodies

Vocab Words for "Smaller Solar System Bodies"

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Asteroids are _____

*Most asteroids lie in _____ between _____ and _____.

Meteoroids are _____

*As a Meteoroid travels through the atmosphere of a planet or satellite it begins _____

-The Meteor is _____

-The Meteorite is _____

A comet is _____

*Eventually a comet gets _____

*As it is pulled toward the sun, it displays a _____ and a _____

*The Coma is _____

*The Ion Tail is _____

*The Dust Tail is _____

*_____ is the most famous comet. It was seen in _____ and will be seen again in _____

There is a belt of comets called the _____

*The Kuiper Belt is _____

-Pluto is a part of it.

Beyond the Kupier Belt is the _____

*The Oort Cloud is the _____