



Stars In Your Back Yard



Activity 2: Backyard Star Count

Objectives:

- ☆ Students will discover that the sensitivity of their eyes in dark conditions increases with time (their eyes adapt to the dark).
- ☆ Students will see that the number of stars they can see depends on how long they let their eyes adapt to the dark, and how much light pollution they have in their back yard (how bright the sky is).

Materials:

- ☆ A *clear* night with *no moon* between April and November. **It must be perfectly clear!**
- ☆ Chart 1 and Data Sheet
- ☆ A pencil
- ☆ A very faint flashlight with a red filter (see box on page 4) or a red LED flashlight
- ☆ A watch

Methods:

Step 1: Dress warmly and go outside after it's completely dark. Find a place in your yard (or near your home if you have no yard) where you can see all of the Little Dipper. If you can, find a spot where you cannot see any bright lights: no streetlights, lighted signs, neighbors' porch lights, or brightly lighted windows on homes, including yours! Get comfortable – you might sit in a chair facing North. Protect your eyes from lights! If you see a car's headlights passing by, cover your eyes!

Step 2: Refer to your watch, and enter the time you went outside (hour and minute) on the Data Sheet. Use the flashlight as little as possible!

Step 3: Find the Little Dipper. Again, use the flashlight as little as possible!

Step 4: Beginning with *Polaris*, labeled "A" on the Data Sheet, locate all the lettered stars that you can see. As you get higher up the alphabet and to the faintest stars you can see, it will take you some time with each star to decide if you can or can't see it. For the faintest star you can see, you will only see it some of the time. Take a minute or two to decide, not longer. Using the "Observation 1" table on your Data Sheet, check off all the stars you see. *It is important for the observation that you try hard to see as faint as you can, but be scientific and honest!* It is also important to use the flashlight just as little as is necessary to help you know where to look – if you use it too much it will ruin your

night vision and you will see only bright stars. After you finish this first observation, enter the time (hour and minute) at the top of the Data Sheet table.

Step 5: Repeat Step 4 three more times, each time about five minutes after the previous count. Check off the visible stars on your Data Sheet, and indicate the time that you finish each observation at top of each table.

Step 6: Go Back inside

Record your name: _____ your age: _____

Record the street address of your home (include house number!) or the location you made the observations (example: 211 West Aspen Ave): _____

Use Google Earth® to find your house or observing location; enter its latitude _____ and longitude _____

Record your Teacher's Name: _____ and your grade: _____

Were any bright lights visible from your observing location? _____

If your answer above is yes, describe the light(s) and how far away it was (example: neighbor's porchlight, across the street):

Step 7: Using your Data Sheet, enter your data in the table below, listing time, number of minutes in the dark, and letter of faintest star seen. In the last column, convert the letter of the faintest star to the astronomical magnitude using the conversion table on page 6.

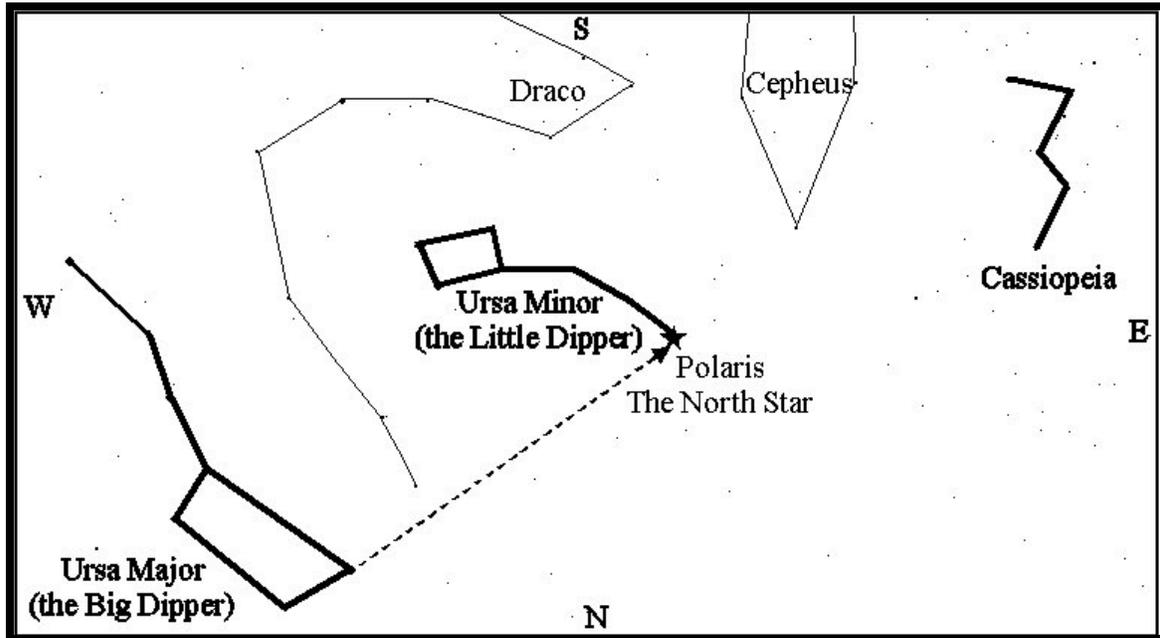
| Time (hour:minute) | Minutes since coming outside | Letter of Faintest Star Seen | Magnitude of Faintest Star |
|-------------------------------|---|---|---------------------------------------|
| | | | |
| | | | |
| | | | |
| | | | |

Step 8: Go online to http://www.flagstaffdarkskies.org/stinyby_instructions.htm and enter the results from your Data Sheet.

Step 9 (optional): Make a graph of these data, with the number of minutes in the dark across the horizontal axis, and the magnitude of the faintest star up the vertical axis. If your observation times are not exactly at 0, 5, 10 and 15 minutes in the dark, plot the points at the proper location for your times.

Step 10: Analyze your results. How many stars did you see? Did you see more at the first observation, or at the last? Why? What was happening to your eyes? Do you think you would see more stars if you waited even longer in the dark?

Chart 1: The Northern Sky. Facing north at 7:30pm MST in early October, the Big Dipper will be setting in the Northwest. It may be hidden by nearby buildings or trees! The “Pointer Stars” in the cup of the Big Dipper can be used to point to the North Star. The North Star can also be found by looking about halfway between the Big Dipper and Cassiopeia. Cassiopeia appears as a zigzag shape, or a “w” on its side.



Making Your Nightvision Flashlight

Materials needed:

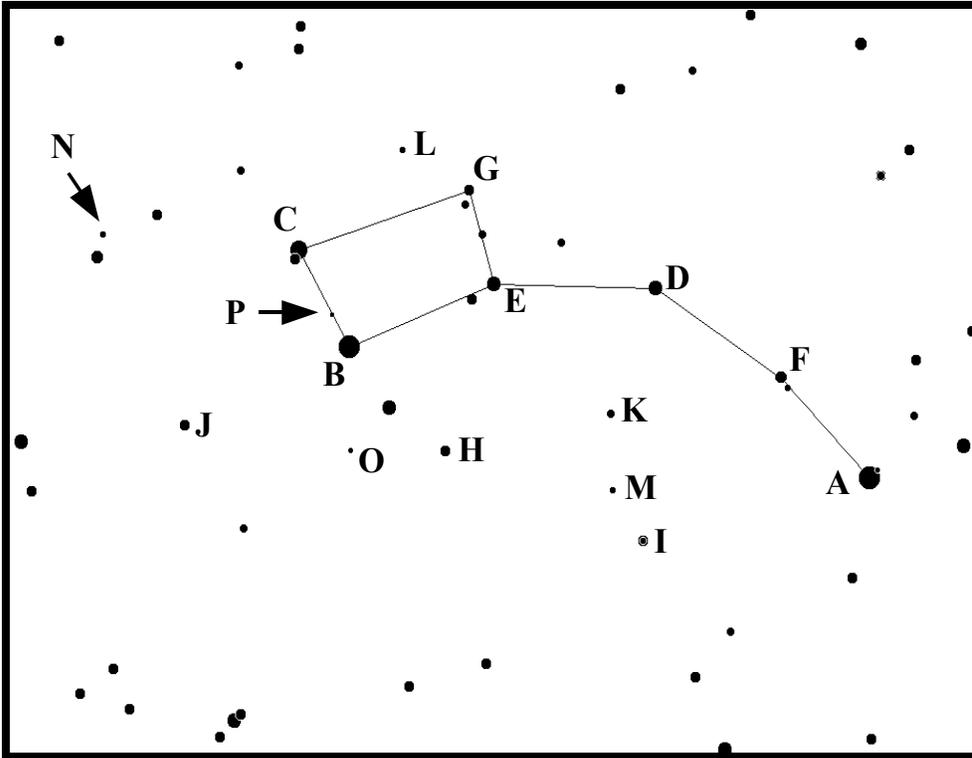
- regular flashlight – do not use a very bright one!
- piece of red cellophane about 6 x 6 inches
- piece of heavy brown paper shopping bag about 6 x 6 inches
- rubber band

Cover the flashlight lens with the red cellophane square, then the brown paper bag square. Use the rubber band to hold them in place. Use even this faint light only as much as absolutely necessary to preserve your most sensitive night vision!

Data Sheet

Observer's Name: _____ Date: _____

Time you came outside (hour:minute): _____



Observation 1
Time

| Star | Check |
|------|-------|
| A | |
| B | |
| C | |
| D | |
| E | |
| F | |
| G | |
| H | |
| I | |
| J | |
| K | |
| L | |
| M | |
| N | |
| O | |
| P | |

Observation 2
Time

| Star | Check |
|------|-------|
| A | |
| B | |
| C | |
| D | |
| E | |
| F | |
| G | |
| H | |
| I | |
| J | |
| K | |
| L | |
| M | |
| N | |
| O | |
| P | |

Observation 3
Time

| Star | Check |
|------|-------|
| A | |
| B | |
| C | |
| D | |
| E | |
| F | |
| G | |
| H | |
| I | |
| J | |
| K | |
| L | |
| M | |
| N | |
| O | |
| P | |

Observation 4
Time

| Star | Check |
|------|-------|
| A | |
| B | |
| C | |
| D | |
| E | |
| F | |
| G | |
| H | |
| I | |
| J | |
| K | |
| L | |
| M | |
| N | |
| O | |
| P | |

Limiting magnitude conversion – Ursa Minor

Using this table, we can convert the letter of the faintest star seen in Activity 2 to the astronomical *limiting magnitude* (**Lm**). The system of magnitudes is based on the ancient system devised originally by the Greeks to rank the stars by brightness: first magnitude stars are the brightest, and sixth are the faintest visible to the eye. Today astronomers have precisely quantified this old system, and magnitudes for stars can be determined to one-hundredth of a magnitude or even more precisely. We now know that good observers in unusually good sky conditions can see even fainter than the sixth magnitude. How faint did you see?

| Letter | Lm |
|---------------|-----------|
| A | 2.1 |
| B | 2.4 |
| C | 3.0 |
| D | 4.3 |
| E | 4.4 |
| F | 4.4 |
| G | 5.0 |
| H | 5.1 |
| I | 5.3 |
| J | 5.5 |
| K | 5.8 |
| L | 6.0 |
| M | 6.1 |
| N | 6.3 |
| O | 6.5 |
| P | 8.7 |