# TRB 6:4 - Act 3 - Dot to Dot: Patterns in the Night Sky

## Summary

Students will observe and record the location of various constellations over time.

## Materials

Activity A

- black craft paper, shaped in a large oval to cover a bulletin board (same shape as the opening in a star finder)
- smaller pieces of black craft paper or construction paper
- glow-in-the-dark stars, star stickers, or fluorescent markers or paint
- white or yellow string or chalk (optional)
- graph paper, 1/4 " squares
- books with myths and stories about the stars (See Appendix)
- transparency of a star finder map such as Uncle Al 's Star Finder, available at http://www.lhs.berkeley.edu/starclock/skywheel.html (Note: The Sky Wheel can be printed off free for teacher and student use. The copyright must show on it. Permission needs to be acquired from Alan Gould for distributing to students and other teachers. Email: agould@uclink.berkeley.edu
  Or
  Star Finder, available from Learning Technologies, Inc., 59 Walden Street, Cambridge, Massachusetts, 02140,1-800-537-8703, $1.00.

Advance Preparation:

Using large pieces of black paper, lay out the background for a large star map on a bulletin board. Make an overhead transparency of a star finder such as Uncle Al 's Star Wheel (see Materials) to project an enlarged image on the wall. The size you use will depend on the space available. Using the transparency as a pattern, construct three simple, easy-to-recognize circumpolar constellations: the Big Dipper, the Little Dipper, and Cassiopeia. Put each constellation on a single piece of black paper so that they can be moved throughout the year. Use glow-in-the-dark stars, star stickers, or fluorescent markers or paint to make the stars. Label each constellation and Polaris. (Polaris is the North Star --it will be the last star in the handle of Ursa Minor.)

Use the star finder as a guide to determine where you will place the constellations in their approximate correct positions for 8:00-9:00 p.m. in the current month, but do not put the constellations on the bulletin board yet. Plan to place Polaris in the upper center part of the star map (see star finder). Plan to change the position of the constellations each month. Also have enough room to

add other constellations as they appear throughout the year.

Activity B

- star finders, such as Uncle Al's Sky Wheel, available at http://www.lhs.berkeley.edu/starclock/skywheel.html or available from Learning Technology, Inc., 59 Walden Street, Cambridge, Massachusetts, 02140, 1-800-537-8703, $1.00
- cardstock
- scissors
- tape

Additional Resources:

Heifetz Planisphere. Sturdy plastic star finder, principles and instructions printed on back. Available from Learning Technologies, Inc., 59 Walden Street, Cambridge, MA, 02140, (800) 537-8703, $9.95.

Night Star, advanced star map, soft, movable rubber, for more dedicated star gazers.1334 Brommer Street, Santa Cruz, CA, 95062.

Star and Planet Locator, Edmunds Scientific, (800) 728-6999
Dickinson, Terence. Exploring the Night Sky.1998. Good description of light time and relating it to objects in space, star distances, and constellations. Good pictures and photos. Text covers about half the pages. 72 pages.
Hinz, Joan. Dot to Dot in the Sky: Stories in the Stars. 2001. Excellent resource material for constellations. Describes fifteen common constellations; how to locate them, a myth that goes with each, interesting highlights, and scientific "space notes." 64 pages. $12.95.
National Audubon Society. First Field Guide: Night Sky .1999. Nice overview of all astronomy topics. About half the book focuses on finding objects in the night sky, 160 pages, pocket size paperback. $8.95.
Rey, H.A. Find the Constellations.1976. Excellent beginners guide to finding the constellations in the northern hemisphere. Well-illustrated, extensive index, glossary and timetable for sky viewing. A classic. 72 pages.
Rey, H.A. The Stars: A New Way to See Them.1976. "Clear, vivid, text with charts and maps showing the positions of the constellations the year round. One of the best books available for its purpose." It gives thorough descriptions and directions for locating constellations and their positions relative to each other. Many drawings and diagrams.160 pages.
Thompson, C.E. Glow in the Dark Constellations: A Field Guide for Young Stargazers.1989. Simplified guide to constellations, describes how to find twelve common constellations throughout the year, includes a myth for each constellation. Illustrations have glow-in-the-dark ink to distinguish the constellation in the sky.32 pages.
There are many amateur astronomy associations throughout Utah. Please check Hansen Planetarium 's website for the most up-to-date information on the club nearest you.

## Background for Teachers

Constellations are patterns of stars visible from Earth in the sky at night. The stars in any given constellation form a pattern only as they appear from Earth and are usually many light years apart from each other. Although the positions of the constellations as they appear in the sky change over the course of a year, they are constant and predictable from year to year.
Many ancient civilizations organized the sky into constellation patterns. They associated these star patterns with stories or images of mythological creatures and heroes. The particular stars grouped into an individual constellation varied from one civilization to another. More than half of the constellations recognized today were identified by the ancient Greeks.
Constellations were more than just interesting patterns in the sky. The rising or setting of particular constellations was used to determine both the time of night and the season of the year. They were used to determine when to plant crops. Seafaring people used stars for navigation. Using stars for navigation continues today. As Earth revolves around the sun, the visible constellations change from season to season. Particular constellations are associated with the various seasons. Circumpolar constellations such as Ursa Major (Big Dipper) are visible throughout the year as they appear to revolve around Polaris (North Star).
Constellations are used as reference points on a star map to help people communicate with each other concerning the location of various objects in the night sky such as the moon, planets, stars, comets, meteor showers, etc. In 1930, the International Astronomical Union established eighty-eight constellations with precise boundaries.

## Intended Learning Outcomes

1-Use science process and thinking skills
2-Manifest scientific attitudes and interests
3-Understand science concepts and principles

4-Communicate effectively using science language and reasoning
6-Understand the nature of science

Instructional Procedures

Invitation to Learn:

Several days before you begin this activity place the replica of the constellation Cassiopeia (without its name) and the title “Mystery Constellation ” in a conspicuous place in your classroom. Ask your students if any of them know what this constellation is, or where it can be found. Suggest that they try to locate it in the next few nights.

Since the positions of constellations and the particular constellations that are visible change through the seasons, students will gain a better understanding about the constellations if they are studied throughout the school year. This lesson describes activities that begin in the fall (when it is dark enough at 9:00 MDT and 8:00 MST to see stars) and continue throughout the school year. If that is not possible, the lessons may be taught in a shorter period with some adaptations.

Show students the replica of the Cassiopeia constellation again. Ask if any students have found this constellation. Show them the replicas you have prepared of the Big Dipper and the Little Dipper. Ask students if they have seen these patterns in the sky. Explain that these are constellations visible in the Northern Hemisphere. Their positions relative to Earth change over the course of a year. Place the constellations on the bulletin board in their correct positions. Locate Polaris and explain that it is also called the North Star because it always appears to be directly north. Its position is constant.

Use a pointer to outline the constellation figures on the bulletin board. Or if you prefer, use string or chalk to permanently outline the constellations. Tell at least one myth associated with each constellation. Ideally tell several myths from different cultures. (See Additional Resources) Tell students that they will be finding other things about the constellations in the following months. Have students record the positions of these three constellations in their science journals. Challenge the students to find these constellations the following evening.

Discuss student observations in looking for the constellations. Talk about any particular challenges they faced. Depending on the time of year, the Big Dipper may be hidden behind mountains in some parts of Utah. Also, light pollution may affect visibility in populous areas. Have the students record observations in their journals.

Introduce two additional circumpolar constellations (Ciphers and Drano) to the students. Tell myths associated with these constellations or assign students to present the information. Add these constellations to the star map. Challenge students to locate these constellations in the night sky. The next day, discuss the student findings and place these constellations on the star map. Have the Students record observations in their journals.

Help students become more familiar with these constellations by graphing them on grid paper. Use the following coordinates to help graph the constellations.

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)
Cassiopeia:((L, 1);(K, 4);(O, 4);(S, 5);(R, 2)
Cepheus:(G, 6);(E, 10);(I, 12);(J,8);(O, 11)
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)

Have students transfer their graphed constellations to their science journal and record information about each constellation.

Next have students make constellations to be used on the star map. You may have students choose the constellations or assign them. (See list below for possible constellations) Let students use the star finder transparency to make the constellations in the same scale as the

classroom star map.

Have each team research the stories and myths associated with their constellation, identify any particularly bright star(s), and determine the time of year when the constellation will be visible at 9:00 P.M.

COMMON NORTHERN HEMISPHERE CONSTELLATIONS

The constellations are listed in the months when they appear high in the sky at around 9:00 p.m. Bright stars are in parentheses. For more constellations visit Michigan State website (see Additional Resources.) Many of these constellations are also visible in other months as well. Consult a star map for details. Circumpolar constellations such as Ursa Major, Ursa Minor, Cassiopeia, Cepheus, and Draco are visible throughout the year as they appear to revolve around the North Star.

**August -September October -November December -January**

Lyra (Vega)*Pegasus Orion (Betelgeuse and Rigel)
Cygnus (Deneb)*Andromeda Canis Major (Sirius)
Cepheus Cassiopeia Taurus*(Aldebaran) Perseus

**February -March April -May June -July**

Gemini (Pollux and Castor)Ursa Major Bootes (Arcturus)
Canis Major (Sirius) Leo Ursa Minor
Ursa Major Virgo (Spica) Corona Borealis
Draco
Scorpius (Antares)

*Another common star formation is the Summer Triangle including the stars of Vega, Deneb, and Altair. Pleiades is a star cluster and part of the constellation Taurus.

Next have the students report on their constellations to the class. You may have all teams report at the same time, but consider having teams report over a period of time. That way they can report during the month when their constellation is most visible in the sky (at 9:00 p.m.). Also, if the constellations are introduced one at a time, it will be easier for students to keep them straight. Have each team place their constellation on the star map in the correct position.

One month later, ask students how the positions of the constellations have changed in the night sky. Challenge students to find out where the constellations now appear in the night sky. The next day readjust the constellations to their new positions. Use the star finder transparency to help you adjust the star map.

In the following month introduce any new constellations and reposition the star map. As the months progress, the positions of the constellations change. Discuss with students why different constellations appear. Help students understand that the constellations are constant, but as the Earth revolves around the sun, new constellations appear and others disappear. The constellations nearest the North Star are visible year round (although mountains may block their visibility during part of the night). These are known as circum polar constellations. The further south a constellation, the less time it is visible during the year in the Northern Hemisphere.

Activity B

Students make and use a star finder to help them locate constellations and stars in the night sky. This activity reinforces the idea that the apparent movement of constellations is caused as the Earth rotates on its axis, and that different constellations become visible during the year because the Earth revolves around the Sun.

Plan for a star finder for each student. They may be purchased (See Materials) or made from a star finder patterns on cardstock. A good source is Uncle Al's Star Finder (See Materials). This activity may be used before Activity 1,if you choose, but it might be easier for students to do if they have some background knowledge about constellations.

Ask students what things are visible in the night sky and how can they find out what things are visible to them on particular nights. Explain that a simple star finder is a tool that can help them find some of the main things visible in the night sky.

Have students make their own star finders. Cut out the star map and star locator pieces according to printed instructions. Tape together star locator and insert star map.

Orient students to the parts of the star finder. If you have been doing Activity 1 with the students, they should recognize that the star map is similar. Practice aligning times on the star locator with dates on the star map. Identify stars and constellations that will be visible tonight at 8:00,10:00, 12:00 midnight, etc.

Have students find the constellation of their astrological “sign.” Also have them notice which constellations are not visible.

Ask questions to help students discover that the constellations that are visible will vary by date and time of night.

Questions to ask:

What constellations are found in the sky in Fall? Winter? Spring? Summer?

What happens to stars during the day?

Why do the constellations change from season to season?

Are there any constellations that are visible during every season? Why?

Are there any stars that do not seem to move?

Why are some constellations not visible during some parts of the year?

How is the sky different from 8:00 to 10:00? 12:00 midnight? 4:00 A.M.?

## Extensions

Have a "star party " at night and use the star finders for locating constellations. Have students teach family members about the constellations using star finders. Arrange for telescopes and astronomers to help. (See Additional Resources.)

During a "star party," it is a good time to introduce some of the brightest stars. Teach students that the magnitude or brightness of a star depends on a combination of several factors: size of star, temperature of star, and distance from Earth. As students learn the names and locations of stars they will have a reference point for understanding the differences in sizes and distances of stars in the sky.

Make a Star Clock. This is a simple device that is used to determine the time by the location of stars relative to the North Star. The clock is rotated until the stars on the clock line up with the stars in the sky. A simple star clock is available on the same Internet site as Uncle Al 's Star Finder (See Materials).

| Star | Constellation | Color | Distance |
|---|---|---|---|
| Sirius | Canis Major | Blue | 8.6 light years |
| Arcturus | Bootes | Orange | 37 light years |
| Vega | Lyre | Blue white | 25 light years |
| Capella | Auriga | Yellow | 42 light years |
| Rigel | Orion | Blue white | 773 light years |
| Procyon | Canis Minor | White | 11 light years |
| Betelgeuse | Orion | Red | 522 light years |
| Altair | Aquila | White | 17 light years |
| Aldebaran | Taurus | Red | 65 light years |
| Antares | Scorpius | Red | 197 light years |
| Spica | Virgo | White | 262 light years |
| Pollux | Gemini | Yellow | 31 light years |
| Fomalhaut | Piscis Austrinus | White | 25 light years |

| | | | |
|---|---|---|---|
| Deneb | Cygnus | White | 1467 light years |
| Regulus | Leo | White | 77 light years |
| Castor | Gemini | White | 49 light years |

Have students make constellation viewers using film canisters. The constellation viewer will have pinholes in the bottom to simulate seeing the constellation. These constellation viewers could be made and/or used at a star party.

Prepare constellation patterns that will fit within the circumference of a film canister lid. To do this, isolate constellation patterns on a star finder (see Materials). Reduce or enlarge the pattern if necessary. Next make reverse images of the constellations. Students cut out constellation patterns, place the reverse image pattern on the outside bottom of film canister, and tape it in place. Using a pushpin, students poke holes through the stars on the pattern and the film canister bottom. Students can view the constellations by holding the canister toward a light source and looking through the open canister.

Another option is to have students research and complete an information box about the constellation on the viewer. The information box is taped around the outside of the canister or rolled up and put inside the canister for easy reference. The box should be a rectangle that measures "height by circumference" of the canister. Information could include how to find the constellation, when it appears in the sky, a description, myths associated with it, etc. Students may either wrap the information box around the outside of the canister and tape it in place, or roll up the information box and place it inside the film canister.

Sample Information Box

The Big Dipper, part of the constellation Ursa Major
Northern Sky
Best time to view: January -- October
Importance: The two outer stars of the cup point to the North Star
The Big Dipper is a group of stars or an asterism that is part of the larger constellation Ursa Major (Big Bear). It is one of the easiest star groups to recognize because all seven stars are fairly bright stars and it is in the northern sky year round. The Big Dipper is useful because it helps locate other constellations.
One version of a Greek legend says that Zeus ' wife Hera was jealous of Callisto and changed her into a bear. Native Americans saw a bear (the dipper) being chased by three hunters (the handle). The second hunter is carrying a pot (a double star) for cooking the meat.

## Assessment Plan

Have students teach others how to make a star finder and explain how it works. For example, students could teach their parents or siblings how to make and use one at a star party in the evening.

Have students draw constellations and write what they have learned about them and stars in their journals.

Have students explain why the constellations visible at 4:00 or 5:00 in the morning are the same stars that will be visible in the evening four to six months later.

When students have made constellations or film canister viewers, organize a round robin and have the students teach their constellations to each other.

## Bibliography

This lesson is part of the Sixth Grade Science Teacher Resource Book (TRB3) http://www.usoe.org/curr/science/core/6th/TRB6/. The TRB3 is designed to be your textbook in teaching science curriculum to your students. This book covers all the objectives of each standard and benchmark. If taught efficiently, a student should do well on the End-of-Level (CRT) tests. The TRB3 is designed for teachers who know very little about science, as well as for teachers who have a broad understanding of science.

## Authors

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