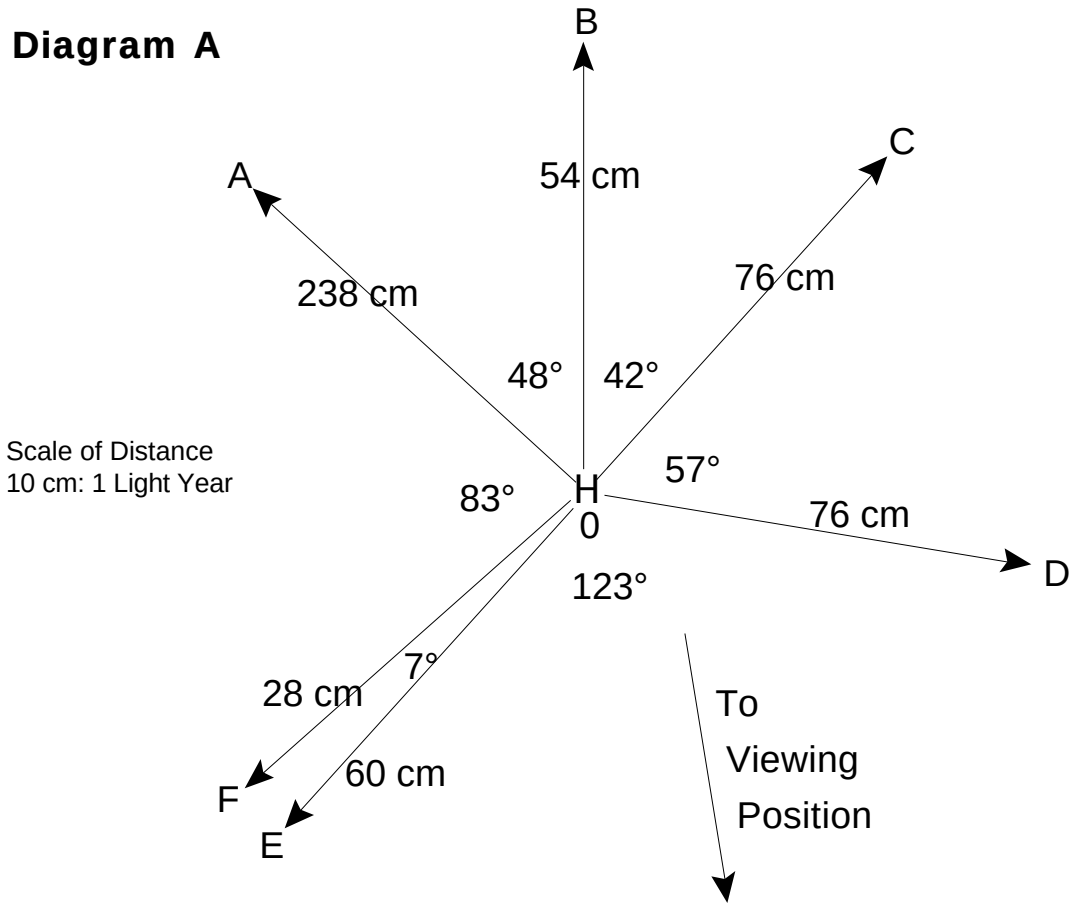
Date _____ Per. _____

The word constellation has changed in meaning through the years.
To the ancient people constellations were pictures in the stars that helped them convey their legends, traditions and values. You might call the night sky our earliest and most enduring "Power Point" presentation. But to most of today's observers, constellations are patterns that help us navigate through the stars. To modern astronomers, the 88 constellations are the small regions of the night sky that together make up the observable universe.

The Big Dipper is actually an asterism. (An asterism is a pattern of stars that are just a part of a constellation or a group of stars that belong to more than one constellation.) The Big Dipper is a part of the constellation Ursa Major. (The Great Bear) But the familiar pattern that we know as the Big Dipper, like all stellar patterns, is just an accident of our position in the universe. The following exercise will illustrate this fact.

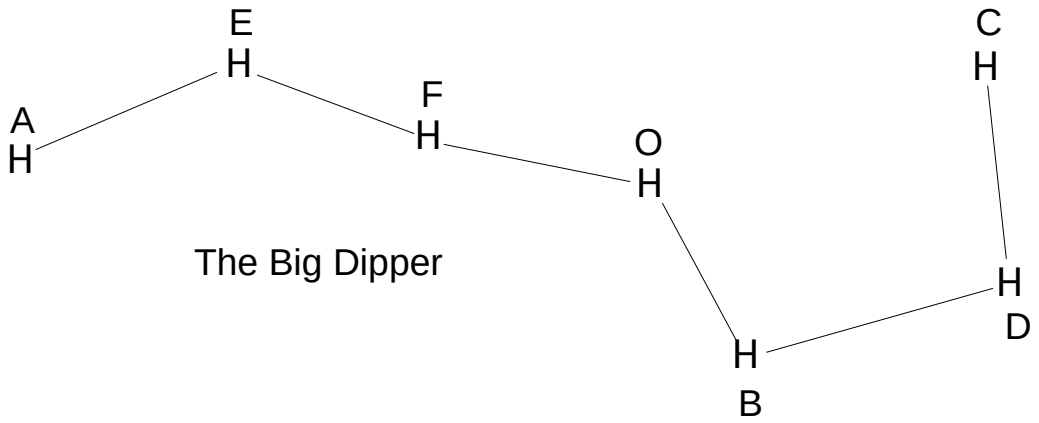
Materials:
- Meter Sticks and/or Metric Tape Measure
- Protractor
- 7 styrofoam spheres approximately 1-2 cm in diameter
- Black Thread or String
- Optional: (Digital?) Camera & Overhead Projector or Flood Lamp

Diagram A



Directions:
1. Place the diagram above on the floor below the position where you will suspend star 0.
2. Suspend star "O" approximately at eye level.
3. Position the other stars (A-F) according to the angles and distances shown above.
4. Make a line from C to D and extend it another 620 centimeters beyond D. That will be your viewing (Earth) position.
5. Adjust the height of the stars so they look like Diagram B on page 2.

Diagram B



Unlike it's bigger and better known name sake, the Little Dipper is a true constellation. The seven stars of Little Dipper are also the major stars of Ursa Minor; The Little Bear. But Ursa Minor contains just three bright stars and it is difficult to see unless the sky is very dark and free of light pollution from the moon and artificial lights.

Wrap-Up:

1. Why has the definition of the word "constellation" changed through history?

   _____

   _____

2. Name several constellations, other than Ursa Major and Ursa Minor.

   _____

3. What is an asterism? _____

   _____

4. Name several other "asterisms" beside the Big Dipper.

   _____

5. Why is line D-C in the diagram above of special interest to us in Earth science?

   _____

6. Polaris is not one of the brightest stars. In fact, 32 other stars (including the Sun) are brighter. Why is the North Star so important to us?

   _____

EXTENSION: Use a meter stick and the scale on Diagram A to measure the distance between the Earth and each of the stars in the the Big Dipper. Determine those distances in both light years and in Astronomical Units.

Big Dipper in 3 Dimensions Key

1. Constellation were initially thought of as pictures in the sky to convey legends, then patterns to navigate the night sky and finally the various regions of the observable universe.

2. Other constellations include Orion, Cassiopaea, Draco and the twelve constellations of the Zodiac.

3. An asterism is a group or pattern of stars that are a part of a constellation, or stars within more than one constellation.

4. Other asterisms include the belt of Orion, the backwards question mark in Leo, the V or the Pleiades in Taurus.

5. A line from the Pointer Stars in the Big Dipper leads us to Polaris.

6. The North Star is important because it is the only star that is always in the same compass direction. All the other stars move through the sky.

EXTENSION:

Those distances will vary between about 60 light years and roughly 770 light years. This would make the distances in Astronomical Units (the distance between the Earth and the Sun) between 3.8 million and 37 million Astronomical Units.

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Unit 8

The Big Dipper in 3 Dimensions Tips

Difficulty: Not Easy

Content: Fairly Important

Preparations: Select a place to make the model.

Materials: None

Time: 30 - 40 minutes

Suggestions for the Teacher:
1. To make one model, the class would need to work as a single lab group. Splitting the class into smaller groups would require more room. (Two models in a standard science room is quite feasible.)

Student Intro: Explain how the class will work as (a) larger lab group(s).

Post-Lab: None

Extensions:

I. See the end of the lab.

II. Alternate way to make a Big Dipper Model.

(Data from Larry & Nancy Lebofsky, Dept of Planetary Sciences, University of Arizona, Tucson, AZ 86721)

Stars of the Big Dipper (Units can be centimeters of any other convenient units.)

Alkaid	X = 2.2	Y=15.0	Z=15.0	Mizar	X= 7.6	Y=8.8	Z=10.5
Alioth	11.1	8.2	9.6	Megrez	15.7	6.3	8.8
Phecda	17.3	6.3	8.8	Dube	23.4	10.4	5.0
Merak	25.6	7.8	9.3	(Y coordinate x10 = Earth distance in light years.)			

III. Note the Earth Science Picture of the Day for April 29, 2003
<http://science.nasa.gov/ppod/y2003/29apr_bigdipper.htm>
(Thanks to Steve Kluge of Fox Lane HS, in Bedford, NY.)

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