

Wish Upon a Constellation

Pink 8-17

Abstract

The purpose of my science fair project is to investigate whether constellations are different or similar throughout the seasons. I decided to do this project because of my fascination with stars and, my love for astronomy. The actual idea of deciding if the constellations change throughout the seasons came from both my brother Brent, and his passion for astronomy, as well as previous science fair project observations.

Constellations are various groups of stars that are given a specific title or name. Constellations were used by many early civilizations for a variety of reasons but most importantly they were used to determine the season of the year. There are a grand total of eighty-eight constellations, all of which were discovered and observed by many people, including the Greeks and Egyptians. A map was created by Eugene Delaporte to give each constellation a boundary. Many people mistake the Big Dipper and Little Dipper as constellations but, in fact they are asterisms. Circumpolar constellations are able to be seen most of the year. However, Seasonal Constellations can only be seen during the season in which they are visible.

To illustrate the constellations of the Northern Hemisphere, a model was constructed to show the seasonal and circumpolar constellations. Materials were gathered in order to make a box to simulate the night sky. The box is constructed of wood and painted black to resemble the night sky. Battery-operated light bulbs are used to create the light for the stars. A rocker switch is used to turn lights on and off. Constellation night maps were printed and used to punch out the stars on black poster board. The poster board is inserted into the front opening of the box, the lights are turned on and the constellations are lighted and ready for viewing.

I learned many new things about constellations through the research and construction of the model for this project. For example, I like most people thought both of the Dippers are constellations. I also learned that many constellations are seasonal and not visible throughout the year. Finally, I also decided to make a constellation night sky model and learned how to assemble a model consisting of the construction of a wooden box and electrically wiring batteries, light bulbs, and a switch. I also made night maps to insert into the model to illustrate the constellations. I plan to use the model as an instructional tool when others have questions about constellations.

Acknowledgments

I have many people to acknowledge and thank for supporting me with this science fair project. I would like to begin by thanking both my parents for their continued support in all my activities. I want to thank my dad for assisting me on the model, some of the parts required the use of power tools and my dad was willing to show me how to use these tools safely. I learned a lot about wood cutting and drilling and I also learned how to solder wires and make electrical circuits. Next, I would like to thank my brother for giving me the terrific idea that was the basis for this entire project. I also would really like to thank my science teacher, Mrs. Kear, for presenting me with this wonderful opportunity to participate in the 2010 Science Fair. I am very thankful for all the help and the many examples Mrs. Kear gave me so I could understand the layout of the project. Lastly, I want to thank my friends and classmates that stood by me and continued to support and encourage me. I want to say thank you again to all of the people that truly supported and helped to make this project a reality.

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Purpose

The purpose of my science fair project is to investigate whether all eighty-eight (88) constellations can be seen at all times from any given place on the Earth. I decided to do this project because of my fascination with stars and, my love for astronomy. I have often looked skyward at night and saw the familiar constellations like Orion and Ursa Major but knew there were many more constellations out there in space. I wondered if all of them were there and just not visible because of clouds or other things that might obstruct my view of them. The actual idea of exploring the visibility of the constellations throughout the seasons came from both my brother, and his passion for astronomy, as well as previous science fair project observations.

Review of Literature

I. Introduction- History of Constellations

Constellations, by definition are any various groups of stars to which definite names have been given (*www.dictionary.com*). Forty-eight constellations were named and discovered by the Greeks. Stars in a constellation are not necessarily close together, but are a group of stars that can be spread apart by thousands of light years. The Arabs, Egyptians, and the Babylonians also observed many of the constellations, but did not name the constellations we have come to know today.

The early civilizations, for example the Greek and Babylonian civilizations referred to the stars as a resource to tell when a season was approaching, or ending, and to keep track of all the seasons and ultimately years. The Greeks named most of the constellations that we are familiar with today. Names given to the constellations were of Greek and Arab mythical animals and people, whose resemblance was closest to the actual animal, or person. The Egyptians had identified and labeled some constellations besides the ones that were already previously named in the earlier years.

Johann Bayer (1572-1625) added twelve new constellations to the few the Egyptians already had. The next person to identify, and add more constellations was Johannes Hevelius (1611-1687). Then more constellations were observed by Nicholas Louis de Lacaille (1713-1763) and his assistances Peitr Dirksz and Frederick de Houtman who were Dutch navigators. Around 1920, the International Astronomical Union decided it would be best to create boundaries or guidelines for the eighty-eight constellations we have today, so they hired a Frenchman, Eugene Delaporte to be the one to make a map or chart of the constellations. In 1930, Mr. Delaporte gave a presentation of the new map that he created that illustrates the

constellations we know and use today. [See the maps created by Mr. Delaporte in the Picture Section of this report (pages 19-22)].

II. The Constellations of the Northern Hemisphere

Circumpolar Constellations are constellations that circle around the North Celestial Pole. Circumpolar constellations are the only constellations that usually appear in the northern hemisphere and are visible most of the whole year. There are only five groups of circumpolar constellations that are actually considered to be circumpolar. Some of the constellations in these five groups are the Ursa Minor, Ursa Major, Draco, and Cepheus. The Ursa Major can best be seen near the Big Dipper because the stars that make the Big Dipper are also part of the constellation Ursa Major. The Ursa Minor is the group of stars that make up the Little Dipper. This being said both the Little Dipper and, the Big Dipper are actually not considered constellations but are instead called asterisms.

Asterisms are a group of stars that are not a constellation themselves but when combined with other stars form a constellation, like the Little Dipper and, the Big Dipper which are a part of the constellations Ursa Minor and Ursa Major respectively. The Polaris star or the North Star, is the star closest to the North Pole. This star is in the Ursa Minor constellation.

Seasonal constellations are constellations that only appear during a certain season hence their name. These constellations are visible when they are illuminated by the sun and because of their positions in the sky there are times of the year that they are not illuminated by the sun and are then unable to be seen. Since the Earth axis of rotation is tilted at 23.5° relative to the sun the northern hemisphere of the Earth is closer to the sun in the summer months and farther away during the winter months which explains the seasonal changes in temperatures and hours of daylight over the course of one (1) Earth year or twelve (12) months. The path that is followed

by the Earth as it travels around the Sun is called the ecliptic. Because of the rotation of the Earth and its orbit around the Sun, the constellations are divided into two groups. Since some constellations never rise nor set they are called circumpolar. The remaining constellations are called seasonal constellations. The actual constellations that are circumpolar or seasonal will depend largely on the latitude one views them at. With the exception of the North or South Circumpolar constellations, the majority of the seasonal constellations can be observed over the course of one full Earth year.

III. Specific Seasonal Constellations

In the spring the constellations Cancer and Leo can be found in the northern hemisphere, along with many other constellations. Constellation Leo is Latin and translates to lion. The combinations of stars, which make the constellation, resemble a lion, which is why it was named Leo. The Greeks decided to name the constellation after a lion that had his tail literally cut off by Hercules. During the dry season of Ancient Egypt, when the Nile River would flood lions from the desert would travel to the river, for various reasons. This took place when the sun was facing Leo; some consider this to be the reason for choosing that name for constellation Leo. Unlike most of the constellations, constellation Leo is one of the thirteen zodiac signs. Leo falls under the days of July 23 to August 22, of the zodiac symbols. Regulus, also known as Alpha Leo, is referred to as the “prince” or “heart of the lion”. It is also the brightest star of the constellation Leo and is actually the 25th brightest star in the sky. Constellation Leo is able to be seen best in the month of April.

In Latin the word Cancer means crab so the stars are arranged in a pattern that resembles a crab. The reason for naming this constellation Cancer was because of the minor role this played in the twelve roles of Hercules. While Hercules was fighting Hydra, a multi headed

monster, a goddess Hera, that did not particularly like Hercules, sent a crab to harm him. The crab pinched onto Hercules toe but, did not do any damage because, Hercules crushed him. Hera was appreciative with the crab's attempt so in return she sent the crab into the sky, to the place she reserved for him.

Cancer is another of the thirteen zodiac signs. This constellation is the zodiac sign for those whose birthday falls between June 21 to July 22. Cancer is best see in the sky during the month of March.

In the summer Hercules and Scorpius are two of the many constellations that appear in the Northern Hemisphere. Hercules was the son of Zeus and was known as the strongest and the greatest demigod, in Greek mythology. Hercules had to undergo many challenges to be exact twelve, all of which he completed successfully. Hercules defeated the crab (constellation Cancer) and the lion (constellation Leo). Constellation Hercules can be most excellently spotted during July.

Constellation Scorpius was the group of stars that showed darkness and death. This constellation really resembles its given name of Scorpius, which translates to scorpion. The scorpion is believed to have killed the great hunter Orion.

It is said that while Orion was fleeing from the scorpion, so he retreated to the water, swimming to his love Artemis. The god Apollo was not happy with Orion for loving Artemis, so to punish Orion he challenged Artemis. He dared Artemis that she could not hit a target, but she of course denied this, and proved it to him by shooting the target Apollo chose. The target ended up being Orion however, Artemis had no clue. Constellation Scorpius is best seen during July.

Aquarius and Pegasus are constellations that appear in the Northern Hemisphere during the autumn/fall. Pegasus is one of the larger constellations to appear in the northern hemisphere, and

is believed to form a winged-horse. Hippocrene had exterminated Chimaera, so he thought it would only be fair that he go to Mount Olympus, which housed the gods. However, he was very head-strong, so Zeus who was extremely angry sent an insect to sting him. The insect instead stung the horse, Pegasus, which in return threw Hippocrene off of him. Bellerophon brought Pegasus up to the gods, and Pegasus later became the Zeus' horse. Pegasus is best perceived during October.

Aquarius is an older constellation this is defined as the water carrier. Many cultures refer to this constellation as a man that is pouring water from a bucket. This idea comes from the reality that the sun hits Aquarius during the rainy season. This constellation is another of the zodiac signs. This zodiac sign covers January 21 to February 19. Aquarius is best witnessed during October.

The Orion and Taurus constellation appear in the winter in the Northern Hemisphere. The Taurus is a bull and represents strength and power. The Taurus was believed by Greeks to have been a camouflaged Zeus, and was one of the animals to have been hunted by Orion. One story is that Zeus was in love with Europa. One day Europa was outside when she saw a big bull, she went over to him and climbed on top of him. The bull ran away with her taking her to Zeus so they could marry. Taurus is also a zodiac signs and covers from April 21 to May 21. This constellation is best spotted in January.

The Orion forms a hunter, is the "head" of the constellation family, and is one of the most famous constellations we know. The belt of the Orion points to the Sirius, which is one of the stars in the constellation of the Larger Dog, Sirius and is also the brightest star of all in the constellation. The Orion was a hunter and was believed to have hunted many different animals. Such animals are Lepus (rabbit) and Taurus (bull). Orion died when he stepped on Scorpius

(scorpion), he was later sent up to the gods along with his beloved dogs. The Orion is best observed in January.

The seasonal constellations are seasonally opposite meaning the constellations visible in the northern hemisphere in the summer are visible in the Southern Hemisphere in the winter. Likewise the “autumn” northern hemisphere constellations are visible during the spring in the southern hemisphere.

Of the eighty-eight (88) constellations there are six (6) North Polar Constellations (which are only visible from the Northern Hemisphere), fourteen (14) South Polar Constellations (visible only from the Southern Hemisphere) and the remaining 68 that are called Seasonal Constellations that are visible from both hemispheres but at only certain times of the year. This means that there are 74 constellations (6 North Polar + 68 Seasonal) that can be viewed in the Northern Hemisphere throughout the year and 82 constellations (14 South Polar + 68 Seasonal) that can be seen in the Southern Hemisphere throughout the year.

The six (6) North Polar Constellations are Camelopardus, Cassiopeia, Cepheus, Draco, Ursa Major, and Ursa Minor.

The sixty-eight (68) Seasonal Constellations are listed below and grouped by the season when they are best viewed. The 13 constellations of Northern Hemisphere Autumn (Southern Hemisphere Spring) are Andromeda, Aquarius, Aries, Cetus, Grus, Lacerta, Pegasus, Perseus, Phoenix, Piscis Austrinus, Pisces, Sculptor, and Triangulum.

The 18 constellations of Northern Hemisphere Winter (Southern Hemisphere Summer) are Auriga, Caelum, Canis Major, Canis Minor, Carina, Columba, Eridanus, Fornax, Gemini, Horologium, Lepus, Monoceros, Orion, Pictor, Puppis, Reticulum, Taurus, and Vela.

The 16 constellations of Northern Hemisphere Spring (Southern Hemisphere Autumn) are Antlia Boötes, Cancer, Canes Venatici, Centaurus, Coma Berenices, Corvus, Crater, Hydra, Leo, Leo Minor, Lupus, Lynx, Pyxis, Sextans, and Virgo.

The 21 constellations of Northern Hemisphere Summer (Southern Hemisphere Winter) are Aquila, Ara, Capricornus, Corona Australis, Corona Borealis, Cygnus, Hercules, Delphinus, Equuleus, Indus, Libra, Lyra, Microscopium, Ophiuchus, Scorpius, Scutum, Serpens, Sagitta, Sagittarius, Telescopium, and Vulpecula.

The fourteen (14) South Polar Constellations are Apus, Chamaeleon, Circinus, Crux, Dorado, Hydrus, Mensa, Musca, Norma, Octans, Pavo, Triangulum Australe, Tucana, and Volans.

The ecliptic path was described earlier, and any constellation lying within the ecliptic is called a zodiac constellation. There were originally twelve (12) zodiac constellations but in recent history it has been discovered that a thirteenth constellation, Ophiuchus, is within the ecliptic and is now considered as a zodiac constellation. The thirteen (13) zodiac constellations are Aquarius, Aries, Cancer, Capricornus, Gemini, Leo, Libra, Ophiuchus, Pisces, Sagittarius, Scorpius, Taurus, and Virgo.

Materials List

- 1- 10 ounce (oz.) can of black Rustoleum™, spray paint.
- 1- 10 oz. can of silver Rustoleum™, spray paint.
- 1- 1/2 inch (“) by 48” by 48” piece of plywood.
- 24- 1” long finishing nails.
- 4- Eveready™ 9 volt (v) batteries.
- 4- Radio Shack™ 7.2v light bulbs.
- 4- Radio Shack™ light bulb sockets.
- 4- Radio Shack™ 9v battery holders.
- 4- Radio Shack™ 9v battery connectors.
- 1- Radio Shack™ rocker switch.
- 1- Radio Shack™ 36” length of 22 gauge wire.
- 2- 24” by 20” black, poster board.
- 1- Elmer’s™ Craft Colors Fine Orange Paint Pen.
- 1- Elmer’s™ Craft Colors Fine White Paint Pen.
- 1- Claw Hammer.
- 1- 8oz bottle of Elmer’s™ Wood Glue.
- 18- Stanley™, #4 by 1/4” long wood screws.
- 1- Stanley™ 1/8” diameter Routing Bit.
- 2- Sheets 8.5” x 11” hp™ transparency film.
- 1-Pack Best Occasions™ Acrylic Rhinestone Accents.
- 1- Rotator Pin made from old/used earring stud with clasp.

Procedure

Step 1: Collect all the materials needed to build the model (see the materials list).

Step 2: Cut 2 pieces of plywood to size ½ inch (") by 10" by 10.5", these are the side pieces.

Step 3: Cut 1 piece of plywood to size 1/2" by 10" by 10", this is the back piece.

Step 4: Cut 1 piece of plywood to size 1/2" by 10" by 11", this is the top piece.

Step 5: Cut 1 piece of plywood to size 1/2" by 10.5" by 11", this is the bottom piece.

Step 6: On 2 of the side pieces cut a ½" deep by 1/8" wide slot. See figure 1.



Figure 1

Step 7: Assemble 2 side pieces to the back piece, and fasten with 3 finishing nails per side. See figure 2.



Figure 2

Step 8: Assemble top and bottom pieces to back and sides, and fasten with 3 finishing nails per side.

Step 9: Paint the inside of the box with silver Rustoleum™ spray paint. Paint the outside of the box with black Rustoleum™ spray paint. See figures 3 and 4.

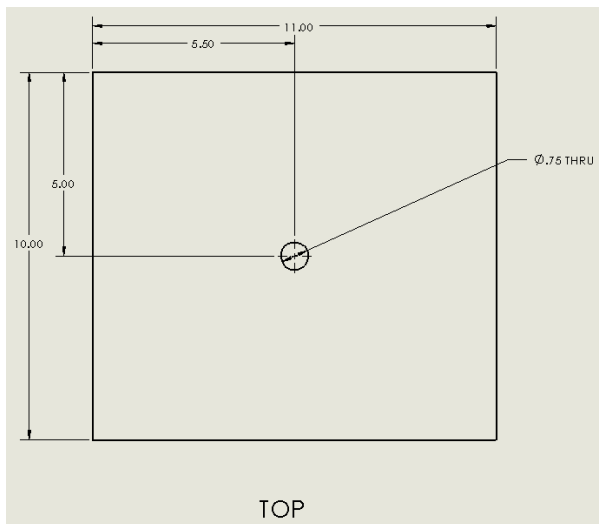


Figure 3



Figure 4

Step 10: Drill $\frac{3}{4}$ " diameter hole into top piece of plywood, as shown in drawing 1 and figure 5.

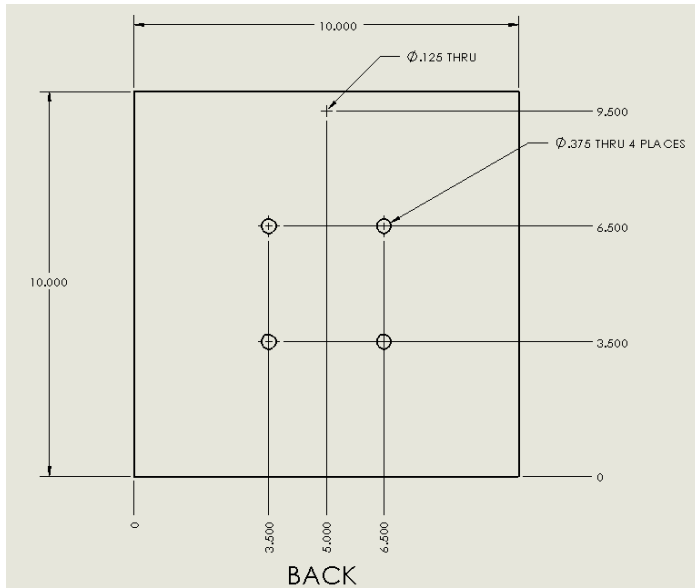


Drawing 1



Figure 5

Step 11: Drill 4, 1/4" diameter holes and 1, 1/8" diameter hole into the back piece of plywood, as shown in drawing 2 and figure 6.



Drawing 2

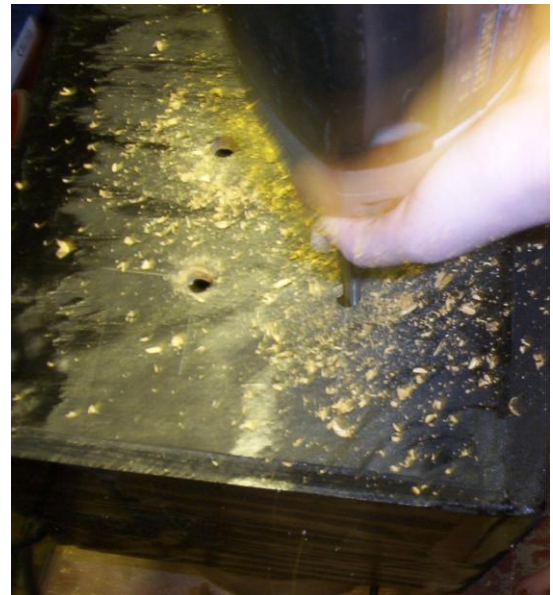


Figure 6

Step 12: Insert the 4 light bulbs sockets into the 4 holes, of the back piece, and secure with 1 screw for each socket. See figures 7 and 8.

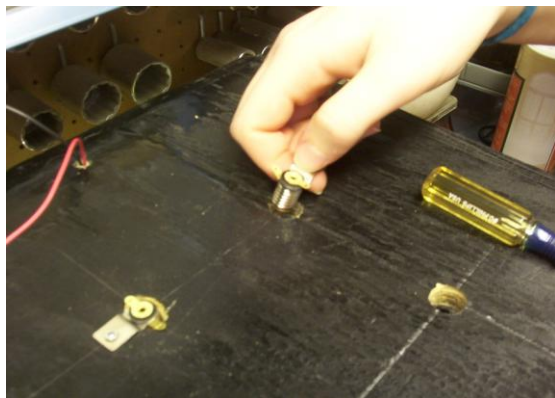


Figure 7

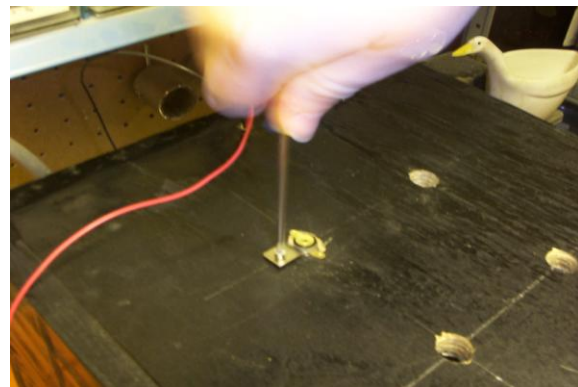


Figure 8

Step 13: Fasten the 4 battery holders, to the back piece using 1 screw for each battery holder.

See figure 9.

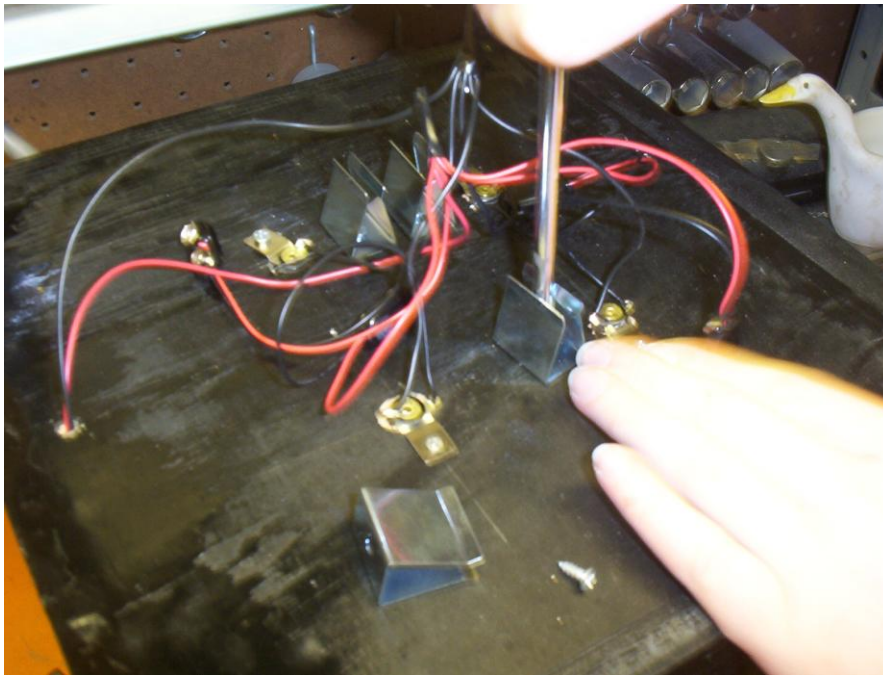


Figure 9

Step 14: Install rocker switch to the top of the box, using wood glue.

Step 15: Connect and solder all wires for the battery holders, light bulb sockets, and rocker switch. See diagram 1 and figure 10.

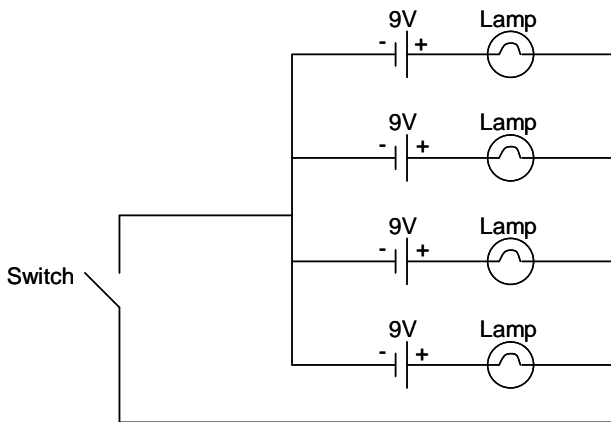


Diagram 1

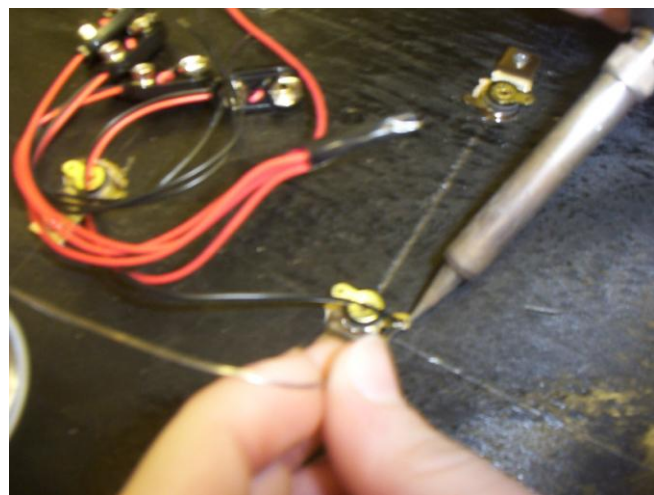


Figure 10

Step 16: Install 4 light bulbs into the light bulb sockets. (One bulb per socket) See figure 11.



Figure 11

Step 17: Insert the 4 batteries into the 4 battery holders.

Step 18: Turn the rocker switch on to test the electrical connects. (All 4 light bulbs should turn on) See figure 12.

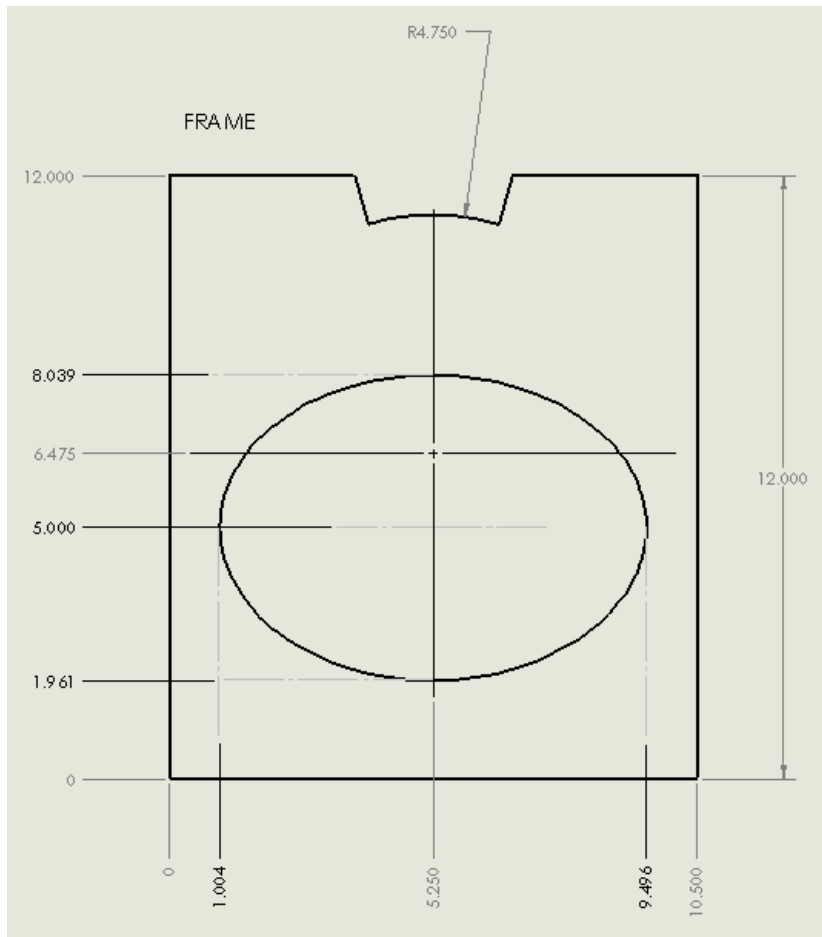


Figure 12

Step 19 Cut a 10 ½” wide by 12” long piece of black poster board.

Step 20: Cut an oval out of the middle of the frame.

Step 21: Cut an upward semicircle on the top, middle of the frame. (Refer to drawing 3 to see how it should look.)



Drawing 3

Step 22: Print and cut out a map of Northern Hemisphere constellations.

Step 23: Punch holes out of all the stars by using a hammer and 1” finishing nail. (Have a parent help you with this step.) See figure 13.



Figure 13

Step 24: Glue the map onto a 10 ½” diameter circle, with a 2” frame, to the back of the map.

See figure 14.



Figure 14

Step 25: Glue a piece of transparency film on to the back of the map, and cut off any excess transparency film.

Step 26: Glue a piece of transparency film on the back of the frame over the large oval opening.

Step 27: Using a paint pen, label the frame with markings for North, South, East and West.

Step 28: Insert the map between the transparency film on the back of the frame and attach rotator pin thru front side of map and thru transparency film on back-side of frame. Install rotator pin clip to hold in place. Map should rotate freely inside frame.

Step 29: Insert the map and frame assembly into front of box using slots in side pieces as a guide. See figure 15.

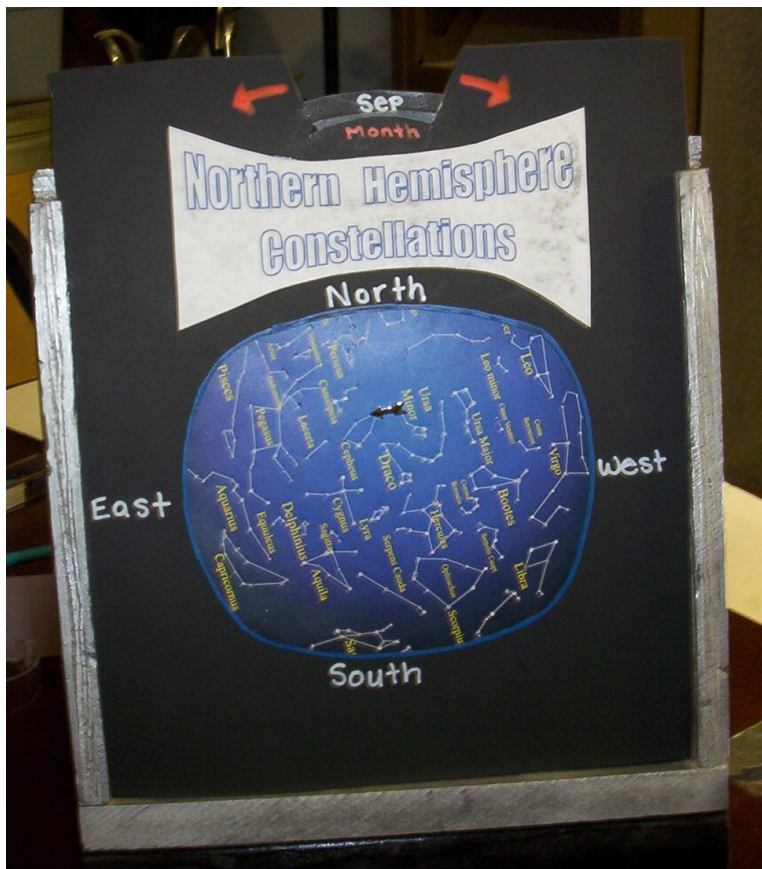


Figure 15

Step 30: Illuminate map by turning on lights inside box using rocker switch on top of box. Since the model is battery operated, please turn of switch when finished viewing. See figure 16.

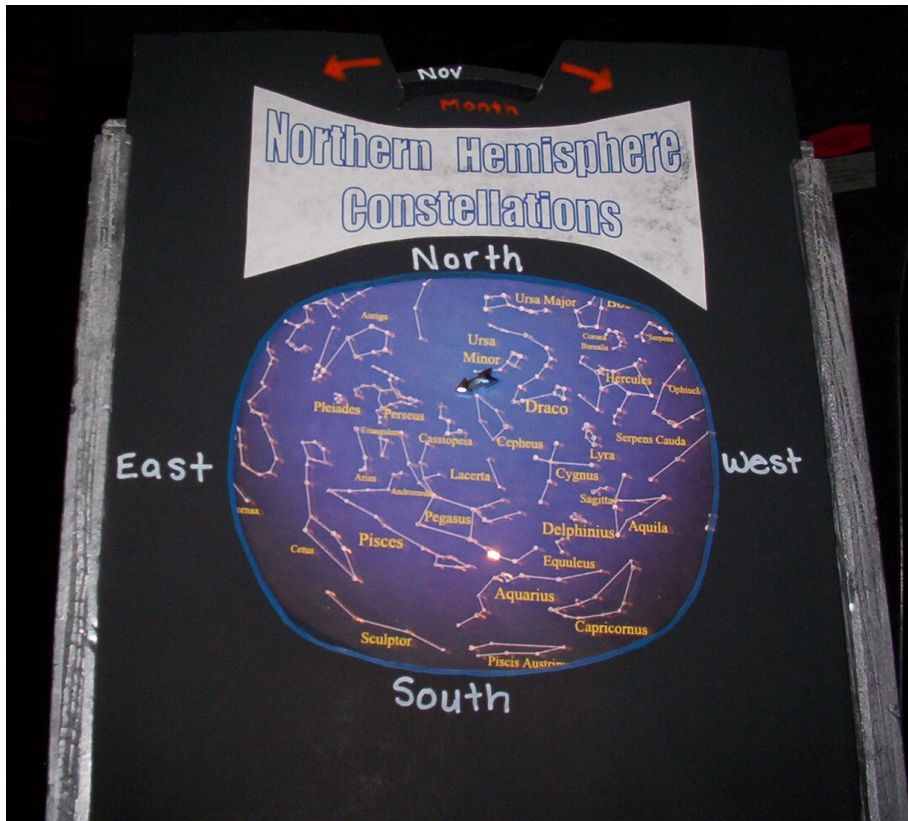
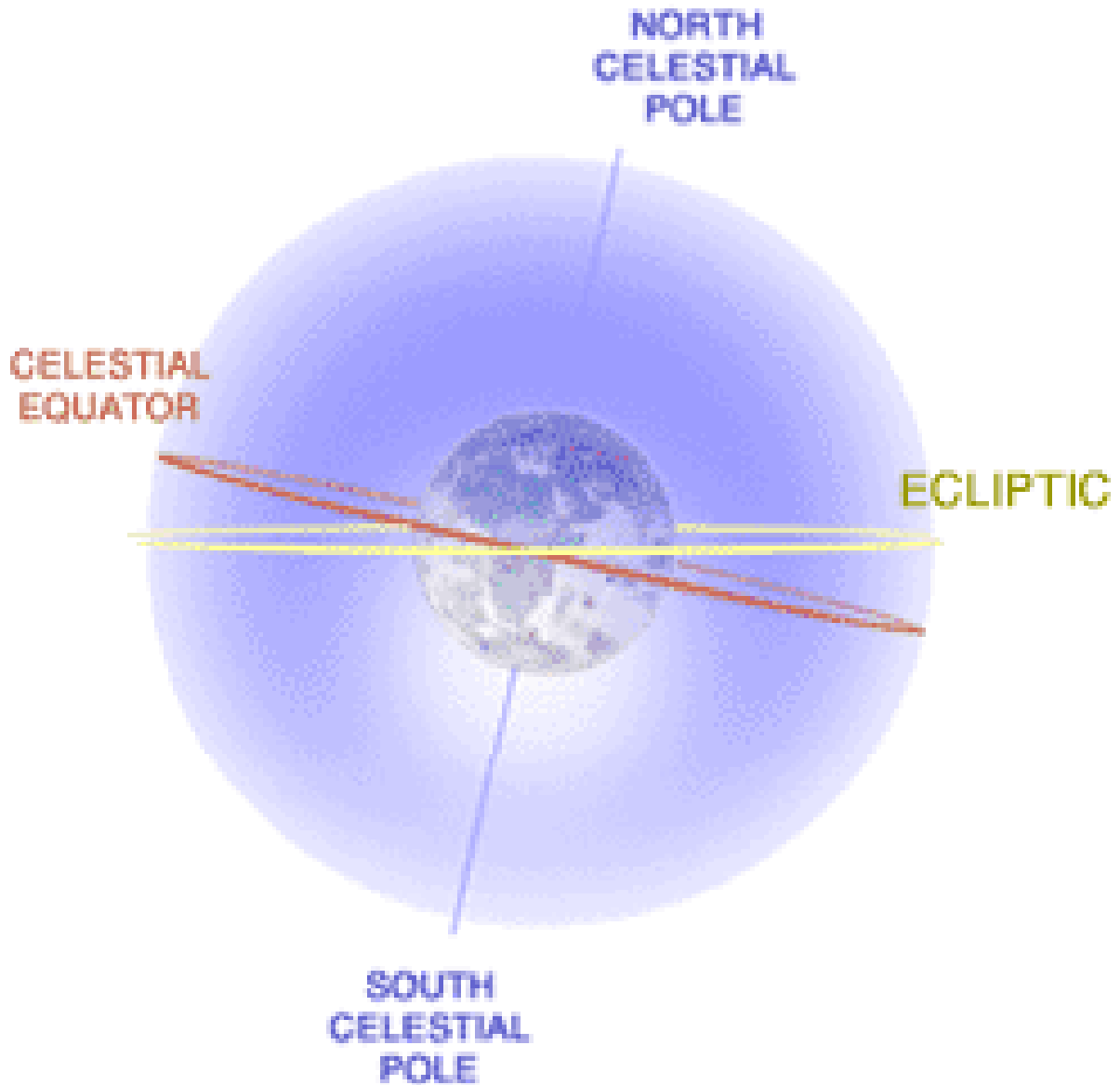


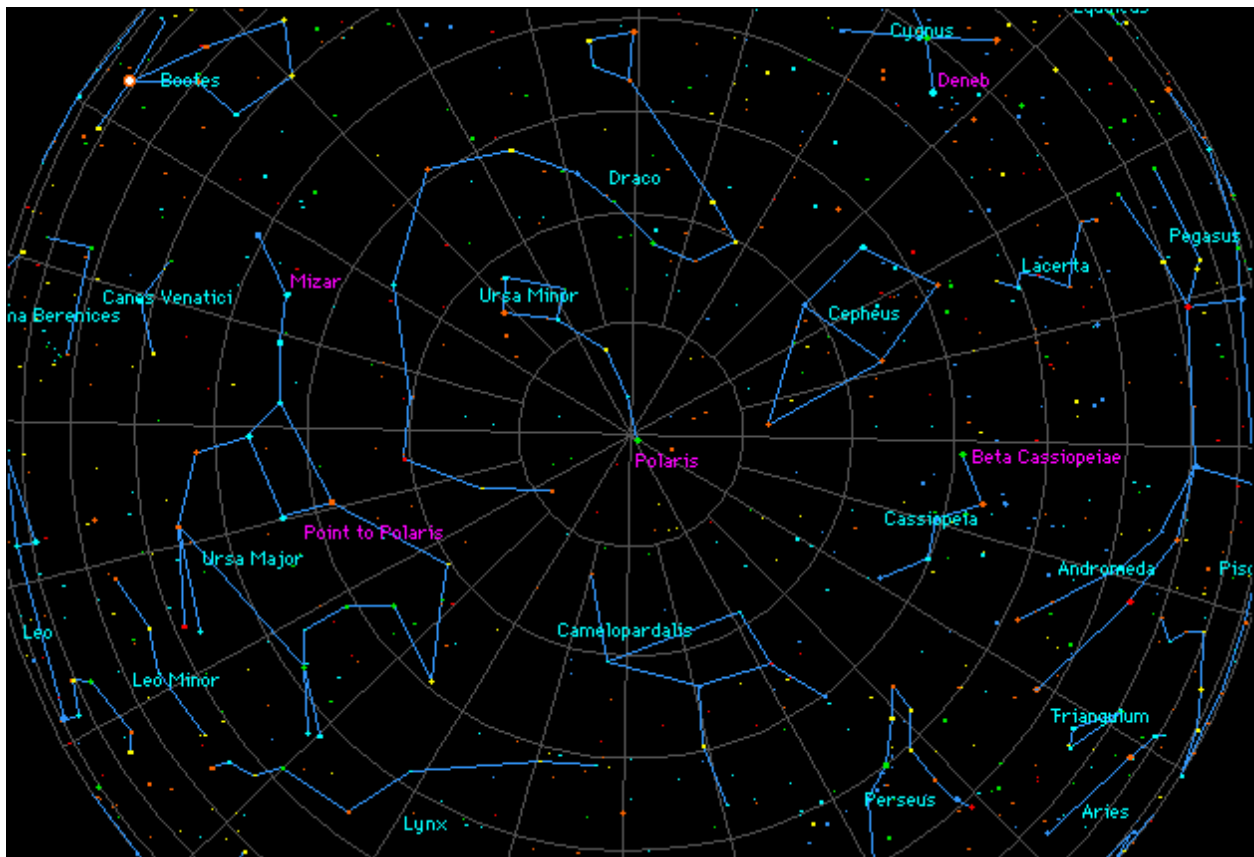
Figure 16

Pictures

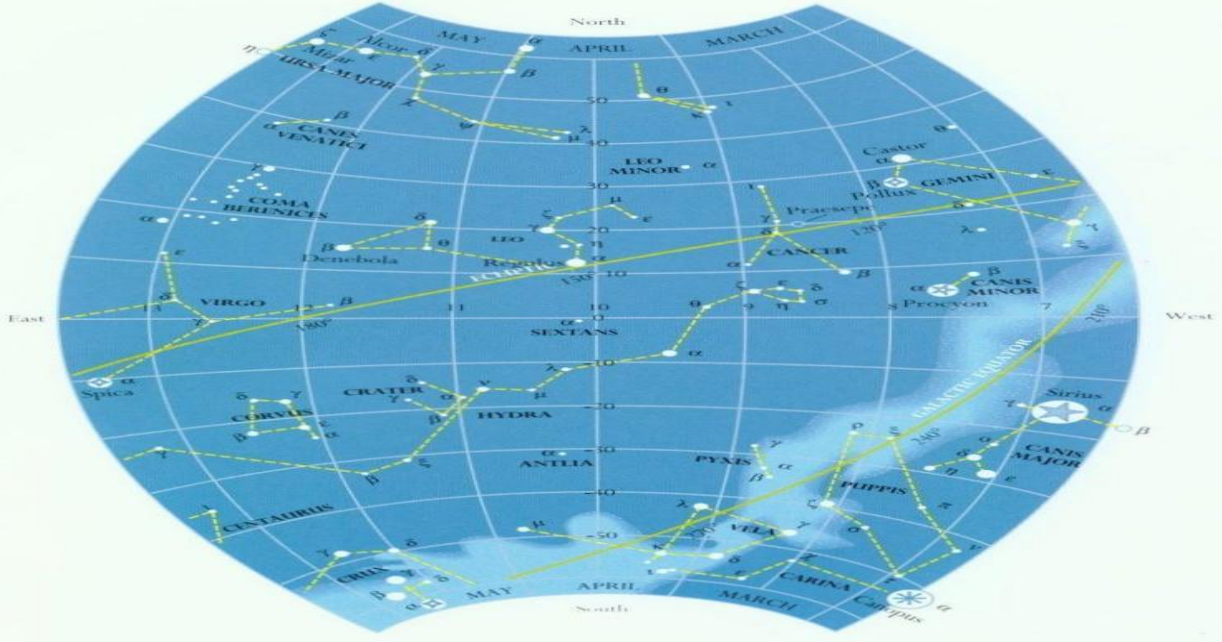
Picture 1- A diagram of the Earth's celestial poles, celestial equator and tilt relative to Sun. The diagram also shows the ecliptic plane. (Picture courtesy of <http://wikimedia.org>).



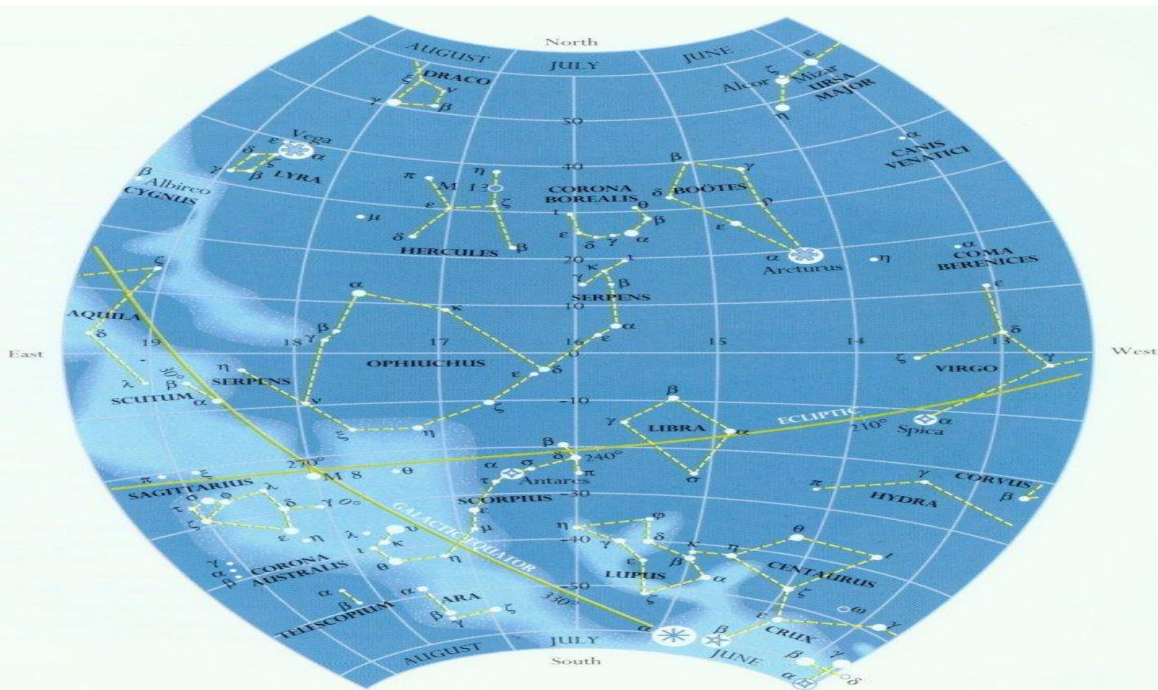
Picture 2- A night-time map of the sky showing the circumpolar northern constellations (Picture courtesy of <http://www.windows.ucar.edu>).



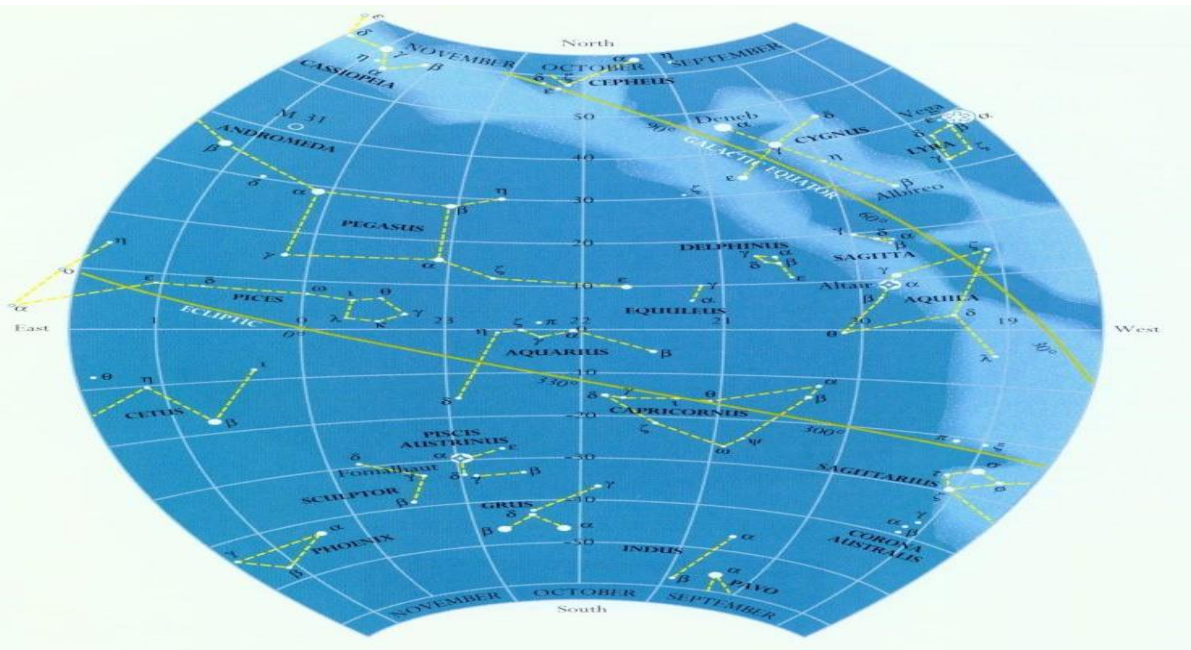
Picture 3- A map that contains the constellations that are present during **spring** in the northern hemisphere. Note the ecliptic plane and the constellations of the zodiac that are on the ecliptic plane. (Picture courtesy of <http://stars.astro.illinois.edu>)



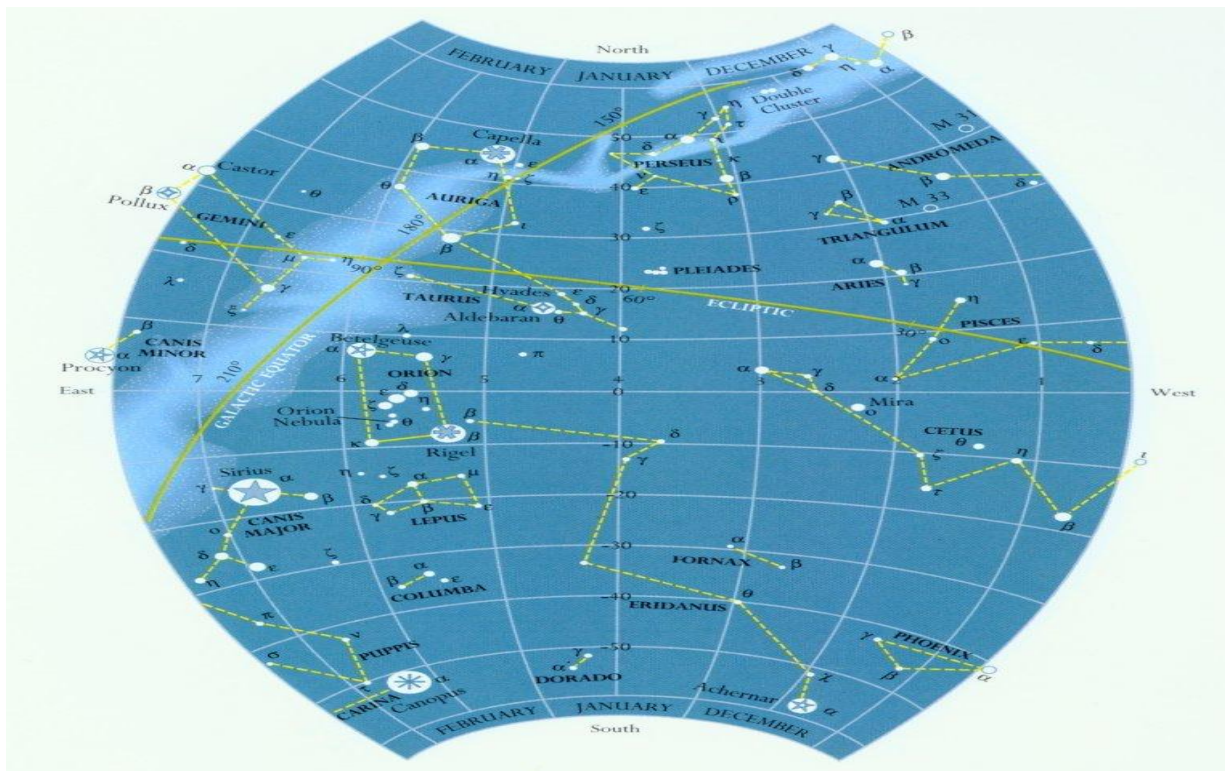
Picture 4- A map that contains the constellations that are present during the **summer** in the northern hemisphere. (Picture courtesy of <http://stars.astro.illinois.edu>).



Picture 5- A map that contains the constellations that are present during **autumn** in the northern hemisphere (Picture courtesy of <http://stars.astro.illinois.edu>).



Picture 6- A map that contains the constellations that are present in the northern hemisphere that appear only in the **winter** (Picture courtesy of <http://theamateurastronomer.com>).



Conclusion

The purpose of this project was to determine if all eighty-eight (88) constellations are visible at all times. Through research on constellations I found that while the constellations are not changing the ability to see them varies throughout the year. Because of the Earth's axial tilt and yearly orbit around the Sun, the ability to view the constellations is dependent on several factors. For people living in the Northern Hemisphere there are six (6) constellations that are visible all year and they are called the North Polar constellations. Likewise there are fourteen (14) constellations always visible in the sky of the Southern Hemisphere and they are called the South Polar constellations. That leaves sixty-eight (68) constellations that are visible only at certain times throughout the year and these are called seasonal constellations. Therefore the constellations are constant and not changing but the ability to observe the constellations depends on where and when they are being viewed. In conclusion, constellations are always out there and their visibility will depend on a person's location and season of the year.

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Glossary

Circumpolar- around or near a pole, as of the earth

International Astronomical Union- the International Astronomical Union (IAU) was founded in 1919. Its mission is to promote and safeguard the science of astronomy in all its aspects through international cooperation. Its individual members - structured in [Divisions](#), [Commissions](#), [Working groups](#) and [Program Groups](#) - are professional astronomers from all over the world, at the Ph.D. level and beyond, and active in professional research and education in astronomy. Besides, the IAU collaborates with various [organizations](#) all over the world

North Celestial Pole- the celestial pole above the northern hemisphere; near Polaris

Seasonal- pertaining to, dependent on, or accompanying the seasons of the year or some particular season; periodical

Ecliptic- the path or orbit the Earth takes around the Sun