STARS AND BEYOND

Teacher Guide

including

Lesson Plans, Student Readers, and More Information

Lesson 1 - Components of the Universe

Lesson 2 - Reading a Celestial Globe - Lab

Lesson 3 - Stars - Lab

Lesson 4 - Constellation - Lab

Lesson 5 - Constellations of the Zodiac

designed to be used as an Electronic Textbook
in class or at home

materials can be obtained from the Math/Science Nucleus

EARTH SCIENCES - STARS AND BEYOND

Lesson 1 - COMPONENTS OF THE UNIVERSE

MATERIALS:

reader

Objective: Students compare the components of the Universe.

Teacher note

The components of the Universe include everything that is out there as you look up from Earth. The Solar System is only a very small part of the entire Universe. So most of what we see is beyond our Solar System. Ask students to name the different components. Below is a guide.

A *star* is a ball of hot gas held together by its own gravity. Most of the points of light are stars either in our galaxy (the Milky Way) or stars from other galaxies. There are many types of stars from neutron to white dwarfs.

A *galaxy* is a large scale aggregate of stars, plus some gas, dust, and possibly solar systems, which are held together by gravity.

A *globular cluster* is a roughly spherical group of hundreds of thousands to millions stars, also held together by gravity. Globular clusters seem to be made of very old stars. They are usually part of a galaxy.

Large *Magellan Cloud* is a small group of about 10,000 stars. Only visible in the southern hemisphere and is a companion galaxy to the Milky Way.

A *quasar (*short for quasistellar radio source*)* is a point source, no more than one light year in diameter that emits tremendous amounts of energy, as much as hundreds of galaxies. Current hypotheses suggest that quasars are powered by super massive black holes. They are usually found in galaxy.

A *planet* is a spherical body which circles a star in a regular orbit. Part of the Solar System.

A *comet* is a kilometer size mass of frozen gas and rock which orbits the Sun. Comets may be leftovers from the formation of the Solar System.

An *asteroid* is a mass of rock and minor amounts of frozen gas. Like comets, asteroids are probably leftovers from forming the planets. Most asteroids are in orbits between Mars and Jupiter. They range in size from dust specks to over 300 kilometers in length. Part of the Solar System. When a fragment of an asteroid hits the Earth, it is referred to as a meteorite.

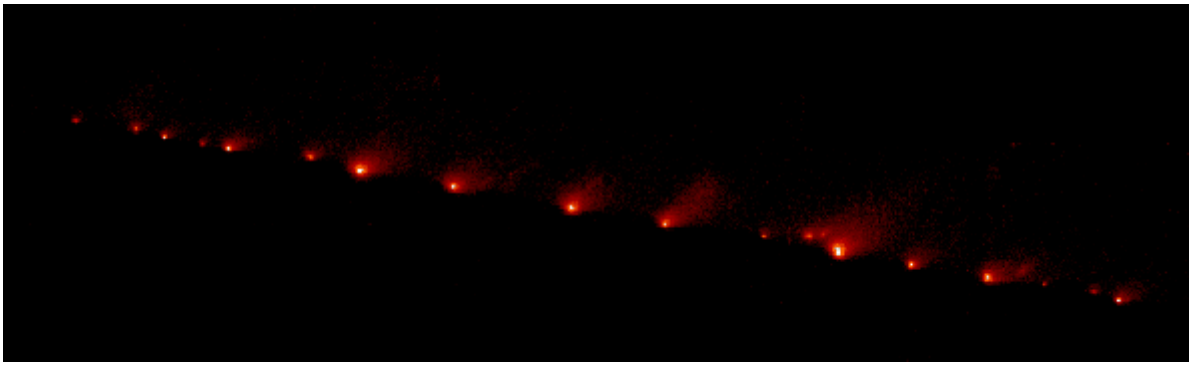
COMPONENTS OF THE UNIVERSE

When the Sun is warming the Earth and you look up into the blue sky, what do you see? You might see a few clouds moving lazily across the sky. But what would happen if the light of the Sun disappeared? You would see stars and other components of the **Universe**. So there are stars during the day, we just can't see them! What else is in the Universe?

Iron meteorite taken from Antarctica.

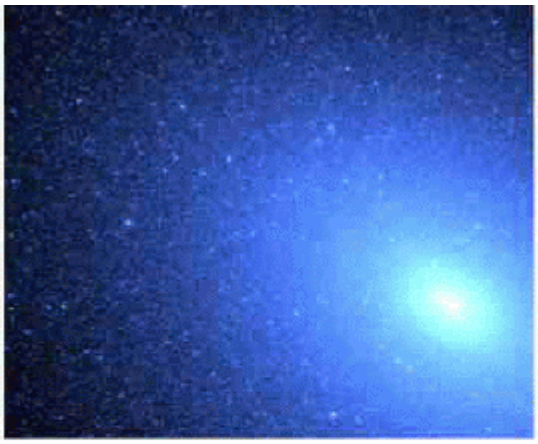
There are **stars**, **galaxies**, **globular clusters**, and **quasars** that are part of the Universe beyond our **Solar System**. There are different types of individual stars representing different parts of their life. For instance a **planetary nebulae** has a round shape with shells of gas being thrown from stars that are ending their lives. A Herbig -Haro object is a young star that is ejecting jets of material back into space. Look at other objects beyond the Solar System. Many of these objects are light years apart. A **light year** is the distance light travels in one year, or about 6 trillion miles.

But we also see objects that are within our Solar System like **planets**, **comets**, **asteroids** and **meteorites**.



Comet Shoemaker-Levy 9 in 1994.

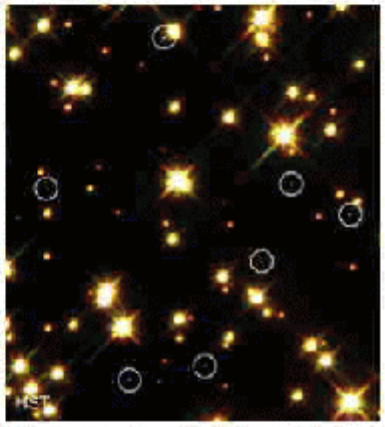
OBJECTS BEYOND THE SOLAR SYSTEM



Star: Blue Giant

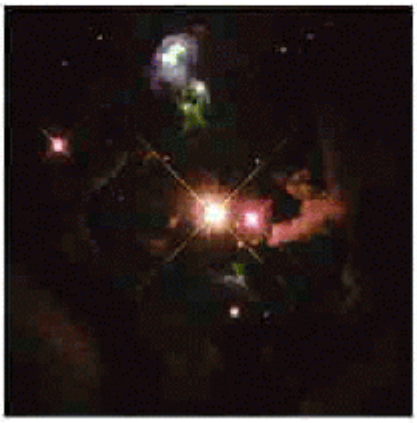
Galaxy: Double Spiral

Globular Cluster

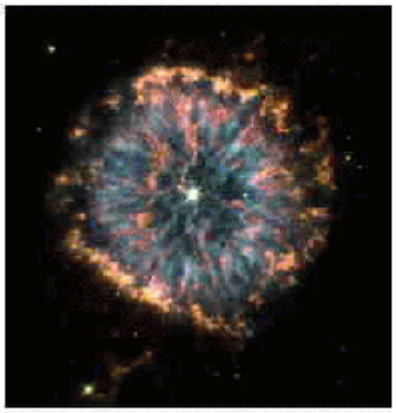


Star: White Drawf

Large Magellan Cloud



Herbig-Haro Object



Planetary Nebulae

Star Classification

Teacher note

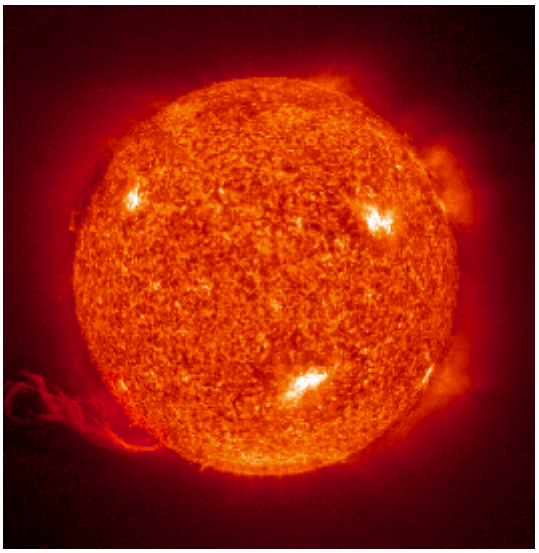
A *star* is a ball of hot gas held together by its own gravity. Gravity also causes stars to undergo nuclear fusion within their interiors. The energy release associated with this fusion causes the star to shine. The energy of fusion balances the star's gravity, preventing it from collapsing. However, when a star's internal energy dwindles, the star may fade from sight into a *white dwarf* star or a *neutron star*, an extremely high density object composed of 99% neutrons. Neutron stars are probably remnants from supernova explosions. A *pulsar* is a rapidly spinning neutron star. For reasons that are not fully understood, pulsars emit regular bursts "pulses" of radiation.

Stars come in a variety of types. These include:

1. *Binary Stars* - A system of two stars, orbiting around on another. Binary (and other multiples) stars are very common. Astronomers estimate that about half of all stars are members of multiple-star systems.
2. *Main Sequence Stars*- Stars on the "main sequence" part of the H-R diagram, which classifies stars in terms of absolute magnitude and temperature. Main sequence stars get brighter as they get hotter. Our Sun and the majority of the stars in the Universe are on the Main Sequence.
3. *Giant and Supergiant Stars*- Large stars that occur above the main sequence, which are unusually large and cool. Supergiant stars are brighter than giant stars.

Stars appear to the naked eye as spiky, twinkling lights or **scintillation**, especially at night. The stars near the **horizon** also seem to flash and change color. The twinkling and flashing effects are not due to the stars themselves but to the Earth's atmosphere. **Turbulent** air currents cause the star's light to dance around. The spikiness of star images is due to optical effects in the observer's eyes. In reality, stars are spheres of gas similar to our own Sun. Stars are held together by **gravity**.

Astronomers classify stars in two ways. The first classification uses the star's **spectrum**, the color(s) of light that the star emits. A star's spectrum is caused by the temperature in the outer



The Sun

layers of the star. If the star is hot, it looks blue. If it is cool, it looks red. The chart below shows the basic classification of stars by **spectral type**. The temperatures for stars are measured in a unit called, **Kelvin**. The temperature of a star in degrees Centigrade is equal to its temperature in degrees Kelvin plus 273. In other words, real hot!

Try to guess what temperature and spectral type our Sun is from the chart below.

Spectral Type	Color	temperature (K)	Example
O	BLUE	40,000-25,000	Zeta Puppis
B	BLUE	25,000-11,000	Spica Regulus Rigel
A	BLUE-WHITE	11,000-7,500	Vega, Daneb Sirius
F	WHITE	7,500-6,000	Canopus, Procyon Polaris
G	YELLOW-WHITE	6,000-5,000	Alpha Centauri
K	ORANGE	5,000-3,500	
M	RED	3,500-3,000	

Brightness

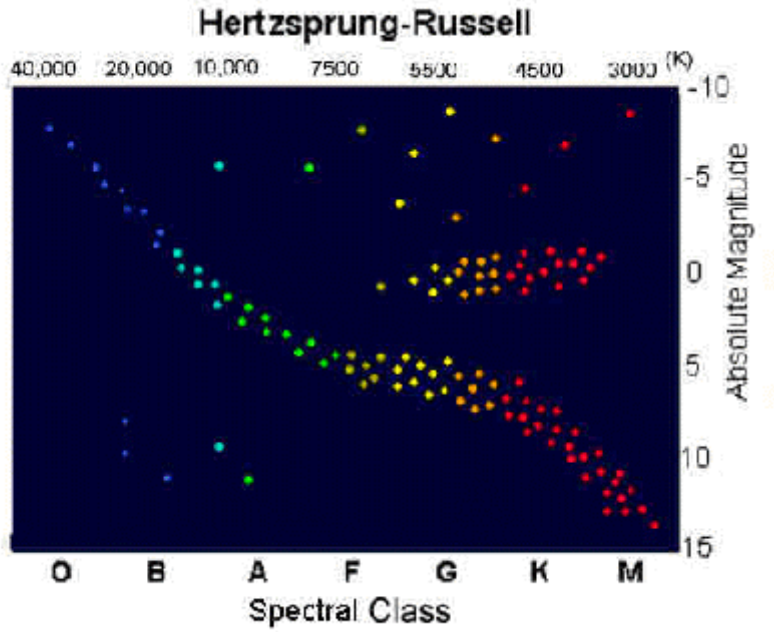
Teacher note

Stars are not at the same distances from the Earth. In order to compare them to our Sun, it is necessary to calculate their magnitudes as if they were at the same distances. The absolute magnitude is the apparent brightness of stars when observed from a distances of 10 parsecs (or 32.6 light years).

The brightness of a star compared to the Sun is called luminosity. The Sun is a "1" and mathematically the luminosity is determined from the absolute magnitude.

These comparisons help us to get a feeling for the vast differences in distances between the stars in the Universe.

How much brighter is Spica than the Sun. Spica is 2250 times brighter than our Sun.



The second way stars are classified is by brightness, or **absolute magnitude**. Absolute magnitude depends on the energy output of a star. Brighter stars release more energy. A problem with this classification is that a very bright star that is far away looks less bright than a dim star that is close by (**relative brightness**). This issue is fixed by mathematically comparing the brightness of stars as if they were all the same distance from Earth. The chart below shows some examples of stars and their absolute magnitudes. Note that the lower number indicate brighter stars. How much brighter is Spica than our Sun?

Star	Absolute Magnitude	Brightness compared to the Sun
Proxima Centauri	15.45	1/17700
Barnard's Star	13.24	1/2310
Sun	4.83	1
Sirius	1.45	22.5
Arcturus	-0.31	114
Spica	-3.55	2250

Galaxies

Teacher note

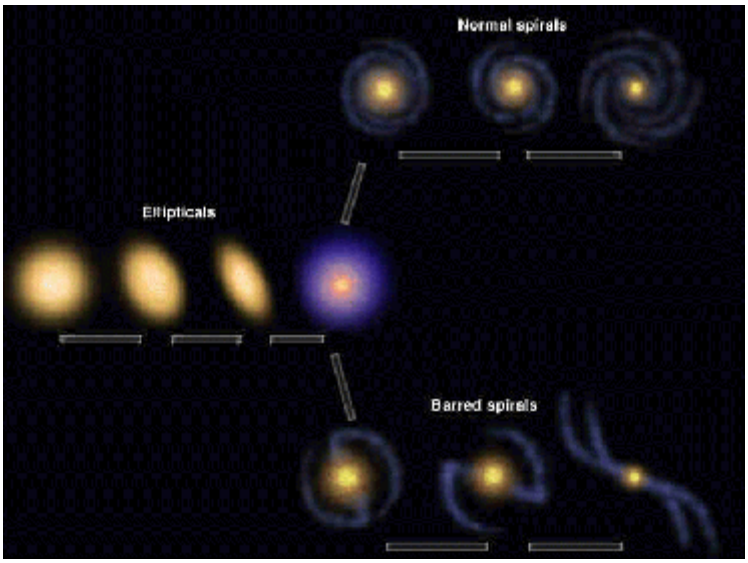
The Universe is dotted with galaxies throughout. They are like cities of stars. Galaxies tend to group themselves with other galaxies. For instance, the Milky Way is part of a cluster known as the "Local Group" which contain thousands of other galaxies.

Astronomers classify galaxies into three main types based on shape including elliptical, spiral, and irregular. Spiral galaxies are divided into the normal spiral and barred spiral. Spiral have arms winding out from a central bulge. In barred spirals the arms emerge from the ends of a bar of stars and runs across the galaxy center as shown in the diagram.

Sir William Herschel

Early astronomers would look into the Universe with their telescopes and notice "milky" areas that they could not be defined as one star. Sir William Herschel, in the late 1700's, counted stars and recorded them, developed a notion of the Galaxy. **The Galaxy** referred to our own Milky Way with its billions of stars, with our Sun and planets being a component.

Other **galaxies** were found throughout the Universe. These islands of stars had different shapes and sizes. The Andromeda Galaxy is **spiral**, and is larger than our Milky Way Galaxy. Most galaxies are named for their shape and given numbers to identify them. For instance, **elliptical galaxies** are classified with a "E." The picture on the right shows different shapes that galaxies can take.



EARTH SCIENCES - STARS AND BEYOND

Lesson 2 - READING A CELESTIAL GLOBE

MATERIALS:

celestial globe

Objective: Students learn to read a celestial globe.

Teacher note

A celestial globe shows the complete northern and southern hemispheres and the main stars of each hemisphere. It is divided into 88 regions called constellations. The purple band that runs around the globe is the Milky Way Galaxy. The dotted line within this band is the galactic equator. There is a second smaller purple area in the southern hemisphere between 5h and 6h, at -70°. This is called the Magellanic Cloud. It is a small galaxy in orbit around the Milky Way. The North Star represents the north celestial pole. It is the axis that the Earth appears to revolve around. On this celestial globe it represents North. In the real sky, the North Star appears at a declination similar to the latitude on which you are located. For example, if you are on the 40° latitude the North Star will be about 40° above the horizon. The horizon is a line or circle that appears to be the boundary between sky and land.

On this celestial globe the equator is 90° from the North Star. This does not correspond to the Earth's equator, so it is called the celestial equator. From the celestial equator parallel lines are spaced north and south. These are the parallels of declination, which indicate the distance of a star from celestial equator. If a star is north of the celestial equator it is written as +, at the celestial equator it is 0, and south of the equator it is written -.

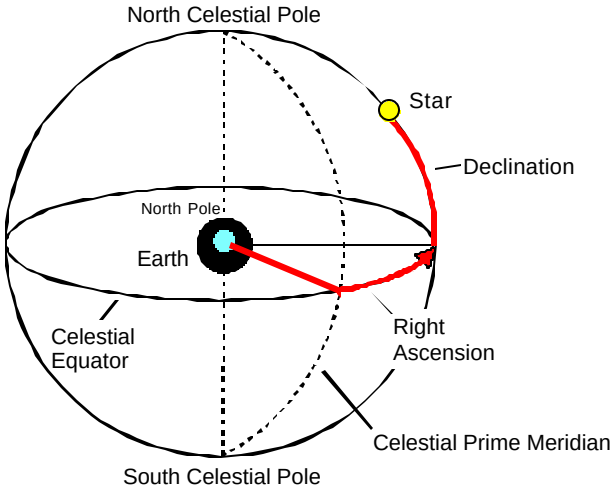
The 0 hr line of right ascension is the point where the Sun crosses the celestial equator on its way north each year. Technically, this point is known as the spring (or vernal) equinox. This point defines a half circle from the north to the south celestial pole called the celestial prime meridian. The right ascension coordinate of the prime meridian is 0 h. Going eastward, the celestial globe is divided into 24 sections by hour circles. For example, the hour circle opposite the prime meridian is the 12h line. The celestial globe is read by first finding the declination of the observer's (that's you) location. The names of the months are along the plane of the equator in the celestial globe. The stars found in the month of observation will be present in the sky during that month. Locations can also be found on celestial globes in a manner similar to latitude and longitude. The declination is read as positive (+) above 0 and negative (-) below 0. For example. the star Betelgeuse is located at 8°, 6h.

Go over with students how to read a celestial globe before they start the lab.

ANSWERS: 1. Double or multiple star; 2. Globular cluster (M13); 3. Double star (Sirius);

READING A CELESTIAL GLOBE

Imagine the Earth inside a bubble. The bubble is divided into a grid. You look up to the bubble and you see a star and you need to locate that position. The bubble is actually what we see of the Universe as we look outward. A person in Australia will see a different part of the Universe than someone in the United States. So how can you locate a star or galaxy so you can look at it again?



A system of **declination** and **right ascension** can help us locate the position of a star, galaxy, or other object in the sky. In the northern hemisphere, the **North Star** does not appear to move as much as the other stars, so this is referred to as the **North Celestial Pole**. From there they developed a system similar to our **longitude** and **latitude** to find a location on Earth.

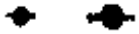
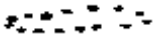
On this celestial globe the equator is 0º. This does not correspond to the Earth's equator, so it is called the **celestial equator**. From the celestial equator **parallel** lines are spaced north and south. These are the parallels of declination, which indicate the distance of a star from the celestial equator measured in degrees. If a star is north of the celestial equator it is written as +, at the celestial equator it is 0, and south of the equator it is written -.

The 0 hour line of right ascension is the point where the Sun crosses the celestial equator on its way north each year. This point defines a half circle from the north to the south celestial pole called the **celestial prime meridian**. Each successive line increases 1 hour, for a total of 24 hours. However, line 24 h is the same as 0h.

The celestial globe is also divided into 88 constellations to help locate different regions in the Universe.

There are symbols throughout the globe to help you identify the nighttime sky. See if you can figure them out before you look at the legend.

LEGEND FOR READING THE CELESTIAL GLOBE

relative magnitude	the larger the circle the brighter it appears to us on Earth Ž Ž
double or multiple stars	
variable star	
open cluster	
globular cluster	
galaxy	
diffuse nebula	
planetary nebula	
letter and then numbers with M, N, or I	galaxy, star clusters, or nebulae names
east/west lines	represent the declination from the real equator
north/south lines	represent time during the year
dotted lines with names	boundaries of the constellations, total of 88
dotted lines without names	represent either galactic equator or ecliptic
Greek alphabet	helps identify a star, used like a first name and in most cases refers to brightness (alpha being the brightest)
numbers	refer to stars

Consult dictionary for objects you may not be familiar with.

READING A CELESTIAL GLOBE

PROBLEM: What do the symbols on the celestial globe mean?

HYPOTHESIS: _____

MATERIALS: celestial globe

PROCEDURE: At the given location determine the type of object found. Use the legend to define the object. Draw a picture of the symbol.

name	declination	right ascension
1. hint: in Eridanus constellation	- 40	3h
2. hint: in Hercules constellation	40	between 16h and 17h
3. hint: in Canis Major constellation	between - 20 and -10	between 6h and 7h
4. hint: in Ophiuchus constellation	between 0 and + 10	18h
5. hint: in Aquarium constellation	- 20	between 22h and 23h
6. hint: purple	+ 10 to + 20	between 6h and 7h
7. hint: in Triangulum constellation	+ 30	between1h and 2h

Are certain constellations located only in the Northern Hemisphere and others only in the Southern Hemisphere? _____

Why? _____

CONCLUSION: _____

_____

EARTH SCIENCES - STARS AND BEYOND

Lesson 3 - STARS

MATERIALS:

celestial globe

Objective: Students locate stars using a celestial globe.

Teacher note

A star's gravity is so high the elements in the star fuse together. This cause the star to emit heat and light, which makes it shine, so we can see it at night. About 2,000 stars are visible to the naked eye on a clear, dark night.

If you want to learn more about the constellation look at http://www.astronomical.org and look under constellations.

Answers:

Betelgeuse = +10; 6h; Orion; red subgiant that is not stable
Procyon = between 0 and +10; 8h; Canis Minor
Achernar = -60; between 1h and 2 h; Eridanus
Algol = +10; 3h; Perseus; variable blue dwarf
Spica = -10; between 13h and 14h; virgo
Pollux = +30; 8h; Gemini
Hadar = -60; between 2h and 3h; Centaurus
Mira = 0, between 2h and 3h; Cetus
Deneb = between +40 and +50; between 20h and 21h; Cygnus
Capella = between +40 and +50; 6h; Auriga

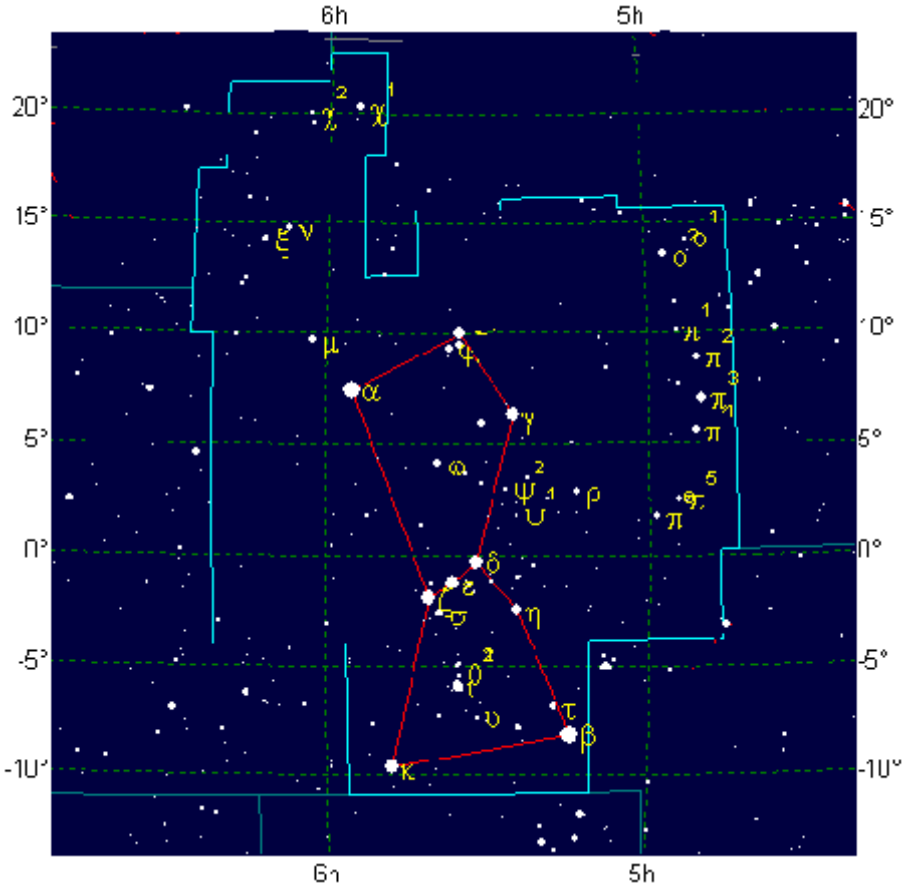
In the different hemispheres you can see different stars and galaxies because of the direction you see in the Universe. Celestial globes provide a way to locate stars; it also gives information on type, magnitude, and brightness.

If you would like your students to find the constellations in their area there are several websites that help locate them. We recommend the following:

STARS

Stars can be easily found on a celestial globe if you know the approximate month in which it appears and in which **hemisphere** you are looking. The sky is different during the same time of the year in the United States and southern Africa. There are so many stars that it seems impossible to learn them. It takes time, but remember early **civilizations** did not have television, so they spend many hours looking at the night time sky and creating their own movies with their creative mind. A teenager in the time of the **Egyptians** would probably see warriors and romance in the night time sky.

See what stars you can locate and determine in which constellation you find it. For example the picture on the right shows the constellation **Orion**. The three bright stars of **Alnitak**, **Alnilam**, and **Mintaka** make up Orion the Hunter's belt. The entire region outlined in light blue is the constellation Orion.



STARS

PROBLEM: Can a celestial globe provide scientific information on stars?

HYPOTHESIS: _____

MATERIALS: celestial or constellation globe

PROCEDURE: Follow the directions for reading the celestial globe. In the chart below, you are given the name of a star and a month when it can be seen. Find the star's location (declination and ascension). For each star, determine the type of star and write it below. Include the constellation that you find each star in. Record any other information about the star that you might find.

LOCATION/OTHER INFORMATION	NAME	MONTH
1.	Betelgeuse	December
2.	Procyon	January
3.	Achernar	October
4.	Algol	November
5.	Spica	April
6.	Pollux	January
7.	Hadar	April
8.	Mira	October
9.	Deneb	July
10.	Capella	December

Are certain stars located only in the northern hemisphere and others only in the southern? Why? _____

_____

CONCLUSIONS:_____

_____

EARTH SCIENCES - STARS AND BEYOND

Lesson 4 - CONSTELLATIONS

MATERIALS:

celestial globe
lab sheet

Objective: Students locate the 88 constellations.

Teacher note

The stars in the night sky are traditionally divided into 88 groups, known as constellations, which astronomers use as a convenient way of locating and naming celestial objects. The main constellations of the sky were devised at the dawn of history, by Middle Eastern peoples who believed that they could see a likeness to certain fabled creatures and mythological heroes among the stars.

In particular, the 12 constellations of the Zodiac were of importance in the most ancient times. The Sun appears to pass in front of each of the zodiacal constellations in its yearly path around the heavens. It should be noted, however, that the astrological "signs" of the zodiac are not the same as the modern astronomical constellations, even though they share the same names.

The ecliptic is the apparent yearly path of the Sun among the stars. In the winter the Sun rises and sets in its lowest position in the sky and in the summer it rises and sets in its highest position in the sky.

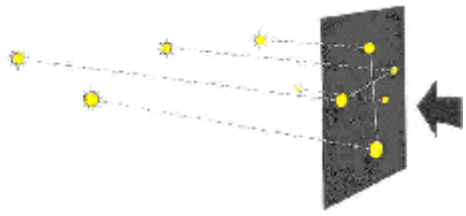
The equinox (called the meridian on the celestial globe) does not keep its place in the stars, but move as the Earth and solar system move through the Milky Way. Polaris, the present North Star, was not always the north star, and other stars have been or will be "north stars" at different times. The star Thuban in the constellation Draco was the North Star when the Pyramids in Egypt were being built.

If the North Star moves, it makes sense that the other objects in the sky move also. Spring which now begins with the Sun in the constellation Pisces, began with the sun in in the constellation Aries a few thousand years ago ecliptic.

In the following exercises students look at the different constellations throughout

CONSTELLATIONS

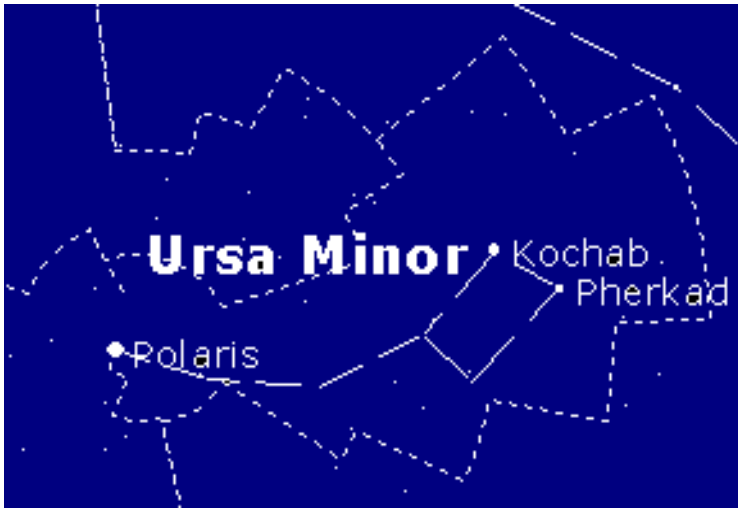
Most of the stars in a constellation have no real connection with each other at all. They may all lie at vastly different distances from Earth, and simply form a pattern by chance. The main stars in each constellation are labeled with a letter of the **Greek alphabet**, the brightest star usually being termed alpha.



The brightness of a star is called its **magnitude**. Stars have different brightness for two reasons. First, stars radiate different amounts of light; more energetic stars are the brightest . Second, stars lie at vastly differing distances from the Earth. A small star that is close to the Earth can appear brighter than a large star that is far away from the Earth.

See if you can find the 88 constellations and then read more about the **Zodiac** and how **astronomy** and **astrology** are different.

Constellations can help make the heavens come alike for the observer. Each image in the sky helps to chart an area so it is easy to identify. A constellation refers to an entire sector, but there are many patterns that can be identified. An **asterism** is a pattern of stars that does not form the main or full pattern of an "official" constellation. For example, in the northern hemisphere the Big Dipper is only an asterism of the official Ursa Major (the Great Bear). Ursa Minor, the Little Bear constellation is visible in the northern hemisphere all year long. Polaris, the North Star can be found at the end of the asterism, the Little Dipper. Ursa Minor was created in the 6th century B.C. as a navigational aid for sailors. Can you find the Little Dipper in the figure to the right?

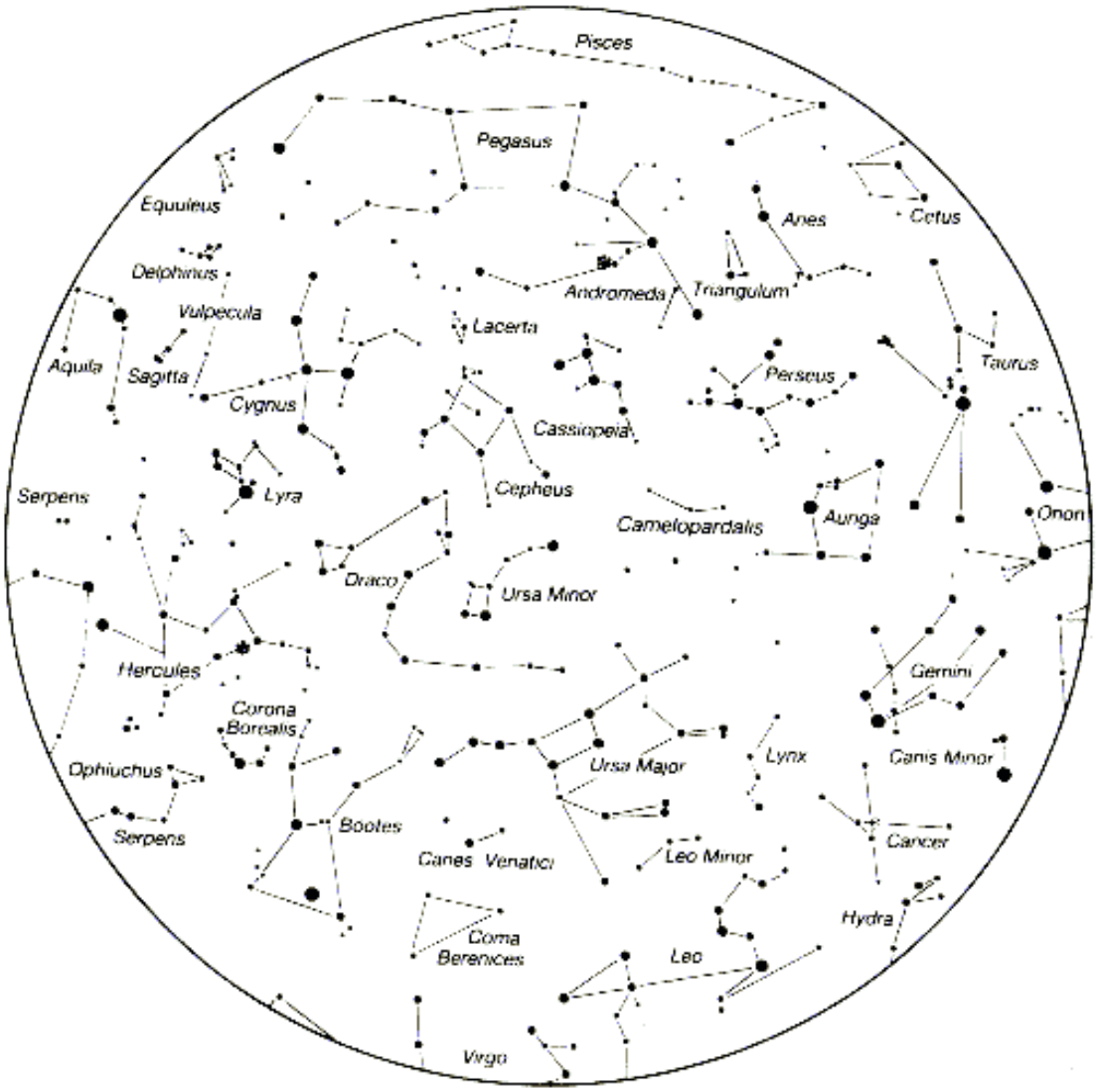


CONSTELLATIONS

PROBLEM: Can you find all 88 constellations?
MATERIALS: grids of northern and southern hemisphere; celestial globe
PROCEDURE: Look at the list of constellations. Put the number of the constellation on the pictures of the northern and southern hemisphere.

SOUTHERN HEMISPHERE

NORTHERN HEMISPHERE



CONCLUSION: What importance are these 88 constellations?

_____

_____

LIST OF THE 88 CONSTELLATIONS

1. ANDROMEDA (Princess)
2. ANTLIA (Air Pump)
3. APUS (Bird of Paradise)
4. AQUARIUS (Water Bearer)
5. AQUILA (Eagle)
6. ARA (Altar)
7. ARIES (Ram)
8. AURIGA (Charioteer)
9. BOOTES (Herdsman)
10. CAMELOPARDALIS (Giraffe)
11. CANCER (Crab)
12. CANES VENATICI (Hunting Dog)
13. CANIS MAJOR (Big Dog)
14. CANIS MINOR (Little Dog)
15. CAPRICORNUS (Sea Goat)
16. CARINA (Keel of Ship)
17. CASSIOPEIA (Queen)
18. CENTARUS (Centaur)
19. CEPHEUS (King)
20. CETUS (Whale)
21. CHAMAELEON (Chameleon)
22. CIRCINUS (Compass)
23. COELUM (Graving Tool)
24. COLUMBA (Dove)
25. COMA ABERENIES (Bernice's Hair)
26. CORONA AUSTRA. (Southern Crown)
27. CORONA BOREALIS (Northern Crown)
28. CORVUS (Crow)
29. CRATER (Cup)
30. CRUX (Southern Cross)
31. CYGNUS (Swan)
32. DELPHINUS (Dolphin)
33. DORADO (Swordfish)
34. DRACO (Dragon)
35. EQUULEUS (Horse)
36. ERIDANUS (Po River)
37. FORNAX (Furnace)
38. GEMINI (Twins)
39. GRUS (Crane)
40. HERCULES (Hercules)
41. HORROLOGIUM (Clock)
42. HYDRA (Sea Serpent)
43. HYDRUS (Water Snake)
44. INDUS (Indian)
45. LACERTA (Lizard)
46. LEO (Lion)
47. LEO MINOR (Little Lion)
48. LEPUS (Hare)
49. LIBRA (Balance)
50. LUPUS (Wolf)
51. LYNX (Bobcat)
52. LYRA (Harp)
53. MENSA (Table Mt.)
54. MICROSCOPIUM (Microscope)
55. MONOCEROS (Unicorn)
56. MUSCA (Fly)
57. NORMA (Level)
58. OCTANS (Octant)
59. OPHIUCHUS (Serpent Holder)
60. ORION (Hunter)
61. PEGASUS (Winged Horse)
62. PAVO (Peacock)
63. PERSEUS (Perseus)
64. PHOENIX (Legendary Bird)
65. PICTOR (Easel)
66. PISCES (Fishes)
67. PISCIS AUSTR. (Southern fish)
68. PUPPIS (Stern of Ship)
69. PYXIS (Compass of ship)
70. RETICULUM (Net)
71. SAGITTA (Arrow)
72. SAGITTARIUS (Archer)
73. SCORPIUS (Scorpion)
74. SCULPTOR (Sculptor's tools)
75. SCUTUM (Shield)
76. SERPENS (Serpent)
77. SEXTANS (Sextant)
78. TAURUS (Bull)
79. TELESCOPIUM (Telescope)
80. TRIANGULUM (Triangle)
81. TRIANGULUM AUS. So. (triangle)
82. TUSCANA (Toucan)
83. URSA MAJOR (Big Bear)
84. URSA MINOR (Little Bear)
85. VELA (Sail of Ship)
86. VIRGO (Virgin)
87. VOLANS (Flying Fish)
88. VULPECULA (Fox)

EARTH SCIENCES - STARS AND BEYOND

Lesson 5 - CONSTELLATIONS OF THE ZODIAC

MATERIALS:

reader

Objective: Students read about the zodiac.

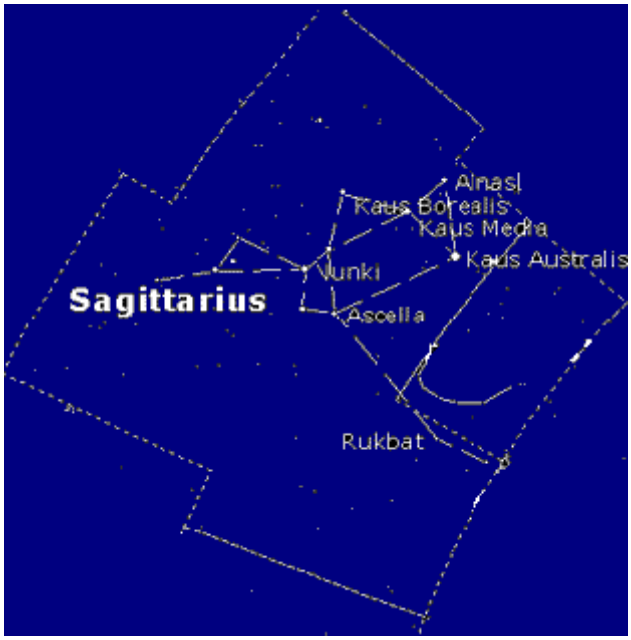
THE CONSTELLATIONS OF THE ZODIAC

For thousands of years, people have seen patterns in the stars in the night sky. Groups composed mainly of stars form recognizable patterns called constellations. Early people recognized that they could tell the basic seasons by looking at certain constellation within a zone called the **ecliptic**. The ecliptic is a band in the sky defined by the trace of the Sun on June 21 (highest in the sky) and December 20 (lowest in the sky). Constellations recognized in this zone are referred to as the Zodiac. This was an important mark to ancient people who were mainly farmers. It was a celestial calendar that helped them determine when to plant their crops and to get ready for winter.

Many civilizations used **monuments** to help them recognize the onset of time. **Stonehenge**, an ancient ruin in England is probably some type of solar and celestial calendar to mark these heavenly events.

Stonehenge in England.

This sky calender and the Zodiac constellations we identify today were first used by **Babylonian** astronomers about 2500 years ago. Babylonia was a Middle Eastern culture that is well-known for its discoveries in astronomy and other sciences. The Babylonians used the Zodiac constellations to tell when spring was coming. This allowed them to tell when it was time to plant crops and to prepare for changes in the weather.



The Babylonians recognized twelve Zodiac constellations. They were adopted by later cultures, and have become associated with myths and stories. For example, the Zodiac constellation **Sagittarius** form the pattern of a **centaur** (a half-man, half-horse creature) named Chiron, who is shooting an arrow. According to **Greek mythology**, Chiron was one of Hercules' teachers. Hercules shot Chiron with a poison arrow by mistake. Hercules made Chiron into a constellation to relieve his suffering.

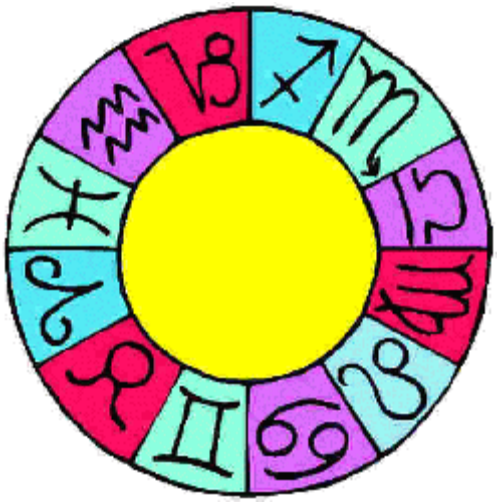
The Constellations of the Zodiac

The Modern Zodiac

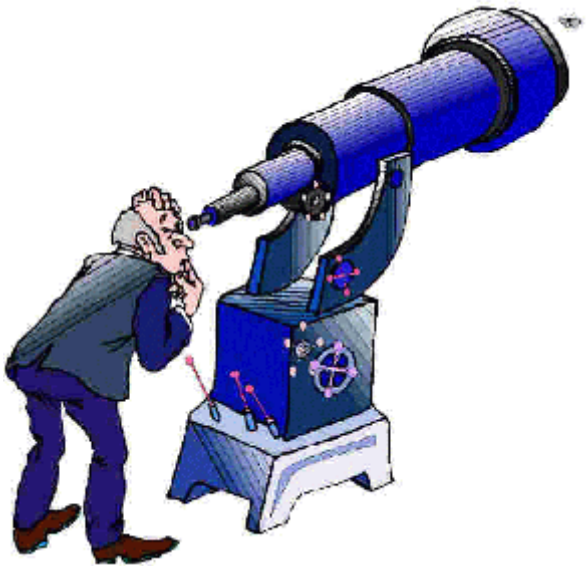
Zodiac Constellation	Symbol and Myth or Story
Pisces	Two Fish. Venus and her son Cupid escaped danger by swimming through the sea as two fish
Aries	The Ram. From Greek mythology, a male sheep with a golden fleece who could fly
Taurus	The Bull. The Greek god Zeus turned himself into a bull to carry off Europa, a girl with whom he fell in love.
Gemini	The Twins. Named after Castor and Pollux, two sons of Zeus.
Cancer	The Crab. Cancer was sent by the Greek goddess Hera to kill Hercules. Hercules crushed him.
Leo	The Lion. Associated with a lion defeated by Hercules
Virgo	The Maiden. The goddess of agriculture and the harvest.
Libra	The Scales. Identified by the Babylonians, and associated with the goddess of justice
Scorpius	The Scorpion. In Greek mythology, a giant creature sent to kill Orion, a great hunter
Ophiuchus	The Serpent Holder. Represents Aesculapius, the Roman god of medicine and healing.
Sagittarius	The Archer. In Greek mythology, a centaur named Orion.
Capricornus	The Sea Goat. A form of the Greek god Pan. A creature who was half-goat and half fish.
Aquarius	The Water Bearer. A Babylonian constellation, which was associated with a time of flooding .

Astronomy and Astrology

Our knowledge of the Zodiac constellations comes from **astronomy**. Astronomy is the study of the origin, movement, and behavior of stars and all the other material in the Universe. Astronomy is a science; it is based on repeated observations of the stars, and accurately predicts their motions and behavior. Some people confuse astronomy with **astrology**. Astrology is not a science but is the belief that the positions of the stars and planets in the Zodiac constellations can be used to predict how people will behave. There is no evidence that astrological predictions are accurate.



What is your sign?



Earth Science- Stars and Beyond - Unit Test

Part 1. Definitions Match the number of the term or concept in Column 1 with the letter of the correct definition in Column 2.

Column 1	Column 2
1. planetary nebulae	a. constellation of the Hunter
2. light year	b. brightness of a star
3. spectral class	c. thought to be a celestial calendar
4. Orion	d. round shape with layer of gas from dying stars
5. Zodiac	e. study of the Universe
6. magnitude	f. a grouping of stars that form a pattern from Earth
7. Stonehenge	g. distance light travels in 1 year
8. astronomy	h. point source of energy
9. constellation	i. associated with astrology
10. quasar	j. color of stars provides information on temperature of stars

Part 2. Multiple Choice Choose the best answer to complete each statement.

1. The shapes of galaxies can be?
    a. elliptical
    b. barred spiral
    c. normal spiral
    d. all of the above

2. A celestial globe is a map of?
    a. as we look outward from any point of Earth
    b. a star map at a specific longitude
    c. Jupiter
    d. as we look inward from any point of Earth

3. The longitude lines on a celestial globe refer to?
    a. degrees
    b. months
    c. distance from Sun
    d. distance to stars

4. How many astronomical constellations are used on a celestial globe?
    a.88
    b.44
    c.108
    d.16

5. The ecliptic is?
    a. a band of stars
    b. an oval
    c. band in sky by highest and lowest trace of Sun
    d. astrological symbol

6. A quasar is?
    a. a point source of energy
    b. plasma
    c part of the Solar System
    d. can be found in a radio

7. Planets, asteroids, meteorites, and comets are part of a?
    a. Quasar
    b. Planetary nebulae
    c. Solar System
    d. Pulsar

8. The Sun is considered what spectral type star?
    a. O, Blue star
    b. A, Blue white star
    c. F, White
    d. G, Yellow-White

9. The brightness of a star is called?
    a. Relative brightness
    b. Absolute magnitude
    c. Relativity
    d. A quasar

10. Which is not a constellation of the Zodiac?
    a. Aquarius
    b. Leo
    c. Copernicus
    d. Sagittarius

ANSWERS:

PART I.

1. D
2. G
3. J
4. A
5. I
6. B
7. C
8. E
9. F
10. H

PART II.

1. D
2. A
3. B
4. A
5. C
6. A
7. C
8. D
9. B
10. C