Astronomy Introduction

Astronomy is the study of celestial bodies. Based on their observations of the Sun, Moon, and Stars, people long believed that the Earth was the center of the universe. In the sixteenth century, Nicholas Copernicus proved that the simplest explanation of the movements of all the heavenly objects, particularly the observable planets, put the sun at the center of the universe. The "Copernican Revolution" placed the Earth as just one of the planets that goes around the sun. Since that time, astronomers have sought to better understand space and the far reaches of the universe.

The Earth is the third planet from the Sun in our solar system. Like all planets and stars, the Earth is approximately a sphere. In all, there are nine planets of very different size, composition, and surface features that move around the Sun in nearly circular orbits. The inner planets—Mercury, Venus, Earth and Mars—are mostly rock. They are separated from the outer planets—Jupiter, Saturn, Uranus, Neptune, and Pluto—by a region of asteroids. The outer planets are mostly gas (except for Pluto).

The night-and-day cycle on earth is produced by the 24-hour rotation of the earth on its axis. This rotation also makes it seem as though the sun and stars are going around the Earth. Stars do not appear to move in relation to each other, and groups of stars—constellations—have been named and used throughout history for navigation as well as for determining important dates. Which stars are visible changes throughout the year as the Earth progresses in its yearly revolution around the sun. In the Fall, an observer is looking at a different part of the universe than in the Spring, as the Earth has moved to the other side of its orbit.

Space exploration has led to new discoveries about the composition and behavior of objects in space. Astronomers hope so use this information to better understand the Earth's past, as well as to predict its future.

According to the National Science Education Standards (1996), students in grades K-4 should develop an understanding that:

- The Sun, Moon, stars, clouds, birds, and airplanes all have properties, locations, and movements that can be observed and described.

- The Sun provides the light and heat necessary to maintain the temperature of the Earth.

- Objects in the sky have patterns of movement. The Sun, for example, appears to move across the sky in the same way every day, but its path changes slowly over the seasons. The Moon moves across the sky on a daily basis much like the Sun. The observable shape of the Moon changes from day to day in a cycle that lasts about a month.

Furthermore, the Standards state:

- By observing the day and night sky regularly, children in grades K-4 will learn to identify sequences of changes and to look for patterns in these changes. As they observe changes, such as the movement of an object's shadow during the course of a day...they will find the patterns in these movements. These understandings should be confined to observations, descriptions, and finding patterns. Attempting to extend this understanding into explanations using models will be limited by the inability of young children to understand that the Earth is approximately spherical. They also have little understanding of gravity and usually have misconceptions about the properties of light that allow us to see objects such as the Moon.

Students in grades 5-8 should develop an understanding that:

- The Earth is the third planet from the Sun in a system that includes the Moon, the Sun, eight other planets and their moons, and smaller objects, such as asteroids and comets. The Sun, an average star, is the central and largest body in the solar system.

- Most objects in the solar system are in regular and predictable motion. Those motions explain such phenomena as the day, the year, phases of the Moon, and eclipses.

The Standards further note:

- By grades 5-8, students have a clear notion about gravity, the shape of the Earth, and the relative positions of the Earth, Sun, and Moon. Nevertheless, more than half of the students will not be able to use these models to explain the phases of the Moon, and correct explanations for the seasons will be even more difficult.

Introducción a la Astronomía

La astronomía es el estudio de los cuerpos espaciales. Basado en las observaciones del sol, la luna y las estrellas, por mucho tiempo la gente creía que la Tierra era el centro del universo. En el siglo dieciséis, Nicolás Copernico probó que, al poner el sol en el centro de los planetas, se obtenía la explicación mas simple del moviemiento de todos los cuerpos celestes. La teoría de Copernicus entonces puso a la Tierra como otro planeta que gira alrededor del sol. Desde esas fechas, los astrónomos han tratado de mejorar su entendimiento de lo que ocurre en los espacios alejados en el universo.

La Tierra es el tercer planeta en relación al sol en nuestro Sistema Solar. Como todos los planetas y estrellas, la tierra tiene una forma casi esférica. En total hay nueve planetas de muy diferentes tamaños, composición y aspecto superficial, que se mueven alrededor del sol en órbitas casi circulares. Los planetas interiores - Mercurio, Venus, la Tierra y Marte - son mayormente rocosos. Estos planetas están separados de los planetas exteriores - Júpiter, Saturno, Urano, Neptuno y Plutón - por una zona de asteroides. Los planetas exteriores son mayormente gaseosos (con excepsión de Putón).

La rotación de 24 horas de la Tierra sobre su eje produce el ciclo del dia y la noche del planeta y lo hace parecer como si el sol y las estrellas giran a su alrededor. Aparentemente, las estrellas no tienen movimiento relativo y hay grupos de estrellas identificados como constelaciones. Estas constelaciones se han usado como guías para navegación y para establecer calendarios. Las estrellas visibles cambian de acuerdo con la temporada del año. En otoño se ven diferentes constelaciones de las que se ven en primavera.

Las recientes exploraciones del espacio han dado nueva información sobre la composición y comportamiento de objetos celestiales. Los astrónomos esperan poder utilizar esta información para comprender el pasado y el futuro de la Tierra.

De acuerdo a las Normas de la Educación Nacional de Ciencia (1996) [National Science Education Standards (1996)], los estudiantes en los grados K-4 deberían desarrollar el entendimiento de que:

- El sol, la luna, las estrellas, las nubes, los pájaros y los aeroplanos, todos ellos tienen características, posiciones y movimientos que pueden ser observados y descritos.
- El sol suministra la luz y el calor necesarios para mantener la temperatura de la tierra.
- Los objetos en el cielo tienen normas de movimiento. El sol, por ejemplo, parece moverse a través del firmamento diariamente por la misma ruta, pero su curso varía

lentamente a través de las estaciones. La luna se mueve a través del cielo en forma cotidiana, más o menos como el sol. La figura que se puede observar de la luna cambia día con día en un ciclo que dura casi un mes.

Más aun, tales Normas estatuyen que:

- Al observar el cielo regularmente de día y de noche, los niños en los grados K-4 aprenderán a identificar las secuencias de los cambios y a buscar las figuras o diseños en esos cambios. Mientras observan los cambios, tales como el movimiento de la sombra de un objeto durante el curso de un día, ellos encontrarán la configuración de esos movimientos. Estas interpretaciones deberían restringirse a observaciones, descripciones y a encontrar figuras y diseños. El intento por extender este discernimiento en explicaciones usando modelos, se limitará por la

inhabilidad de los niños más pequeños para entender que la tierra es casi esférica. Ellos también entienden poco acerca de la gravedad y usualmente mal interpretan sobre las propiedades de la luz que nos permite ver objetos tales como la luna.

Los estudiantes en los grados 5-8 deberían desarrollar el entendimiento de que:

- La Tierra es el tercer planeta en relación al sol en un sistema que incluye la luna, el sol, otros ocho planetas con sus lunas y objetos más pequeños tales como asteroides y cometas. El sol, una estrella tamaño promedio, es el cuerpo central y mayor del Sistema Solar.

- La mayoría de los objetos del sistema solar están en una regular y predecible moción. Estos movimientos o mociones explican tales fenómenos como el día, el año, las fases de la luna y los eclipses.

Ulteriores notas de las susodichas Normas:

- En los grados 5-8 los estudiantes deben tener una clara noción sobre gravedad, la forma de la tierra y la relativa posición de la tierra, el sol y la luna. Sin embargo, mas de la mitad de los estudiantes no podrán usar estos modelos para explicar las fases de la luna y les será aún más difícil entender las correctas explicaciones sobre las estaciones del año.

DAYTIME ASTRONOMY

Grades		
2-6	3-5	30 min. initially; a few min. per day for several weeks

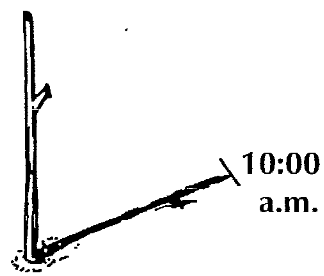
Description: Students will observe changes in the length and position of a shadow over several weeks.

Materials for Each Group: 1 metric measuring tool (size needs to be appropriate for the size of measurements to be made)
chalk

Safety: Be sure the post to be measured will not be casting a shadow into a traffic area.

Procedure:

1. On a sunny day, take the class outside and use chalk to mark the shadow of the flagpole (or other large, vertical pole) on the pavement. Ask students to predict how the shadow will change throughout the day. Periodically throughout the day, return to the flagpole and mark the shadow.



2. Either identify for students or allow students to select a vertical post which they will use throughout this activity. The post may be a flagpole, telephone pole, fence post, playground pole, or a dowel mounted in a wooden base.

3. At the same time of day for several weeks (at least a month), have students measure and record the length and position of the shadow. Older students may use a compass to determine the direction of the shadow. As an alternative, students can draw the position of the shadow, using permanent structures as reference points. Students can keep their observations in a journal.

4. Have students compile their results into a graph to show how the length of the shadow varied over the time period for which they have measurements.

Questions to Ask During the Activity:

1. What causes shadows? [An opaque object blocks the light.]

2. How does the Sun appear to move across the sky during the day? [from east to west]

3. How does the position of the Sun at noon vary throughout the year? [From the first day of summer to the first day of winter, the Sun's position is slightly further south each day. From winter to summer, the Sun's position is slightly further north each day.]

Why It Happens: Variations in the apparent position of the Sun throughout the year result from the tilt of the Earth on its axis as it revolves around the Sun. The summer solstice marks the time when the Sun appears furthest north; the winter solstice marks when the Sun is furthest south. The Tropic of Capricorn is the imaginary line on the Earth where the Sun's rays are vertical at noon on the day of the winter solstice. The Tropic of Cancer is the similar line for the summer solstice. During the vernal (spring) and autumnal equinoxes, the Sun is directly above the equator at noon.

Adaptations for Participants with Disabilities: Students with physical and visual impairments can work with others to gather observations about the shadows.

Extensions: Use a light meter to record the intensity of the light at the same time each day over several weeks.

References: Daytime Astronomy from the Association of Astronomy Educators Newsletter, March 15, 1990.

MOON PHASES

Grades		
3-8	whole class	40 min.

Description: Students will model the phases of the Moon.

Materials for Whole Class:
1 4-6 inch styrofoam ball per student
1 pencil or short wood dowel per student
1 bright (150 W) light bulb in holder

Safety: The light bulb will become hot; handle it with care.

Procedure:

1. Have each student mark one side of the styrofoam ball with an X. This ball represents the Moon; the side with the X is the side we can see from Earth.

2. Arrange the students in a circle around the light bulb. The light bulb will represent the Sun; each student's head represents the Earth.

3. Turn on the light bulb in the center of the circle and dim any other lights in the room and close any window shades.

4. Have students place their styrofoam "Moons" on the ends of their pencils.

5. Holding the Moon between themselves and the light bulb (the Sun) with the X towards their faces, have students describe the view of the Moon from the Earth (their heads). This would be the new moon.

6. Keeping the X facing them, have students slowly turn around counter-clockwise, modeling the moon moving around the Earth. Have them describe and record on the Student Data Sheet their view of the Moon as they rotate.

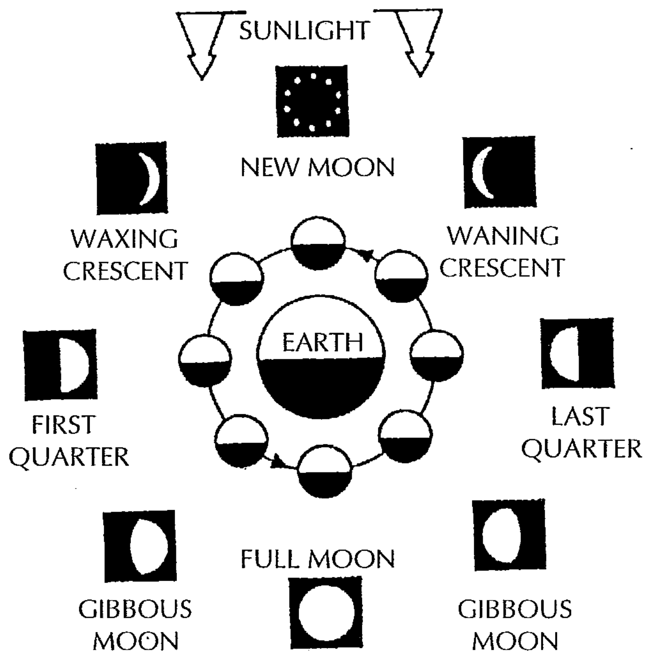
Questions to Ask During the Activity:

1. How does the shadow move across the face of the Moon? [from right to left]

2. How does an eclipse of the Moon happen? [the Earth blocks the light from the Sun]

3. Why isn't there an eclipse of the Moon every month? [the moon's orbit around the Earth is tilted.]

Why It Happens: The Moon orbits around the Earth over a period of approximately 28 days, keeping the same side facing the Earth at all times. Half of the Moon is always illuminated by the Sun; the Moon's phase depends on how much of that illumination is visible from Earth. As the Moon moves from new to full it's said to be "waxing." As it moves back to new moon again, it's said to be "waning."



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A solar eclipse happens when the Moon passes directly between the Earth and the Sun and hides the Sun from view. The Moon is almost 400 times smaller than the Sun, but it can hide the Sun because the Sun is so much farther away and therefore appears smaller. In a lunar eclipse, the Earth is directly between the Sun and the Moon and blocks the Sun's light from the Moon. Lunar eclipses do not take place every month because the Moon usually passes above or below the Earth's shadow.

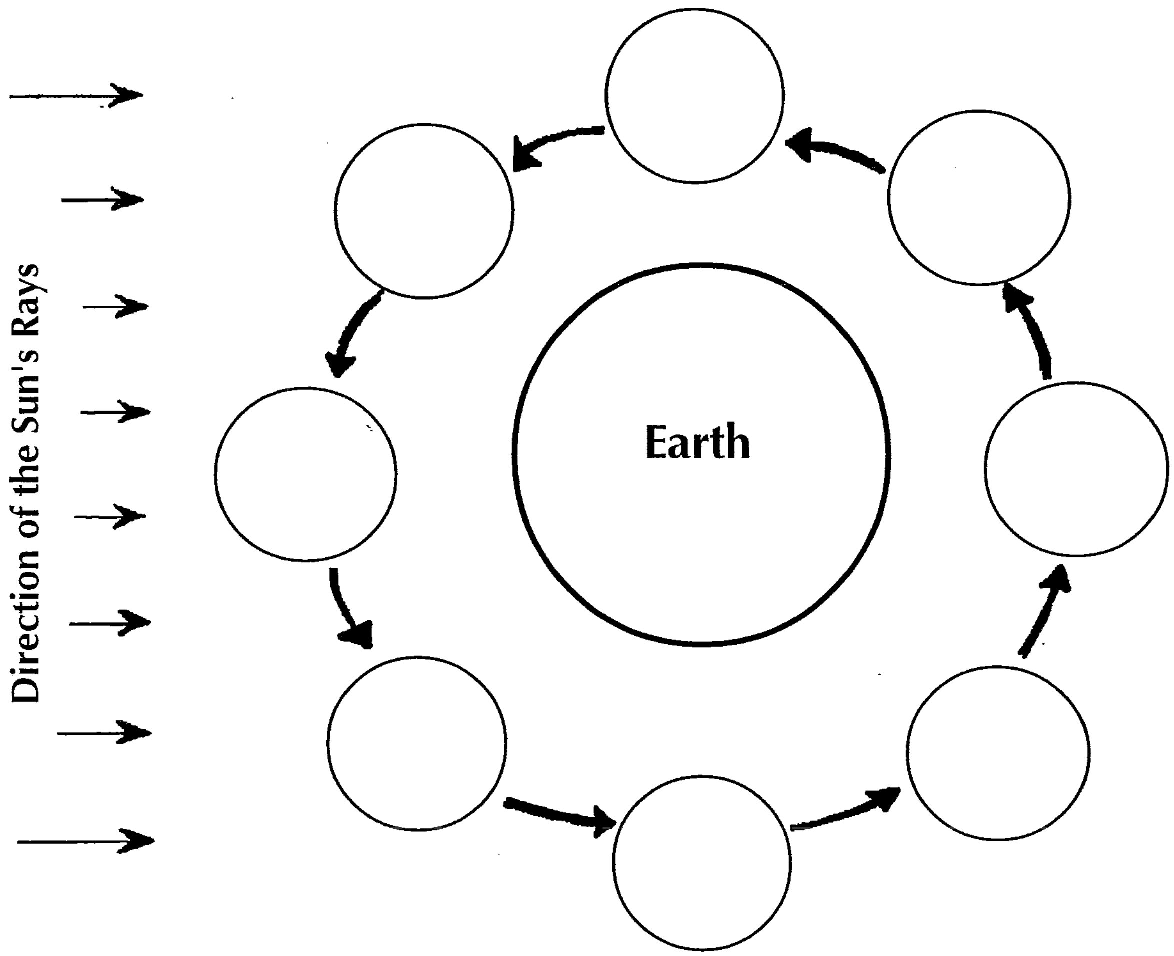
Adaptations for Participants with Disabilities: For students with physical impairments, the styrofoam moon can be attached to a longer pole which is attached to a chair which can turn.

Extensions: Have students make nightly observations of the Moon and keep a journal of its appearance and location in the sky.

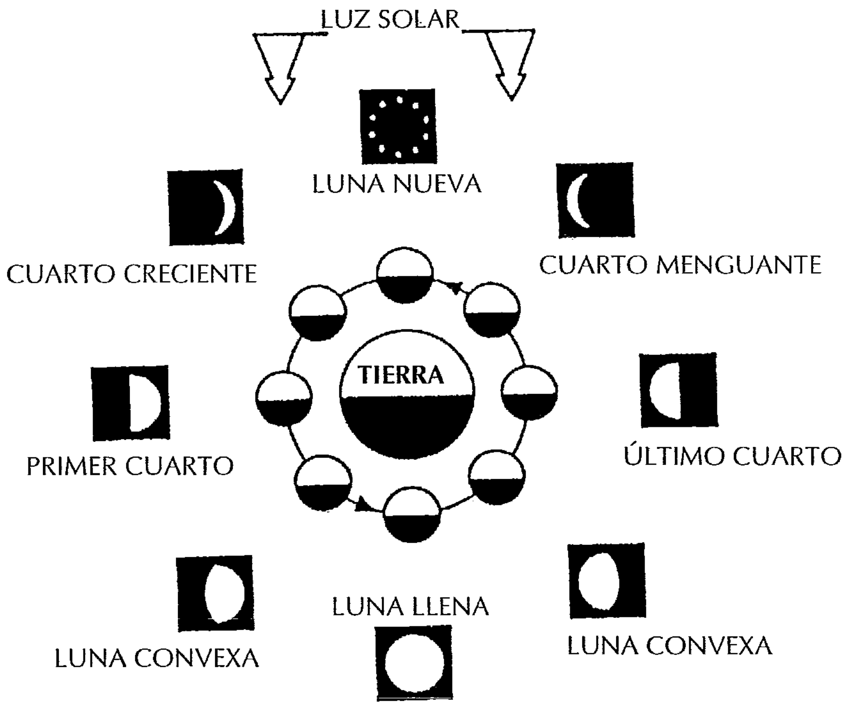
Have students research myths and stories about the Moon.

References: Bosak, Susan V. Science is...: A Source Book of Fascinating Facts, Projects and Activities. Ontario: Scholastic Canada, Ltd., 1992.

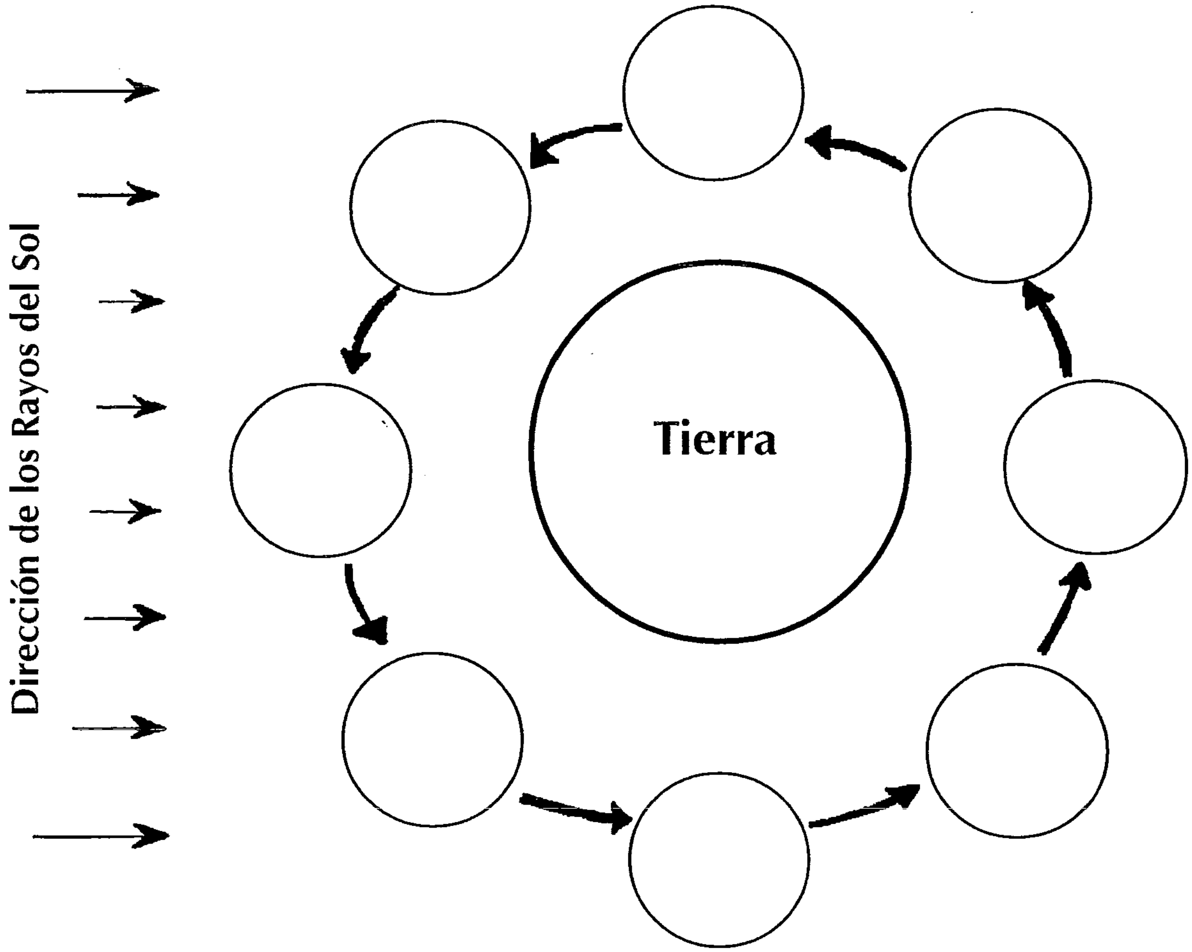
Moon Phases
Student Data Sheet



Fases de la Luna



Fases de la Luna
Hoja de Datos del Estudiante



SCALE MODEL of the SOLAR SYSTEM

Grades		
3-5	whole class	30 min.

Description: Students will make a model of the solar system within the school.

Materials for Whole Class:
3-4 meter sticks or metric measuring tape
1 ball or circle 27 cm in diameter (to represent the sun)
9 index cards

Procedure:

1. Use the information on the table below to draw circles of the correct size on the index cards to represent the planets. Label each planet.

2. Place the Sun at one end of a long hallway or outside on a sidewalk. Use the information from the table to measure the distance from the Sun for each of the inner planets (Mercury, Venus, Earth, Mars). Tape the planet cards to the wall or on sticks at the correct distances from the Sun.

3. If the space allows, continue with the remaining planets as far as possible. Note that on the scale used here, Neptune and Pluto will be over a kilometer from the sun. Identify large, visible landmarks or buildings which are the correct distances for the outermost planets.

Solar system to Scale: 1 m = 4 million km or 1 mm = 4,000km

	Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune	Pluto
Actual									
Distance from Sun (millions of km)	58	108	150	228	778	1,429	2,875	4,504	5,900
Diameter (in km)	4,878	12,104	12,756	6,796	139,823	116,464	50,700	48,900	3,000
To Scale									
Distance from Sun (in meters)	15	27	38	57	195	357	719	1,126	1,475
Diameter (in mm)	1	3	3	2	35	29	13	12	0.8

Questions to Ask During the Activity:

1. What are some examples of scale models with which you are familiar? [toy cars, doll houses, toy animal figures, etc.]

2. Ask students to compare data from the chart: which planet is the largest, which planets are the most similar in size, etc.

Why It Happens: Distances in space are extremely large and very difficult to imagine. This model allows students to compare relative sizes of the planets as well as the distances between them.

The distances from the Sun given for the planets is an average. Their orbital paths are not perfectly circular. At present, Neptune is actually further away from the sun than Pluto.

Adaptations for Participants with Disabilities:

- Allow students with visual impairments to walk the distances between planets and to feel the size of the planets.

Extensions: Challenge students to find spherical objects to represent the planets on this scale. Things like balls, beads, BBs, peas, etc. could be used.

Have students research the distance to the nearest stars outside our solar system. How far away would they be on this scale model?

Change the scale (e.g., 1 mm = 400 km); how does that change the size and distances between planets on the model?

References:

Lind, Karen, ed. Water, Stones & Fossil Bones. Washington, D.C.: National Science Teachers Association, 1991.

CLASSROOM PLANETARIUM

Grades		
3-8	whole class	60 min.

Description: Using a classroom planetarium, students will use a star chart and identify several constellations.

Materials for Whole Class:
Visqueen Black Plastic 10'x25'
2" wide tape (plastic, duct, or masking)
push pins
constellation templates (included in this activity)
scissors
2 floor fans
star charts (see Star Chart activity which follows)
flashlight (optional)

Safety: Control the number of students inside the planetarium at one time to avoid over-crowding and claustrophobia.

Procedure:

1. Spread out plastic and fold it in half end to end. You will end up with one folded piece measuring 10'X12.5'.

2. Tape the edges of plastic together on all sides, leaving an opening large enough to crawl through on three corners.

3. Set up a floor fan in two corners. Tape the plastic to the edges of the fans. Turn on the fans. The planetarium should inflate.

4. Have a student crawl inside and tape direction (north, south, east, west) signs to the walls.

5. Give each student a different constellation template. Using a star chart, have each student decide where their constellation appears in the sky (choose a day and time when all the constellations will appear).

6. Allow several (3-4) students to crawl into the planetarium at a time. Students should tape their constellation template to the ceiling of the planetarium at the place they think their constellation appears in the sky. You may want to check locations.

7. Once the constellations are placed correctly, students can enter again and use push pins to prick holes in the plastic through the templates. Remove the templates. Light will shine through the holes making "stars" in the planetarium "sky."

8. Allow students to re-enter the planetarium again once all the constellations are complete; have them try to identify each constellation.

Why It Happens: A constellation is a group of stars within a definite region of the sky. Many constellations were named by ancient peoples according to the figure the stars seemed to form in the sky. As the Earth revolves around the Sun, the constellations appear to travel westward across the sky. Because of this, certain constellations can be seen only during one of the seasons of the year.

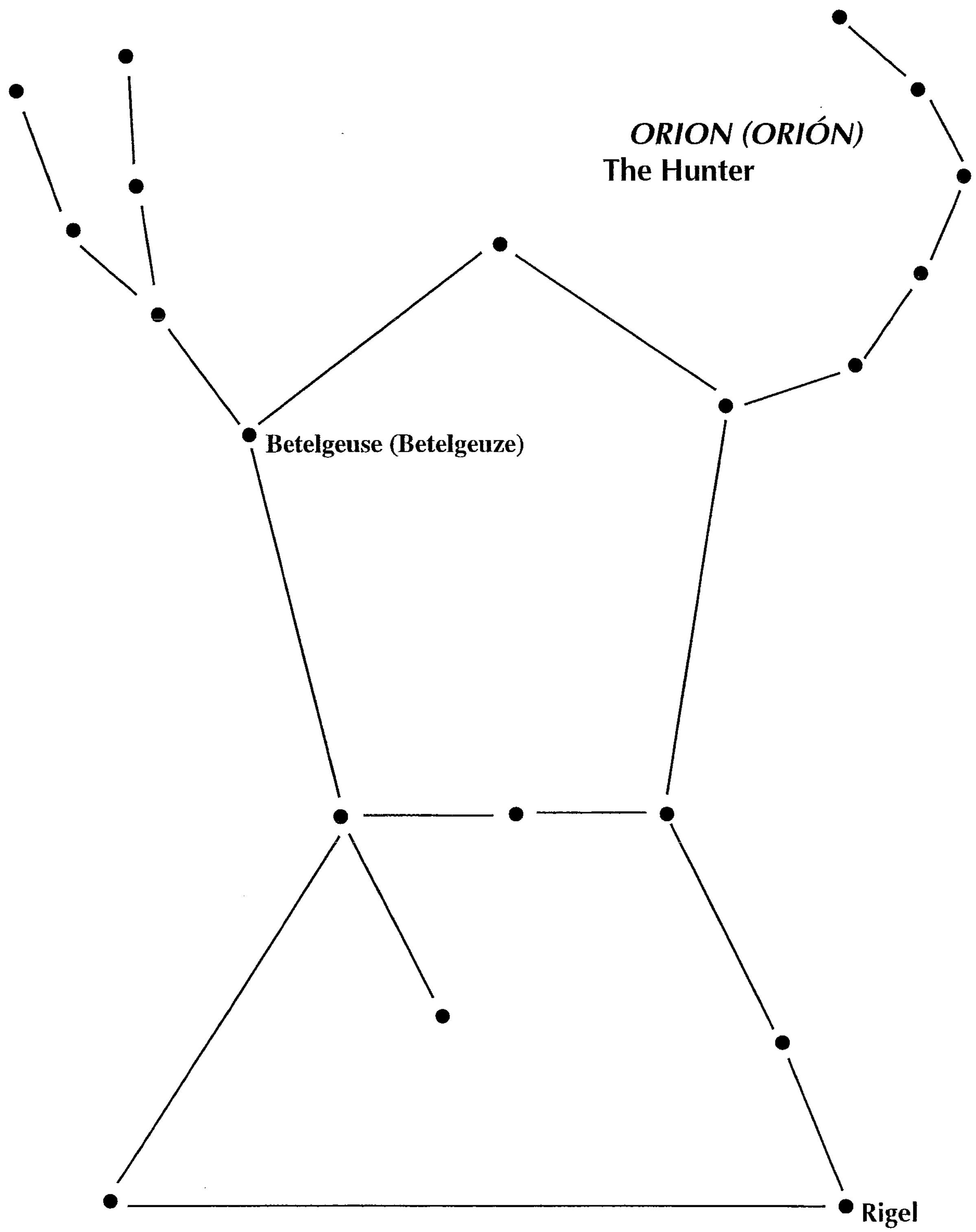
There are different types of star maps and charts that can be used to recognize stars and constellations. The Star Chart activity in this unit gives directions for having students construct a simple chart that can be used throughout the year.

Adaptations for Participants with Disabilities:

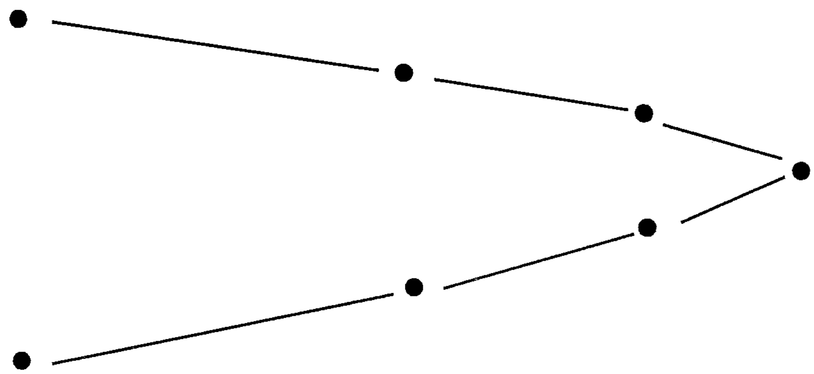
- You may need to modify the opening to allow students with physical disabilities to enter.
- Prepare constellation templates with holes for stars pre-punched to allow students with visual impairments to feel the relative positions of the stars in the constellations.
- If students with hearing impairments need visual contact for understanding instructions, be sure all instructions are given in the lighted classroom.

Extensions: Assign constellations to students several days ahead of time. Have students research the mythology behind their constellation.

Have students rename a constellation and create a myth for it.

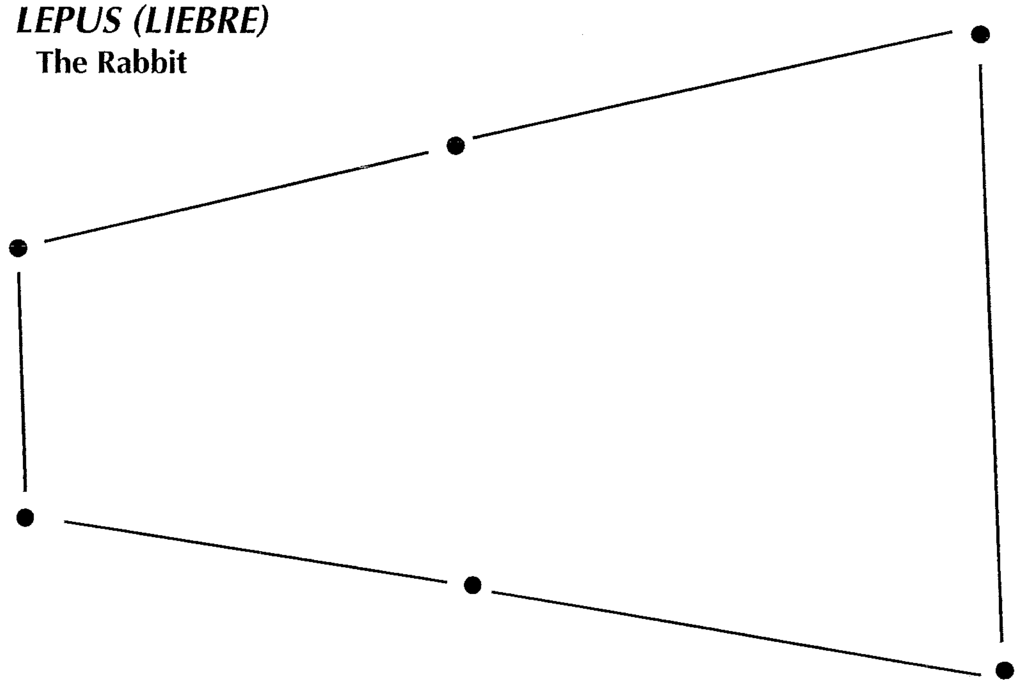

ORION (ORIÓN)
The Hunter
Betelgeuse (Betelgeuze)
Rigel

TAURUS (TAURO)
The Bull

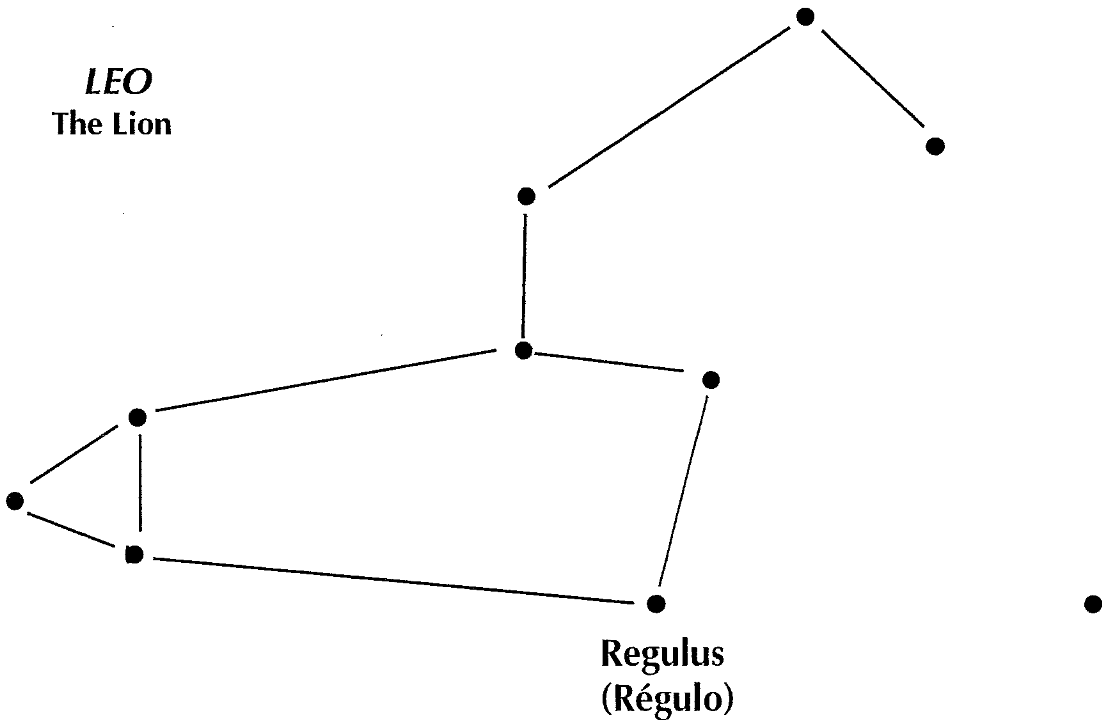


winter (invierno)

LEPUS (LIEBRE)
The Rabbit

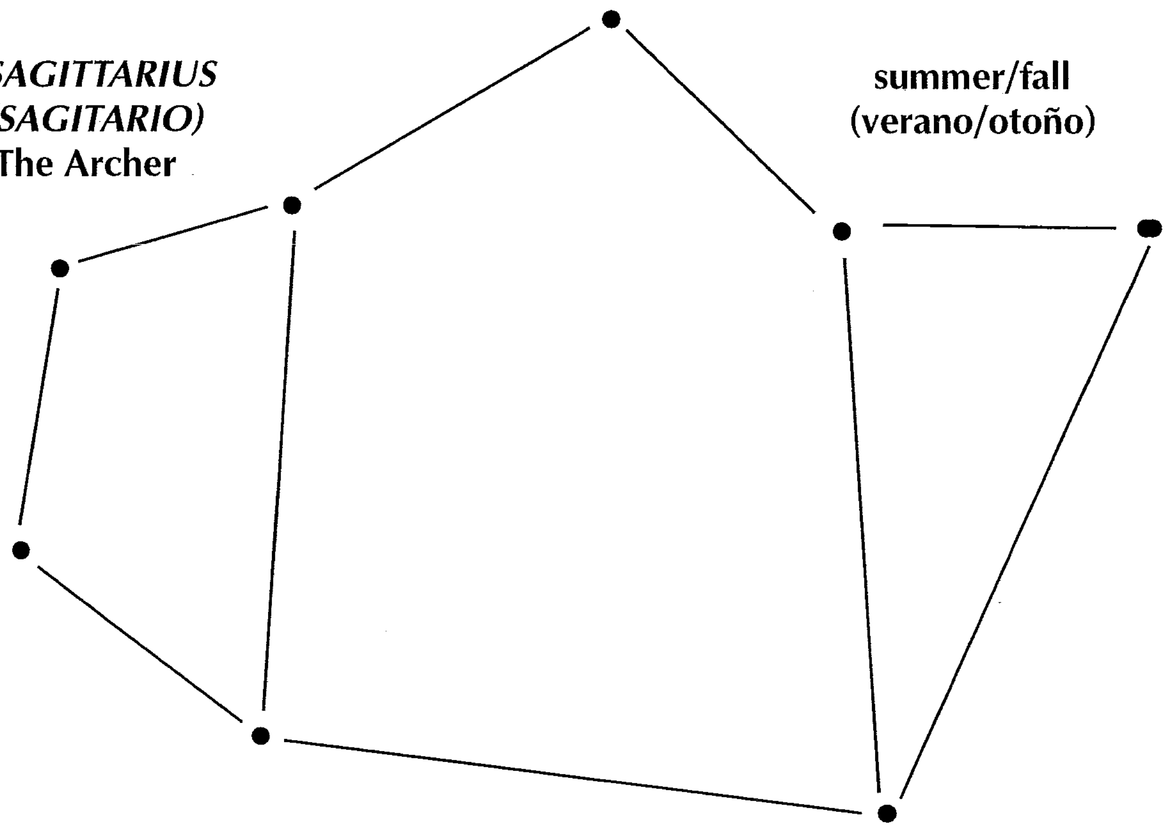


LEO
The Lion



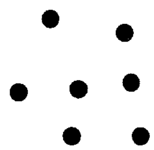
SAGITTARIUS
(SAGITARIO)
The Archer

summer/fall
(verano/otoño)



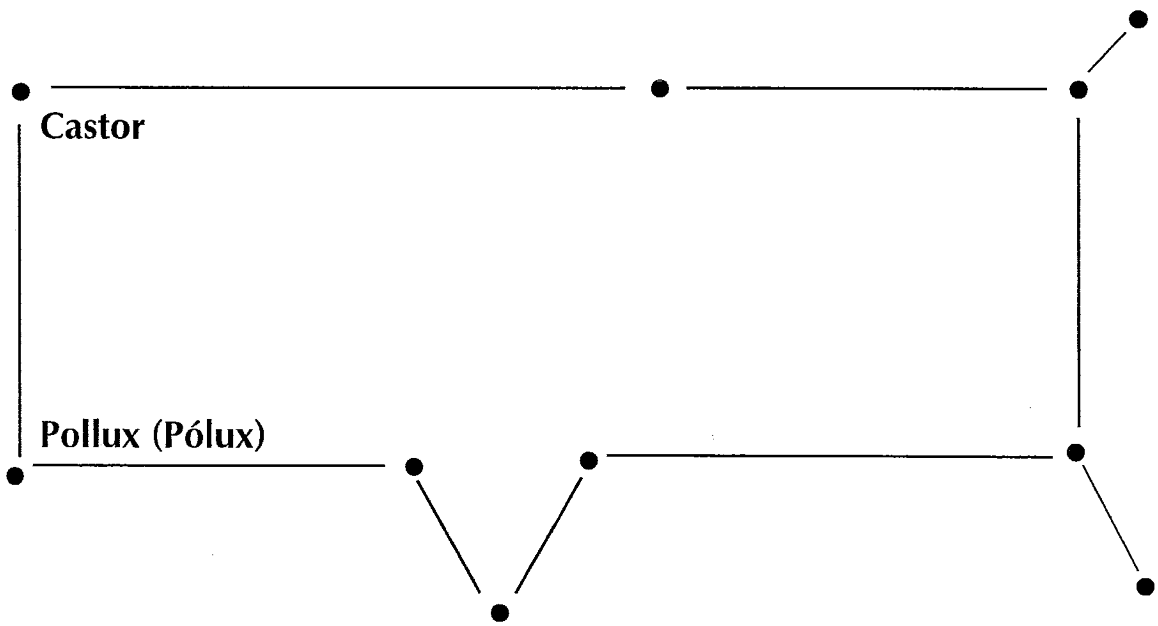
fall/winter/spring
(otoño/invierno/primavera)

PLEIADES
(PLÉYADES, CABRILLAS)
The Seven Sisters

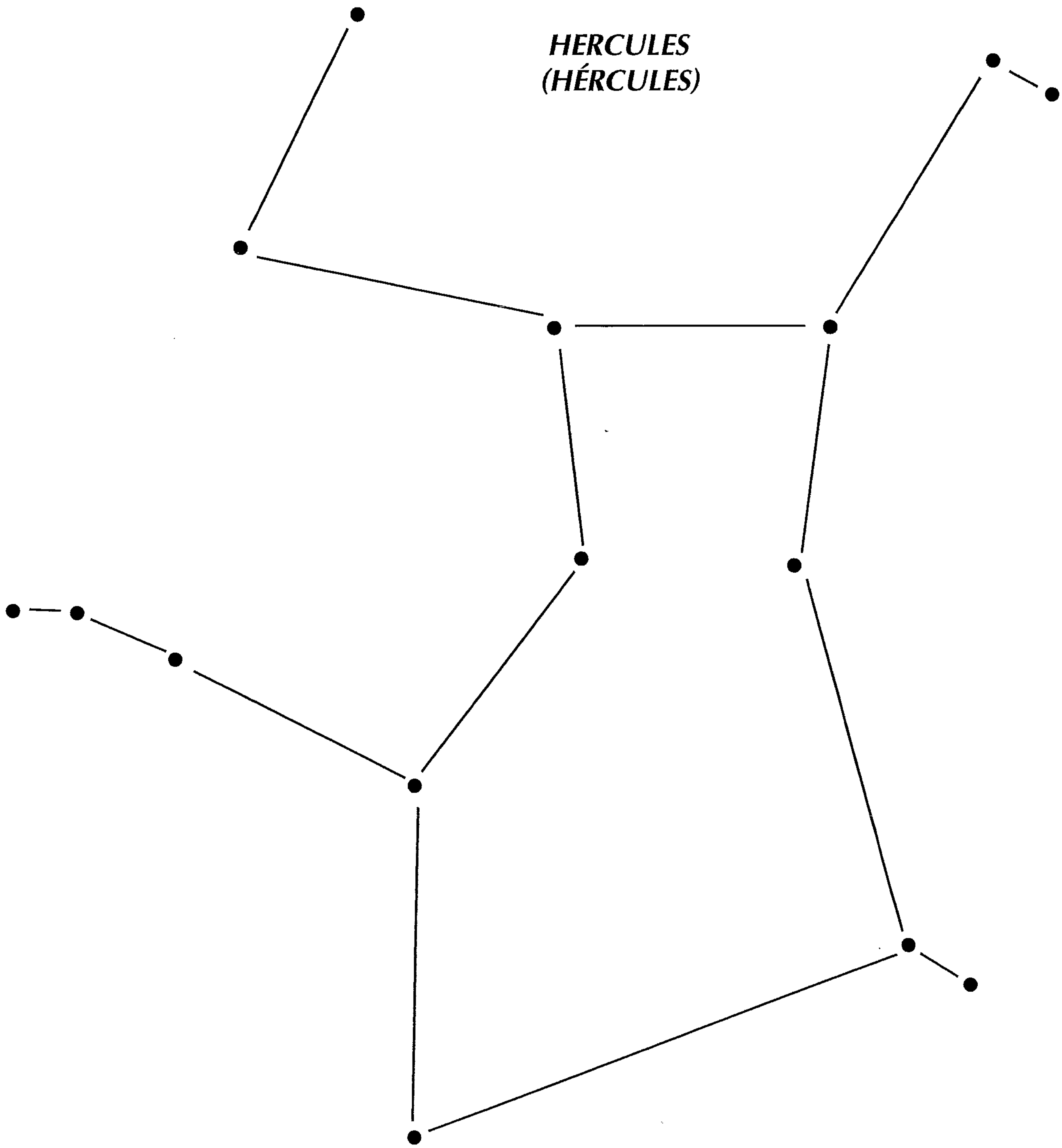


winter/spring
(invierno/primavera)

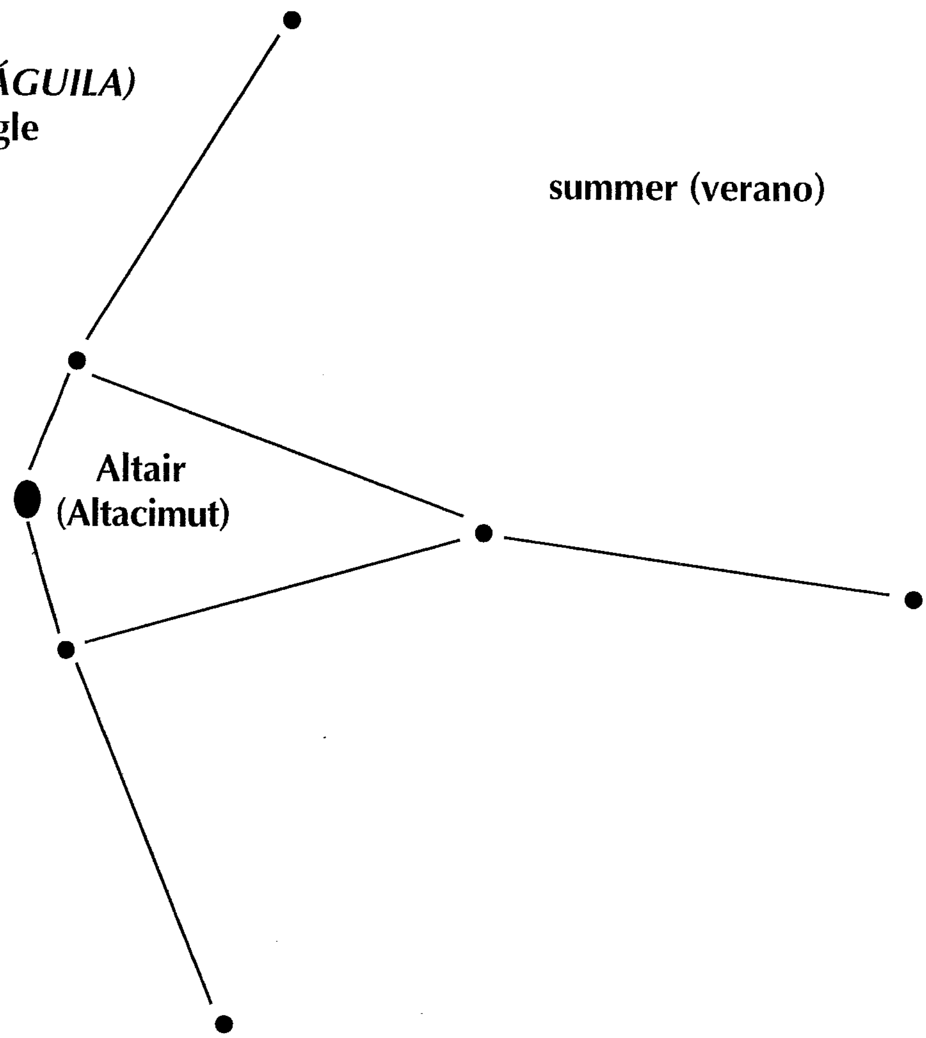
GEMINI (GÉMINIS)
The Twins



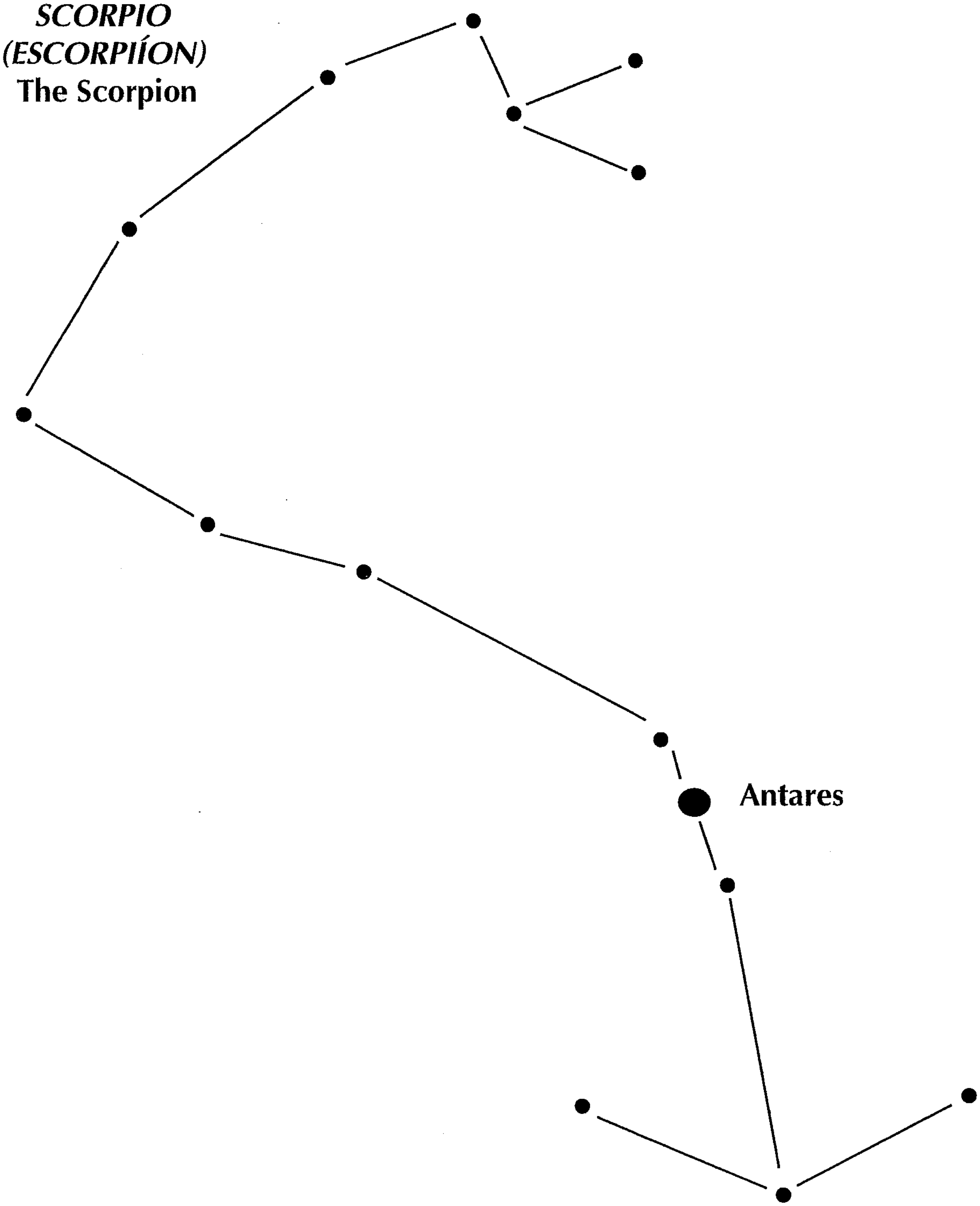
HERCULES
(HÉRCULES)



AQUILA (ÁGUILA)
The Eagle

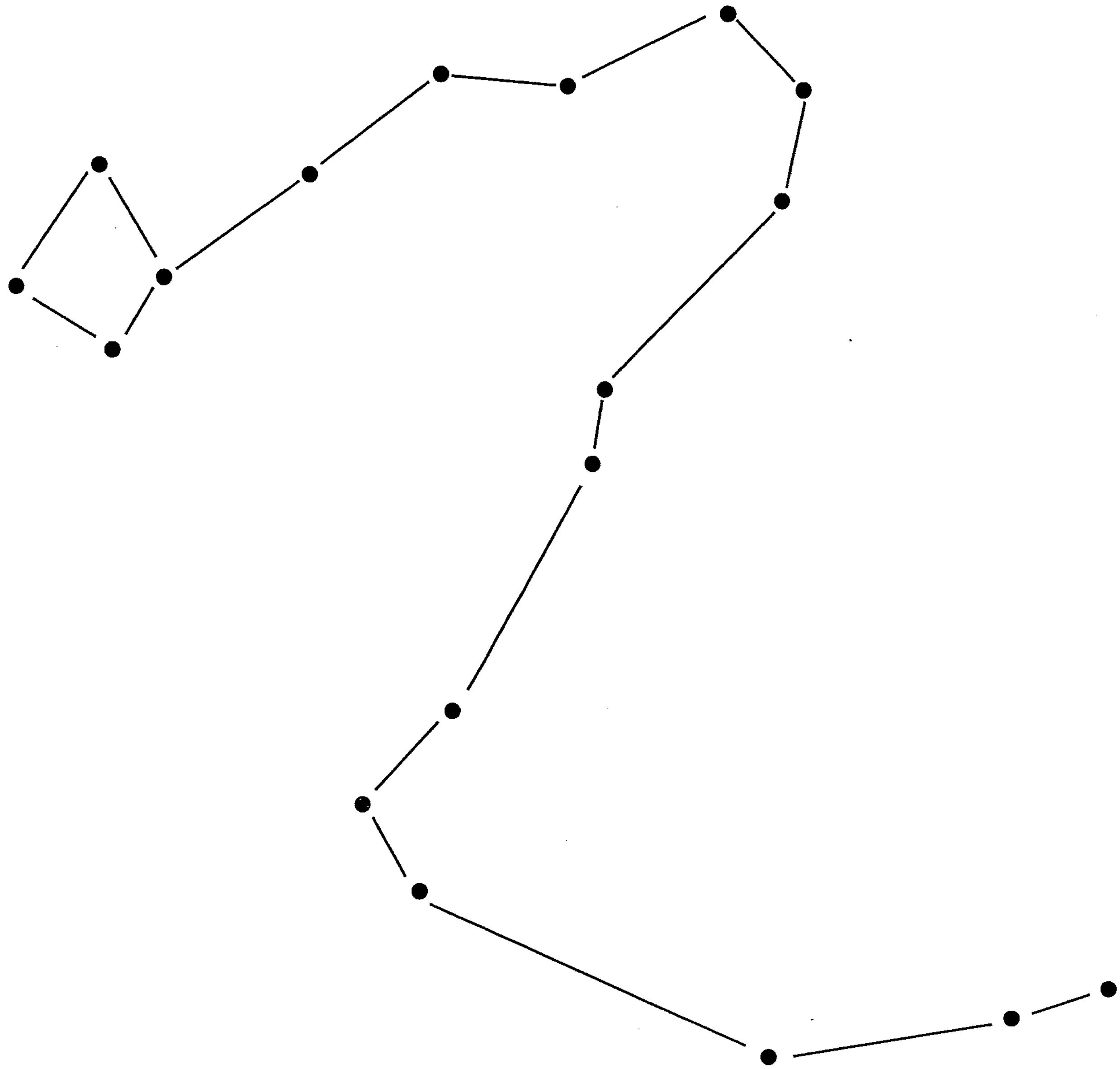


SCORPIO
(ESCORPIÍON)
The Scorpion

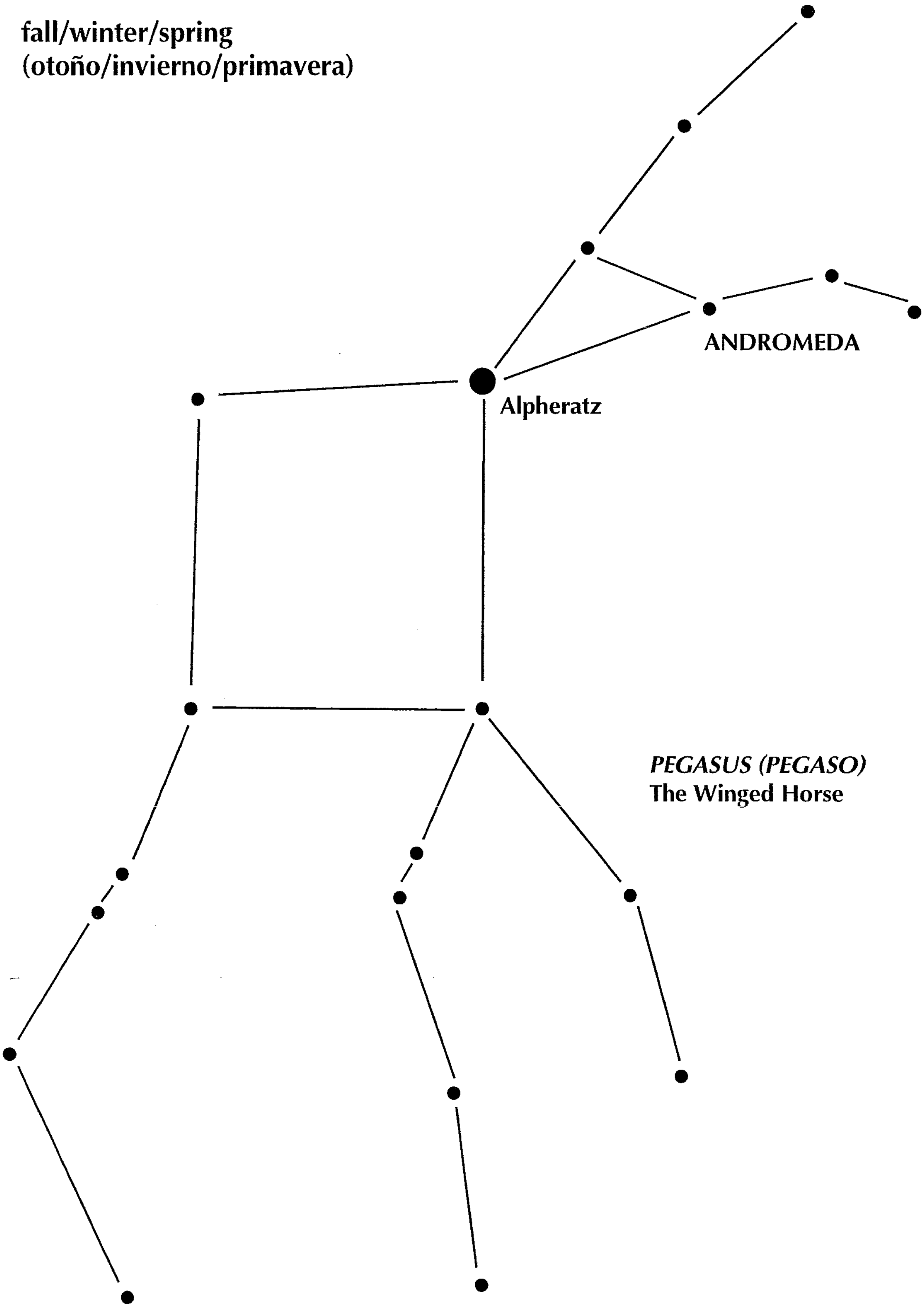


DRACO (DRAGÓN)
The Dragon

all year
(todo el año)

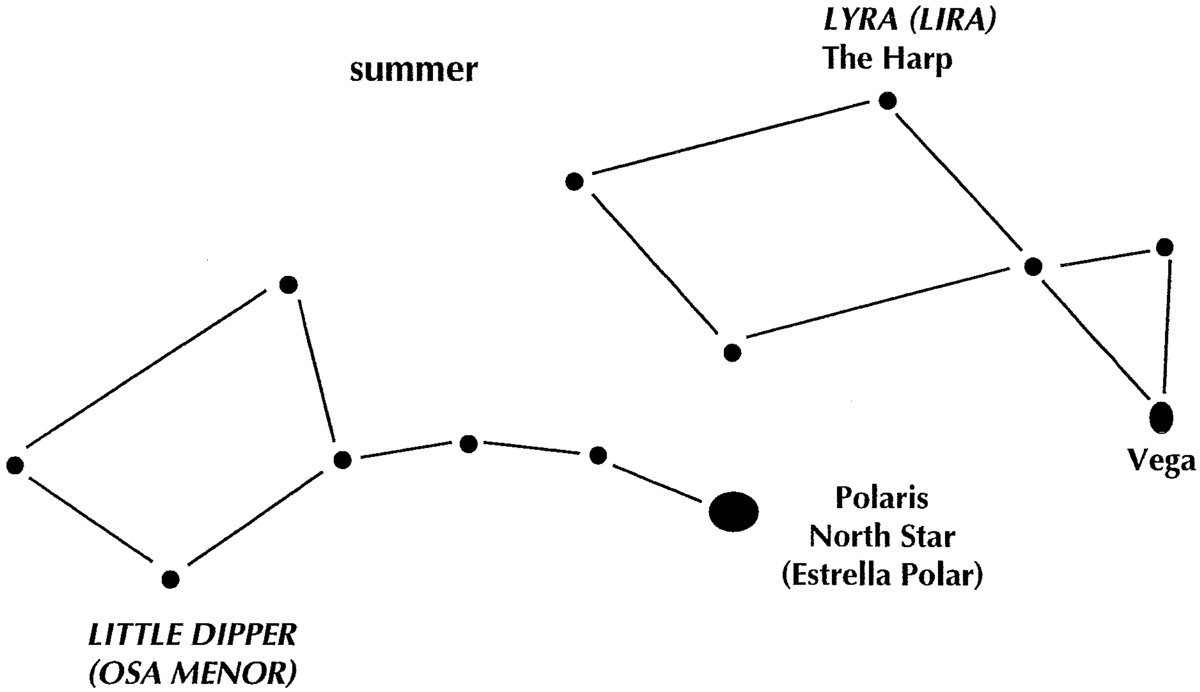


fall/winter/spring
(otoño/invierno/primavera)

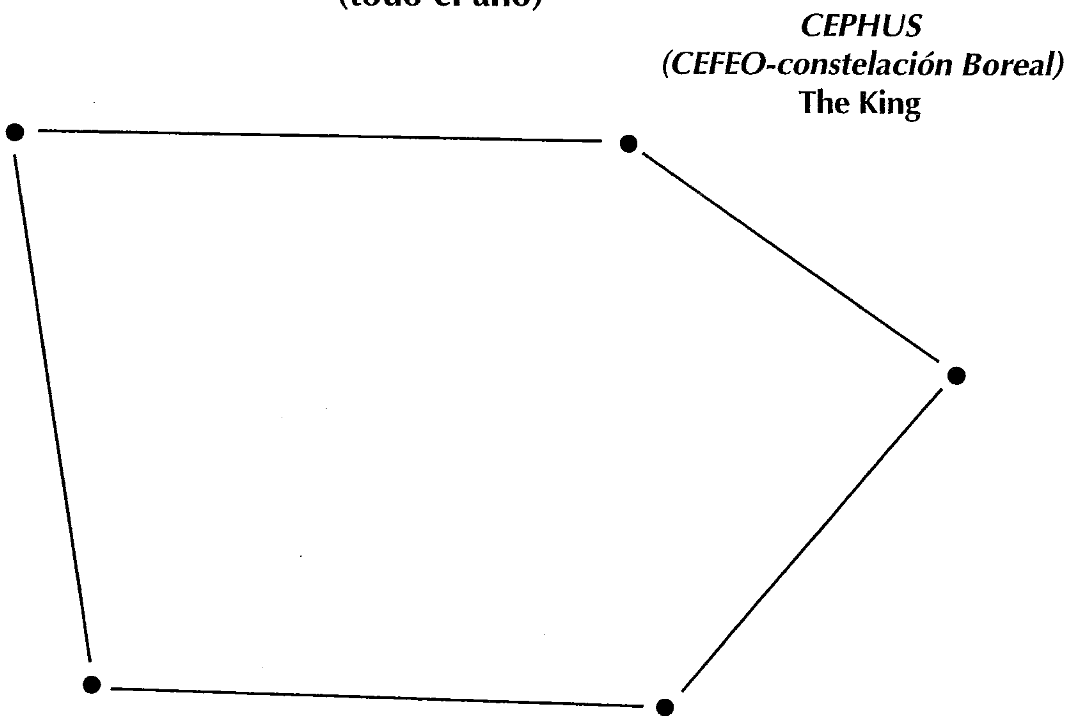


PEGASUS (PEGASO)
The Winged Horse

summer

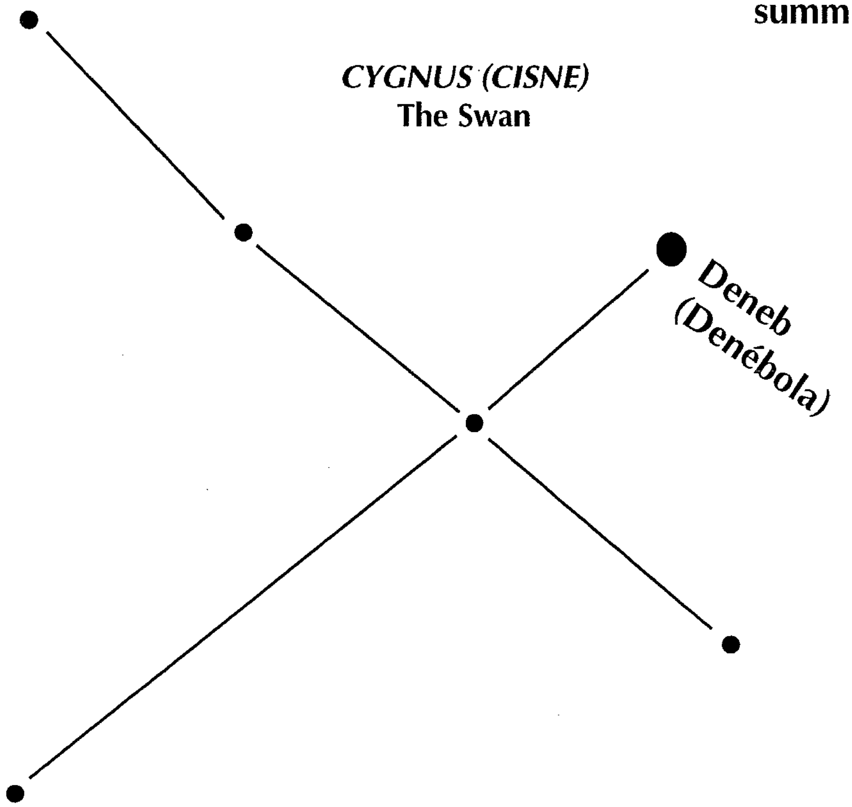


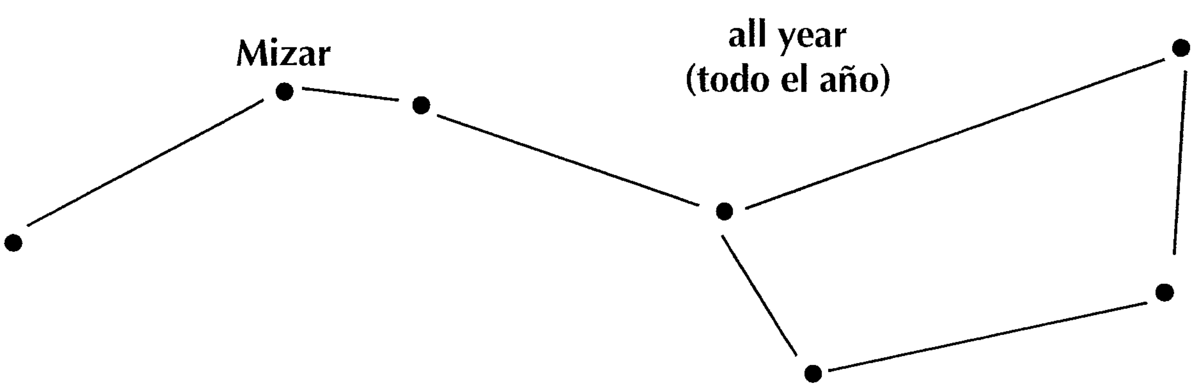
all year
(todo el año)



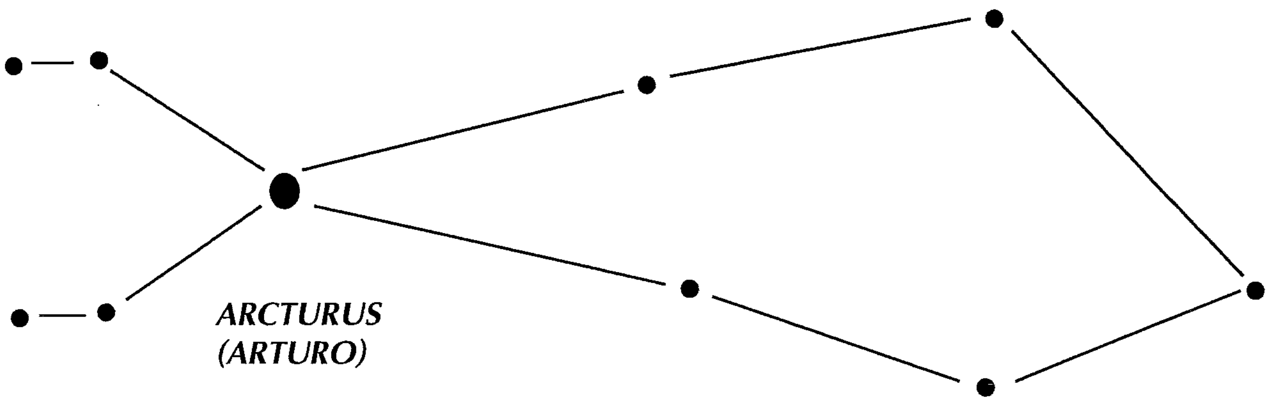
summer (verano)

CYGNUS (CISNE)
The Swan

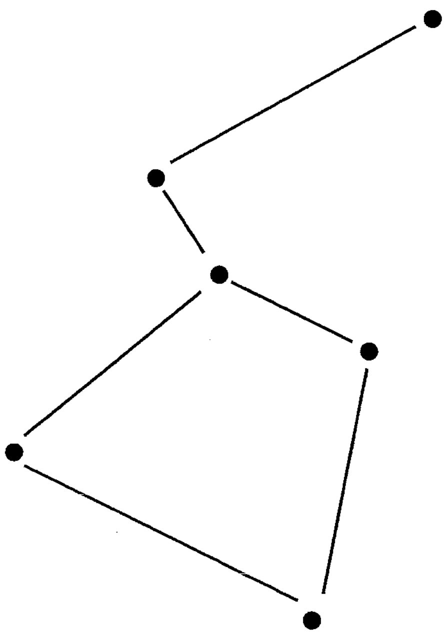




THE BIG DIPPER
(OSA MAYOR)

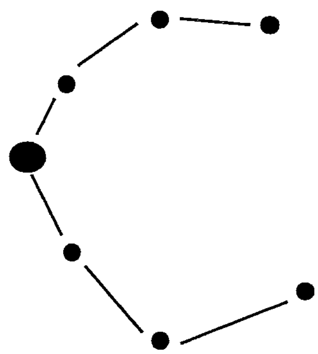


BOOTES (BOYERO)



CASSIOPEIA (CASIOPEA)
The Queen

all year
(todo el año)



CORONA BOREALIS
(CORONA BOREAL)

summer (verano)

STAR CHARTS

Grades		
3-8	individuals	20 min.

Description: Students will construct a simple star chart and use it to observe the night sky and identify constellations.

Materials for Each Student: copies of star chart and star chart viewer on card stock
blank card stock
scissors
staplers (1 for every 5 or 6 students, if possible)

Safety: Caution students to get parent permission to go outside at night to view the stars.

Procedure:

1. Pass out star charts and 1 blank piece of card stock for each student.

2. Have students cut out star chart and star chart viewer.

3. Have students staple star chart viewer to blank card stock.

4. To use star chart, insert chart into viewer. Rotate chart to the correct day and time. Demonstrate for the students how to use the chart and viewer.

5. Direct students to use the viewer and chart at home at night. To do so, they should go outside, face north, and hold the viewer over their heads. Use the chart to identify constellations.

Why It Happens: Since ancient times, people have imagined "pictures" of people, animals and objects in the sky. The groups of stars that form these pictures are called constellations.

As the Earth travels around the Sun, the stars visible during any season depend on the Earth's position relative to the sun. During the spring, you see a different section of the night sky than you will see in the fall and you will see different stars.

In the Northern Hemisphere you can see the stars appear to circle the North Star throughout one night. This apparent movement is caused by the Earth's rotation on its axis. The North Star does not appear to move because it is located almost directly above the Earth's north pole.

Adaptations for Participants with Disabilities:

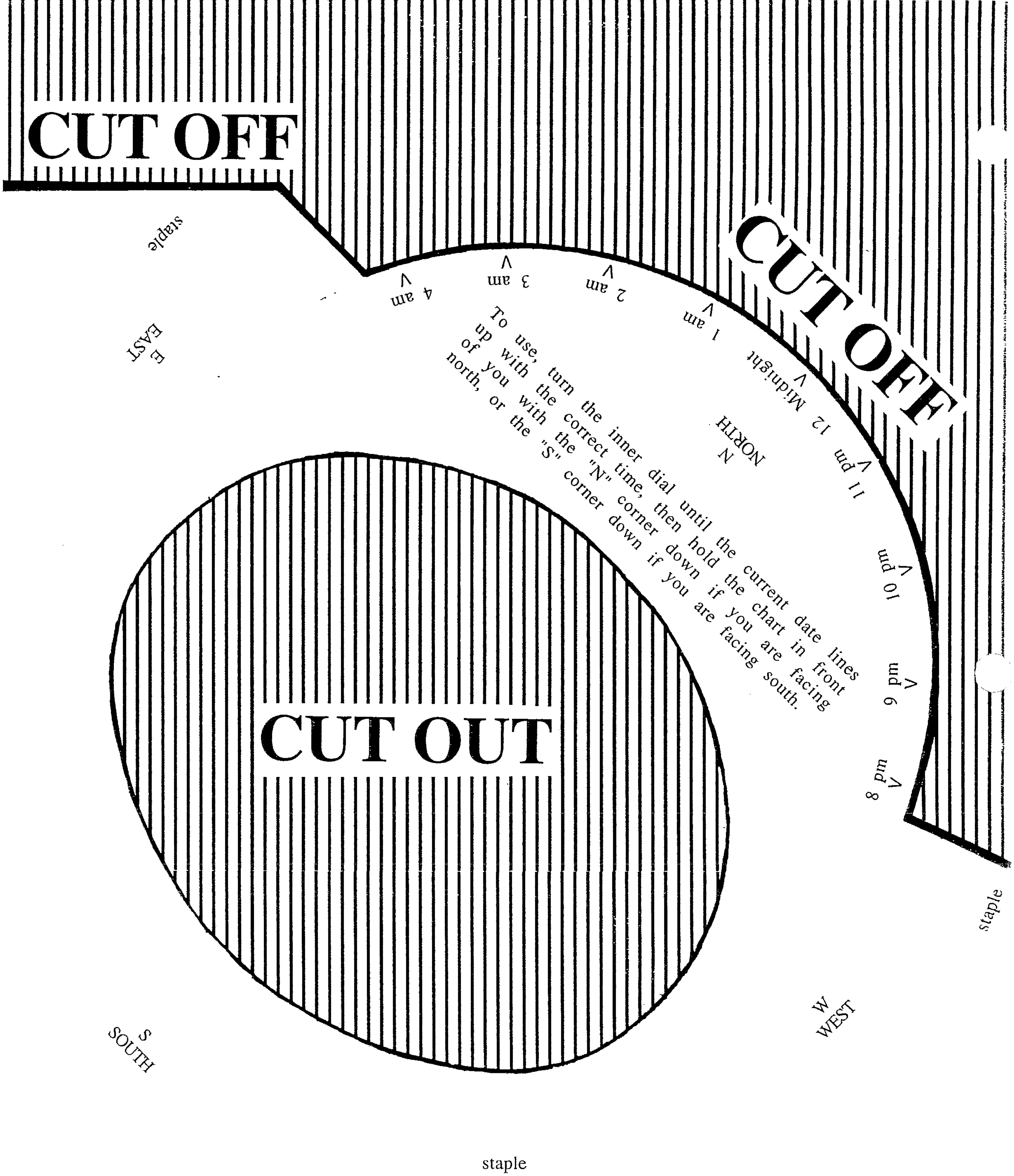
- Students with physical impairments may require assistance in using the star chart outside.

Extensions: Have students keep a journal of visible constellations over several weeks or months and record how the constellations appear to move.

Have students research the myths behind the constellation names.

References: National Optical Astronomy Observatories, Tucson, Arizona.


JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
CETUS
PISCIS AUSTRINUS
AQUARIUS
CAPRICORNUS
PEGASUS
ANDROMEDA
TRIANGULUM
ARIES
PERSEUS
AURIGA
CASSIOPEIA
CEPHEUS
LACERTA
EQUULEUS
DELPHINUS
AQUILA
SAGITTA
CYGNUS
Deneb
Albireo
LYRA
Vega
DRACO
URSA MINOR
URSA MAJOR
LYNX
GEMINI
Castor
Pollux
CANCER
CANIS MINOR
Procyon
MONOCEROS
PUPPIS
COLUMBA
LEPUS
ORION
LEO MINOR
LEO
Regulus
SEXTANS
HYDRA
CRATER
CORVUS
VIRGO
Spica
COMA BERENICES
CANES VENATICI
BOOTES
Arcturus
CORONA BOREALIS
HERCULES
SERPENS CAPUT
SERPENS CAUDA
OPHIUCHUS
LIBRA
SCORPIUS
Antares
SAGITTARIUS
LUPUS
CENTAURUS
PYXIS
ECLIPTIC
MILKY WAY



Do It Yourself Star Finder

USING an ASTROLABE

Grades		
4-8	individuals or pairs	20 min. in class; observation time at home

Description: Students will construct a simple astrolabe and use it to make observations of the night sky.

Materials per Person:
1 straw
tape
6 inches of string
1 paper clip or small metal washer
1 copy of protractor

Safety: Caution students to **never look directly at the sun** with the astrolabe.

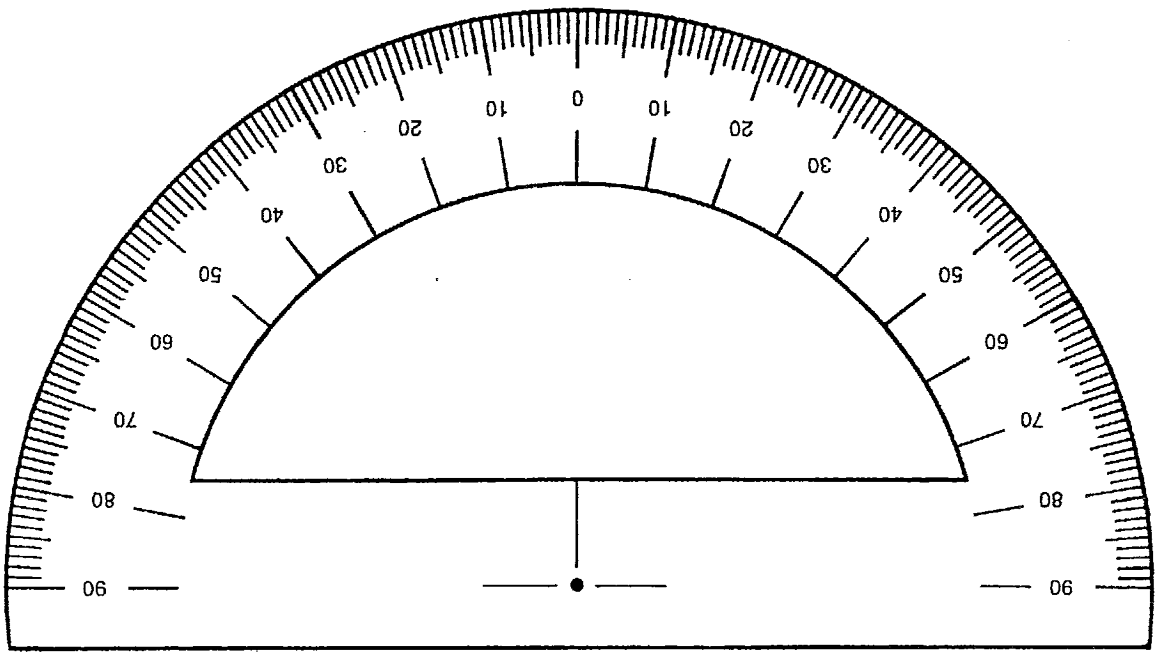
Procedure:

1. Follow the instructions on the Student Activity Sheet to make an astrolabe and use it to show students the finished product. Then have students follow the instructions to make their own astrolabe.
2. Have students practice using the astrolabe on objects in and around the clasroom. Discuss variations in the readings.
3. Have students take their astrolabes home to make observations of the night sky as directed on the Student Activity Sheet.

Questions to Ask During the Activity:

1. Why are astrolabes more reliable for measuring the position of stars than for measuring the position of objects in the classroom? [Stars are so far away that differences resulting from the position of the viewer are negligible.]

Why It Happens: Astrolabes were used by ancient astronomers to measure the angle above the horizon of an object in the sky. If the object is relatively close to the viewer, then differences in position and height of the viewer can produce variations in measurements.


0
10
20
30
40
50
60
70
80
90

Using an Astrolabe
Student Activity Sheet

Description: An astrolabe is an ancient device used to observe and calculate the positions of stars and planets. You will construct a simple astrolabe and use it to make observations of the night sky.

Materials Per Person:
1 straw
tape
6 inches of string
a paper clip or small metal washer
a copy of a protractor
1 piece of tag board or cardboard

Safety: **Never look directly at the sun with the astrolabe (or without it, either!)**

Procedure:

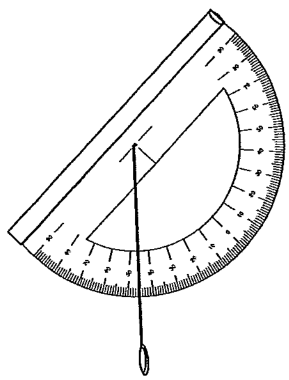
1. Cut out the protractor. Glue it to a piece of tag board or cardboard.

2. Punch a hole through the center dot on the protractor.

3. Thread the string through the hole. Tape the thread to the back side of the protractor cut-out.

4. Tie the paper clip or washer to the loose end of the string.

5. Tape the straw along the straight edge of the protractor. Be sure the straw is attached to the protractor evenly.



6. To use the astrolabe, hold the straw in front of you and look through it to "sight" an object. Allow the string to move freely as the astrolabe tips up. Once the object is sighted, place your finger over the string to hold it in place against the protractor. Look at the angle measurement marked by the string; this is the altitude, or height (in degrees) above the horizon, of the object you sighted. (Use the charts which follow to record your observations.)

Observations of the Night Sky

I. Stars

Measure the altitude of any star. Repeat the measurement, standing in the same place, with the same star at least three times in a row. Record your observations below. [Optional: use your star chart to identify the star.]

Star Name ______________________________

measurements			
	1st	**2nd**	**3rd**
altitude			

II. New Moon

Check a calendar or the newspaper for the date of the next new moon. Begin this activity about four days after the new moon. At the same time each clear night for the next 10 nights, and standing in the same place, measure the altitude of the moon. Record your observations below.

Date	Time	Altitude of the Moon

Describe any patterns you detect in the position of the moon.

III. Full Moon

Check the calendar or newspaper for the date of the next full moon. On that night, measure the altitude of the full moon every hour for two or three hours beginning about 7 pm. Be sure to stand in the same place each time. Record your observations below.

Date	Time	Altitude

How much does the altitude change in one hour?

Usando un Astrolabio
Hoja de Actividad para el Estudiante

Descripción: Los estudiantes construirán un astrolabio simple y lo usarán para hacer observaciones nocturnas del firmamento.

Materiales: 1 popote
cinta adhesiva
un cordón de 6 pulgadas de largo
un sujetador de papeles o una rondana de metal
una copia de un transportador
una etiqueta o un trozo de cartoncillo

Medidas de Seguridad: **NUNCA VER DIRECTAMENTE AL SOL** con el astrolabio (¡Y tampoco sin el!)

Procedimiento:

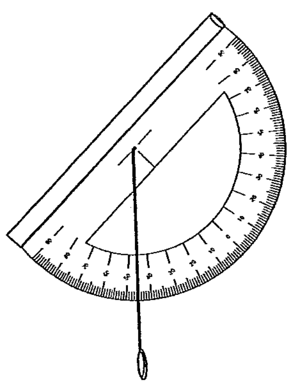
1. Recortar el transportador. Pegarlo a la etiqueta o trozo de cartoncillo.

2. Hacer una perforación en el punto central del transportador.

3. Pasar el cordón por el agujero. Pegar el cordón con cinta adhesiva por el reverso del transportador recortado.

4. Atar el sujetador de papeles o la rondana metálica al extremo suelto del cordón.

5. Pegar el popote con cinta adhesiva en la orilla recta del transportador. Asegurarse de que el popote este unido uniformemente al transportador.



6. Para usar el astrolabio, sostener el popote frente a tí y mirar a través de él para "observar" un objeto. Dejar que el cordón se mueva libremente mientras el astrolabio lo toca ligeramente. Una vez que el objeto ha sido observado, colocar el dedo sobre el cordón para mantenerlo contra el transportador. Mirar el ángulo medido y marcado por el cordón; esta es la altitud o altura (en grados) sobre el horizonte, del objeto observado.

Observaciones Nocturnas del Firmamento

I. Estrellas

Medir la altitud de cualquier estrella. Repetir las medidas por lo menos tres veces seguidas con la misma estrella y parándose en el mismo lugar. Anotar sus observaciones en la parte de abajo. [Opcional: Usar su mapa de estrellas para identificar la estrella.]

Nombre de la Estrella ____________________

Altitud:

Medida por primera vez ____________________

Medida por segunda vez ____________________

Medida por tercera vez ____________________

II. Luna Nueva

Consultar un calendario o el periódico para saber la fecha de la siguiente luna nueva. Empezar esta actividad mas o menos cuatro días después de que empiece la luna nueva. Al mismo tiempo, cada noche clara, por las siguientes diez noches y parado en el mismo lugar, medir la altitud de la luna. Anotar sus observaciones en la tabla de abajo.

Fecha	Hora	Altitud de la Luna

Describir cualquier razgo que se detecte en la posición de la luna.

III. Luna Llena

Revisar el calendario o el periódico para saber la fecha de la siguiente luna llena. En ésa noche medir la altitud de la luna llena cada hora, por dos o tres horas, empezando más o menos a las 7 p.m. Asegurarse de estar parado en el mismo lugar cada vez. Anotar sus observaciones en la tabla de abajo.

Fecha	Hora	Altitud de la Luna Llena

¿Cuánto cambió la altitud en una hora?