

Astronomy

Students will learn about the phases of the moon and be able to identify basic constellations.

Grade Level: 3-6

Objectives:

- Students will know and understand the phases of the moon
- Students will be able to identify some of the major constellations in the night sky
- Students will understand how far the stars are away from the Earth in relation to the sun

Materials Needed:

- A roll of toilet paper
- Styrofoam balls (moons)
- Skewer sticks
- A floor lamp (minus shade)
- Laser pointer

Prep Time: 10 mins.

Activity Time: 1 hour

Follow-up Activities:

- Night Hike/ Solo Hike

Nevada State Standards Addressed:

- **E5.B1**– There are more stars than anyone can count
- **E5.B3**– Stars are like the Sun but so far away they look like points of light
- **E5.B5**– Constellations appear to move across the sky & can be seen in different seasons

NAAEE standards Addressed:

- **1.3**– Openness to Inquiry
- **3.1**– Critical & Creative thinking
- **3.2**– Applying skills to issues **5.2**– Different ways of learning

Key Vocabulary:

Full Moon: The phase of the moon in which it is visible as a fully illuminated disk. This phase occurs when the Moon is on the opposite side of the Sun and is not in Earth's shadow.

New Moon: The phase of the Moon that occurs when it passes between Earth and the Sun making it fully obscured in shadow.

Waxing: To show a progressively larger illuminated area, as the moon does in passing from new to full.

Waning: To exhibit a decreasing illuminated area from full moon to new moon.

Gibbous: More than half but less than fully illuminated. Used to describe the Moon or a planet.

Crescent: Partly but less than half illuminated. Used to describe the Moon or a planet.

Lead In Information

Tonight we are going to learn about the night sky including the sun, the moon, and the stars. Does anyone know what a constellation is? Can you point one out?

Preparations:

Assemble the "moons" with the skewers and Styrofoam balls. Set up the lamp in the middle of the room. If outside, a bright headlamp can be used for the phases of the moon. Make sure you have your laser pointer. Gather students in a clearing of trees where many constellations are visible.

Activity 1: Toilet Paper Astronomy

Step 1: Get out a brand new roll of toilet paper (approx. 200 squares).

Step 2: Explain that the distance from the earth to the sun (the closet star) is 93 million miles away which = one sheet of TP.

Step 3: Have one student take the roll of toilet paper and walk backwards very slowly and gently so as not to tear the TP until the roll is all unraveled.

Step 4: Now explain that the next closest star (Alpha Centauri) is 4.37 light years or 25.8 Trillion miles away.

Step 5: Explain that in order to show that to scale, we would need to unroll 1,386 more TP rolls end to end to show the distance to the next closest star.

Step 6: Have the volunteer neatly roll up the TP.

Activity 2: Phases of the Moon

Step 1: Hand out a "moon" on a stick to each student and have them stand in a circle facing the light source (headlamp or floor lamp if inside). Talk about the "lunar month" and how it is roughly 28-30 days like the calendar month, just not exactly in line with the days. Ask, "Is the full moon on the same day each month?"

Step 2: Have students hold "moon" in right hand straight out from their body and close left eye covering the light source with the "moon."

Step 3: Explain that this is a New Moon, when none of the moon is illuminated by the sun.

Step 4: Have students rotate counter-clockwise 90 degrees and watch what happens to the moon. Only the right half should be illuminated. This is a 1st quarter moon.

Step 5: Have the students rotate another 90 degrees counter-clockwise so that now the entire moon is illuminated. This is a full moon.

Step 6: Have students rotate yet another 90

degrees counter-clockwise and watch as the right half of their moon disappears. This is a 3rd quarter moon (or 3 quarters moon.)

Step 7: Have students rotate one more 90 degrees to face the light source again at the "new moon."

Step 8: Do a quick review of each phase (i.e. "Show me a full moon," "Show me a 1st quarter moon," etc.)

Step 9: Now explain waxing and waning. The moon is waxing during the 1st half of the lunar month from the new moon to the full moon. The moon is waning during the 2nd half of the lunar month from the full moon back to the new moon.

Step 10: Explain a Crescent moon and a Gibbous moon and show the students when and where those happen.

Activity 3: Constellations

Step 1: If not still in the clearing, return there so that you can all clearly view the constellations.

Step 2: Explain that the stars in the sky often are part of constellations which are groups of stars that if you were to draw lines between them, they would make up a character or object, many of which have stories behind them from Native American or Greek Mythology. Does everyone know what Mythology is? (Explain this if need be before going on.)

Step 3: Tell the Native American Story about how Coyote put all the stars in the sky and why he now howls at night. (See attached story. Or, tell your favorite constellation story here.)

Step 4: Point out some of the major constellations in the night sky. (In the summer you should be able to clearly see Ursa Major– the big dipper or big bear, Ursa Minor– the little dipper or little bear, Draco– the dragon, Bootes, and Hercules.)

Step 5: Point out Polaris (the North Star) by following the outer edge of the big dipper to the end of the handle of the little dipper. This star is Polaris.

Step 6: Point out Bootes. You can find Bootes by following the handle of the big dipper to the next brightest star in the area (Arcturus). It is the bottom of the “kite” shape that makes up Bootes’ body. Bootes is a hunter and a herdsman who is

surrounded by big beasts including the big and little dippers (or bears). The story says that he fought the great bear (who was the goddess Callisto in disguise) but Zeus intervened and saved the bear and put her in the sky.

Step 7: Point out Hercules and tell the story of Hercules and his 12 Labors. (See attached story.)

Review Questions:

- What are the 4 main phases of the moon?
- How long is a lunar month?
- What is Waxing?
- What is Waning?
- What is the moon doing tonight?
- Will it be the same tomorrow night?
- Is tonight’s moon a crescent or a gibbous?
- What are constellations?
- What is your favorite constellation and why?

Evaluation:

Ask students to name constellations as you point them out with the laser pointer. Also, you can ask the questions about that night’s moon while outside doing astronomy as evaluation for how much they learned during phase of the moon.

Learning Intelligence Addressed:

- Kinesthetic
- Logical– Mathematical
- Spatial
- Linguistic

The Story of Hercules

Hercules was the Roman name for the greatest hero of Greek mythology -- Heracles. Like most authentic heroes, Heracles had a god as one of his parents, being the son of the supreme deity Zeus and a mortal woman. Zeus's queen Hera was jealous of Heracles, and when he was still an infant she sent two snakes to kill him in his crib. Heracles was found prattling delighted baby talk, a strangled serpent in each hand. When he had come of age and already proved himself an unerring marksman with a bow and arrow, a champion wrestler and the possessor of superhuman strength, Heracles was driven mad by Hera. In a frenzy, he killed his own children. To atone for this crime, he was sentenced to perform a series of 12 tasks, or "Labors", for his cousin Eurystheus, the king of Tiryns and Mycenae. By rights, Hercules should have been king himself, but Hera had tricked her husband Zeus into crowning Eurystheus his half brother instead.

As his first Labor, Heracles was challenged to kill the Nemean lion. This was no easy feat, for the beast's parentage was supernatural and it was more of a monster than an ordinary lion. Its skin could not be penetrated by spears or arrows. Heracles blocked off the entrances to the lion's cave, crawled into the close confines where it would have to fight face to face and throttled it to death with his bare hands. Ever afterwards he wore the lion's skin as a cloak and its gaping jaws as a helmet.

King Eurystheus was so afraid of his heroic cousin that when he saw him coming with the Nemean lion on his shoulder, he hid in a storage jar. From this shelter he issued the order for the 2nd Labor which is perhaps his most famous labor of all.

Heracles was to seek out and destroy the monstrous and many-headed Hydra. The mythmakers agree that the Hydra lived in the swamps of Lerna, but they seem to have had trouble counting its heads. Some said that the Hydra had eight or nine, while others claimed as many as ten thousand. All agreed, however, that as soon as one head was beaten down or chopped off, two more grew in its place.

To make matters worse, the Hydra's very breath was lethal. Even smelling its footprints was enough to kill an ordinary mortal. Fortunately, Heracles was no ordinary mortal. He sought out the monster in its lair and brought it out into the open with flaming arrows. But now the fight went in the Hydra's favor. It twined its many heads around the hero and tried to trip him up. It called on an ally, a huge crab that also lived in the swamp. The crab bit Heracles in the heel and further impeded his attack. Heracles was on the verge of failure when he remembered his nephew, Iolaus, the son of his twin brother Iphicles.

Iolaus, who had driven Heracles to Lerna in a chariot, looked on in anxiety as his uncle became entangled in the Hydra's snaky heads. Finally he could bear it no longer. In response to his uncle's shouts, he grabbed a burning torch and dashed into the fray. Now, as soon as Heracles cut off one of the Hydra's heads, Iolaus was there to sear the wounded neck with flame. This kept further heads from sprouting. Heracles cut off the heads one by one, with Iolaus cauterizing the wounds. Finally Heracles lopped off the one head that was supposedly immortal and buried it deep beneath a rock.

Who would have thought that after he conquered the great beast that it would be poisonous Hydra venom that eventually brought about his demise. Later in his life, Hercules' wife Deianara is tricked into giving him a tunic covered in centaur blood only to find that it was actually soaked with poisonous Hydra venom. Hercules unknowingly puts on his new tunic and dies in agony. However, his strength and character as well as the story of his 12 labors are so legendary that the Greeks chose to give him his own constellation thus capturing him forever in the night sky.

Why the Coyote Howls:

A very long time ago, before the two-legged's walked the Earth, the world was very different from the way it is now. Back then, in the beginning times there were no stars in the night sky, and there was no moon. The nights were very dark, and the animals could not see to walk around and so were always bumping into each other. Finally they talked and decided to go ask the Great Spirit for help.

The animals gathered and talked to Great Spirit. They told Great Spirit that they were grateful for all they had, yet they wanted something else. They would like to be able to see at night. Great Spirit nodded and smiled and told the animals "watch me, little ones." He then picked up a bright shiny stone from a stream and placed it in the sky, where it became a star. "This is the home star" Great Spirit explained "it does not move, use it to find your way home when you are lost" (note, this star is Polaris, the North Star.)

Then Great Spirit told the animals to go collect up piles of these shiny stones and carry them up into the sky and make pictures of themselves. The animals began this task, but soon the little animals grew tired. After awhile longer, the bigger animals also grew tired.

Back they went to Great Spirit and asked for more help. "Go to Coyote" Great Spirit said "tell him to help you." And so they did. Now Coyote thought he was the wisest and most clever of all the animals, and he did not want to waste his time helping the other animals. Still, he also did not want to offend Great Spirit. So coyote told the animals to leave their stones with him, and he would finish the job for them. After the animals left, Coyote began thinking of what a grand picture of himself he would create in the sky, "it will be better than all the others," he thought. It will have the most stones and will be the brightest of all!

Suddenly Coyote was reminded that he must finish the animals work. Coyote did not want to waste a lot of time finishing the pictures of the other animals. So, hurriedly he snatched up the bag of stones and flung them up into the air. The stones went here and there, all over. None of the stones really helped finish the pictures of the other animals. And that is why not all constellations appear finished, and why some do not look like what they are named after. But, coyote was punished for his treachery, for in his haste, he forgot to save stones for his own picture! Coyote was furious and he howled in rage. That is why Coyote howls at night now, because he cannot see a picture of himself in the night sky!