

UID Constellations

Lesson plan created & developed by Laura Venner

Grades: 5-12

Type: Indoor

Duration: Flexible

Subjects: Space Science, Earth Science, Mathematics, Chemistry

NJCCCS: 5.4.6.A.2, A.4
5.1.8.A.1, A.2, A.3; B.1, B.2, C.1, C.2, D.1, D.2
5.1.12.A.1, A.2, A.3, B.2, B.3, C.1, C.2, C.3, D.1, D.2
5.4.12.A.1, A.3, A.4,

Objectives:

Students will: (1) use the scientific method to form a hypothesis about the stars; (2) gain an understanding of stellar compositions, characteristics, life cycles, and distances; (3) learn about perspective and perception; (4) understand the Earth's movement and orientation (precession, rotation, and etc.) in space; (5) be exposed to the Greek alphabet; (6) learn about mythology and constellations; (7) create a tactile constellation and a "what's my sign" board specific to their individual dates of birth.

Vocabulary: constellation, asterism, mythology, light year, perspective, perception, hypothesis, Celsius, Fahrenheit, Kelvin, temperature, atmosphere, star, planet, brightness, luminosity, astronomy, absolute magnitude, apparent magnitude, fusion, heliocentric universe, geocentric universe.

Materials needed for activities:

UID Constellations activity: foam core, various sized pompoms in star related colors, permanent marker, utility knife, glue, 1/8" wooden dowels, pony beads, fabric/puff paint and/or Braille label maker.

What's My Sign activity: black foam core, silver glitter, multi-colored glitter, blue glitter, silver paint marker, ruler, utility knife, a pencil, a copy of NASA's "What's Your Sign" page found at: <http://spaceplace.nasa.gov/starfinder2/>, and a copy of NASA's "Constellations in the Zodiac" page found at: <http://spaceplace.nasa.gov/starfinder3/>.

Activities:

UID Constellations (adapted from Ben Wentworth 3D Constellations activity with express permission provided by Mr. Wentworth): This activity is aimed at teaching students: the difference between cosmic perspective and perception, the colors of stars, the distances of stars from the Sun, and how to recognize constellations.

What's My Sign activity (created and developed by Laura Venner): This activity is aimed at teaching students: about the precession of the Earth about its axis, how to recognize constellations including Ophiuchus, the significance of star gazing to cultures around the world, and the movements of cosmic objects through space.

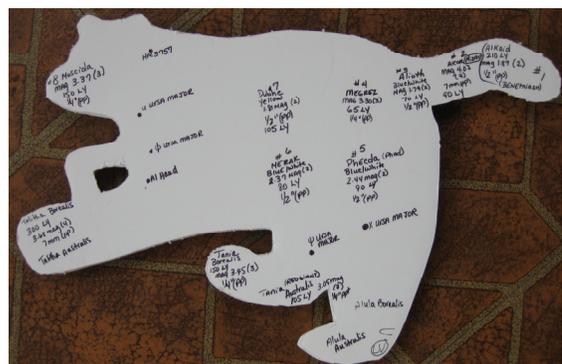
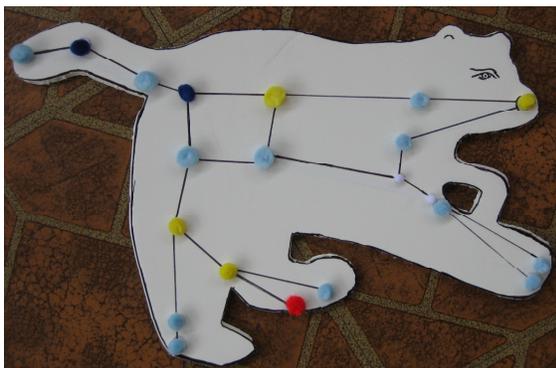
Procedures:

Part 1 - Constellations: Assign the students the task of observing the stars of the night sky and choosing a pattern of stars they find interesting prior to presenting this lesson. Once the observing sessions are completed begin the lesson with a discussion about what they observed. Ask the students to explain their findings: Were the stars they observed close together? Were all the stars the same size? Did they make a special pattern and what pattern did they imagine? After the discussion is complete present a lesson on stars and constellations including all of the topics of the lesson plan that you wish to cover with the students. Once the lecture portion of the lesson is over have the students create a constellation using the procedure below.

Part 2 – Motions of the Earth and the Sun: Present a lesson regarding the precession of the Earth and what that means in relationship to the constellations or Sun signs. At this point an introduction to Ophiuchus would be beneficial. Some media outlets erroneously reported that Ophiuchus is a new constellation that just appeared in the night sky. Ophiuchus presents a teachable moment by providing educators with a modern day example of how facts are sometimes manipulated and distorted for political, religious, or social reasons. The concepts of a heliocentric versus a geocentric universe can also be discussed at this time as ancients believed the Sun was travelling through the constellations. After the lecture portion of the lesson I like to conclude with the “What’s My Sign” activity followed by a group discussion and ending with the students creating their own zodiac sign constellation board.

UID Constellation activity (students): I made several modifications to the original constellation activity in an effort to design an activity that subscribes to the Universal Instructional Design (UID) model. To see Mr. Wentworth’s original 3D constellation activity go to: <http://www.lauravenner.com/educator-resources/Ben-Wentworth-Constellations/>.

- 1) Select the constellation you desire to create and make a pattern for tracing the constellation on to the student’s foam core. I have pictured Ursa Major as an example below.
- 2) Trace and cut the constellation shape. If you are dealing with young students it may be advantageous, and safer, to have the constellation pre-cut from the master pattern.
- 3) Orient the constellation properly and begin assigning the star locations along with any other information you find useful. The number of stars you include in the constellation can be left to the student’s or to your discretion. The side of the foam core that has the writing placed on it will be the backside of the constellation.
- 4) Once the information is in place the students can begin gluing the pompoms onto the foam core. The pompom sizes correlate to the apparent magnitudes of the stars and the pompom colors correlate to the colors of the stars in the constellation.



UID Constellation activity (educators): Follow the UID Constellation activity (students) listed on page 2 to make the constellation that represents apparent magnitude and star colors. To create a constellation that also represents the light year distances of the stars from our Sun follow the directions listed here:

- 1) Select the constellation you desire to create and make a pattern for tracing the constellation on to the student's foam core. I have pictured Cygnus as an example below.
- 2) Trace and cut the constellation shape. If you are dealing with young students it may be advantageous, and safer, to have the constellation pre-cut from the master pattern.
- 3) Orient the constellation properly and begin assigning the star locations along with any other information you find useful. The number of stars you include in the constellation can be left to the student's or to your discretion. The side of the foam core that has the writing placed on it will be the backside of the constellation.
- 4) Take a pencil and make a mark where the stars appear on the foam core constellation.
- 5) Once the marks are made take a nail and punch a hole through the foam core.
- 6) After all the holes are punched turn over the foam core model and punch the holes through again so that any residual foam core material is pushed through to the backside of your constellation.
- 7) Turn the foam core again and glue the pony beads onto the holes. Be sure that any glue gets eliminated from the inside of the pony bead as the dowel will sit inside of the pony bead.
- 8) Take the fabric paint and begin placing drops next to the pony beads representing the number of the star position. The same amount of drops will be placed on the corresponding dowels so that the visually impaired can place the dowels into the correct locations on the foam core by counting and matching the number of fabric paint drops. A Braille label maker may be utilized in place of the fabric paint.
- 9) Place the foam core constellation aside and allow to dry overnight.
- 10) Begin cutting your dowels to the appropriate lengths.
- 11) The dowel length will correspond with the light year distance of the represented star from our Sun.
- 12) Please see the formula for calculating dowel lengths on page 5.
- 13) Please note that the longest dowel will represent the star that is closest to our Sun.
- 14) Once the dowels are cut, glue the pompoms (stars) onto the tops of the dowels and then place the fabric paint drops or Braille labels onto the dowels. I prefer to glue all of the components of the constellations with a glue gun.
- 15) Once the fabric paint and glue have dried place the dowels into the corresponding pony beads.



As you can see by the Cygnus UID constellations below, the stars match with respect to the pompom locations, sizes, and colors with the only difference being the addition of the light year dowels. This consistency allows the students to clearly identify that the stars are not close to each other or to our Sun even though they appear to be similar in other ways.



Left side Cygnus includes light year dowels.



Teachers hard at work at the Buehler Challenger & Science Center Accessibility Workshop – 3/22/2012

Note: The workshop was delivered prior to my modifications which is why the pompom colors do not match the star colors.

UID Constellations

by Laura Venner

Cygnus:

<u>Star position</u>	<u>Star Name</u>	<u>Greek Designation</u>	<u>Apparent Magnitude</u>	<u>Pom Pom Size</u>	<u>Light Years</u>	<u>Dowel Size (cm)</u>	<u>Primary Color of Star</u>
# 1	Deneb	α (alpha)	1.25 (1)	3/4"	3227	0.58 (.6)	Blue/White (Supergiant)
# 2	Sadr	γ (gamma)	2.23 (2)	1/2"	1523	1.22 (1)	Yellow/White (Supergiant)
# 3	η Cygnus	η (eta)	3.89 (4)	1/4"	139	13.26 (13)	Orange (Giant)
# 4	Albireo	β (beta)	3.1 (3)	1/4"	385	4.84 (5)	Orange
# 5	κ Cygnus	κ (kappa)	3.80 (4)	1/4"	123	15.25 (15)	Orange
# 6	ι Cygnus	ι (iota)	3.76 (4)	1/4"	122	15.25 (15)	White
# 7	θ Cygnus	θ (theta)	4.49 (4.5)	5 mm	61	30.5 (31)	Yellow/White
# 8	Rukh	δ (delta)	2.87 (3)	1/4"	171	10.89 (11)	Blue/White (Supergiant)
# 9	Gienah	ε (epsilon)	2.48 (2)	1/2"	72	25.41 (25)	Orange (Giant)
# 10	ζ Cygnus	ζ zeta	3.21 (2)	1/4"	151	12.7 (13)	Yellow

Formula for obtaining the dowel lengths:

Formula developed by Kathie Klein

The dowel value was obtained using the following method:

The star that is closest to the Sun = 1.

The star that is given the designation of 1 will determine the dowel lengths for all of the other stars in the constellation. In this case the closet star has a distance of 61 Light Years.

Divide each star's light year value by the "closest star's" light year value.

For example: $3227/61 = 52.91$	$122/61 = 2$
$1523/61 = 24.96$	$61/61 = 1$
$139/61 = 2.27$	$171/61 = 2.80$
$385/61 = 6.31$	$72/61 = 1.18$
$123/61 = 2.01$	$151/61 = 2.47$

Once you have completed your initial calculations, you must decide on the length of your longest dowel. Remember, the star with the shortest light year will be the star that is closest to us and therefore will have the longest dowel association.

In the case of Cygnus, we decided the longest dowel should not exceed half of the LY value in centimeters. Therefore, the star closest to the sun is represented by a dowel that is 30.5 cm in length. We arbitrarily chose to halve the LY value for the star closest to the Sun.

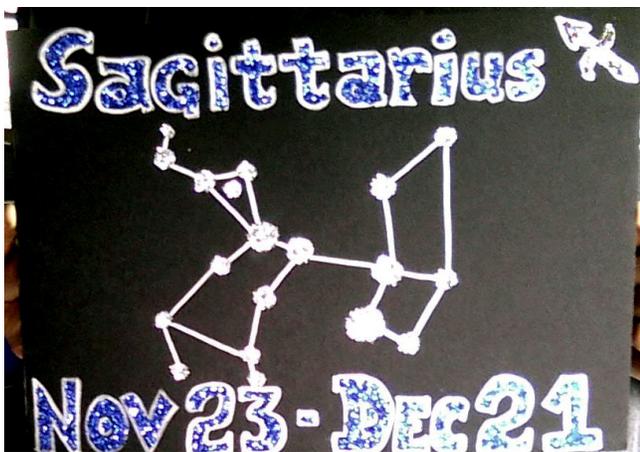
Finally, take the determined value of the closest star and divide by the proportion.

In this case the calculation will be: $30.5/X$. For example, the star in the number one position, Deneb, is calculated as follows: $30.5 / 52.91 = 0.58$ cm.

“What’s My Sign” activity:

- 1) Teachers should create the 13 zodiac constellations prior to the lesson.
- 2) Cut black foam core boards into 4 pieces.
- 3) On each piece of black foam core write, in pencil, the name of the constellation on the top of the board and draw the corresponding zodiac symbol next to the constellation name.
- 4) Underneath the name and symbol draw the constellation.
- 5) Write the “traditional” zodiac date category on the bottom of the board.
- 6) On the back of the foam core board draw the zodiac symbol again with the corresponding date that the sun appears to “travel” through the constellation in the current age.
- 7) Once this is done you can either use a paint pen to outline the information or use glitter to highlight the information on the boards. Please see photos below.
- 8) Have the students form a circle.
- 9) Ask all the students that are Aries to stand behind the sign that represents Aries and all the students that are Aquarius to stand behind the sign that represents Aquarius and so on until all of the students are standing behind what they believe to be the sign that represents their birth sign.
- 10) Have the students check the front of the signs to be sure that their date of birth falls on or between the dates listed.
- 11) Repeat this process for the other constellations of the zodiac.
- 12) Once all of the students are standing behind their zodiac constellation sign, have each group turn their boards around and check their date of birth with the dates that now appear under the zodiac sign.
- 13) Have the students stand behind their new zodiac sign. Hopefully, a few students will be standing without a sign because their date of birth is not represented by the 12 signs of the zodiac. These students should have dates of birth that fall under the zodiac sign Ophiuchus.
- 14) Bring forward the board with Ophiuchus represented on it and have the Ophiuchians stand behind the board.
- 15) Discuss the earth’s precession and the zodiac. Point out why we do not see the constellation that we are born under during the evening on our birthday.
- 16) Have the students make a constellation sign that represents the date of their birth according to the current position of the earth.

This is a fun activity that is informative while serving as a good ice breaker activity. I usually follow this activity with a star wheel activity and in cases where applicable a Star Lab presentation. The star wheel activities can be found by visiting the following websites: <http://spaceplace.nasa.gov/starfinder/> , <http://www.lawrencehallofscience.org/starclock/skywheel.html>.



Accessible “What’s My Sign” Activity: (created and developed by Laura Venner)

Making an accessible version of the “What’s My Sign Activity” is easy. You will need the following materials: black foam core, silver paint marker, ruler, utility knife, a pencil, a copy of NASA’s “What’s Your Sign” page found at: <http://spaceplace.nasa.gov/starfinder2/>, and a copy of NASA’s “Constellations in the Zodiac” page found at: <http://spaceplace.nasa.gov/starfinder3/>, fabric or puff paint, Braille label maker.

- 1) Begin by creating the 13 zodiac constellations.
- 2) Cut black foam core boards into 4 pieces.
- 3) On each piece of black foam core write, in pencil, the name of the constellation on the top of the board and draw the corresponding zodiac symbol next to the constellation name.
- 4) Underneath the name and symbol draw the constellation.
- 5) Write the “traditional” zodiac date category on the bottom of the board.
- 6) On the back of the foam core board draw the zodiac symbol again with the corresponding date that the sun appears to “travel” through the constellation in the current age.
- 7) Once this is done use the fabric/puff paint to outline the information thereby making the information tactile. In addition to outlining the text, use the Braille label maker and attach labels for all of the text on the boards. Use fabric/puff paint to fill in the circles that represent the stars. Lay the boards flat and let the fabric/puff paint dry overnight.
- 8) Have the students form a circle.
- 9) Ask all the students that are Aries to stand behind the sign that represents Aries and all the students that are Aquarius to stand or sit behind the sign that represents Aquarius and so on until all of the students are standing or sitting behind what they believe to be the sign that represents their birth sign.
- 10) Have the students check the front of the signs to be sure that their date of birth falls on or between the dates listed.
- 11) Repeat this process for the other constellations of the zodiac.
- 12) Once all of the students are standing behind their zodiac constellation sign, have each group turn their boards around and check their date of birth with the dates that now appear under the zodiac sign.
- 13) Have the students stand or sit behind their new zodiac sign. Hopefully, a few students will be standing or sitting without a sign because their date of birth is not represented by the 12 signs of the zodiac. These students should have dates of birth that fall under the zodiac sign Ophiuchus.
- 14) Bring forward the board with Ophiuchus represented on it and have the Ophiuchians stand or sit behind the Ophiuchus board.
- 15) Discuss the earth’s precession and the zodiac. Point out why we do not see the constellation that we are born under during the evening on our birthday.