



Astronomical Adventures

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Ann McWilliams
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Adventure: **Astronomical Adventures**
Major Concept: **Stars and Planets**
Location: **Amphitheater**
Duration: **45 min. to 1 Hour**

Purpose: The purpose of this lesson is to become familiar with major stars, constellations and planets visible in the night sky and understand concepts related to these heavenly bodies.

Science TEKS:

- 4.6A Identify patterns of change such as in weather, metamorphosis, and objects in the sky
- 5.5 The student knows that a system is a collection of cycles, structures, and processes that interact.
- 5.2B Collect information by observing and measuring
- 5.2C Analyze and interpret information to construct reasonable explanations from direct and indirect evidence
- 5.6A Identify events and describe changes that occur on a regular basis such as in daily, weekly, lunar, and seasonal cycles

Materials:

Camp will provide:

High beam flash light to use as a pointer

Student will provide:

Poncho on which to lay back and look up at the stars

Backpack (flashlight to be placed inside to keep it from turning on during the program; closed pack becomes a pillow)

Safety Hints:

- Never run or throw rocks in the amphitheater area.
- Have students line up at the top of the amphitheater and enter stairways slowly, in an orderly manner to take seats. Falling on 2000 lb. rocks will hurt!

Objectives: Students will

- relax and enjoy the calm the vesper and nocturnal portion of the 24 hour period.
- observe the location of stars, constellations and planets visible in the season they are residing at Adventure Camp.
- understand that we are not the first civilization to appreciate and study scientifically astronomical phenomena.
- analyze the magnitude of the distances between heavenly objects.
- recognize patterns of change in the solar system, galaxy and universe.
- listen to stories of ancient peoples who struggled to explain the existence of stars and constellations.

Vocabulary:

Vespertine:	of or pertaining to dusk or evening time of the day
Nocturnal:	Belonging to the nighttime
Nebula:	a mass of dust, gas or both between stars (Nebulae gases begin to heat up to 15 million °C and glow becoming a new star.)
Star:	a ball of hot hydrogen gas generating its own heat and light energy. Hydrogen in its core is changing into helium gas by nuclear fusion.
Supernova:	an explosion that occurs as a star dies reaching 1 billion °C
Black Hole:	Results after the supernova of a massive star
Neutron Star:	also known as pulsars, neutron stars result after the supernova of a smaller star
Blue star:	indicates a younger star
White Star:	indicates a star older than a blue star
Red Star:	the star about to reach the supernova stage in the life of a star
Planet:	a round, solid mass which orbits a star and reflects light radiated by the star
Moon:	a round, solid mass which orbits a planet and reflects light from the star its planet orbits

Extension Activities:

Visit the following Web sites to find answers to the many questions this lesson will generate in student's minds. These websites have lots of fun things to do and observe about every aspect of astronomy along with great teacher aids.

1. <http://imagine.gsfc.nasa.gov/docs/teachers/lifecycles/starchild5.pdf>

Nasa Star lesson "The Life Cycles of Stars" (Level 1 appropriate for fifth grade), additional astronomy lessons and puzzles. TEACHERS: IF YOU ARE GOING TO USE THE WEBSITE YOU MAY PRINT APPROPRIATE PUZZLES TO ADD TO THE STUDENT BOOKLET FOR CAMP.

2. **Black Holes**

- http://starchild.gsfc.nasa.gov/docs/StarChild/universe_level1/black_holes.html

This page explains for the student what black holes are and how we know they exist.

- http://starchild.gsfc.nasa.gov/docs/StarChild/universe_level2/black_holes.html

This page contains information about black holes and how we know they exist, links to glossary terms and a movie about a "Journey into a Black Hole."

3. <http://www.enchantedlearning.com/subjects/astronomy/stars/index.shtml>

Wow Facts on Stars, constellations and other Astronomy facts, easy to use

4. Learn more about Chief Seattle and his most revered environmental speech at the following websites:

➤ <http://www.chiefseattle.com/history/chiefseattle/chief.htm>

➤ <http://www.kyphilom.com/www/seattle.html>

References:

<http://starchild.gsfc.nasa.gov/>

<http://imagine.gsfc.nasa.gov/docs/teachers/lifecycles/starchild5.pdf>

http://starchild.gsfc.nasa.gov/docs/StarChild/universe_level1/black_holes.html

http://starchild.gsfc.nasa.gov/docs/StarChild/universe_level2/black_holes.html

<http://www.enchantedlearning.com/subjects/astronomy/stars/majorstars.shtml>

<http://www.ufrsd.net/staffwww/stefanl/myths/stories.htm>

Van Cleave, Janice. Constellations for Every Kid. New York: John Wiley & Sons, Inc, 1997.

Teacher Background

During cold weather students need to wear gloves, wool scarves, hats and several layers because of the cold stone and not moving around for a while. Remind adults and student at the evening meal prior to the lesson.

Have students line up at the top of the amphitheater and enter stairways slowly, in an orderly manner to take seats. Falling on 2000 lb. rocks will hurt!

Instructors need to bring along a powerful, high beam but narrow beam flashlight. Don't forget to turn off all surrounding lights before beginning the program.

Be sure students know the setup procedure so you don't have lights flashing everywhere. Get them to place flashlights into backpack before seating them so their eyes may begin to acclimate to the darkness.

The Story: Begin telling this story right at dusk just prior to the stars beginning to come into view, have students lay back on their poncho at the amphitheater so they are noticing stars coming out as you tell the story---don't mention this purpose to them, just let it happen. That way the end of the story is a surprise to most of them.

When pointing out constellations begin by finding the Summer Triangle. It becomes a marker for other things you will want to find later.

Use the two book resources the Web site listed below to get to know the short version of the **constellation stories**. Don't get bogged down in an explanation of the mythology and religious aspects, instead just make it a fun, interesting story or fable from another culture. It is good for students to know that other cultures in past times were capable of studying the same stars we talk about with them.

<http://www.ufrsd.net/staffwww/stefanl/myths/stories.htm>

Van Cleave, Janice. Constellations for Every Kid. New York: John Wiley & Sons, Inc, 1997.

ISBN # 0-471-15979-4

Rey, H. A. The Stars: A New Way To See Them. Boston: Houghton Mufflin Co., 1980.

ISBN # 0-395-24830-2

How do I know what can be viewed each season and month of the year? *Skywatch* magazine publishes a yearly issue that addresses all the monthly viewing information for the Northern Hemisphere including sky maps. Purchase at Barnes and Noble. It comes out in October of each year for the following year, buy a copy quickly because they go fast and it is not republished.

Procedure: Astronomical Adventures

Description	Procedure
<p>Setup</p>	<ul style="list-style-type: none"> ➤ Have students turn off flashlight and place it into their backpack before entering the amphitheater seating. Zip pack up so nothing falls/rolls out. ➤ After sitting down, students remove poncho from backpack, unfold and spread it out so they can lie back to look up at the stars. ➤ Use backpack as a pillow. <p>Tell the Native American Story at dusk or in the dark just prior to pointing out the stars, constellations and planets. While pointing out the constellations share stories about each one. Make sure it is the short version of them to make the timing of this lesson work out. Students enjoy the stories as much as they do looking at the stars. Consult reference books and included website for various stories to use.</p>
<p>Directions</p>	
<p>Intro</p>	<p>NOTE to instructor: The following is a sample lesson to give you an idea of what can be done. Make it your own adding or substituting as you like. Consult the Skywatch issue to know what can be viewed each month of the year.</p> <p>The Introductory Story</p> <p>This story takes place long <u>before there were humans</u> on the North American continent, and great forests of evergreens covered the land of the northwest. There were huge firs, cedars, hemlocks, spruces, lodge pole pines. All of the animals were happy with one another living in the forests, meadows, lakes and ponds of the far northwest.</p> <p>Just on the edge of the vast forest was a beautiful meadow with a pond. One day chipmunk scampered near the edge of the pond and noticed his reflection. He looked this way and that at his reflection. He decided that he was quite handsome and just <u>had</u> to be the most beautiful animal in the forest. "Just look at my beautiful coloring, soft fur and cute little tail that I sit on. I can fill my cheek pouches with acorns and scamper along the forest floor carrying seeds from place to place."</p> <p>Now, gray squirrel was drawn out of the protection of the forest toward the pond when he overheard chipmunk talking incessantly to himself. When he got closer he overheard chipmunk bragging that he had to be the most handsome and beautiful animal of the forest. Well, squirrel took exception to this remark, interrupting chipmunk to say that it couldn't be so. Gray squirrel began listing his wonderful attributes and decided that without a doubt he himself <u>had to be</u> the most beautiful animal of the forest. An argument began between the two of them that</p>

<p>Discussion & Identification</p>	<p>gradually became louder and louder. Pretty soon all of the animals of the forest were arguing back and forth about who what the most handsome and beautiful.</p> <p>Suddenly the Great Spirit heard the terrible sounding noise coming from the vast forest. The Great Spirit was extremely unhappy with discord happening in the peaceful forest of the northwest. He must do something about it! He decided to take away the sun to punish the animals of the forest. So, the Great Spirit took his huge, colorful blanket and covered the forest, cutting out all the sunlight. The animals went to sleep in the total darkness and slept for a really long time.</p> <p>After a while they were tired of sleeping all of the time. Some of the animals woke up and wondered when the sun would return so that they could go out to play again but since it was still dark they went on back to sleep. Much time passed before they awoke again and tried to figure out what they could do. One time when they awoke they heard a slight sound; it was hummingbird trying to take the blanket off the forest. She would fly as fast as she could, hit the blanket with a small thud and fall back to earth. She kept trying over and over. All of a sudden they heard one whispered voice saying, "try it again, hummingbird". Pretty soon more animals were encouraging hummingbird and she flew up so hard her sharp little beak poked a hole in the blanket letting a tiny bit of sunlight through. Well, then <u>all</u> the animals got really excited and were cheering her on. She was poking many holes into the now but not lifting it off completely.</p> <p>The Great Spirit heard a loud noise again coming from the peaceful forest of the northwest. But this time it made the Great Spirit very happy because all the animals were working together again. He decided to stop punishing the animals but wanted them to remember the lesson he had taught them. So He decided to remove the blanket for part of the time letting the sun come into the forest and covering the forest in darkness for part of the time.</p> <p>Now... we <u>know that this story is true</u> because every evening when the sun sets, you can still see the holes that hummingbird made in the Great Spirit's blanket!</p> <p>(Hopefully, students will get the connection between the story and the stars they are see appearing in the evening sky.)</p> <p>Star Program</p> <p>Can anyone tell me what a star is?</p> <p>Use the information defining stars from the following lesson on the Nasa Website; it is a step by step definition of the Life of a Star from beginning to end. Answers all the usual questions you get. Try not to mention the word sun as you define a star to them.</p>
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<http://imagine.gsfc.nasa.gov/docs/teachers/lifecycles/starchild5.pdf>

Which star is our closest star?

Sun, 92 million miles away from earth, sunlight takes 8 minutes to travel from its surface to the earth's surface, it would take 1.3 million earths to equal the size of the sun, it takes 250 million years for the sun to make one revolution around the Milky Way galaxy, 25,000 light years away from the center of the galaxy.

How many stars are there? (About 1 billion in the Milky Way galaxy alone) On a clear night we can only see around 20,000 stars with our naked eyes; that is, without a telescope or infrared goggles. Even though we cannot see how many there are in the universe, scientists can mathematically predict that number. Now, the Hubble space telescope is helping us get a more accurate estimate all the time.

Does anyone know what a constellation is?

(Group of stars that make a pattern that can be repeatedly recognized.) Many cultures have observed these patterns in the sky and made up stories about them as a way to entertain one another and explain what they couldn't understand.

I want to show you how to locate some of the constellations that you will be able to find back at home. These are the constellations which have the brightest stars giving you the best chance to locate them tonight and again on another night. Astronomers officially recognize approximately 66-70 constellations around the world. Many have such dim stars they are too difficult for us to manage without the darkest of skies. When you return home you can take your poncho out into the back yard, lie down, look up and find the same ones we will see tonight.

NOTE to Instructor: Always begin by finding the Summer Triangle; it is easy to find and becomes a marker for other things you will want to locate later in the program.

Summer Triangle

- ❖ Look above your head (except in winter months when it is off sides a bit)
- ❖ Three stars: Vega, 26 light years away, and the fifth brightest star in our sky (the star from the Jodie Foster movie, "Contact," and a car is named after this star), Deneb (1,500 light years away) and Altair (17 light years away)

The Speed of Light and measuring distance in Space using Light Years

Can you tell me what the speed of light is?

- ❖ Light: 186,000 miles per second
- ❖ REPEAT AFTER ME: 1001.....,they repeat.....you say," That

represents one second. In the time it takes you to say that, light energy has traveled around the earth about 10 times.

- ❖ Some will ask about the speed of sound at this point: (Speed of sound varies with density of the substance. (Through soft things sound travels about 1000 ft/sec to steel, 17,000 ft/sec)
- ❖ However, light years are used to measure distances between stars and planets and stars. "What is a light year?" (One light year is the distance light travels at the rate of 186,000 miles each second for one year, about 6 million, million miles in one year)
- ❖ So for Vega, the light you see tonight left Vega 26 years ago and it is just now arriving on earth for you to see, **OR** if you want to see the light that leaves Vega tonight you have to come back when you are 36 years old (if you are 10), 37 yrs. old (if you are 11). Give students time to think about this. "For Deneb, come back in 1,500 years, I'll be here to show you the light that leaves that star tonight. Ha!"

Big Dipper (Ursa Major)

- ❖ What is a dipper? (A cup with a handle on it. In cowboy movies you see them use a dipper to drink water from the bucket of water they pulled up from the well.)
- ❖ *Mizar* and partner star are a double star in the middle of the handle. Were used as an eye test for Roman soldiers and some Native American tribes, if you could see two you could become a soldier/warrior if you couldn't you were out.
- ❖ *Duhbe*, "dubhe brothers" are the pointer stars at the front of the dipper portion that point toward the *North Star*, *Polaris*, currently the Pole Star of the Northern Hemisphere. Is *Polaris* the largest star in the sky? (No, but most people assume that it is before finding it in the night sky.)

North Star

- ❖ Not the largest star in the sky; *Sirius*, located in *Canis Major*, the great dog is the brightest after the Sun.
- ❖ *Polaris* is actually a double star but is so far away we can tell this easily.
- ❖ Its distance from earth is estimated to at 360 to 820 light years away.
- ❖ At its brightest, *Polaris* is about 6,000 to 10,000 times brighter than our Sun. When you have found it you have also found the Little Dipper
- ❖ A small looking blue star, meaning it is a fairly young and very hot star. Blue stars are about 54,000 degrees at their surface. Red stars are old stars by comparison and much cooler, around 5,000 degrees at the surface.
- ❖ If you were on top of the earth and looked up the North Star would be at the zenith, directly above your head.
- ❖ We are at latitude 45 degrees, so if you point your arm due north at a 45 degree angle you should be pointing at the North Star.
- ❖ Believe it or Not! In 12,000 years Vega will be our North

	<p>Star. Because of the way our earth spins like a wobbling top.</p> <p>Little Dipper (Ursa Minor)</p> <ul style="list-style-type: none"> ❖ Polaris, the north star, is the large star at the tip of the handle of the Little Dipper ❖ Most of the stars of this constellation are too small to see except in the darkest sky ❖ Looks like the little dipper is pouring into the big dipper <p>Cassiopeia, the Queen (similar story to the one the Native Americans tell)</p> <p>Cephas, the King (located upside down near his queen)</p> <p>Cygnus, the Swan (is flying in the Milky Way)</p> <p>Milky Way Galaxy</p> <ul style="list-style-type: none"> ❖ Named by the Greeks from their word for milk, <i>gala</i>. A spray of spilled milk across the sky is what it looked like to them. I think it looks like powdered sugar spilled across the sky. ❖ Some of the dark spots are caused by cosmic dust so thick it blocks out star light and some by black holes (dead stars). ❖ The ancient Incas of Peru thought it looked like an alligator eating its tail. (The black hole and cosmic dust make one section look like an open alligator mouth trying to eat its own tail.) <p>Pleiades, the seven sisters</p> <ul style="list-style-type: none"> ❖ Scientists have discovered that there are actually 300 stars making up this "little" cluster the shape of a kite. <p>Pegasus' wing, the Great Square and Andromeda</p> <ul style="list-style-type: none"> ❖ We usually point out only the wing of Pegasus because his body is much smaller and made up of faint stars, it takes a really dark night to be able to see the body clearly. <p>Orion, the hunter (<i>Betelgeuse</i>, red star and <i>Rigel</i>, blue star)</p> <ul style="list-style-type: none"> ❖ This constellation is a fun one because we have an easily seen example of a very large young star, <i>Rigel</i>, and a very old star that could go out at any time, <i>Betelgeuse</i>. ❖ You can have a fun discussion here about the possibility that <i>Betelgeuse</i> may have already gone out but the light from the supernova is still traveling through space and hasn't arrived at earth yet. <p>Taurus, the bull</p> <ul style="list-style-type: none"> ❖ You will be able to find the bull's v-shaped face, call it the bull's horns and they will be satisfied. On the darkest nights you may be able to make out a couple of the legs of the bull but the stars are really faint.
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What to do on Rainy, Cloudy Nights

Option 1

The same program can be done indoors. Take sheets of card stock, 8.5 X 11.0 size, one sheet for each constellation you are sharing with the group. With a pencil place a dot for each star making up the constellation. Then punch a clean hole where each star (dot) using an awl or ice pick. Place the piece of card stock on an overhead projector and the constellation appears on the wall or screen when you are in a dark room.

At the end of the program instruct the students to look for all of these the next night and report back to you which ones they have found. They really do find most of them on their own.

Option 2

Have teachers do one of their "bring along" rainy day activities or choose one out of the rainy day book provided to the camp as a substitute activity.

Option 3

Create a substitute activity from the materials provided on the following NASA website. Bring laptops into the Education Building to utilize visuals provided on this source.

<http://starchild.gsfc.nasa.gov/>

Option 4

A constellation myth is a story that usually contains a moral and explains why that particular constellation is in the sky. Have students divide into groups of two. They will make up their own constellation and draw it on black construction paper using a white crayon to represent the stars. In their journal they write a constellation myth to fit their constellation. Be creative and appropriate. At the end have some groups volunteer to share their stories.

Materials Needed: Black construction paper, white crayon or color pencil, student booklet or plain paper, and pencil.

Option 5

1. Using the white board, teacher draws a picture of the Big Dipper (Ursa Major) constellation. Use yarn to draw lines to connect the stars. As you are drawing, tell the story of the Ursa Major. Ask Students what a constellation is. Then have them write the definition in their journal.
2. Repeat step one for each of the following constellations: Ursa Minor, Draco, Cepheus, and Cassiopeia.
3. After discussing the story of each constellation, students will use graph paper and coordinates to make the star patterns of each constellation.
4. Teacher provides the grid coordinates to the students (page in student journal or use an overhead projector) and explains how to plot points on the x and y axes: (X ,Y) – Horizontal on X axis, Verticle on Y axis.

Ursa Major: (M, 37); (Q, 34); (R, 34); (U, 33); (W, 35); (Z, 32); (X, 30).

Ursa Minor: (R, 17); (O, 18); (N, 20); (M, 22); (K, 22); (L, 25); (N, 25).

Draco: (B,33); (C,30); (E,32); (D,34); (B,24); (C,22); (F,24); (G,22); (G,28); (G,30); (I,31); (N,30); (R,27); (U,27).

Cepheus: (G, 6); (E, 10); (I, 12); (J, 8); (O, 11).

Cassiopeia: (L, 1); (K, 4); (O, 4); (S, 5); (R, 2).

5. After students have plotted the stars on their graph paper, have them transfer the star patterns onto white drawing paper. Use a dark map pencil or marker to trace.
6. Students put together their own star viewers that show them compass direction. Teacher should instruct students how to use star viewers prior to going outside. Students cut out duplicated copies of star viewer and attach the two pieces with a paper fastener. Students hold them over their head so that north points in the correct direction. (This is why you need a compass!) Teachers help students to look for the stars from their viewer in the night sky. Another place to look for Star maps is www.skymaps.com. You could print out a copy of a star map for each student. Check to see that you print out the map for the correct time of year.

Option 6

Title: The Night Sky

Weather: **All**

Good

Bad

TAKS Objective 4 The student will demonstrate and understanding of the Earth Sciences
TEKS objective: 4.6 A the student knows that change can create recognizable patterns. The student is expected to (A) identify patterns of change such as in weather, metamorphosis, and objects in the sky

Location: Education Building or in the classroom after returning to school.

Student Actions	Teacher Comments
<p>Educational Center:</p> <ol style="list-style-type: none"> 1) Using the links to the right, ask students to investigate constellations that they could find in the night sky 2) Draw and name one of the constellations in their science journal. 3) Using the North Star as a reference point, students should write directions on where their constellation is located in the night sky. 4) After dark, students will try to find the constellation they put in their journal in the night sky. 5) Students will find a different, interesting group of stars in the night sky, draw and name their own constellation 6) Extension: Students may write their own mythological story for their constellation. 	<p>Resources:</p> <p>http://www.fourmilab.to/yoursky/ http://www.astronomical.org/portal/modules/wfsection/index.php?category=1 http://www.astro.wisc.edu/~dolan/constellations/java/Cygnus.html</p> <p>This last website is an Interactive star chart. Very Cool!!!</p>