Activity 6: Using Star Maps

Introduction

The night sky is a beautiful and bewildering display of stars. To see how the display changes, from hour to hour and night to night, you need to be able to identify the star patterns called constellations. Your students will learn how to find constellations in the night sky by reading star maps.

By teaching your students how to use star maps you will make it possible for them to become familiar with the night sky, to observe its changes, and to better understand the relationship between the Earth and the stars. In later years, the ability to use star maps will help your students find planets, comets, galaxies, and nebulae.

Time Frame

Part I: Using Star Maps	30 minutes
Part II: Changing Stars	20 minutes
Part III: Spinning Earth Revisited	20 minutes

Good conditions for viewing the stars are even more important for this activity than for the previous one. Introduce star maps on a day when it is likely that the evening will be clear and the full Moon is at least a few days away. Many constellations include very faint stars, and it is much more difficult to identify the constellations if the Moon is bright or the sky is cloudy. If possible, plan an evening "star party" to help your students locate all the constellations on the map.

What You Need

For the class:

- ❑ 4 large sheets of black paper or poster board
- ❑ 1 box of large gold stars or round yellow stickers
- ❑ 1 box of small gold stars or round yellow stickers
- ❑ masking tape

For each student:

- ❑ 1 copy of the current star map (see "Getting Ready," page 42)

Note: The star maps in this activity work for the continental United States and other countries in the same latitude. If you are much further north or south, you may wish to make your own maps based on a star finder with interchangeable star wheels for different latitudes, such as *The Night Sky* by David Chandler, sold by Sky Publishing Corporation, 49-50-51 Bay State Road, Cambridge, MA 02138.

Getting Ready

1. On a clear evening before presenting this unit, select the current star map, and read the directions for its use on the following pages. (Each of the six star maps in this activity remain current for the two months marked at the top.) Then, go outdoors to see which constellations you can find most easily.

2. Have the poster from the previous activity showing the Big Dipper, the Little Dipper, and the North Star (Polaris); and make three others showing constellations that are close to the horizon. Use black paper or poster board, and gold stars. (Use large and small dots or gold stars to represent brighter or dimmer stars in the sky.) Do **not** write the names of the constellations or draw the dotted lines between the stars—the pattern of stars on your posters should resemble as much as possible their appearance in the night sky.

3. Tape the posters of constellations to the walls of your classroom, using the star map as a guide. Tape the Big Dipper poster on the wall in the front of your classroom. Place southern constellations on the back wall, eastern constellations on the right (when facing the front of the room), and western constellations on the left.

4. Make one copy of the current star map for each student.

Part I: Using Star Maps

1. Focus your students' attention on the poster of the Big Dipper and the North Star. If your students have done Activity 5, "Making a Star Clock," ask them the name of the constellation. (If the students have not done the activ - ity, explain that the constellation is called the Big Dipper.) Invite a student to point out the handle and the bowl of the Big Dipper. Also, ask her to show how the two pointer stars at the end of the Big Dipper's bowl point toward the North Star.

2. Explain that the ancient Romans called this same constellation *Ursa Major*, which meant "Big Bear" in their language, Latin. Invite the students to imagine this group stars as a giant bear in the sky.

3. Explain that the North Star is over the North Pole of the Earth. So, when you face the North Star you are facing north. Ask the students: "Which way is south?" [Behind you.] "East?" [To the right.] "West?" [To the left.] To help the students remember these directions, you can suggest that they imagine they are standing on a big compass face, or a big map of the United States, with north pointing ahead, east to the right, west to the left, and south to the rear.

4. Give each student one current star map. Explain that the names of the constellations shown on the maps were created about 2,000 years ago. To avoid confusion when talking about a particular part of the sky, astronomers all over the world have agreed to call the constellations by these names.

5. Explain how to use a star map:

   a. First pick the constellation you want to find. For example, find *Ursa Minor* (the Little Dipper) on your star maps.

   b. The map locates the constellation in the sky. Constellations in the center of the circle are high in the sky, near the *zenith* (the part of the sky that is directly overhead). Constellations near the edge of the circle are low in the sky, near the horizon (the line where the land meets the sky). Where should we look to see the Little Dipper? (North, or a little to the east or west, depending on the season.)

Interestingly, many other cultures also see this constellation as a bear. If you have time, you may want to share the Native American story on page 44 "The Bear in the Oak Tree Forest," that originated with the Wasco tribe of the Pacific Northwest.

c. The map also provides information that tells you which direction to face in order to see a constellation. Is *Ursa Major* closest to the part of the circle that says northern, southern, eastern, or western horizon? [Your students will notice that *Ursa Major* is closest to the northern horizon.] That means we must face north in order to see *Ursa Major*.

d. What constellation in the real sky must we locate in order to determine direction? [The Big Dipper and the North Star.] So, in order to find any constellation, you must first use the Big Dipper and North Star to determine "north" and thus the other directions.

e. Now, to find the constellation, **hold the map so the direction you are facing appears on the bottom of the page.** Look in the sky to see the pattern of stars shown on the bottom half of the map.

The Bear in the Oak Tree Forest

Long ago there was a great oak forest that was enchanted and magical, because every night at midnight the trees in this forest would move around and visit each other. One day a bear wandered into this forest and got so lost, he couldn't find his way out. He became frightened, and when midnight came, he was terrified to find the trees moving about. The poor bear started racing madly all over and bumping into trees right and left. The trees did not appreciate this intruder at all, and one tree was so upset that it started chasing the bear. Because bears generally are faster than trees, this chase lasted almost till dawn. The tree knew that he and all the other trees had to go back to their original places by dawn, or the Sun would notice that they had moved. So the tree, just at twilight, made one last grasp at the bear with its longest branch and just barely caught the bear by the tail. Then the tree swung the bear up into the sky where we see him now. That is why his tail is so long.

5. Test your students' understanding by challenging them to find the other three constellations that you have placed around the room, one at a time. Use the following procedure:

a. Select one of the constellations for which you have made a poster, and tell the students that they are going to locate that constellation in the "sky."

b. Ask them to look at their star maps to see if the constellation is high overhead or near the horizon.

c. Ask what direction they should face to see that constellation.

d. Tell them to face in that direction and find the constellation.

e. Do the same for the other two constellations.

6. Invite your students to take their maps home and find as many constellations as possible in the real night sky. Suggest that they stand near a streetlight or use a flashlight to see the star map at night.

Part II: Changing Stars

1. The day after a clear evening, when the students have had an opportunity to use their star maps, ask about their experiences: "Which constellations did you find? Was it hard or easy?"

2. Urge your students to use their star maps again when the stars are just coming out. They should find at least one constellation near the eastern horizon and one near the western horizon.

3. Then, just before bedtime, they should go outside again to see if those constellations have moved.

4. If your students have done Activity 5, "Making a Star Clock," ask them to recall how the stars near the North Star changed during the night. Ask them to predict how the constellations in the eastern and western parts of the sky will change. Then, have them observe and find out. [Stars in the east will rise, stars in the west will set, and stars in the north will circle the North Star.]

Part III: Spinning Earth Revisited

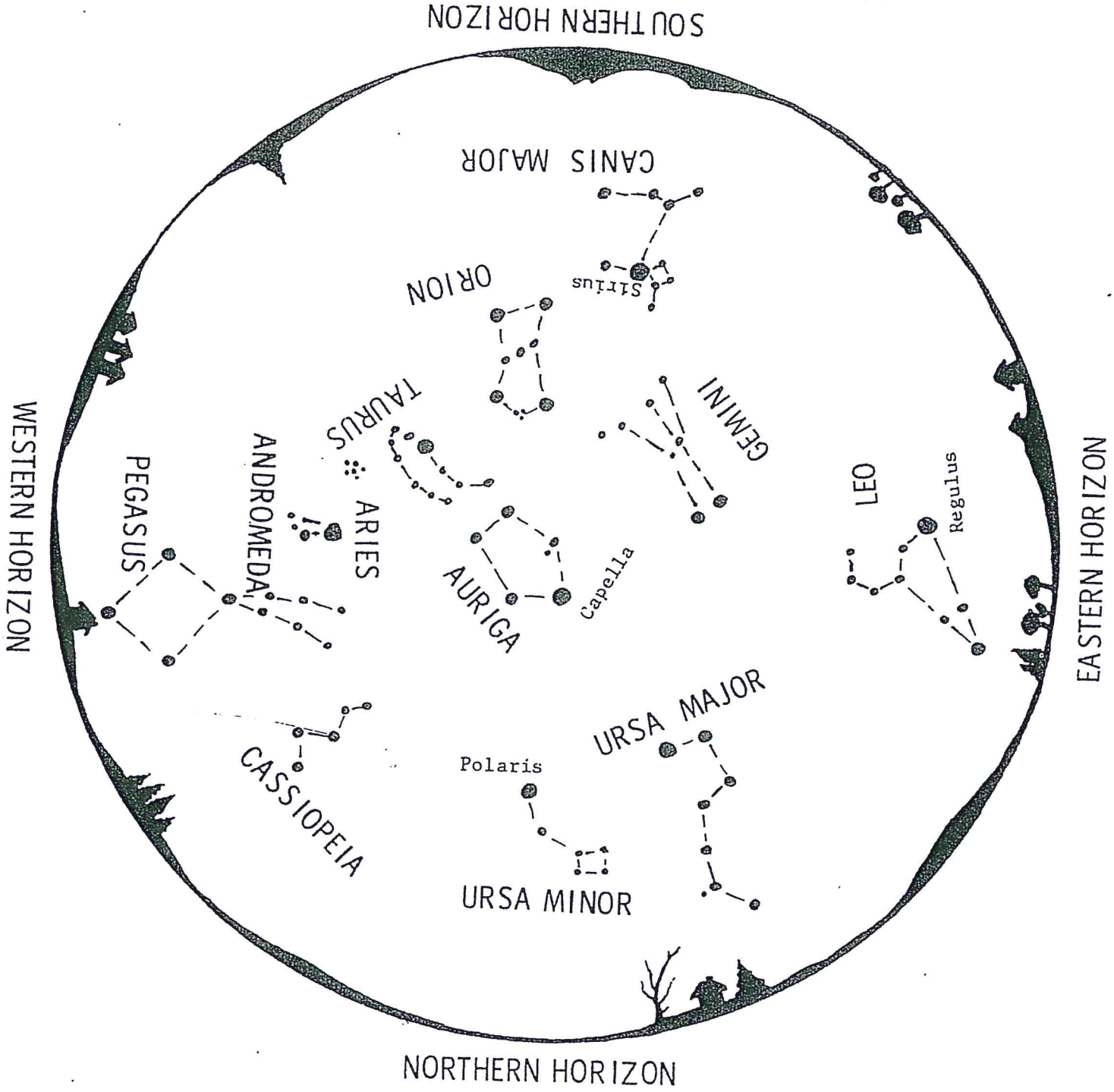
1. Ask the students if they were able to observe constellations in the east and west, and if the constellations moved later in the evening. [Those in the east rise in the sky, and those in the west get lower, or sink below the horizon.]

2. As in Activity 5, "Making a Star Clock," have your students stand and imagine that they are each the Earth, and that all of the people and objects in the room are the constellations. Instruct them to slowly turn in place and look straight ahead. They will see new objects (stars) move into view on one side, go across their line of vision, and go out of view on the other side.

3. To recall how the stars move near the North Star, they can again look overhead as they slowly turn, and see everything appearing to go around a single point in the ceiling.

Evening Star Map for January - February

9 - 10 PM

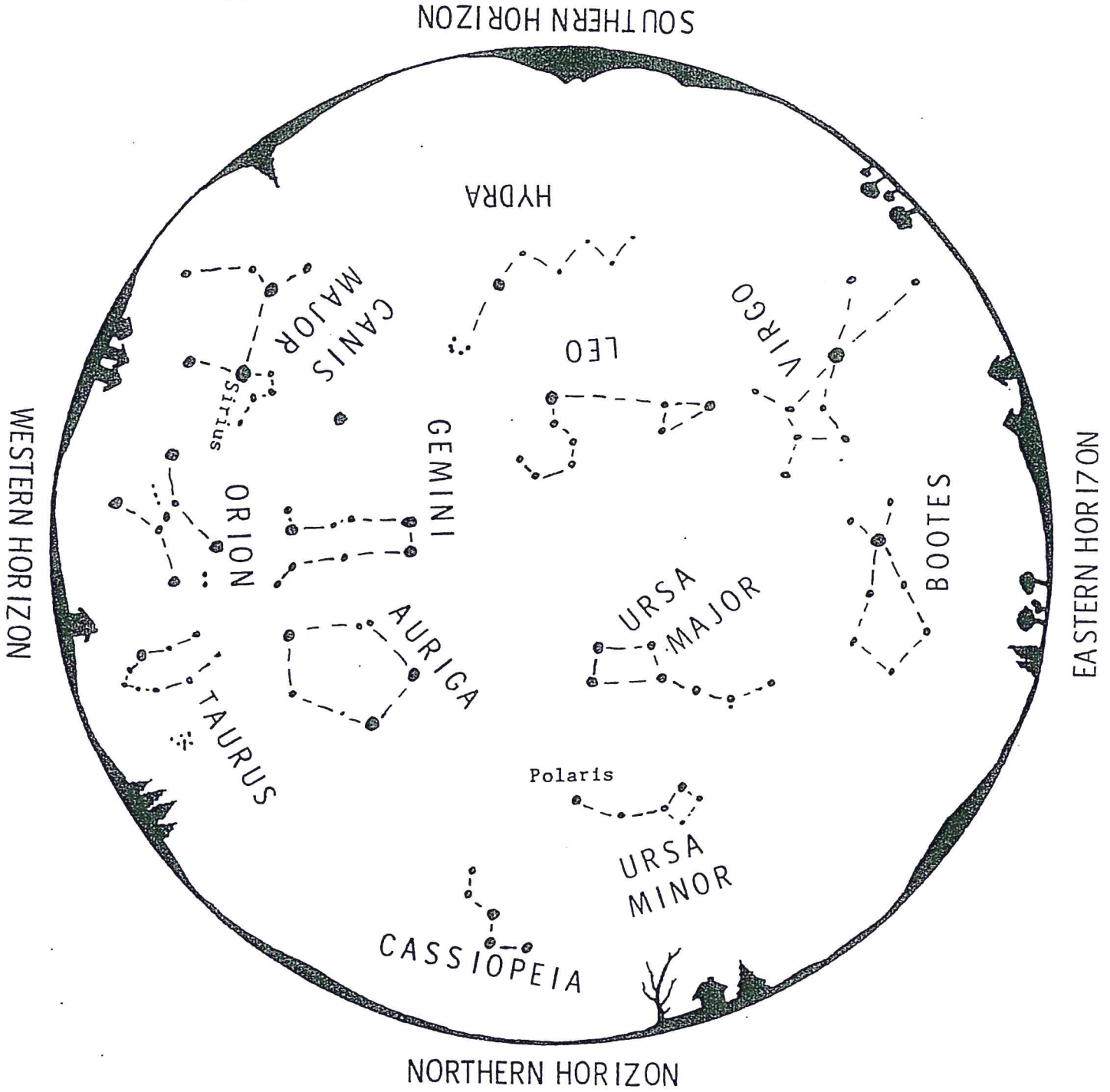


to use map:

Hold this sheet in front of you. Turn the map so the direction you are facing is on the bottom. The constellations in the sky will match the constellations on the map.

Evening Star Map for March - April

9 - 10 PM

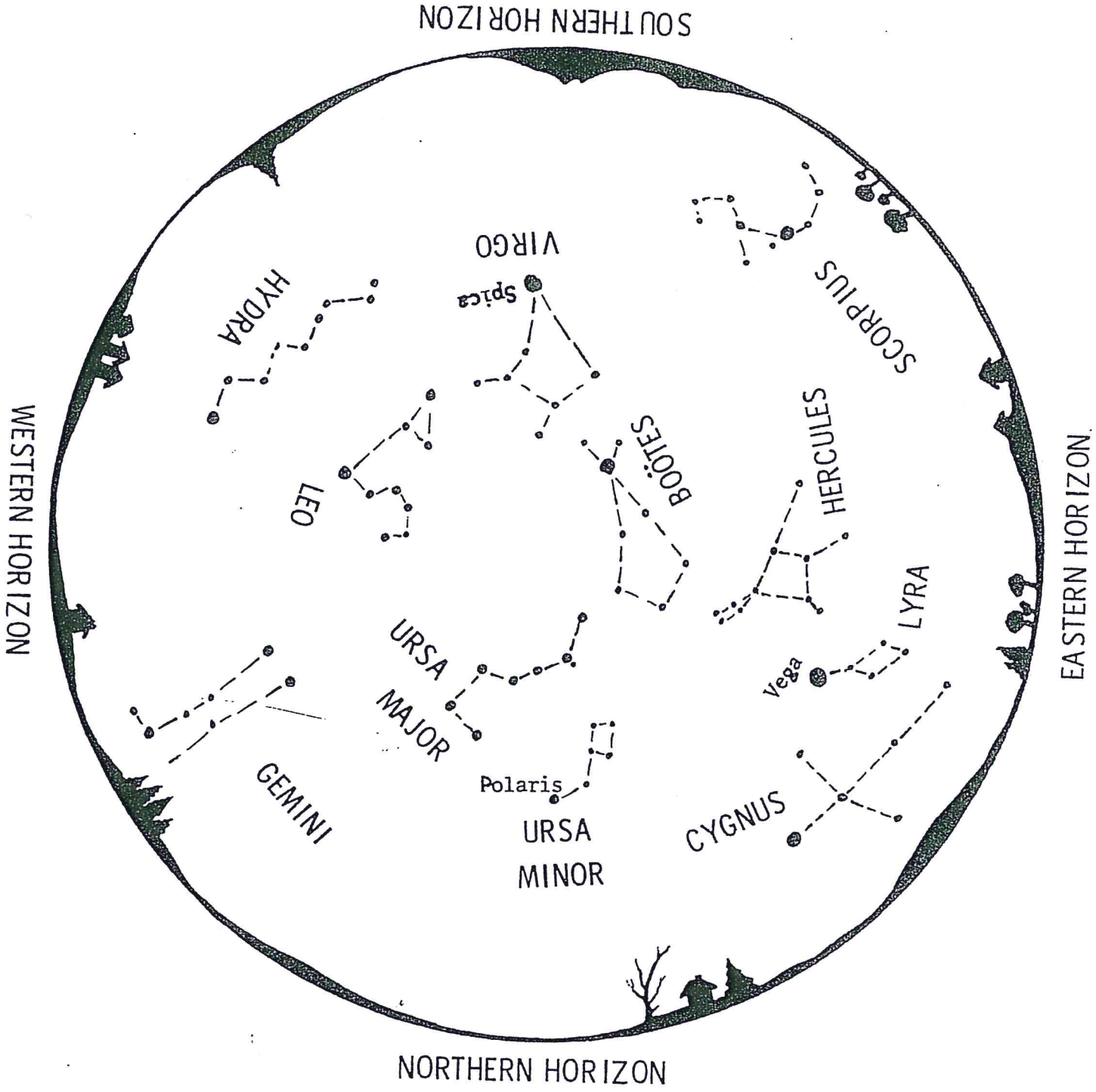


to use map:

Hold this sheet in front of you. Turn the map so the direction you are facing is on the bottom. The constellations in the sky will match the constellations on the map.

Evening Star Map for May - June

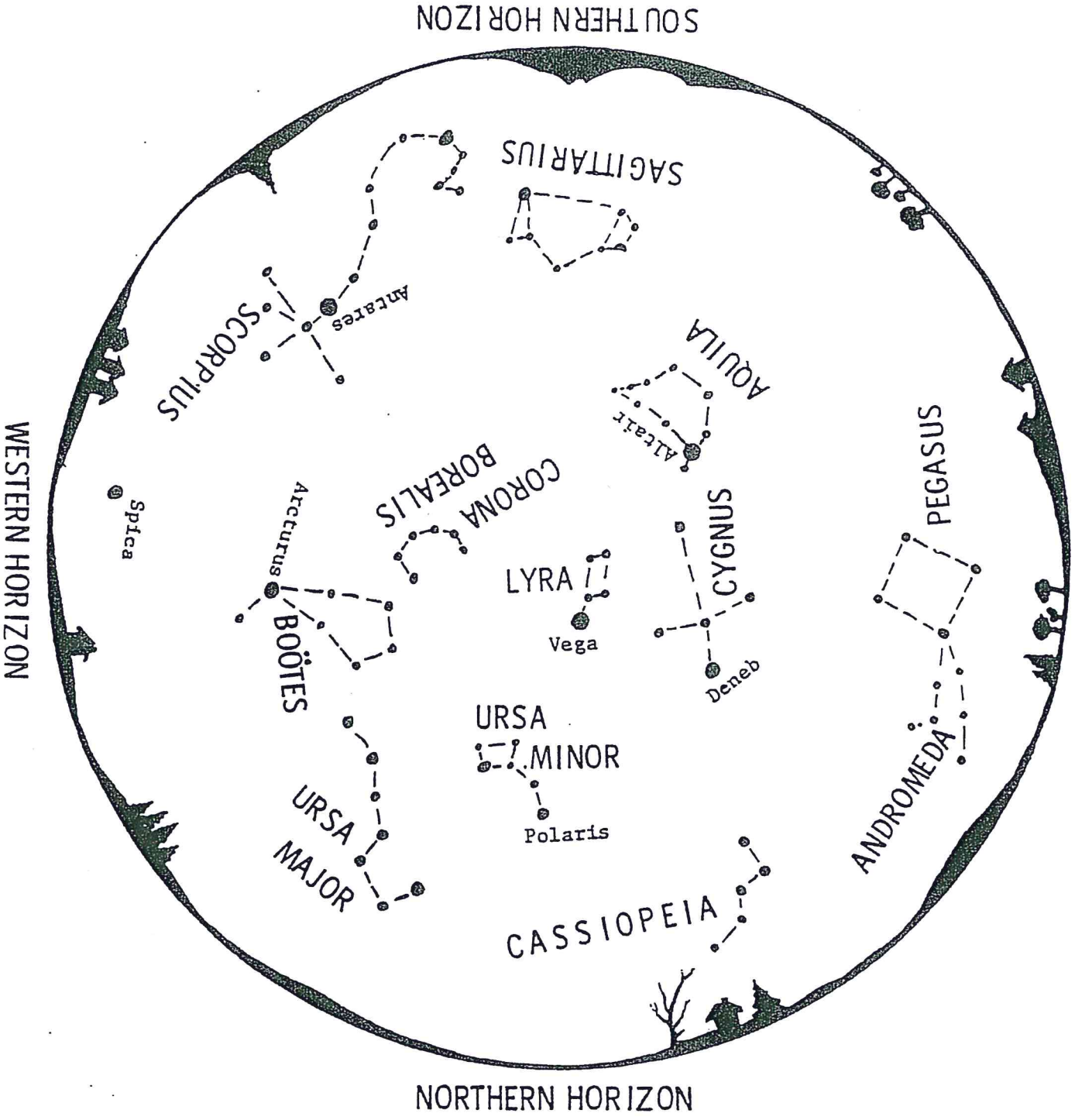
9 - 10 PM



to use map:

Hold this sheet in front of you. Turn the map so the direction you are facing is on the bottom. The constellations in the sky will match the constellations on the map.

Evening Star Map for July - August

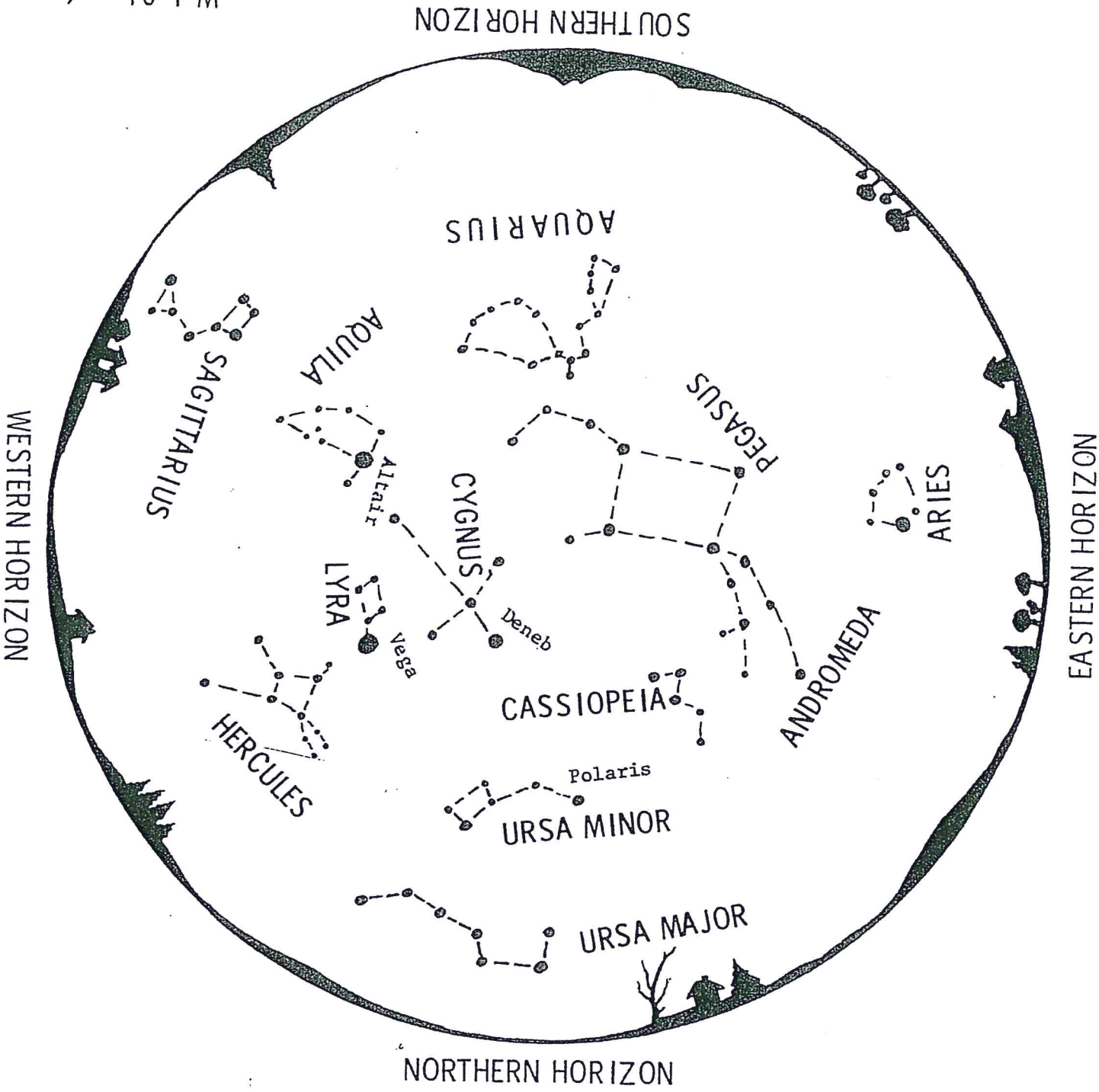


to use map:

Hold this sheet in front of you. Turn the map so the direction you are facing is on the bottom. The constellations in the sky will match the constellations on the map.

Evening Star Map for September - October

9 - 10 PM

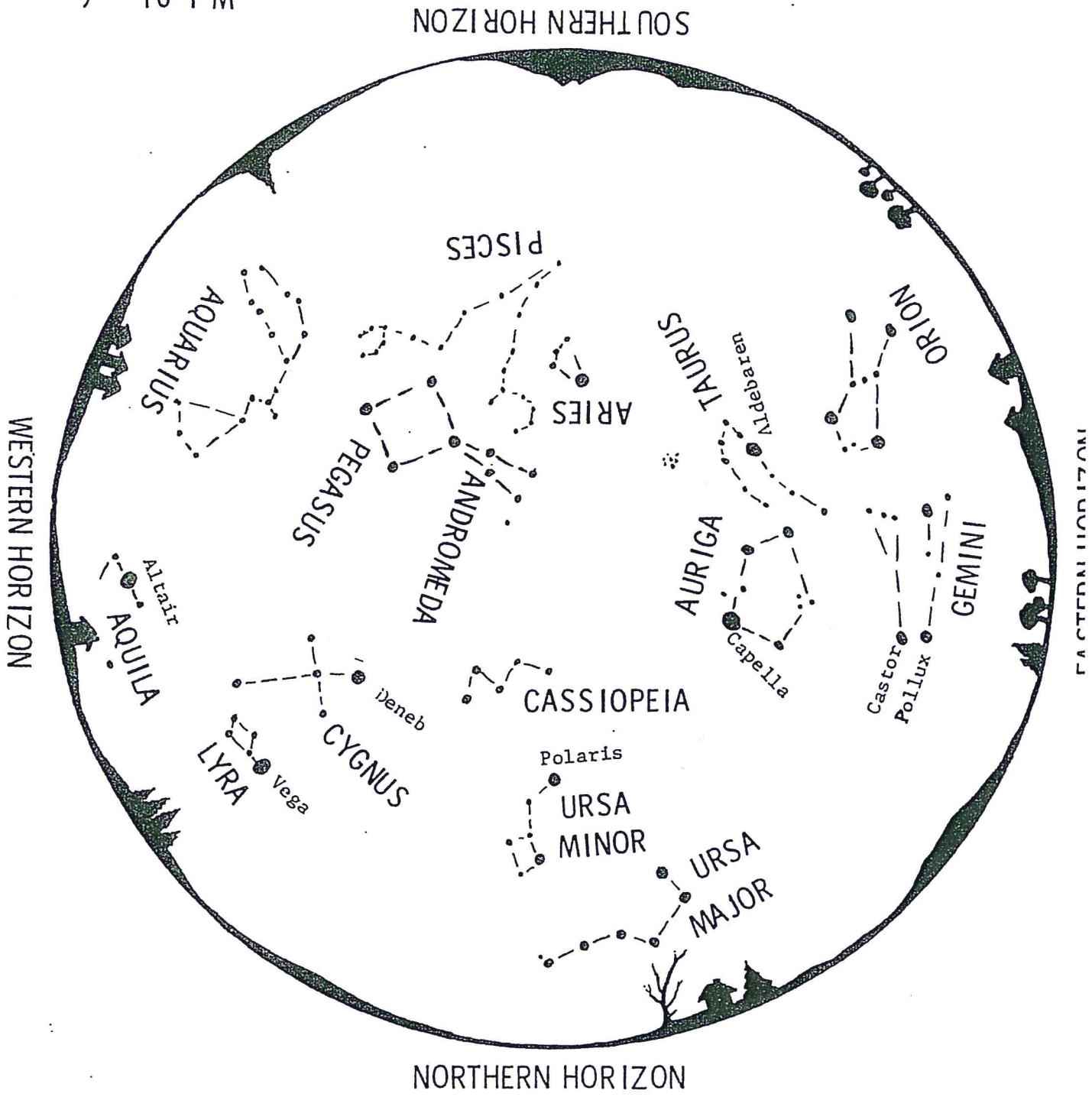


to use map:

Hold this sheet in front of you. Turn the map so the direction you are facing is on the bottom. The constellations in the sky will match the constellations on the map.

Evening Star Map for November - December

9 - 10 PM



to use map:

Hold this sheet in front of you. Turn the map so the direction you are facing is on the bottom. The constellations in the sky will match the constellations on the map.

What Did Your Students Learn?

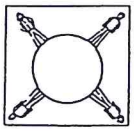
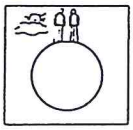
Many concepts are presented in this unit. Two of these important ideas concern the Earth's shape and gravity. You can determine how much your students learned if you save their questionnaires about these concepts from Activity 2. (See page 14.)

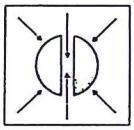
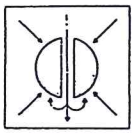
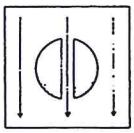
Make two copies of the opposite page entitled "Levels of Understanding About the Earth's Shape and Gravity." On the first copy create a profile of your students' ideas before the unit. Administer the same questionnaire again after the unit. Use the second sheet to create a profile of their ideas after doing these activities.

To create a profile of your students' ideas, use the information on the next page to score each questionnaire on the Earth's shape concept and on the Gravity concept. Use the histograms to plot the scores of your students on these two concepts.

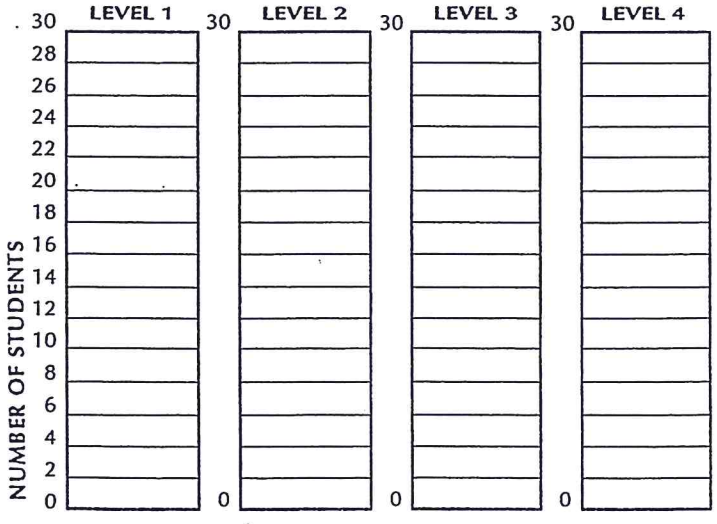
Please do not be disappointed if your students do not all advance to higher levels of understanding right away! Learning that the Earth beneath our feet is really a huge ball in space is not an easy concept; and many people learn this gradually after many experiences like those in the *Earth, Moon, and Stars* unit. Our understanding continues to deepen over time. You can feel very proud if the class profile has shown some movement from lower to higher levels of thinking on these two concepts.

Levels of Understanding About the Earth's Shape and Gravity

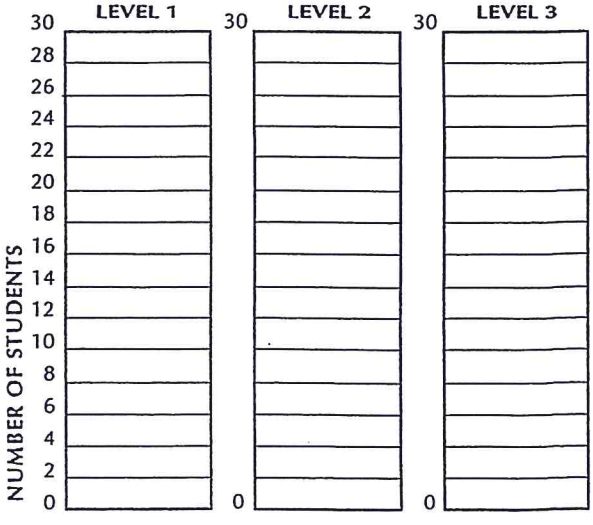
EARTH'S SHAPE		Definition of each level	How to classify answers	Number of students
	SHAPE LEVEL 4	The Earth is shaped like a ball, and people live all around the ball.	QUESTION 1: Answer D and QUESTION 2: Answer D.	
	SHAPE LEVEL 3	The Earth is shaped like a ball, but people live just on top of the ball.	QUESTION 1: Answer D and QUESTION 2: Answers A, B, or C.	
	SHAPE LEVEL 2	The Earth is shaped like a ball, but people live on the flat parts of it (or inside the ball).	QUESTION 1: Either answer B or C.	
	SHAPE LEVEL 1	The Earth is flat.	QUESTION 1: Either Answer A or E, or no answer at all.	

GRAVITY		Definition of each level	How to classify answers	Number of students
	GRAVITY LEVEL 3	Objects fall toward the *center* of the Earth.	QUESTION 3: Rocks are shown falling straight down to the surface of the Earth, near each figure's feet, and QUESTION 4: The rock is shown falling toward the Earth's center, where it either falls through and bobs up and down, or stops in the center.	
	GRAVITY LEVEL 2	Objects fall toward the *surface* of the Earth.	QUESTION 3: Rocks are shown falling straight down to the surface of the Earth, near each figure's feet, and QUESTION 4: The rocks do not end up in the Earth's center. (They may be shown passing all the way through the earth, sticking to the Earth's surface, or taking some other path.)	
	GRAVITY LEVEL 1	Objects fall *down* in space.	QUESTION 3: Rocks are *not* shown falling straight down to the surface of the Earth. (They may be falling down to the bottom of the page or shooting at some other angle around the planet.)	

CLASS PROFILE—EARTH'S SHAPE



GRAVITY



Conclusion

All of the activities in *Earth, Moon, and Stars* are designed to provide your students with a good basic framework for comprehending the ball-shaped object on which we live, and its relation to the infinite reaches of the universe. The use of models in many of these activities helps provide students with new ways of understanding phenomena and analyzing problems, in addition to being one of the best ways to convey astronomical concepts. The sense of scientific history embodied in ancient models and myths helps students understand that human knowledge is relative and always in the process of change, that even our own seemingly advanced theories will be modified by the discoveries of the future.

We live in an age when the human species has been able to voyage into outer space, walk on the Moon, land exploratory craft on other planets, and process information from distant galaxies by means of new technologies. This constantly expanding contact makes a clear and stimulating introduction to astronomy an invaluable asset to students of all ages. It is our hope that *Earth, Moon, and Stars* will help serve as such an introduction for your students.

More Recent Nonfiction Books on Space Science Your Students May Enjoy

Moon Landing by Richard Platt. Candlewick Press, 2008.

Tycho Brahe: Pioner of Astronomy by Don Nardo. Compass Point Books, 2007.

Maria Mitchell: The Soul of an Astronomer by Beatrice Gormley. Eerdmans Books for Young Readers, 2004.

Exploring Our Solar System by Sally Ride and Tam O'Shaughnessy. Crown, 2003.

The Moon by Seymour Simon. Simon and Schuster, 2003.