STEM at HOME

SCIENCE ★ TECHNOLOGY ★ ENGINEERING ★ MATH

PRESENTED BY: girlstart

Astronomy Day

Wrap up your STEM Extravaganza at Home with an entire day dedicated to astronomy! First, learn all about constellations as you build your own personal viewer and discover the consequences of light pollution. Then, explore Girlstart's virtual Starry Nights to hear about constellations from different cultures. Finally, design your own unique "star show" using the night sky as your planetarium. By the end of the day, you'll be a master astronomer!

Astronomy Day Guide:

- Part 1: Constellation Viewers – a hands-on STEM lesson for the entire family.
- Part 2: Light Pollution – learn about light pollution and how it affects our ability to see the stars.
- Part 3: Virtual Starry Nights – re-visit some of Girlstart's past virtual Starry Nights.
- Part 4: Design Your Own Star Show – use an interactive star map to plan out your own star show. Then, head outside when it gets dark to view your favorite constellations in real time!

TEKS:

SCI K/1.8: Earth and space. The student knows that there are recognizable patterns in the natural world and among objects in the sky.
SCI K/1.8 C: The student is expected to observe, describe, and illustrate objects in the sky such as the clouds, Moon, and stars, including the Sun.
SCI 8.8 A: The student is expected to describe components of the universe, including stars, nebulae, and galaxies.

Career:

Astronomers study planets, moons, stars, galaxies, meteors, comets, and their interactions with each other. They must have an in-depth knowledge of physics to understand how forces such as gravity change throughout space. Astronomers work together sharing their knowledge to better understand how the universe works.

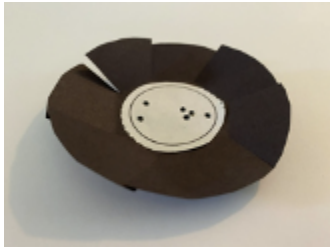
Part 1: Constellation Viewers

Materials:

- Black construction paper
- Cardboard, foam board, or cork board (at least 4.5” x 4.5”)
- Clear tape
- Constellation Pattern Template (attached below)
- Giant push pin
- Glue stick
- Markers
- Paper towel or toilet paper tube
- Scissors

Experiment/How To:

1. Cut the black piece of construction paper into an approximately 4.5-inch square.
2. Pick your favorite constellation from the Constellation Pattern Template and cut it out around the dotted line. Glue this constellation circle to the center of the construction paper square.
3. Place the construction paper square on top of the piece of cardboard, foam board, or cork board. Use a giant push pin to punch holes where the stars are located in the pattern. (Safety: An adult should assist when using the giant push pin.)
4. Trim the black construction paper square into a rough circle shape. Make sure to leave a border around the constellation circle.
5. Make cuts from the outer edge of the construction paper to the edge of the constellation circle, but do not cut into the constellation pattern.
6. Fold each of the wedges you just cut by holding the constellation circle with your thumb on the edge of the white constellation paper and folding the wedge of black construction paper upwards. Look at the photo below if you need help visualizing this step.
7. Center the constellation on the top of the toilet paper or paper towel tube. Make sure the



constellation circle is facing down, and tape each wedge to the side of the tube.
8. Use markers, stickers, or colorful paper to decorate your constellation tube. Don’t forget to write the name of your constellation on the side!
9. Close one eye and use the other eye to look through the tube at the constellation pattern.

STEM Connection:

Constellations are groups of stars that form recognizable patterns. However, for ancient Greek society, constellations were much more than just patterns of stars in the sky. They were a way to immortalize religious figures, preserve mythology, and study astronomy. Astronomy is considered to be the oldest science, and the movement of constellations told people when to plant crops and helped them track the changing seasons. The Greeks also used constellations to guide them across seas and deserts. Even today, constellations help us keep track of stars in the sky, locate galaxies and nebulae, and name newly-discovered stars.

In the Northern Hemisphere, you can see Cassiopeia, Ursa Major, and Ursa Minor all year long because they are circumpolar constellations. This means that they rotate around the north pole. However, other constellations are only visible during certain times of the year. In the winter, Canis Major, Gemini, Orion, Perseus, and Taurus are visible in the night sky. Bootes, and Leo appear in the spring. In the summer, Cygnus, Hercules, Sagittarius, and Scorpius are visible, and in the fall, you can see Pegasus and Pisces. Isn't it neat that you can see such a wide variety of star pictures throughout the year?

Part 2: Light Pollution

Let's learn about light pollution! First, do a quick experiment:

- Hold your constellation viewer about six inches away from your face. Close one eye and use your other eye to look through the tube. Can you see your constellation?
- Next, move the constellation viewer so that it is about three inches away from your face. Close one eye and use your other eye to look through the tube. Now can you see your constellation?
- Finally, close one eye and hold your constellation viewer all the way up to your other eye. Look through the tube. You should definitely be able to see your constellation now!

Why does your constellation viewer work best when it is closest to your face? When you hold the viewer all the way up to your eye, the only light that you see is from the stars at the end of the tube. As you move the viewer away from your eye, more "outside" light is able to get in, so the stars in the constellation do not appear to shine as brightly.

The same thing happens outdoors! Are you able to see stars during the day? Probably only one star (the sun). The sun's bright light blocks our ability to see other stars! When light from the sun goes away at night, light from distant stars becomes visible. Did you know that everyone on Earth has the potential to see just over 4,500 stars *each and every night*? And that is without using a telescope!

Most nights it seems like there are many fewer stars in the sky, though. Sometimes this is because clouds, buildings, or trees are covering the stars. However, even on a clear night, many stars are not visible to our eyes, especially in the middle of a neighborhood or city. This is because of light pollution. Light pollution is a phenomenon caused by man-made sources of light which artificially brighten the night sky and affect our ability to see the stars.

Here is an interesting story: In 1994, Los Angeles experienced a widespread power outage due to an earthquake. The entire city went dark! Many residents called 911 to report a "giant silvery cloud" engulfing the sky. What do you think this mysterious, silvery cloud was?

It was a bunch of stars! Many Los Angeles residents had never seen a sky without light pollution. And light pollution doesn't just affect astronomers or people trying to stargaze. Exposure to artificial light at night can be bad for human health, and many animals rely on specific day-night cycles, which can be disrupted by light pollution.

Turning off all lights everywhere would technically take care of our light pollution problem, but this would also be incredibly dangerous because people need lighting to see at night! There is a way to help fix our light pollution problem, though. Quite a bit of outdoor lighting is not built very well and light spills into the sky rather than focusing its brightness on the areas that people actually want illuminated. Special outdoor lighting designs can help make it much easier for us to see the stars at night, and there is even an entire organization dedicated to helping reduce light pollution, the International Dark-Sky Association.

Check out this photo, taken before and during a 2003 Northeast power outage. Look how beautiful the sky looks without light pollution!

Part 3: Virtual Starry Nights

Girlstart hosts an event called Starry Nights on the first Thursday of each month. This spring, we moved to virtual Starry Nights with hands-on activities and star shows from our mini planetarium posted online, and we'd love for you to check them out! Each month has hands-on STEM activities and a star show video related to a different theme.

You can find all of our hands-on STEM activities and star show videos on our Starry Nights website: https://girlstart.org/our-programs/starry-nights/

And here is a list of Virtual Starry Nights we currently have available, with links to each star show:

APRIL 2020 – Featuring a Lunar Show

- Link to star show: https://girlstart.org/wp-content/uploads/2020/04/Girlstart-Lunar-Starry-Night-1.mp4

MAY 2020 – Featuring an Egyptian Mythology Star Show

- Link to star show: https://www.youtube.com/watch?v=LpBdz5mOpck

JUNE 2020 – Featuring a Greek Star Show

- Link to star show: https://www.youtube.com/watch?v=JrhFTF9I6r0&feature=youtu.be

We will continue to offer Virtual Starry Nights on the first Thursday of each month until it is safe to meet back in person. Here is a list of our upcoming Virtual Starry Night events – we'd love to have you join us!

- September 3rd – Greek
- October 1st – Solar System
- November 5th – Native American
- January 7th, 2021 – Inuit

Part 4: Design Your Own Star Show

Now that you've had a chance to design a constellation viewer and experience some of Girlstart's Virtual Starry Nights, it is time for you to create your very own show!

Steps to create your own star show:

1. Choose which constellations you would like to include in your show. Check out the list below, which includes visible constellations on August 15th.
2. We've provided stories for a few of these constellations for you to use as inspiration. However, feel free to get creative, do some research, and write your own constellation stories as well!
3. Decide where you will view your star show. If you are able to go outside, think about a place with the least amount of light pollution. If you cannot go outside, that is not a problem! You can use an interactive star chart (https://skyandtelescope.org/interactive-sky-chart/) and view the night sky from inside your home.
4. Once it gets dark (or you are ready for your indoor star show), enjoy learning all about your favorite constellations as you view them in real time. We encourage you to grab other members of your household to share your star show with as you look up at the night sky.

List of constellations visible in the night sky on August 15th (Northern hemisphere):

- Cassiopeia
- Cepheus
- Draco
- Leo
- Sagittarius
- Scorpius
- Ursa Major (the Big Dipper)
- Ursa Minor (the Little Dipper)

To find out exactly *where* to see these constellations in the night sky, go to the following link (https://skyandtelescope.org/interactive-sky-chart/) and follow these instructions:

1. Enter your ZIP Code.
2. Make sure the date is accurate and adjust the hour and minute to the correct time.* This can easily be done for the current time by clicking "now" under the "submit" button.
3. Choose which night sky objects you would like to view by checking the corresponding "display option" checkboxes. For now, just make sure that "constellation names," "constellation lines," and "buildings & trees" boxes are checked.
4. Press submit and view the star map! The large circle on the right shows a view of the entire night sky. The yellow text labels around the circle, "facing north, west, etc." tell you which direction to look to see the different constellations.
5. If you drag and drop the polygon within this circle, the left "selected view" will show you what that portion of the sky looks like from the ground.
6. Can you find all of the summer constellations listed above? Remember that clouds and light pollution might affect how many stars you can see in the sky.

*NOTE - this website uses a 24-hour clock, or "military time." This means that days run from midnight to midnight, and the hours go up to 24 instead of just 12. AM times stay the same between regular and military time, but for any "PM" regular times, you add 12 hours to get the military time. So, if you are trying to enter 8:00pm, you would enter 20:00 for military time (12:00 + 8:00).

Constellation Stories

Cassiopeia and Cepheus

"In a wonderful kingdom long ago lived a princess named Andromeda. Andromeda was the daughter of the great King **Cepheus**, and even though she was incredibly famous, she was not spoiled at all. She was as kind as she was beautiful, and lived happily in her city by the sea. There was one small problem, though… her mother, Queen **Cassiopeia**, was also very beautiful, but not nearly as kind as Andromeda. In fact, she constantly bragged about how beautiful she was, how beautiful her daughter was, and how beautiful her entire kingdom was. She went as far to boast that princess Andromeda was more beautiful than any of the Greek god's daughters. Word got around to the gods that Queen **Cassiopeia** was being incredibly boastful and rude. The sea god Poseidon was so angry that he flooded King **Cepheus** and Queen **Cassiopeia's** city by the sea, and sent a giant set monster named Cetus to terrify the entire population!

This horrified the people and after the flood waters dried up, the monster Cetus remained. You never knew when he was going to pop up, and he was incredibly dangerous. This made the people very unhappy. King **Cepheus** asked a local oracle what he could do to put a stop to this terror caused by Cetus the sea monster. The oracle told him that he had two choices: He could either sacrifice his entire town to another flood, or sacrifice his beloved daughter, Andromeda, to the sea monster. What a horrible choice to have to make! It saddened him greatly, but he decided that he must save the lives of his entire kingdom, so he ordered that his daughter Andromeda be chained to a tree on a cliff that overlooked the sea, very near the place where Cetus had last been sighted.

That day, a hero named Perseus was out adventuring, very happy after his successful attempt to beat Medusa, a monster that could turn anyone or anything to stone with just her eyes. He sailed past King **Cepheus** and Queen **Cassiopeia's** kingdom just as servants were chaining princess Andromeda to the tree! As soon as the servants left, the giant sea monster Cetus reared its ugly head, leapt out of the water, and reached for Andromeda. Perseus and Andromeda screamed! Andromeda noticed something in Perseus' hand – the head of Medusa – and she quickly told him to point Medusa's head at the monster. Perseus held Medusa's head up to Cetus and the sea monster instantly turned to stone! Cetus sank to the bottom of the ocean, Perseus freed Andromeda from her chains, and they went to share the good news with the whole kingdom. Perseus and Andromeda eventually fell in love, got married, and took over King **Cepheus** and Queen **Cassiopeia's** wonderful kingdom by the sea. The gods decided that their story was so legendary that it should live on forever, so they placed their pictures in the sky so no one would ever forget this incredibly story."

Draco

"A long time ago, Zeus gave his new wife Hera some very valuable golden apples as a wedding present. Because they were so precious, Hera sent **Draco** the Dragon to guard them. **Draco** was extremely powerful – he had poisonous, fiery breath, and his scales were enchanted so that no arrow could ever pierce them. He remained coiled around the golden apple tree all day, and never allowed anyone to come near except for his friend Atlas. Atlas was a giant who held the world on his shoulders. One day, the hero Hercules was tasked by an Oracle to get the apples away from **Draco** the Dragon. This seemed like an impossible task! But Hercules was extremely clever and went to Atlas, **Draco's** only friend, for help.

Atlas was also a bit clever, however, and said that he would agree to help Hercules get the apples from **Draco** only if Hercules helped him hold up the world for a bit. Atlas and Hercules switched places, with the agreement that Atlas would quickly bring the golden apples back to Hercules so that he wouldn't have to hold up the super heavy earth for very long! This agreement didn't last though because Atlas loved being free so much that, after stealing the golden apples from **Draco**, he ran away with them and left Hercules to support the earth for eternity. Now, if you'll remember, Hercules was extremely clever, and Atlas was only a bit clever. Hercules pleaded with Atlas to hold up the earth for a just a few seconds so that he could quickly re-adjust his shoulder placement. Atlas reluctantly agreed, but as soon as he began supporting the earth, Hercules quickly ran away! So, Hercules succeeded in stealing the golden apples from **Draco** the Dragon. Hera was not happy about this, and decided that it would be best for **Draco** to take on a different task. She placed the dragon into the heavens as a constellation in the northern sky, where **Draco** continues to remain a watchful guard."

Ursa Major and Ursa Minor

The Ursa Major and Ursa Minor constellations are named after bears! Ursa Major means "great bear" and Ursa Minor means "smaller bear." You can find them near each other in the night sky. Both of these bears have an important role in Greek mythology, and the Greek astronomer Ptolemy gave these constellations their names.

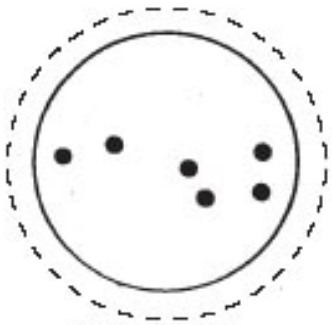
Ursa Major is named after the beautiful Callisto. Zeus, the king of all of the Greek gods, fell in love with Callisto and they had a son named Arcas. One day, Callisto was magically transformed into a bear and had to spend her days hiding from scary hunters!

One day, Callisto's son Arcas was in the forest and saw the bear Callisto. He did not know that this bear was his mother, so he pulled out a spear to kill her. Oh no! Luckily, Zeus was watching over both of them, so he quickly used his powers to send Callisto and Arcas into the sky. Callisto became the constellation Ursa Major and Arcas became the constellation Ursa Minor.

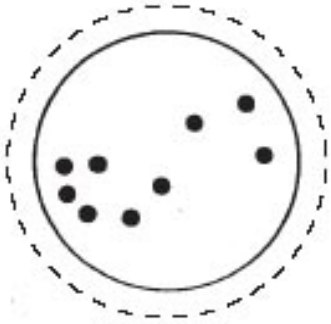
Resources:

http://mommaowlslab.blogspot.com/2013/09/diy-constellation-tubes.html?utm_source=feedburner&utm_medium=email&utm_campaign=Feed:+MommaOwlsLab+(Momma+Owl%27s+Lab)
https://amazing-space.stsci.edu/resources/print/classroom_activities/scibkgd_cnstlatn_qa.pdf
https://sciencing.com/list-constellations-visible-seasonally-7789783.html
https://www.underluckystars.com/blog/the-origin-of-the-greek-constellations/
https://www.eurekacamping.com/blog/article/5-constellations-everyone-can-find
https://www.constellation-guide.com/seasonal-constellations/summer-constellations/#:~:text=For%20northern%20observers%2C%20these%20are,Ophiuchus%20in%20the%20southern%20sky.
https://study.com/academy/lesson/ursa-major-minor-constellation-myths-lesson-for-kids.html
https://www.darksky.org/light-pollution/
https://skyandtelescope.org/interactive-sky-chart/

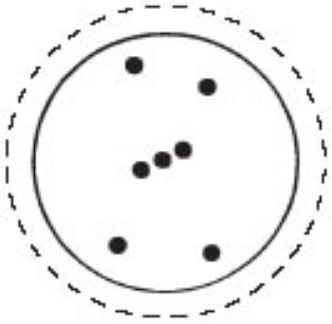
Constellation Pattern Template



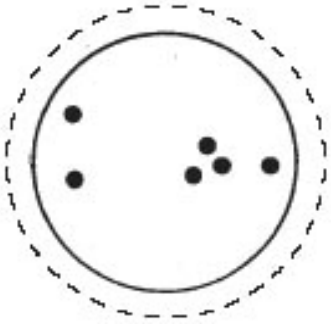
URSA MAJOR,
the Great Bear



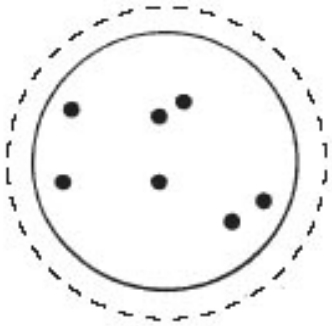
SCORPIUS,
the Scorpion



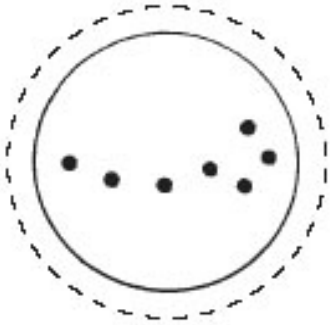
ORION,
the Hunter



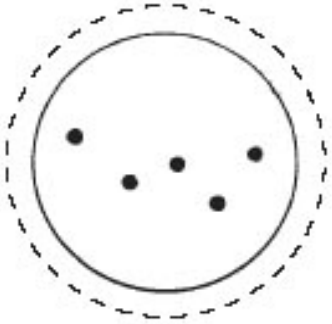
TAURUS,
the Bull



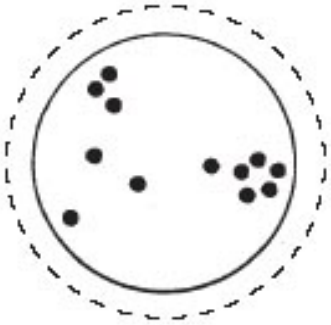
PEGASUS,
the Flying Horse



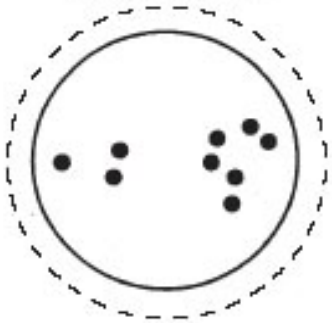
URSA MINOR,
the Little Bear



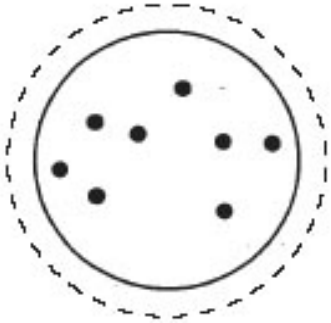
CASSIOPEIA,
the Queen



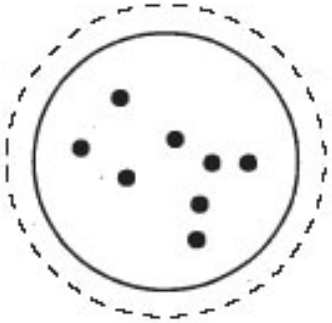
PISCES,
the Fishes



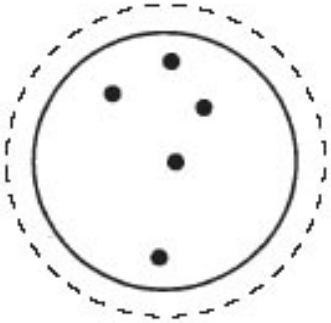
LEO,
the Lion



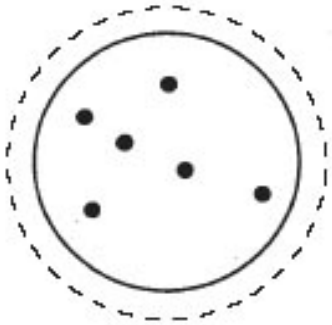
SAGITTARIUS,
the Archer



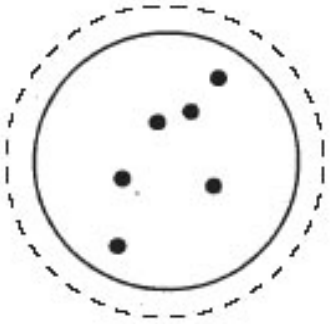
GEMINI,
the Twins



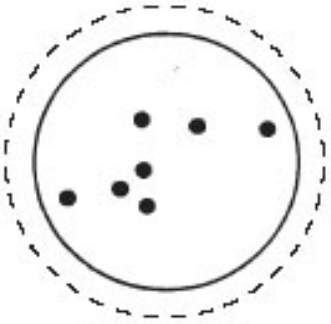
BOOTES,
the Herdsman



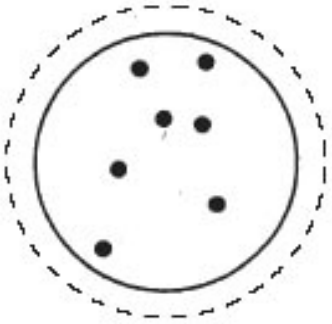
CYGNUS,
the Swan



PERSEUS



CANIS MAJOR,
the Big Dog



HERCULES