Science SCI.V.4.3 **Grade: 7**

Strand V: **Using Scientific Knowledge in Earth Science**

Standard 4: **Galaxy and Universe** - **All students will describe and explain how objects in the solar system move**

Benchmark 3: **Describe and explain common observations of the night skies.**

Constructing and Reflecting:

SCI.I.1.1 - Generate scientific questions about the world based on observation.
SCI.I.1.3 - Use tools and equipment appropriate to scientific investigations.
SCI.I.1.6 - Write and follow procedures in the form of step-by-step instructions, formulas, flow diagrams, and sketches.
SCI.II.1.1 - Evaluate the strengths and weaknesses of claims, arguments, or data.
SCI.II.1.3 - Show how common themes of science, mathematics, and technology apply in real-world contexts.
SCI.II.1.5 - Develop an awareness of and sensitivity to the natural world.

Vocabulary / Key Concepts

- perceived/actual movement of moon across sky
- moon phases
- eclipses
- stars and constellations
- planets
- Milky Way
- comets
- comet tail
- meteors

Sun is the light source for all solar system objects (except meteors - friction with atmosphere)

- emitted light
- reflected light

Context

- outdoor observing of the skies using:
  - telescopes
  - binoculars
  - "naked-eye" viewing
- telescopic and spacecraft-based photos of:
  - planets
  - moons
  - comets
- news reports of planetary and lunar exploration

Knowledge and Skills	Resources
Students will identify basic well-known constellations and stars. By diagramming the phases of the moon over time, they will develop an understanding of perceived and actual movements of the moon, planets, and many other objects in the night sky.	Coloma Resources: Moon Lab – "Keeping a moon Journal" attached – no text required Lab – "Phases of the Moon" attached – no text required Comets & Meteors See Benchmark 2 (V.4.2) Constellations Read Constellation Myths-attached Activity - "Constellation Myths" steps attached – book from library needed • Science Plus – Holt, Rinehart, Winston Book Researching the Solar System (page 418) Developing a Travel Poster (page 419) Create an Alien (page 420) • Science Plus • The Temperature of a Star - Lab (page 424) • Investigating an Ellipse – Lab (page 403) Other Resources: • Exploratorium – Saturn – Jewel of the Solar System – activities and images from the *Cassini-Huygens* spacecraft. Excellent! • Center for Educational Resources (CERES) Project – TONS of astronomy materials for teachers – from NASA and Montana State Univ. • Michigan Teacher Network Resources – 38 on this topic – Lots of fun choices! • Mount Wilson Observatory – San Gabriel, CA – photos and info from a working observatory. Cool! • Sky and Telescope – How To: Telescopes and Binoculars – informative and useful site!

Resources Continued

- Astronomy Magazine Online – premier trade magazine includes awesome photos, articles, maps and more.
- Earth and Sky Radio show – online – EXCELLENT site with lots of teaching materials and info corresponding to the daily radio show.
- Bill Nye: Outer Space, Planets, Space Exploration, Sun, Moon
- Science Explosion: Space Science
- "Starry Night: Backyard" astronomy software
- *Moon Phases* Teaching Unit, available at www.jcisd.org, Instructional Services, Math and Science
- http://skymaps.com/downloads.html

Videoconferences Available
For more information, see www.remc11.k12.mi.us/dl or call Janine Lim 471-7725x101 or email jlim@remc11.k12.mi.us

V.4.MS.3 Describe and explain common observations of the night skies
Alpha Base One from Brownsburg Challenger Learning Center
Asteroids from NASA Glenn Research Center
Cassini Mission to Saturn from NASA Glenn Research Center
Comets: Visitors from the Unknown! from NASA Glenn Research Center
Exploration of the Solar System from NASA Glenn Research Center
Exploring Mars from NASA Glenn Research Center
Galileo Mission to Jupiter from NASA Glenn Research Center
Human Exploration and Development of Space from NASA Glenn Research Center
Space and the Solar System from NASA Glenn Research Center
Our Solar Neighborhood Expedition (Astronomy) from NASA Johnson Space Center

Instruction

Focus Question: Why do objects in the night sky appear to change?

On a nightly basis (early Fall or late Spring) students practice using star charts http://skymaps.com/downloads.html to locate constellations in the night sky. Students study the phases of the moon and discuss explanations for the changing phases.

Through role-play they are to use their knowledge in a new situation. For example, a student (earth), holding a ball (moon) could revolve around a light source (sun) to diagram various phases. For a month, students diagram appearance (the amount of reflected light) of the moon and its location relative to the horizon in the night sky.

They research the make-up, appearance and occurrence of meteor showers and comets, offering an account of their presence and composition.

Optional Assessments (Continued from column at right)

Criteria: Correctness of answers
Apprentice - Correctly answers at least fifty percent of the posed questions.
Basic - Correctly answers seventy-five percent of the posed questions with an attempt to use the model as a reference.
Meets - Correctly answers all questions, often using the model as a teaching tool.
Exceeds - Correctly answers all questions, effectively using the model as a teaching tool

Coloma Assessment

"Moon Phases Quiz" (attached)

Optional Assessment

Students create a 3 – dimensional or poster model that shows and explains the earth-moon-sun system. The model should be detailed, colorful, and easy to understand. It should include the phases of the moon with consideration given to misconceptions. http://www.astronomy.org/astronomy-survival/miscon2.html

Students will explain their models to the class answering teacher and student posed questions about the reasons for the various phases we see, conditions for an eclipse to occur, length of revolution, effect on the Earth's rotation, and the amount of reflected light that one sees from Earth.

(Give students rubric before activity.)

Scoring Rubric

Criteria: Construction of model
Apprentice - Fails to construct a model that attempts to show relationships in the system.
Basic - Constructs a model that shows correct and somewhat detailed relationships within the system.
Meets - Constructs a model that accurately shows relationships, is correct, and is easy to understand.
Exceeds - Constructs a model that is very detailed, interesting, and could easily be used as a teaching tool in showing Earth-Moon-Sun system relationships.
Criteria: Explanation of model
Apprentice - Attempts to explain or illustrate required concepts.
Basic - Correctly illustrates at least seventy-five percent of the concepts and details required.
Meets - Correctly illustrates most phases of the Moon and uses model to demonstrate changing phases, an eclipse, and rotation and revolution.
Exceeds - Correctly illustrates and manipulates the model to show all phases of the Moon; demonstrates changing phases, an eclipse, and rotation and revolution.

Teacher Notes:

• The earth is the third planet from the sun in a system that includes the moon, the sun, eight other planets and their moons, and smaller objects, such as asteroids and comets. The sun, an average star, is the central and largest body in the solar system.

• Most objects in the solar system are in regular and predictable motion. Those motions explain such phenomena as the day, the year, phases of the moon, and eclipses.

• Gravity is the force that keeps planets in orbit around the sun and governs the rest of the motion in the solar system. Gravity alone holds us to the earth's surface.

• The sun is the major source of energy for phenomena on the earth's surface, such as growth of plants, winds, ocean currents, and the water cycle. Seasons result from variations in the amount of the sun's energy hitting the surface, due to the tilt of the earth's rotation on its axis and the length of the day.

Focus Questions

- How do objects in the solar system compare in motion and description?
- What are some common observations in the night sky?

ASTRONOMY

KEEPING A MOON JOURNAL

Materials: paper and pencil

1. Select a location that you can return to each night for the next two weeks. This spot is your astronomical observatory. You will need as clear a view as possible of the southern horizon stretching from the east to the west.

2. On a sheet of paper, make a sketch of the southern half of the sky and its horizon extending from the eastern horizon on the left side of your paper to the western horizon on the right. On your drawing include features of the horizon such as trees, houses, etc. to help identify the exact location of the moon. Also label the compass directions east west. and south.

3. In a journal keep a record of the dates and time that you make your observations. Make notes about the moon's phase and position relative to the horizon and record anything else you notice about the moon compared to the previous nights.

4. Make all of your observations at the same time each night. Pick a time that is within one hour of sunset. Each time you make an observation draw the moon at the proper place in the sketch. Show where it is, how high it is above the horizon, and its shape. Be sure to record the date of each drawing next to the moon in your sketch.

5. How did the position and shape of the moon appear to change during the two weeks that you were making your observations?

_____

_____

6. Each night, how did the position of the moon change relative to the previous night?

_____

_____

7. How much of the moon actually has sunshine falling on its surface at any time?

_____

PHASES OF THE MOON

WHAT KIND OF MODEL CAN BE USED TO EXPLAIN THE PHASES OF THE MOON?

Materials: *softball or other similar sized light colored ball for each group light source (200-300 watts, unfrosted) if each individual is doing the activity at the same time*

OR

an overhead projector with the upper lens assembly removed volleyball, if the activity is done as a demonstration

<u>If being done individually:</u>

1. Place the unfrosted light bulb in the middle of the room. Viewers stand in a large circle around the light bulb.

2. The light bulb represents the sun. The ball represents the moon. Your head will represent the earth. Hold the ball in your hand and turn so that the "moon" is between you and the "sun."

3. DESCRIBE the appearance of your moon.

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_____

4. Raise the moon slightly so that you can just see the sun under the moon. DESCRIBE the appearance of your moon.

_____

_____

5. Slowly move the moon counterclockwise around your head. You may need to move your hand so that the shadow of your hand does not fall on the moon. Notice the edge of the shadow as it moves across the softball. This edge is called the terminator. DESCRIBE what happens to the appearance of your moon as you turn through one quarter of a turn.

_____

_____

6. On the back, top half of this sheet, draw a diagram of the relative position of your head, the sun and the moon at this position.

7. What time of day would this moon appear to be highest in the sky?

_____

8. Continue moving the moon counterclockwise until the sun is behind your head. You will need to raise the moon slightly so that the shadow of your head does not fall on the moon. How does the angle between the sun and the moon relate to the amount of the moon that you see as illuminated?

_____

_____

9. How much of the moon is actually illuminated as you do this activity?

_____

10. Continue moving the moon until it is again in the same direction as the sun. DESCRIBE its appearance.

_____

_____

11. On the back, bottom half of this sheet, draw a diagram showing the moon when it is between three quarters and one half the way around from the sun and when it is between one half and all the way around your head.

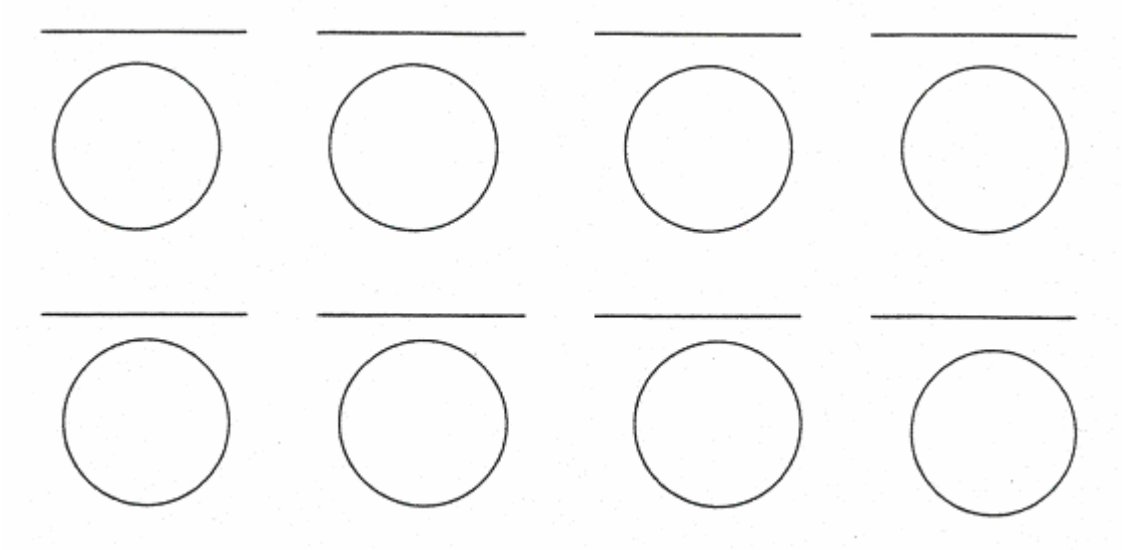
12. Which phases of the moon, which you have seen, would be found in the morning sky?

_____

_____

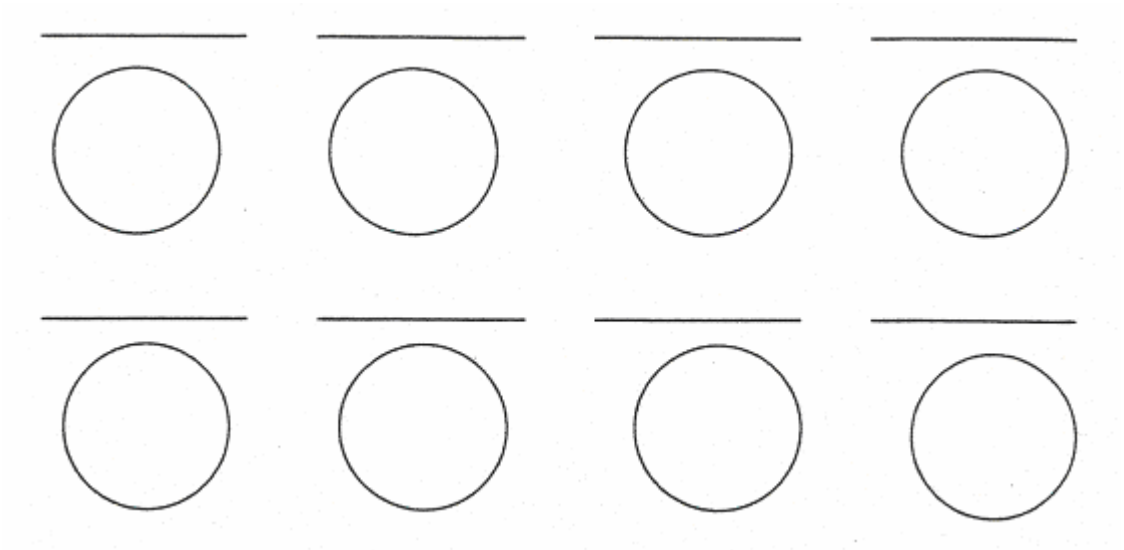
Name: _____ **Date:** _____ **Hour:** _____

Draw and name the following phase of the moon.



Name: _____ Date: _____ Hour: _____

Draw and name the following phase of the moon.



Constellation Myths

* Assign each student a constellation (list attached.)

* Student is to research constellation for the following:
  - Where it is located in the sky.
  - When it can be seen in the western hemisphere.
  - What the constellation represents.

* Students are to then create a myth about how it got into the skies.

* Class Constellation Chart
  - Students will add their constellation onto bulletin board in the correct location. (North Star and direction will be labeled).

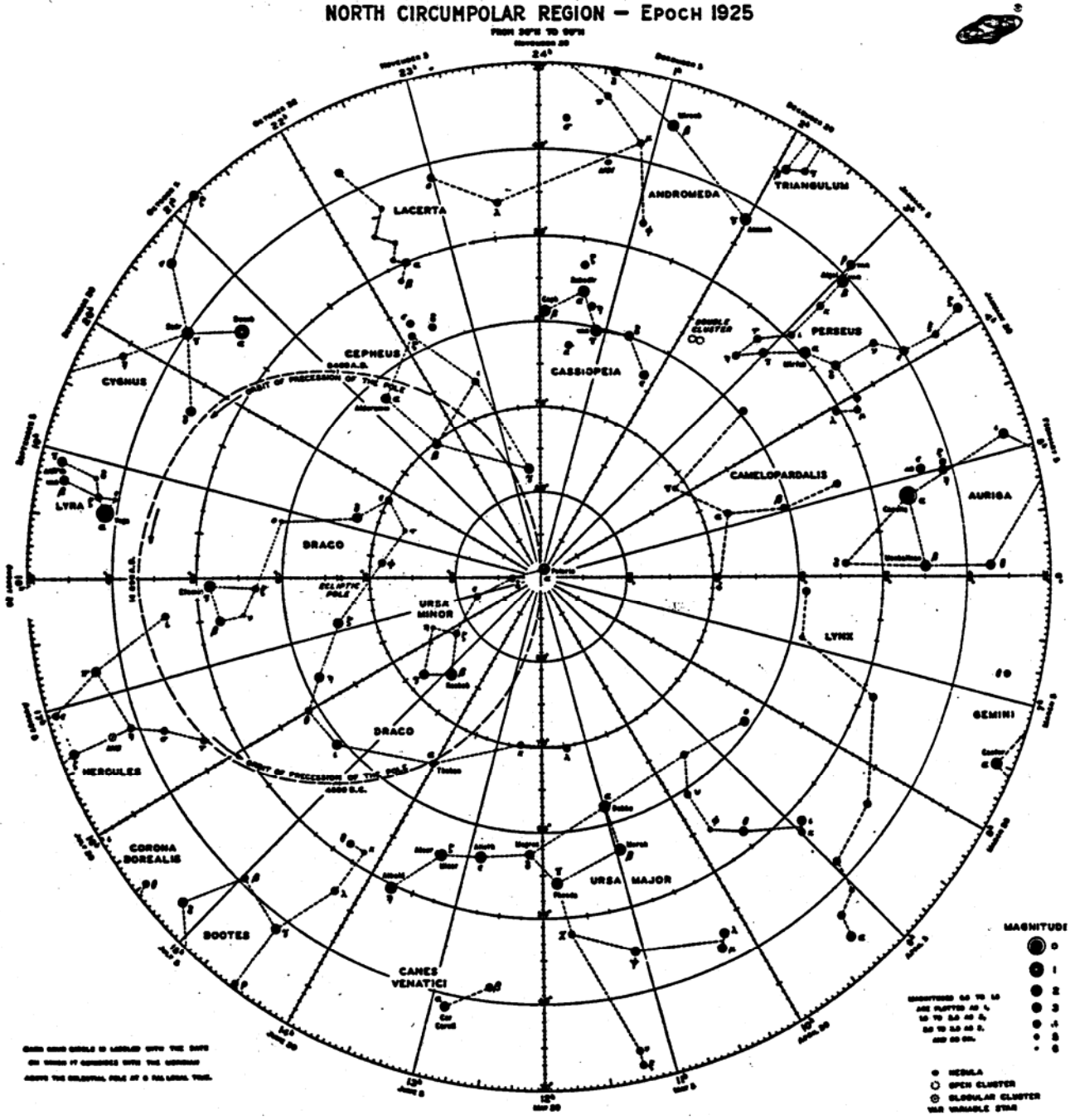
* Individual Student Chart will be copied.

Introduce your students to the "stars" of the universe. Here are the 88 known constellations (with their Latin and English names) on this handy constellation reference chart. Keep this chart where students can use it. They may surprise you by making a game out of memorizing both names of all 88 constellations. They can also use the chart to make crossword puzzles and word hunts, or for report topics and creative writing projects.

Latin Name	English Name	Latin Name	English Name
1. Andromeda	Chained Maiden	45. Lacerta	Lizard
2. Antila	Air Pump	46. Leo	Lion
3. Apus	Bird of Paradise	47. Leo Minor	Small Lion
4. Aquarius	Water Bearer	48. Lepus	Hare
5. Aquila	Eagle	49. Libra	Scales
6. Ara	Altar	50. Lupus	Wolf
7. Aries	Ram	51. Lynx	Lynx
8. Auriga	Charioteer	52. Lyra	Lyre
9. Bootes	Herdsman	53. Mensa	Table
10. Caelum	Chisel	54. Microscopium	Microscope
11. Camelopardalis	Giraffe	55. Monoceros	Unicorn
12. Cancer	Crab	56. Musca	Fly
13. Canes Venatici	Hunting Dogs	57. Norma	Square
14. Canis Major	Great Dog	58. Octans	Octant
15. Canis Minor	Small Dog	59. Ophiuchus	Serpent Bearer
16. Capricornus	Sea Goat	60. Orion	Hunter
17. Carina	Keel	61. Pavo	Peacock
18. Cassiopeia	Lady in Chair	62, Pegasus	Winged Horse
19. Centaurus	Centaur	63. Perseus	Champion
20. Cepheus	King	64. Phoenix	Mythical Bird
21. Cetus	Whale	65. Pictor	Painter's Easel
22. Chamaeleon	Chameleon	66. Pisces	Fishes
23. Circinus	Compasses	67. Piscis Austrinus	Southern Fish
24. Columba	Dove	68. Puppis	Stern
25. Coma Berenices	Berenice’s Hair	69. Pyxis	Compass
26. Corona Australis	Southern Crown	70. Reticulum	Net
27. Corona Borealis	Northern Crown	71. Sagitta	Arrow
28 Corvus	Crow	72. Sagittarius	Archer
29. Crater	Cup	73. Scorpius	Scorpion
30. Crux	Southern Cross	74. Sculptor	Sculptor
31. Cygnus	Swan	75. Scutum	Shield
32 Delphinus	Dolphin	76. Serpens	Serpent
33. Dorado	Swordfish	77. Sextans	Sextant
34. Draco	Dragon	78. Taurus	Bull
35. Equuleus	Little Horse	79. Telescopium	Telescope
36. Eridanus	River Eridanus	80. Triangulum	Triangle
37. Fornax	Furnace	81. Triangulum Australe	Southern Triangle
38. Gemini	Twins	82. Tucana	Toucan
39: Grus	Crane	83. Ursa Major	Great Bear
40. Hercules	Hercules	84. Ursa Minor	Small Bear
41. Horologium	Clock	85. Vela	Sails
42. Hydra	Sea Serpent	86. Virgo	Virgin
43. Hydrus	Water Snake	87 Volans	Flying Fish
44. Indus	Indian	88. Vulpecula	Fox

SC2 CONSTELLATION CHART

NORTH CIRCUMPOLAR REGION — EPOCH 1925



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URSA MINOR - LITTLE BEAR OR LITTLE DIPPER

Native American Myth:

Some native Americans did not see Ursa Major and Ursa Minor as bears at all. Some tribes saw these constellations as stretcher-bearers carrying the sick and the dead. According to the Pawnee of Nebraska, the Big Dipper is made up of four stretcher-bearers followed by a medicine man, his wife, and errand man. The Little Dipper is known as Small Stretcher Bearing a Sick Child. The star that does not walk around (the North Star) watched over them.

Other myths:

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Ursa Minor is important because its brightest star is Polaris, the North Star. Some societies saw Ursa Minor as a dog, but most believed it to be a bear. The only surviving myth is the Greek version that says the little bear is Callisto's son, Arcas. Arcas' mother had been changed into a bear by Jupiter. When Arcas was hunting he attempted to shoot the bear. Jupiter, seeing this, also changed Arcas into a bear. Jupiter then threw the mother and son into the skies by their tails, forever stretching them.

URSA MAJOR - BIG BEAR OR BIG DIPPER

Native American Myth:

A typical story is one told by the Coeur d' Alene tribe in Idaho. They see the constellation as a grizzly bear. In this version there were three brothers that had a grizzly bear for brother-in-law. The two older brothers hated the bear and plotted to kill him. The youngest bear was fond of the bear and attempted to warn him of the older brothers' attack. As the arrows were released, all four were taken up to the sky and transformed into the stars of the Big Dipper. Some versions have the four stars being the bowl stars while other versions have the grizzly bear as the four bowl stars and the three brothers as the three handle stars.

Other Myths:

Greek legends tell of a beautiful woman, Callisto. Juno, queen of the gods, was jealous of Callisto's beauty and plotted to kill her. Juno's husband, Jupiter, liked Callisto and changed her into a bear to protect her. Callisto wandered into the woods until her son, Arcas, happened upon her while hunting. Not knowing the bear was his own mother, Arcas began to shoot her with an arrow. Jupiter, seeing this, changed Arcas into a bear also. As Jupiter grabbed them and threw them into the heavens, their tails became stretched to an unnatural length for bears. Callisto landed in the sky as the Big Dipper with her tail being the handle.