Canned Constellations

Developer: Charles Scaife
Department of Chemistry
Union College
Schenectady, NY 12308

Grade Levels: K through 8

Discipline: Physical Science/Astronomy

Goals:
1. Make your own constellation viewer by punching a constellation pattern into the bottom of a black 35-mm film canister.
2. Learn to identify the patterns of various constellations.
3. Learn to find these constellations in the night sky.

Many of the ideas for this experiment were described in WonderScience (1). Additional information was obtained from A Field Guide to Stars and Planets (2).

You don’t need a telescope or even binoculars to be an amateur astronomer. You can see many stars with your own eyes. You simply need a clear night and a place sufficiently far from city or town lights to be able to see the starry night. You also need to wait briefly to let your eyes get accustomed to the dark. Moreover, you can more easily maintain your adaptation to darkness by covering the lens of your flashlight with red plastic. If you use binoculars, you see the same right-side-up image as with your eyes. However, if you use a telescope, you usually see an inverted image.

Ancient people really used their imaginations to dream up an elaborate picture from the simple pattern of a few stars. Therefore, learning to recognize constellations takes a good imagination and lots of practice. One way to see what constellations look like without even going outside is to make your own constellation viewers. You can even use your constellation viewers to play a game to see who can name the most constellations.

Teacher’s Notes:
Empty film canisters can be obtained very easily at no charge from almost any photograph development store. Take a plastic bag with you because the store will give you more than you can imagine when you tell them about your project! Be sure to get black plastic film canisters, not the translucent plastic ones which let in too much light.

Materials:
1 Black plastic 35-mm film canister for each student
2 Pushpin for each student
Copies of the constellations that you want students to make (the reverse of the way they appear in the sky; six are available from the WonderScience article and are modified in this experiment, with permission, along with three from reference (3), but you can also make your own from reference (3))
1 Pair of blunt-tip scissors for every four students
2 Rolls of household transparent tape
6 Marking pens
Learning to identify various constellations is relatively easy. Finding them in the night sky requires considerably more practice. The following information may be of help (2).

Before you begin your "sky watch," it will be helpful to determine where north, south, east, and west are. Alternatively, if you can locate the Big Dipper, which is often one of the easiest constellations (or "asterism", meaning that it is a part of a larger constellation) to find, you will be able to find the North star and gain a sense of compass direction from that.

The Big Dipper is in the northern sky. It may look something like your mom's gravy ladle. In the evening sky during autumn, the Big Dipper appears to be right side up, while in the spring-time evening sky, the dipper appears upside down. It is formed by seven stars - three form the dipper handle and four comprise the bowl of the dipper. The bowl of the Big Dipper looks somewhat like a square (actually a trapezoid) and is about 10° across. You can measure this 10° by making a fist and holding your fist up at arms' length against the sky. Your fist should appear to just fit inside the bowl of the Big Dipper. The Big Dipper is fairly easy to find because all of the stars comprising it are quite bright, except for the one which connects the handle to the bowl.

Now that you have located the Big Dipper, you can use it to find the North Star, Polaris, as well as other constellations. To find Polaris, locate the outer edge of the bowl of the Big Dipper (the side of the dipper furthest from the handle). The two stars on this outer edge are called the "Pointer Stars." Starting from the Pointer Star at the bottom of the dipper, pretend to draw a straight line from it through the Pointer Star at the top of the bowl. Continue drawing a line from the dipper bowl about five times as long as the distance between the two Pointer Stars, allowing your line to follow the curve of the sky slightly. At the end of your line, you will find Polaris, which is the brightest star in that region of the sky. If you are facing Polaris, you are facing north. Since Polaris remains at this location all year round, once you find Polaris, you know that East is on your right, South is behind you, and West is on your left.

Polaris is the last star in the handle of the constellation, or asterism, called the Little Dipper. The Little Dipper is more difficult to find than the Big Dipper because its stars are not as bright. Therefore, you may need a very dark, clear night to find the complete Little Dipper in the sky. The Little Dipper is smaller than the Big Dipper and its bowl hangs down from the handle.

After you have stopped to visit the Little Dipper, continue your trip from Polaris to another constellation called Cepheus. Following the same arc in the sky that you drew from the Pointer Stars to Polaris, continue drawing your line about half the distance that you have already come. If you imagine yourself to be under the Pointer Stars looking at and past Polaris, ahead and a little to the right you will find five stars forming a trapezoid that covers about the same area as the Big Dipper. This is Cepheus.
Explaination: The constellation Cygnus, is beyond Cepheus. Facing Polaris, pass through the right-hand pair of stars forming the trapezoid of Cepheus for about the same distance as Cepheus was from Polaris, reaching Deneb, the brightest star which is at the top of the Northern Cross.

Thus, the Big Dipper, Polaris, and Cygnus form an angle of about 120°

Again keying on Cepheus, continue your trip to another constellation – Cassiopeia. Following the same arc in the sky that you imagined from the Pointer Stars to Polaris, continue drawing your line about the same distance that you have already come. Imagine yourself to be under the Pointer Stars looking at and past Polaris. A little to the left you will find a “W” in the sky. This is Cassiopeia, which is comprised of five stars. Note that Cepheus and Cassiopeia are on opposite sides of the same arc, but Cassiopeia is about twice as far from Polaris.

Now let’s go back again to our Pointer Stars in the Big Dipper, imagine that we are under the Pointer Stars, face along our imaginary line. At Polaris, take a slightly sharper than 90° left turn. Follow that line about four times as far as you’ve already come to the most prominent group of stars in the sky – three bright stars in a straight line which form the belt of Orion, the Hunter. The other stars surrounding the belt of the constellation comprise about twice the area of the Big Dipper. In mid-northern latitudes, Orion is clearly visible during the winter, but it is below the horizon and not visible during the summer.

Gemini is in the same portion of the sky as Orion. Go back to the Pointer Stars in the Big Dipper, imagine that we are under the Pointer Stars, face along our imaginary line to Polaris, and take a much sharper 70° left turn. Follow that line about two and one-half times as far as you’ve already come to a trapezoidal group of stars comprising Gemini. You can also find Gemini by imagining you are under the center star of the handle of the Big Dipper, looking through both the star in the Big Dipper where the handle connects and the Pointer Star in the base of the pan, and going about twice the distance between the Big Dipper and Polaris. Gemini covers about one and one-half times the area of the Big Dipper.

To find the constellation Lyra, we again find the Pointer Stars, face along our imaginary line to Polaris, but this time we will take a wider than 90° right turn. Travel about twice as far as from the Big Dipper to Polaris and you will find Vega, which is the brightest star in the constellation Lyra.

Now let’s follow our pointer stars in the opposite direction. Locate Polaris and draw a line from Polaris through the pointer stars. Continue drawing that line in an arc about as far as you’ve already come. This time you will come to the constellation of Leo, the Lion. The bright star in Leo is Regulus. Thus, Leo is behind you when you imagine yourself under the Pointer Stars of the Big Dipper looking toward Polaris.

Because all of the stars and constellations in our night sky appear to revolve around Polaris, there will be seasons when some of the constellations will be so low on the horizon that they will be difficult or even impossible to see, depending on where you live. However, there will be other times of the year when the same constellations will be high in the sky and very visible on a dark, clear night. To help you know when to find these constellations, you may want to purchase a good guide to the stars. There are many excellent guides available.
Questions:

1. Can you identify the various constellations correctly? If you think that you recognize them very well, try searching for them with a parent outside in the night sky. The information given in the explanation on finding constellations should help you find them.

2. Which constellation has two pointer stars that point to Polaris or the North Star? In which part of that constellation are the pointer stars?

The pointer stars are part of the Big Dipper. The pointer stars form the outside of the dipper away from the handle.

3. Of which constellation is Polaris or the North Star a part? In which part of that constellation is Polaris or the North Star? Why is Polaris or the North Star so important in finding one’s direction?

Polaris is part of the Little Dipper. It comprises the tip of the handle of the Little Dipper. You are facing north when you face Polaris; therefore, north is identified. East is to your right. South is behind you. West is to your left.

4. Why is Cassiopeia so easy to find in the night sky? How would you describe the position of Cassiopeia in reference to the Big Dipper and Polaris?

Four of the five primary stars of Cassiopeia are fairly bright and form a “W”. Following the arc in the sky that you imagine from the Pointer Stars to Polaris, continue drawing a line about the same distance that you have already come. Imagine yourself to be under the Pointer Stars looking at and past Polaris. A little to the left you will find a “W” in the sky. This is Cassiopeia.

5. Can you describe where some of the other constellations are in reference to the Big Dipper and Polaris?

Study the positions of the various constellations given under Explanation.

References:


Canned Constellations (continued)

**Procedure:**

**CONSTELLATION PATTERNS**

- **Big Dipper**
- **Cassiopeia**
- **Cepheus**
- **Cygnus**
- **Gemini**
- **Leo**
- **Little Dipper**
- **Lyra**
- **Orion**

**MAKING A CONSTELLATION VIEWER**

From the page of constellation patterns, cut out the circle of a constellation pattern that you want to make. (The constellations in the patterns are the reverse of the way they appear in the sky but will appear correctly when observed through the viewer you will make.) Tape the constellation pattern (pattern outward) to the outside bottom of a film canister. Use a pushpin to poke a hole through the bottom of the film canister for each star in the constellation. Make the brighter stars have larger holes by wiggling the pushpin around a little. Remove the lid from the film canister, and use a marking pen to write the name of the constellation on the inside of the lid of the film canister.

**USING THE CONSTELLATION VIEWER**

Remove the lid from the film canister without peeking at the name on the inside of the lid. Look through the open end of the film canister toward a light source to see the constellation. (If the holes forming the constellation are quite large, you may see the constellation better by looking toward a piece of white paper with light shining on it.) Try to identify the constellation, and replace the lid when you are finished.

Play a game to identify the constellations with your friends. Take turns with your friends or your adult partner picking out constellations for the other to view, and try to name them.