Glencoe Science

Chapter Resources

The Sun-Earth-Moon System

Includes:

Reproducible Student Pages

ASSESSMENT

- ✔ Chapter Tests
- ✔ Chapter Review

HANDS-ON ACTIVITIES

- ✔ Lab Worksheets for each Student Edition Activity
- ✔ Laboratory Activities
- ✔ Foldables–Reading and Study Skills activity sheet

MEETING INDIVIDUAL NEEDS

- ✔ Directed Reading for Content Mastery
- ✔ Directed Reading for Content Mastery in Spanish
- ✔ Reinforcement
- ✔ Enrichment
- ✔ Note-taking Worksheets

TRANSPARENCY ACTIVITIES

- ✔ Section Focus Transparency Activities
- ✔ Teaching Transparency Activity
- ✔ Assessment Transparency Activity

Teacher Support and Planning

- ✔ Content Outline for Teaching
- ✔ Spanish Resources
- ✔ Teacher Guide and Answers

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Reproducible Student Pages

Reproducible Student Pages

Hands-On Activities

TRY AT HOME Mini LAB

Making Your Own Compass

Procedure

WARNING: *Use care when handling sharp objects.*

1. Cut off the bottom of a **plastic foam cup** to make a polystyrene disk.
2. Magnetize a **sewing needle** by continuously stroking the needle in the same direction with a **magnet** for 1 min.
3. **Tape** the needle to the center of the foam disk.
4. Fill a **plate** with **water** and float the disk, needle side up, in the water.

Analysis

1. What happened to the needle and disk when you placed them in the water? Why did this happen?

2. Infer how ancient sailors might have used magnets to help them navigate on the open seas.

TRY AT HOME Mini LAB

Comparing the Sun and the Moon

Procedure

1. Find an area where you can make a chalk mark on **pavement or similar surface.**
2. Tie a piece of **chalk** to one end of a 200-cm-long **string.**
3. Hold the other end of the string to the pavement.
4. Have a friend pull the string tight and walk around you, drawing a circle (the Sun) on the pavement.
5. Draw a 1-cm-diameter circle in the middle of the larger circle (the Moon).

Analysis

1. How big is the Sun compared to the Moon?

2. The diameter of the Sun is 1.39 million km. The diameter of Earth is 12,756 km. Draw two new circles modeling the sizes of the Sun and Earth. What scale did you use?

Name Date Class

Moon Phases and Eclipses

Lab Preview

Directions: *Answer these questions before you begin the Lab.*

1. What safety symbols are used in this lab?

2. What precautions should you take with this lab?

In this lab, you will demonstrate the positions of the Sun, the Moon, and Earth during certain phases and eclipses. You also will see why only a small portion of the people on Earth witness a total solar eclipse during a particular eclipse event.

Real-World Question

Can a model be devised to show the positions of the Sun, the Moon, and Earth during various phases and eclipses?

Materials

light source (unshaded)	globe
polystyrene ball	pencil

Goals

- **Model** moon phases.
- **Model** solar and lunar eclipses.

Safety Precautions

Procedure

1. Review the illustrations of Moon phases and eclipses shown in Section 2.

2. Use the light source as a Sun model and a polystyrene ball on a pencil as a Moon model. Move the Moon around the globe to duplicate the exact position that would have to occur for a lunar eclipse to take place.

3. Move the Moon to the position that would cause a solar eclipse.

4. Place the Moon at each of the following phases: first quarter, full moon, third quarter, and new moon. Identify which, if any, type of eclipse could occur during each phase. Record your data in the table on the next page.

5. Place the Moon at the location where a lunar eclipse could occur. Move it slightly toward Earth, then away from Earth. Note the amount of change in the size of the shadow.

6. Repeat step 5 with the Moon in a position where a solar eclipse could occur.

LAB (continued)

Data and Observations

Moon Phase	Observations
First quarter	
Full	
Third quarter	
New	

Conclude and Apply

1. **Identify** which phase(s) of the Moon make(s) it possible for an eclipse to occur.

2. **Describe** the effect of a small change in distance between Earth and the Moon on the size of the umbra and penumbra.

3. **Infer** why a lunar and solar eclipse do not occur every month.

4. **Explain** why only a few people have experienced a total solar eclipse.

5. **Diagram** the positions of the Sun, Earth, and the Moon during a first quarter moon.

6. **Infer** why it might be better to call a full moon a half moon.

Communicating Your Data

Communicate your answers to other students.

Tilt and Temperature

Lab Preview

Directions: *Answer these questions before you begin the Lab.*

1. Why are the particular safety precautions suggested?

2. At what possible angle do you think your paper will be the hottest?

If you walk on blacktop pavement at noon, you can feel the effect of solar energy. The Sun's rays hit at the highest angle at midday. Now consider the fact that Earth is tilted on its axis. How does this tilt affect the angle at which light rays strike an area on Earth? How is the angle of the light rays related to the amount of heat energy and the changing seasons?

Real-World Question

How does the angle at which light strikes Earth affect the amount of heat energy received by any area on Earth?

Materials

tape
black construction paper (one sheet)
gooseneck lamp with 75-watt bulb
Celsius thermometer
watch
protractor

Goals

- **Measure** the temperature change in a surface after light strikes it at different angles.
- **Describe** how the angle of light relates to seasons on Earth.

Safety Precautions

WARNING: *Do not touch the lamp without safety gloves. The lightbulb and shade can be hot even when the lamp has been turned off. Handle the thermometer carefully. If it breaks, do not touch anything. Inform your teacher immediately.*

Procedure

1. Choose three angles that you will use to aim the light at the paper.
2. **Determine** how long you will shine the light at each angle before you measure the temperature. You will measure the temperature at two times for each angle. Use the same time periods for each angle.
3. In the table on the next page, record the temperature the paper reaches at each angle and time.
4. Form a pocket out of a sheet of black construction paper and tape it to a desk or the floor.
5. Using the protractor, set the gooseneck lamp so that it will shine on the paper at one of the angles you chose.
6. Place the thermometer in the paper pocket. Turn on the lamp. Use the thermometer to measure the temperature of the paper at the end of the first time period. Continue shining the lamp on the paper until the second time period has passed. Measure the temperature again. Record your data in your data table.
7. Turn off the lamp until the paper cools to room temperature. Repeat steps 5 and 6 using your other two angles.

LAB (continued)

Data and Observations

Temperature Data

Angle of Lamp	Initial Temperature (˚C)	Temperature at ___ Minutes/Seconds	Temperature at ___ Minutes/Seconds
First angle			
Second angle			
Third angle			

Conclude and Apply

1. **Describe** your experiment. Identify the variables in your experiment. Which were your independent and dependent variables?

2. **Graph** your data using a line graph. Describe what your graph tells you about the data.

3. **Describe** what happened to the temperature of the paper as you changed the angle of light.

4. **Predict** how your results might have been different if you used white paper. Explain why.

5. **Describe** how the results of this experiment apply to seasons on Earth.

Communicating Your Data

Compare your results with those of other students in your class. **Discuss** how the different angles and time periods affected the temperatures.

LAB 1 Laboratory Activity

Earth's Spin

The speed at which Earth turns on its axis can be described in two ways. The velocity of rotation refers to the rate at which Earth turns on its axis. Velocity of rotation refers to Earth as a whole. For any point on Earth's surface, the speed of Earth's rotation can be described as its instantaneous linear velocity. This velocity is the speed of the point as it follows a circular path around Earth.

Strategy

You will determine the instantaneous linear velocity of some points on Earth.
You will compare the linear velocities of points at different locations on Earth.

Materials

globe (mounted on axis)
tape (adhesive)
string
meterstick
stopwatch

Procedure

Part A

1. Place small pieces of adhesive tape on the globe along the Prime Meridian at the equator, at 30° N latitude, at 60° N latitude, and at the North Pole.
2. Line up the tape with the metal circle above the globe; see Figure 1.
3. With your finger on the globe, move it west to east for one second; see Figure 2.
4. For each location marked by tape, measure the distance from the Prime Meridian to the metal circle. Use the string and the meterstick to get accurate distances. Record the distances in Table 1.
5. Realign the metal circle with the pieces of tape. Move the globe west to east for 2 s. Record the distances from the tapes to the metal circle in Table 1.
6. Repeat step 5, moving the globe for 3 s. Record your results in Table 1.

Part B

Calculate the speed of each point for each trial. Record the speeds in Table 2. Use the formula:

velocity (cm/s) = distance (cm)/time (s)

Figure 1

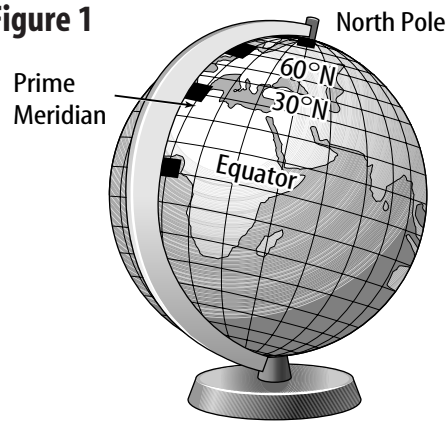
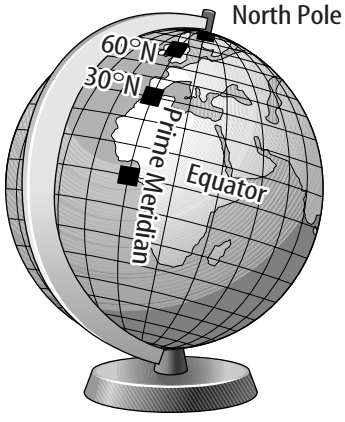


Figure 2



Laboratory Activity 1 (continued)

Data and Observations

Table 1

Latitude	Distance (cm)		
	1 s	2 s	3 s
Equator			
30˚ N			
60˚ N			
North Pole			

Table 2

Latitude	Velocity (cm/s)		
	Trial 1	Trial 2	Trial 3
Equator			
30˚ N			
60˚ N			
North Pole			

Questions and Conclusions

1. Which point moved the farthest distance in all three trials?

_____

2. Which point moved the least distance in all three trials?

_____

3. Which point did not move at all in the three trials?

_____

4. On what does the linear velocity of a point depend?

_____

5. How does the linear velocity change as you move from the equator to the poles?

_____

Strategy Check

_____ Can you determine instantaneous linear velocity?

_____ Can you see that the linear velocity is not the same for all points on Earth?

LAB 2 Laboratory Activity

Earth's Shape

You've probably seen photographs of Earth taken by satellites in space. Such photographs clearly show Earth's round shape. Early astronomers didn't have spacecraft to help them study Earth. They had to rely on observation and measurement. In this activity, you'll explore some methods used by early astronomers to determine Earth's true shape.

Strategy

You will demonstrate evidence of Earth's shape.
You will describe the type of shadow cast by Earth during a lunar eclipse.

Materials

small piece of cardboard
scissors
basketball
flashlight
textbook

Procedure

1. Cut out a triangular piece of cardboard so that each side measures approximately 6 cm.
2. Hold a basketball at eye level about 33 cm from your eye. Have your partner slowly move the cardboard up and over the basketball from the opposite side.
3. In the space below, sketch the cardboard as it appears when the top of the cardboard first comes in sight over the basketball. Make another sketch of the cardboard as it appears when fully visible above the basketball.
4. Darken the room. Use a flashlight to cast a shadow of a textbook against the wall. Do the same for the basketball. In the space below, draw the shadows of the textbook and the basketball.

Data and Observations

Laboratory Activity 2 (continued)

Questions and Conclusions

1. Compare and contrast your two drawings of the cardboard.

2. How were your different views of the cardboard similar to the view of a ship on the horizon approaching shore?

3. How did the cardboard activity demonstrate evidence of Earth's shape?

4. Compare and contrast your drawings of the shadows cast by the basketball and the textbook.

5. During a lunar eclipse, Earth casts a shadow on the Moon. What type of shadow would Earth cast if it were flat? What type of shadow does Earth cast on the Moon during a lunar eclipse?

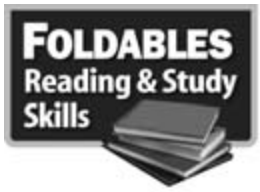
6. How do the shadows you observed demonstrate evidence of Earth's shape?

7. Can you think of any other evidence that demonstrates Earth's round shape? Describe this evidence.

Strategy Check

_____ Can you demonstrate evidence of Earth's shape?

_____ Can you describe the type of shadow cast by Earth during a lunar eclipse?



The Sun-Earth-Moon System

Directions: *Use this page to label your Foldable at the beginning of the chapter.*

Movement

Effects

Earth rotates on its axis.

Earth revolves in an orbit around the Sun.

day and night

the passage of one year

The Moon moves into Earth's shadow.

The Moon moves directly between the Sun and Earth.

lunar eclipse

solar eclipse

Earth's axis is tilted.

seasons

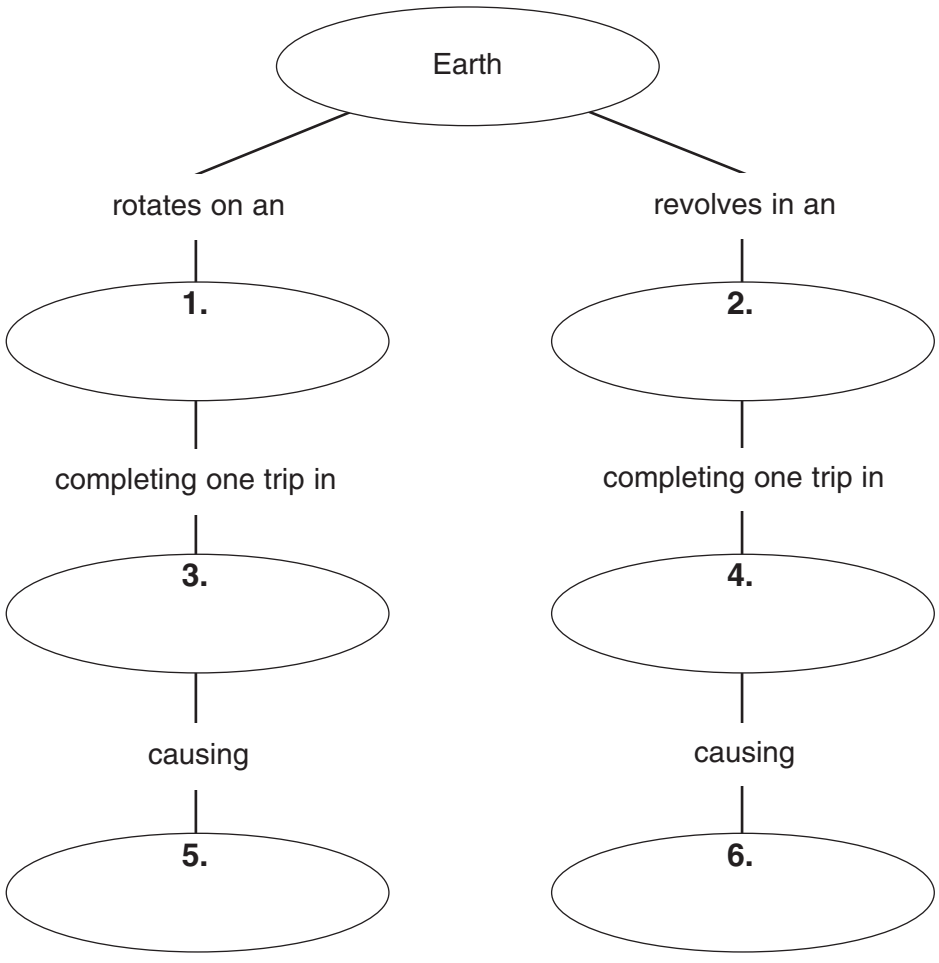
Meeting Individual Needs

Directed Reading for Content Mastery

Overview
The Sun-Earth-Moon System

Directions: *Use the following terms to complete the concept map below.*

the passage of a year	**orbit**	**day and night**
about 365 days	**axis**	**24 hours**



Directions: *Answer the following questions on the lines provided.*

7. What phase comes after the new moon?_____ What phase comes after the full moon? _____

8. Why do scientists believe there might be water on the Moon?

_____

_____

Name Date Class

Directed Reading for Content Mastery

Section 1 ▪ Earth

Directions: *Circle the following terms in the word search below. Words read across or down. Unscramble the circled letters and fill in the blanks below to spell the topic of the puzzle.*

Sun	**summer**	**sphere**	**spring**	**radiation**	**tilt**
hemisphere	**fall**	**ellipse**	**Earth**	**solstice**	**winter**

M C S R Y H R A M M A G
Y S (U) M M E R U D C H A
P T N L P M R O T O N S
E N P R I I M B S L N P
S U O (A) A S H F C Y U (H)
I S C D O P T A I M C E
B P S I S H U L E E L R
J (R) O A T (E) L L I P S E
W I (N) T E R R U T C U B
G N T I M E A R (T) H S T
O G C O U L A L I M C R
W E E N S E A E L G O L
L G L N (S) O L S T I C E

Topic: ___ ___ ___ ___ ___ and ___ ___ ___

Directions: *Use the words from above to fill in the blanks and complete the following sentences.*

1. A round three-dimensional object is called a _____ .

2. Earth's orbit is an _____ –an elongated enclosed circle.

3. It is the _____ of Earth that causes seasons.

4. After the summer _____, days begin to get shorter.

5. In the northern hemisphere, the Sun reaches the _____ equinox on March 20 or 21.

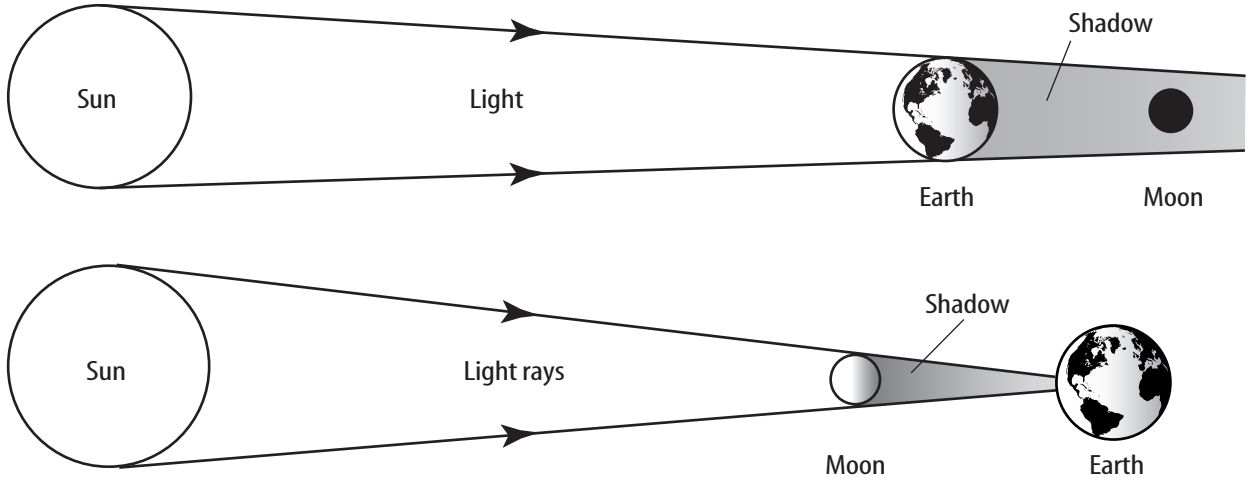
6. Earth's tilt causes the Sun's _____ to strike the hemisphere at different angles.

Name Date Class

Directed Reading for Content Mastery

Section 2 ▪ The Moon—Earth's Satellite
Section 3 ▪ Exploring Earth's Moon

Directions: *Two eclipses are shown below. Explain what is happening during each eclipse and what you would see from Earth.*



1. Lunar eclipse: _____

_____

_____

_____

2. Solar eclipse: _____

_____

_____

_____

Directions: *Answer the following question on the lines provided.*

3. How did *Clementine* increase our knowledge of the Moon?

_____

_____

_____

_____

Meeting Individual Needs

Name Date Class

Directed Reading for Content Mastery

Key Terms
The Sun-Earth-Moon System

Directions: *Write the letter of the term that correctly completes each sentence in the space at the left.*

_____ **1.** Earth moves in a(n) _____ around the Sun.
a. circle **b.** ellipse

_____ **2.** Earth's _____ takes place on an imaginary line called its axis.
a. rotation **b.** revolution

_____ **3.** The point at which the Sun reaches its greatest distance north or south of the equator is the _____.
a. equinox **b.** solstice

_____ **4.** Earth's yearly orbit around the Sun is one _____.
a. revolution **b.** rotation

_____ **5.** During a _____ the dark side of the Moon faces Earth.
a. full Moon **b.** new Moon

_____ **6.** There are equal hours of daylight and nighttime during a(n) _____.
a. solstice **b.** equinox

_____ **7.** The changing appearances of the Moon as seen from Earth are its _____.
a. phases **b.** maria

_____ **8.** After a new moon, when more of the Moon's lighted side becomes visible, the phases are _____.
a. waxing **b.** waning

_____ **9.** When objects hit the Moon, they created craters, or _____.
a. impact basins **b.** magnetic fields

_____ **10.** Dark, flat regions on the Moon are called _____.
a. umbra **b.** maria

_____ **11.** During a _____, the moon blocks the Sun's rays.
a. lunar eclipse **b.** solar eclipse

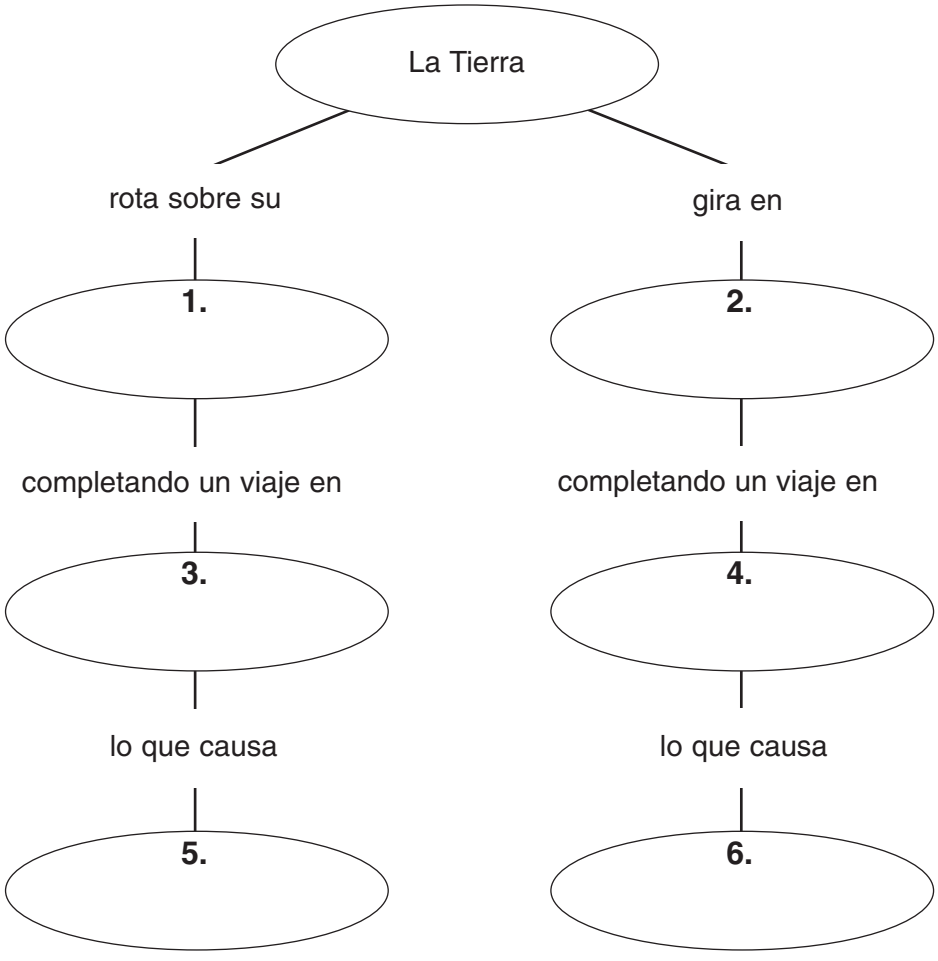
_____ **12.** Because it bulges slightly at the equator, Earth is not a perfect _____.
a. sphere **b.** ellipse

Lectura dirigida para Dominio del contenido

Sinopsis El sistema Sol-Tierra-Luna

Instrucciones: *Utiliza los siguientes términos para completar el mapa conceptual.*

el paso de un año	**órbita**	**día y noche**
aproximadamente 365 días	**eje**	**24 horas**



Instrucciones: *Responde las preguntas.*

7. ¿Qué fase viene después de la luna nueva?_____ ¿Que fase viene después de la luna llena? _____

8. ¿Por qué creen los científicos que puede haber agua en la luna?

_____

_____

Satisface las necesidades individuales

Lectura dirigida para Dominio del contenido

Sección 1 ▪ La Tierra

Instrucciones: *Encierra en un círculo los siguientes términos en la sopa de letras. Las palabras pueden encontrarse de arriba hacia abajo, de lado y al revés. Ordena las letras que aparecen en los círculos y llena los espacios de las oraciones de abajo para obtener el tema de la sopa de letras.*

Sol verano esfera primavera radiación inclinación
hemisferio otoño elipse Tierra solsticio invierno

P (E) R O (T) O Ñ O I S R B N I
R Q A O L E T (I) C I O M N N
I U D S U L M E R U D C H V
M I I T N I P M L O L (O) N I
A N A N P P I I M I S L N E
V O C U O (S) A S N F P Y S R
E X I S C E O A T A I S O N
(R) O Ó P T I C L U L P E L O
A X N R O I T E (A) S I I S B
S J W I Ó E S F E R A C T T
H K G N T I M E A S R H I R
H E M I S F E (R) I O I E C L
R F W E E N S O A E L G I E
V E R A N O S O (L) S T I O T

Tema: ___ ___ ___ ___ ___ ___ y ___ ___ ___

Instrucciones: *Usa las palabras anteriores para llenar los espacios y completar las oraciones:*

1. Un objeto redondo tridimensional se llama _____ .

2. La órbita de la Tierra es un(a) _____, un círculo cerrado alargado.

3. El(La) _____ de la Tierra causa las estaciones.

4. Después del_____, los días se hacen más cortos.

5. En el hemisferio norte, el Sol alcanza su equinoccio de _____ el 20 ó 21 de marzo.

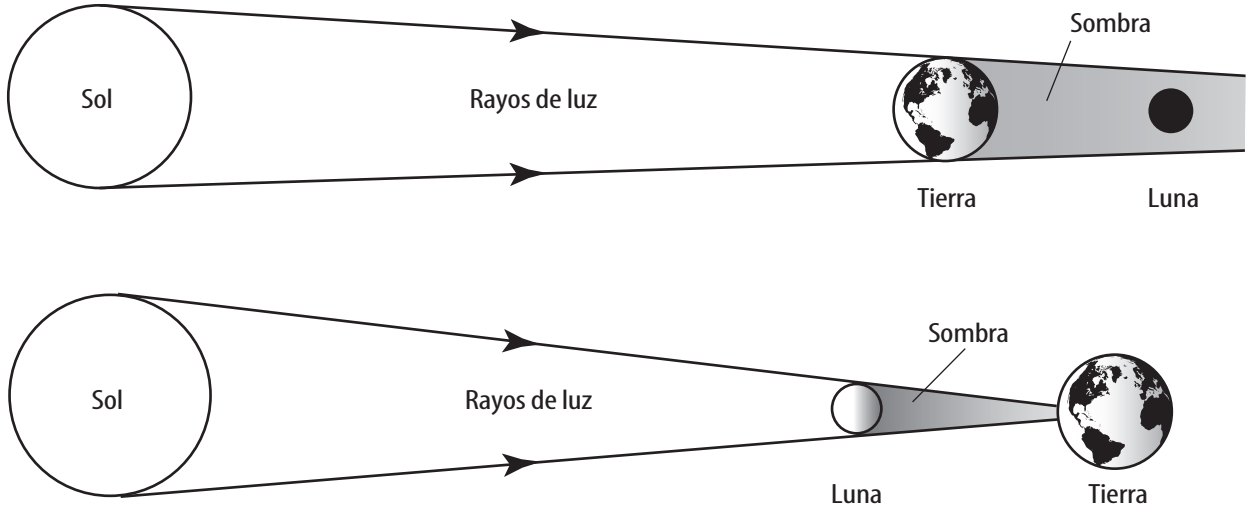
6. La inclinación de la Tierra hace que los(las) _____ del Sol golpeen el hemisferio a diferentes ángulos.

Satisface las necesidades individuales

Lectura dirigida para Dominio del contenido

Sección 2 ■ La Luna, satélite de la Tierra
Sección 3 ■ Explora la luna de la Tierra

Instrucciones: *Arriba se muestran dos eclipses. Explica lo que está sucediendo durante cada eclipse y lo que verías desde la Tierra.*



1.Eclipse de luna:

2. Eclipse de sol:

Instrucciones: *Contesta las siguientes preguntas en el espacio dado.*

3. ¿De qué forma aumentó *Clementine* nuestro conocimiento sobre la Luna?

Satisface las necesidades individuales

Lectura dirigida para Dominio del contenido

Términos clave
El sistema Sol-Tierra-Luna

Instrucciones: *Escribe en el espacio de la izquierda, la letra del término que complete correctamente cada oración.*

_____ **1.** La Tierra se mueve en un(a) _____ alrededor del Sol.
a. círculo **b.** elipse

_____ **2.** El(La)___ de la Tierra ocurre sobre una línea imaginaria llamada eje.
a. rotación **b.** revolución

_____ **3.** El punto en el cual el Sol alcanza la distancia máxima al norte o al sur del ecuador es el _____.
a. equinoccio **b.** solsticio

_____ **4.** La Tierra completa un(a) _____ en su órbita anual alrededor del Sol.
a. revolución **b.** rotación

_____ **5.** Durante la_____, la cara oscura de la Luna mira hacia la Tierra.
a. luna llena **b.** luna nueva

_____ **6.** Durante un _____ las horas diurnas son iguales a las horas nocturnas.
a. solsticio **b.** equinoccio

_____ **7.** Los cambios en la apariencia de la Luna desde la Tierra son sus _____.
a. fases **b.** maria

_____ **8.** Después de la luna nueva, al verse más de la cara iluminada de la Luna, las fases están en _____.
a. creciente **b.** menguante

_____ **9.** Cuando ciertos astros chocaron con la Luna, crearon cráteres o _____.
a. cuencas de impacto **b.** campos magnéticos

_____ **10.** Las regiones planas y oscuras de la Luna se llaman _____.
a. umbra **b.** maria

_____ **11.** Durante un(a) _____, la Luna bloquea los rayos del Sol.
a. eclipse lunar **b.** eclipse solar

_____ **12.** La Tierra no es un(a) _____ perfecto(a) porque está abombada en el ecuador.
a. esfera **b.** elipse

Satisface las necesidades individuales

Name Date Class

SECTION 1 Reinforcement

Earth

Directions: *Circle the term in the puzzle that fits each clue. The terms read across or down. Then write the term on the line.*

M S P H E R E T R L E S
R E V O L U T I O N L D
E Q U A T O R L T L O A
S U M M E R Z T A I S Y
E I A N E R W P T E I Y
A N X L E E L L I P S E
S O L S T I C E O M O A
A X I S M I W I N T E R

_____ **1.** occurs when the Sun is directly over the equator

_____ **2.** earth's spinning that causes night and day

_____ **3.** solstice that occurs in December in the southern hemisphere

_____ **4.** round, three-dimensional object whose surface at all points is the same distance from its center

_____ **5.** a complete orbit made by Earth around the Sun

_____ **6.** imaginary line around which Earth spins

_____ **7.** property of Earth that causes seasons

_____ **8.** shape of Earth's orbit

_____ **9.** solstice that occurs in December in the northern hemisphere

_____ **10.** time it takes Earth to rotate on its axis

_____ **11.** time it takes Earth to revolve around the Sun

_____ **12.** two times during the year, the Sun is directly over this imaginary line that circles Earth halfway between the poles.

_____ **13.** occurs when the Sun reaches its greatest distance north or south of the equator

Meeting Individual Needs

Name Date Class

SECTION 2 Reinforcement

The Moon—Earth's Satellite

Directions: *Identify each phase of the Moon in Figure 1 by writing its name on the line beneath the phase shown. Then answer the following questions on the lines provided.*

Figure 1

1. _____ **2.** _____ **3.** _____ **4.** _____

_____ **5.** What phase occurs between the full moon and the third quarter?

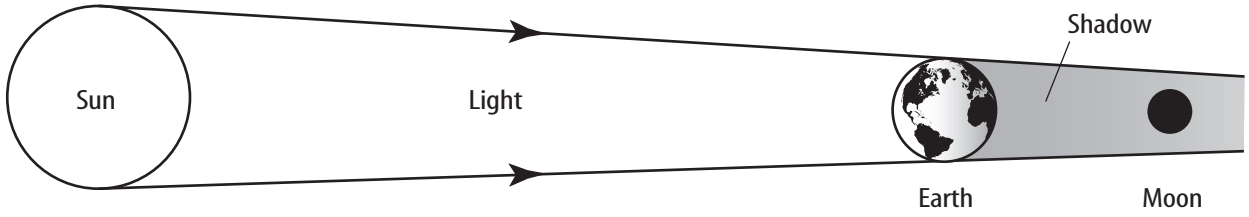
_____ **6.** What phase occurs between the third quarter and the new moon?

_____ **7.** What phase occurs between the new moon and the first quarter?

_____ **8.** What phase occurs between the first quarter and the full moon?

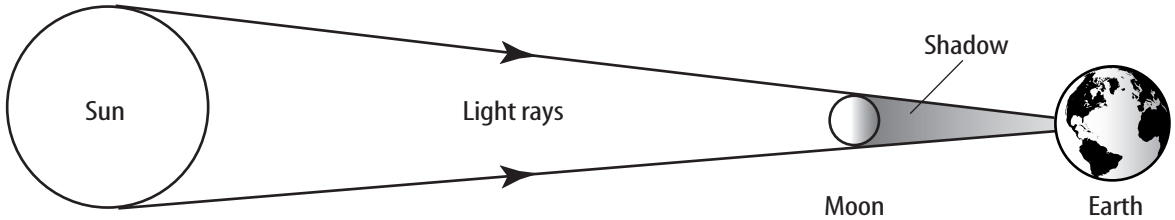
Directions: *Identify Figures 2 and 3 as either a* **total lunar eclipse** *or* **total solar eclipse**. *Then on the lines below, explain why each type of eclipse happens and who would be able to see the eclipse.*

Figure 2



9. _____

Figure 3



10. _____

11. Figure 2: _____

_____

12. Figure 3: _____

_____

Name Date Class

SECTION 3 Reinforcement

Exploring Earth's Moon

Directions: *Complete the following sentences using the terms listed below.*

crust	**lunar**	**shadow**	**thinner**
basin	**minerals**	**water**	**surface**
	ice	**core**	

1. Information from *Clementine* helped scientists measure the thickness of the Moon's _____.
2. *Lunar Prospector* enabled scientists to confirm that the moon has an iron-rich _____
3. Hydrogen is one of the elements that make up _____.
4. The South Pole-Aitken Basin is an impact crater, or impact _____, on the surface of the Moon.
5. The *Clementine* spacecraft was placed in _____ orbit.
6. Throughout the Moon's rotation, most of the South Pole-Aitken Basin stays in _____.
7. *Clementine* also took photographs for use in making a map of the Moon's _____.
8. Some scientists theorize that _____ may exist in the floors of the craters at the Moon's poles.
9. Data show that the Moon's crust is _____ on the side of the Moon facing Earth.
10. Another kind of information collected by *Clementine* indicates what kinds of _____ make up Moon rocks.

Directions: *Answer the following questions on the lines provided.*

11. Why might the South Pole-Aitken Basin be a good place for a solar-powered Moon colony?

_____

_____

12. Where did the spacecraft *Clementine* get its name?

_____

_____

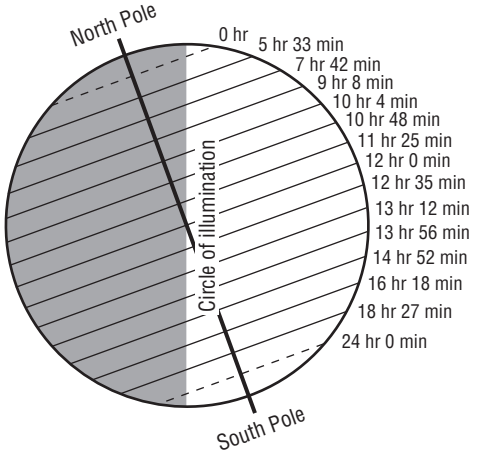
Meeting Individual Needs

SECTION 1 Enrichment

Determining Hours of Daylight

Directions: *The illustrations show the length of day at every 10° of latitude for the winter and summer solstices. On each figure, begin at the equator, which has daylight hours of 12 hours and 0 minutes, and label every 10 degrees north and south of the equator to the 60° latitude north and south. Mark the final north and south latitude shown 66.5°. From this latitude to the poles, the daylight hours remain the same. Use the figures to help you answer the questions.*

Figure 1



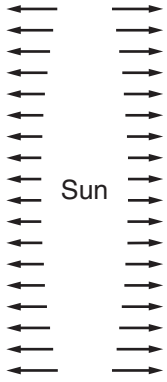
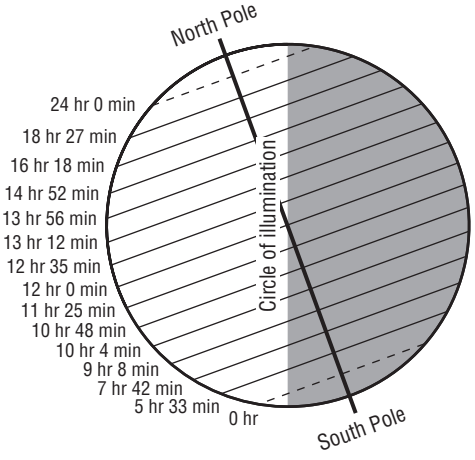


Figure 2



1. Which figure shows the summer solstice for the northern hemisphere? How do you know?

2. If you lived at 50° north latitude, how many hours of daylight would you have during the summer solstice? During the winter solstice?

3. If you lived at the north pole, how many daylight hours would you have at the summer solstice?

4. Look at a map and find the latitude where you live. About how many hours of daylight do you have during the summer solstice? During the winter solstice?

Meeting Individual Needs

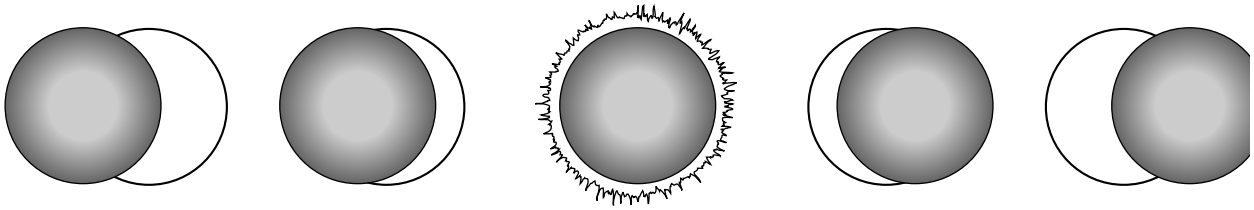
Name Date Class

SECTION 2 Enrichment

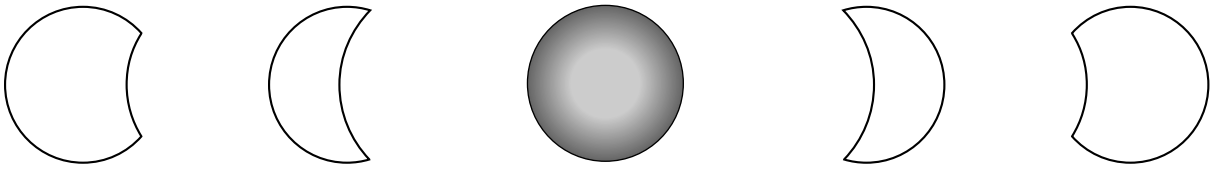
Comparing Eclipses

Directions: *The following observations were made during two eclipses. Study each sketch. Then answer the questions. Note that the moon revolves eastward in its orbit and goes eastward across the sky during an eclipse.*

Total solar eclipse



Total lunar eclipse



1. What makes the shadow during a solar eclipse? During a lunar eclipse?

2. When a person experiences a total solar eclipse, where is that person standing?

3. Is the east side or the west side of the Sun covered first during a solar eclipse?

4. Is the east side or the west side of the Moon covered first in a lunar eclipse?

5. Which of the above eclipses helps show that Earth is a sphere? Why?

6. Why does a lunar eclipse last longer than a solar eclipse?

Meeting Individual Needs

Name Date Class

SECTION 3 Enrichment

Interpreting Facts

Directions: *Use the information in the table and a calculator to answer the following questions.*

Facts About the Moon	
Diameter at the equator: 3,476 km	Period of rotation: about 27.3 Earth days
Circumference at the equator: 10,920 km	Period of revolution around Earth: about 27.3 days
Density: 3.3 g/cm^3	Length of day and night: about 15 Earth days each
Gravity: 1/6 of Earth's	Temperature: high: 127˚C daytime low: –170˚C nighttime
Distance from the Earth: closest: 356,400 km farthest: 406,700 km average: 384,400 km	Atmosphere: almost none

1. Earth's circumference at the equator is 39,843 km. How many times larger is Earth's circumference than the Moon's circumference? _____

2. How many times will the Moon revolve around Earth in 92 days? _____

3. How many times will the Moon rotate on its axis in 92 days? _____

4. If a rock has a mass of 0.15 kg on the Moon, what will its mass be on Earth? _____

5. If a space colonist weighs 800.1 N on Earth, what would the colonist weigh on the Moon?

_____

6. Use the average distance to the Moon to answer this question. If astronauts travel to the Moon and back to Earth again in 144 hours, how many kilometers per hour do they travel?

_____

7. If the space colonists travel at 6,000 km/h, how long will it take them to get to the Moon from Earth when the Moon is at its farthest point from Earth? Its nearest point to Earth? Round your answers to the nearest hour.

_____

8. With the extremes of temperatures on the Moon, what would a Moon colony need to protect people from the temperatures?

_____

_____

Meeting Individual Needs

Name Date Class

Note-taking Worksheet

The Sun-Earth-Moon System

Section 1 Earth

A. Properties of Earth—people used to think that Earth was flat and at the _____ of the universe.

1. Earth is now known to be a round, three-dimensional _____.

a. _____—imaginary vertical line around which Earth spins

b. _____—the spinning of Earth around its axis that causes day and night

2. Earth has a _____ field with north and south poles.

3. Magnetic _____—imaginary line joining Earth's magnetic poles

a. Earth's magnetic axis does not _____ with its rotational axis.

b. The _____ of magnetic poles slowly changes over time.

B. Causes of seasons

1. _____—Earth's yearly orbit around the Sun

a. Earth's orbit is an _____, or elongated, closed curve.

b. Because the Sun is not centered in the ellipse, the _____ between Earth and the Sun changes during the year.

2. Earth's _____ causes seasons.

a. The hemisphere tilted toward the Sun receives more _____ hours than the hemisphere tilted away from the Sun.

b. The _____ period of sunlight is one reason summer is warmer than winter.

3. Earth's tilt causes the Sun's radiation to strike the hemispheres at different _____.

a. The hemisphere tilted toward the Sun receives more total _____ than the hemisphere tilted away from the Sun.

b. In the hemisphere tilted toward the Sun, the Sun appears _____ in the sky and the radiation strikes Earth more directly.

C. _____—the day when the Sun reaches its greatest distance north or south of the _____

1. _____ solstice occurs June 21 or 22 in the northern hemisphere.

2. _____ solstice occurs December 21 or 22 in the northern hemisphere.

Meeting Individual Needs

Note-taking Worksheet (continued)

D. _____—the day when the Sun is directly over Earth's equator

1. Daylight and nighttime hours are _____ all over the world.
2. _____ equinox occurs on March 20 or 21 in the northern hemisphere.
3. _____ equinox occurs on September 22 or 23 in the northern hemisphere.

Section 2 The Moon—Earth's Satellite

A. Motions of the Moon

1. The Moon _____ on its axis.
2. The Moon's rotation takes _____ days with the same side always facing Earth.
3. The Moon seems to shine because it reflects _____.

B. Moon _____—the different forms the Moon takes in its appearance from Earth

1. _____—when the Moon is between Earth and the Sun and cannot be seen
2. _____ phases—more of the illuminated half of the Moon that can be seen each night after the new moon
   - **a.** First visible thin slice of the moon is a _____.
   - **b.** _____ phase—half the lighted side of the Moon is visible.
   - **c.** _____—more than one quarter is visible.
   - **d.** All of the Moon's lighted side is visible during a _____.
3. _____ phases—less of the illuminated half of the Moon is visible after the full moon.
   - **a.** _____—starts after a full moon when more than half of the lighted side is still visible
   - **b.** Only half the Moon's lighted side is visible during the _____ phase.
   - **c.** The last visible slice before a new moon is called the _____.
4. The Moon completes its cycle of phases in about 29.5 days instead of 27.3 days because it is keeping up with Earth's _____ around the Sun.

C. _____—when Earth or the Moon casts a shadow on the other

1. _____—the Moon moves directly between Earth and the Sun, shadowing part of Earth.
   - **a.** Under the _____, or darkest part of the shadow, a total solar eclipse occurs.
   - **b.** A partial solar eclipse happens in the lighter shadow on Earth's surface called the _____.

Note-taking Worksheet (continued)

c. A total solar eclipse is visible only on a small area of _____.

2. _____—when Earth's shadow falls on the Moon

a. If the Moon is completely in Earth's umbra, a _____ lunar eclipse occurs.

b. _____ lunar eclipse—when only part of the Moon moves into Earth's umbra, or the moon is totally in the penumbra

c. A total lunar eclipse is visible on the _____ side of Earth when the night is clear.

D. The Moon's surface has many depressions, or _____, formed from meteorites, asteroids, and comets.

1. Cracks in the Moon's crust caused lava to fill large craters, forming _____, or dark, flat areas.

2. Igneous maria rocks are 3 to 4 _____ years old, indicating craters formed after the surface cooled.

E. Data from _____ suggest that under the Moon's crust might lie a solid mantle, then a partly molten mantle and a solid, iron-rich core.

F. _____ of Moon origin—the Moon formed 4.6 billion years ago from Earth material thrown off when a large object collided with Earth.

Section 3 Exploring Earth's Moon

A. Missions to the Moon

1. Early exploration

a. The first *Luna* spacecraft, launched by the _____ in 1959, enabled close study of the Moon.

b. The *Ranger* spacecraft and the *Lunar Orbiters* of the U. S. took detailed _____ of the Moon in the 1960s.

c. Five *Surveyor* U. S. spacecrafts _____ on the Moon.

d. Astronauts of _____ landed on the Moon in 1969.

2. The *Clementine* spacecraft was placed in lunar orbit in 1994 to _____ the moon's surface.

a. Collected data on the _____ content of Moon rocks

b. Mapped _____ on the Moon's surface

c. _____, or craters, are depressions left by objects striking the Moon.

d. Identified _____, the largest and deepest impact basin in solar system.

Meeting Individual Needs

Note-taking Worksheet (continued)

B. Mapping the Moon

1. Data from *Clementine* yielded a map of the Moon showing its _____.

a. The Moon's crust is _____ under its impact basins.

b. The crust on the side of the Moon facing Earth is _____ than on the far side.

2. The *Lunar Prospector* was launched in 1998 to look for clues about the Moon's _____ and makeup.

a. Small, iron-rich _____ of the Moon supports the impact theory of the Moon's origin.

b. Findings confirmed that _____ was present in deep craters at poles.

Assessment

Name Date Class

Chapter Review

The Sun-Earth-Moon System

Part A. Vocabulary Review

Directions: *Write the letter of the term or phrase that completes the sentence.*

_____ **1.** Earth is a(n) _____, which is a round, three-dimensional object.
a. ellipse **b.** sphere **c.** cone **d.** cylinder

_____ **2.** Earth rotates on its axis about every _____.
a. year **b.** month **c.** week **d.** day

_____ **3.** In the northern hemisphere, the _____ occurs on June 21 or 22.
a. spring equinox **b.** fall equinox **c.** summer solstice **d.** summer equinox

_____ **4.** When all of the Moon's surface that faces Earth is lit up, there is a _____.
a. first quarter moon **c.** full moon
b. third quarter moon **d.** new moon

_____ **5.** _____ are dark-colored, relatively flat regions of the Moon's surface formed when interior lava filled large basins.
a. Craters **b.** Maria **c.** Volcanoes **d.** Eclipses

_____ **6.** In 1998 NASA launched the _____ to continue photographing the Moon and collecting data.
a. *Lunar Prospector* **c.** Hubble Space Telescope
b. *Clementine* **d.** *Ranger*

_____ **7.** A _____ occurs when the Moon moves directly between the Sun and Earth and casts a shadow on Earth.
a. lunar eclipse **b.** waning gibbous **c.** waxing gibbous **d.** solar eclipse

_____ **8.** The imaginary line around which Earth spins is called its _____.
a. axis **c.** International Date Line
b. equator **d.** prime meridian

_____ **9.** The yearly orbit of Earth around the Sun is called its _____.
a. rotation **b.** ellipse **c.** tilt **d.** revolution

_____ **10.** When meteorites or other objects strike the Moon, they create _____.
a. maria **b.** eclipses **c.** magnetic fields **d.** impact basins

_____ **11.** The phase of the Moon that immediately precedes the new moon is the _____.
a. waxing crescent **c.** waning crescent
b. first quarter **d.** third quarter

_____ **12.** If you followed a compass needle pointing north, you would end up at the _____.
a. geographic north pole **c.** geographic south pole
b. magnetic north pole **d.** rotational north pole

_____ **13.** More of the lighted surface of the Moon is facing Earth at _____.
a. waning gibbous **c.** new moon
b. third quarter **d.** waxing crescent

Assessment

Chapter Review (continued)

Part B. Concept Review

Directions: *Identify the type of eclipse shown in Figures 1 and 2. Then use the illustrations to answer the following questions.*

Figure 1

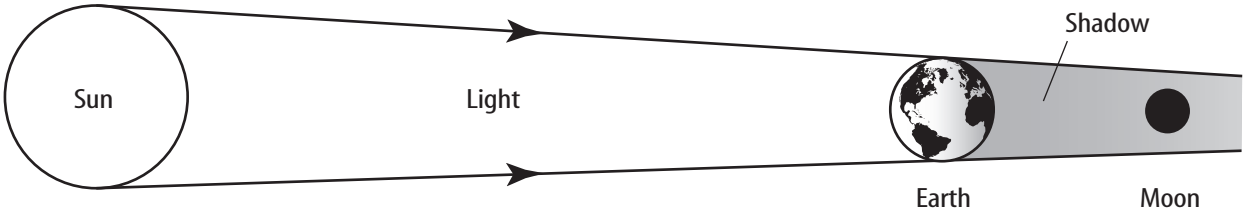
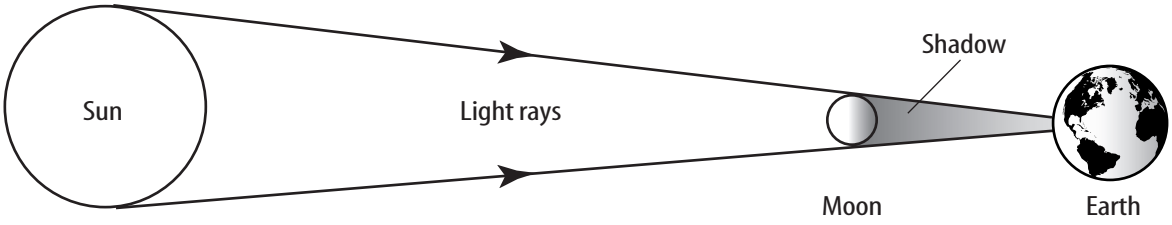


Figure 2



1. Figure 1: _____ **2.** Figure 2: _____

3. What is the light-colored outer shadow on Earth's surface cast by the Moon during a solar eclipse?

_____

4. If you were in the area of Earth that is within the penumbra, would you see a total or partial solar eclipse? _____

5. What causes a lunar eclipse? _____

_____

6. What causes a solar eclipse? _____

_____

7. Is the umbra larger during a solar eclipse or during a lunar eclipse? Why?

_____

_____

Directions: *Answer the following question using complete sentences on the lines provided.*

8. Describe how Earth's tilt leads to seasonal changes.

_____

_____

_____

Assessment

Transparency Activities

Name Date Class

SECTION 1

Section Focus Transparency Activity

A Mysterious Kind of Place

Stonehenge is an ancient and fascinating monument in England. It was built in roughly three phases, starting around 3100 B.C. The photo below shows sunrise aligning with the part of Stonehenge called the Avenue. This happens at the same time in June each year.

1. **Why would the sunrise align with the same point at the same time each year?**
2. **Generally, where does the Sun rise each day? Where does it set?**
3. **Why do some people feel that it is inaccurate to say that the Sun rises and sets?**

Name Date Class

SECTION 2 Section Focus Transparency Activity

A Lovely Gibbous Earth

What would it be like to live on the Moon? We would need a lot of help and protection. There is no atmosphere on the Moon, and the temperatures are too extreme for life as we know it. But if we do build lunar living quarters in the future, we could enjoy seeing a lovely Earth in the sky.

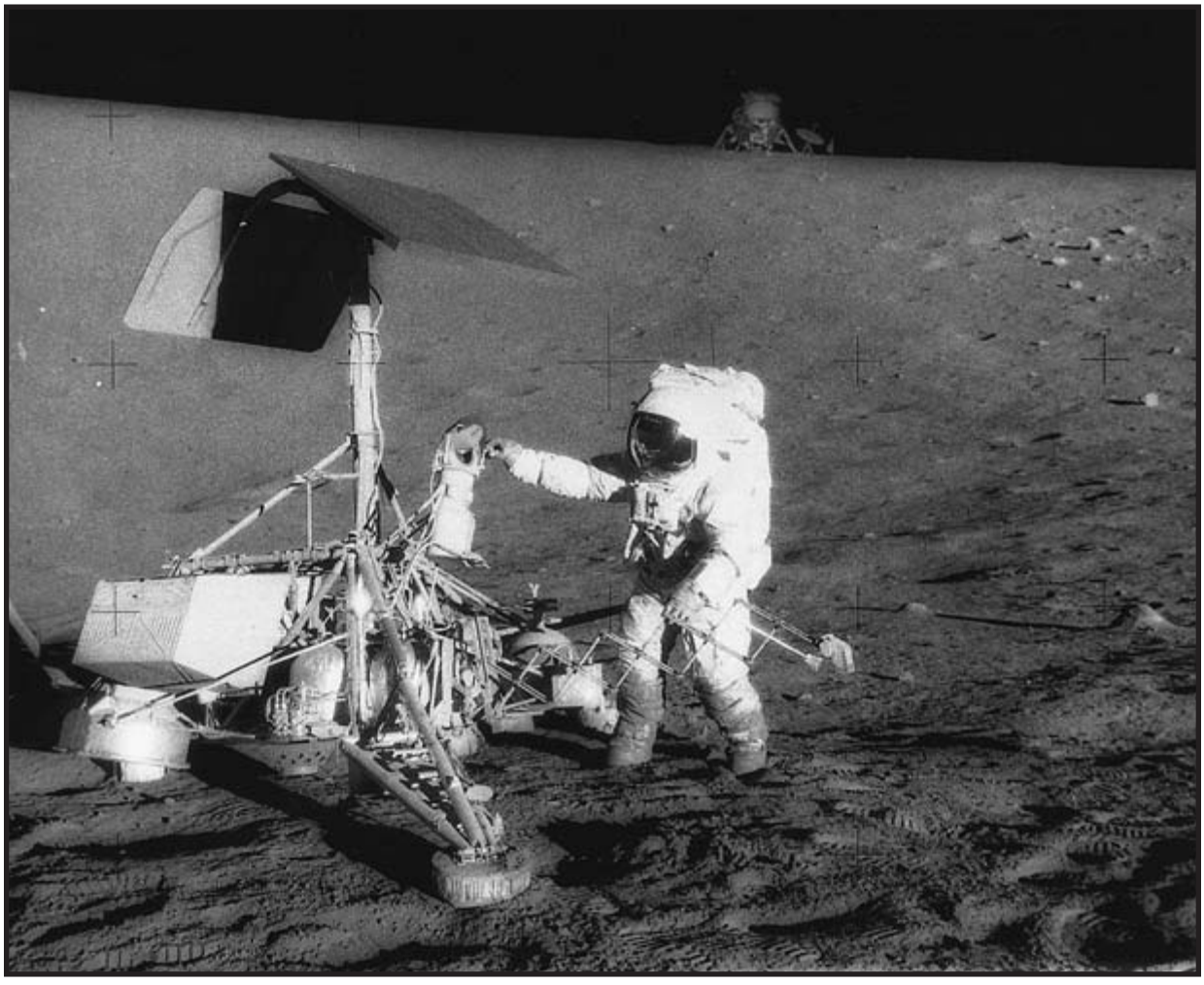
1. **If we lived on the Moon, could we observe phases of Earth similar to the phases of the Moon observed from Earth?**
2. **How could people living on the Moon protect themselves from the harsh conditions there?**

Name Date Class

SECTION 3 Section Focus Transparency Activity

Moon Science

Surveyor 3 was a probe launched in April 1967 to explore the Moon. After spending 31 months on the surface of the Moon, several Surveyor 3 components were retrieved by astronauts of Apollo 12. These parts were returned to Earth for analysis.

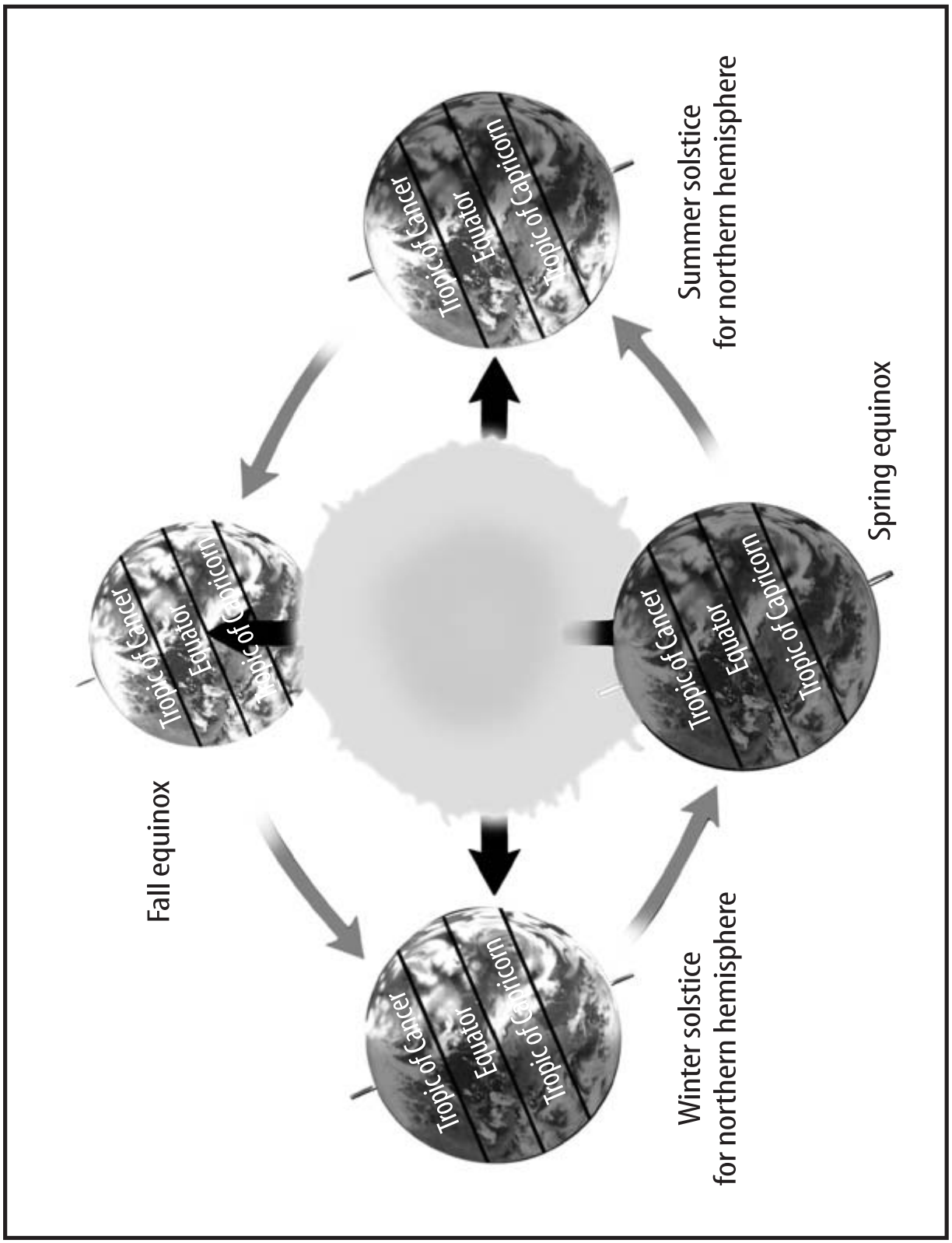


1. **Describe the features of the Moon you can see from Earth.**
2. **How do scientists study the Moon?**
3. **Scientists discovered bacteria inside one of the returned pieces of Surveyor 3. What are some possible explanations for this surprising discovery?**

Name Date Class

SECTION 1 Teaching Transparency Activity

Solstices and Equinoxes



Teaching Transparency Activity (continued)

1. Describe equinox.

2. Describe solstice.

3. Does the distance from the Sun cause Earth's seasons? Why or why not?

4. How are the seasons in the northern and southern hemispheres related?

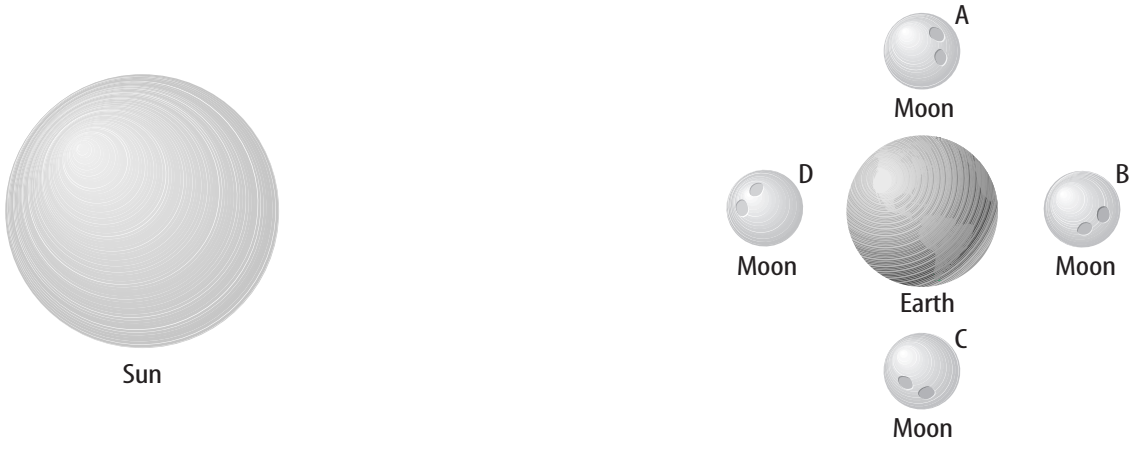
5. Why is the tilt of Earth on its axis important?

6. When the north pole experiences 24 hours of daylight, what is happening at the south pole? Explain.

Assessment
Transparency Activity

The Sun-Earth-Moon System

Directions: *Carefully review the diagram and answer the following questions.*



1. In which situation could a person on Earth see a full moon?

A A
B B
C C
D D

2. In which two situations could a person on Earth see a half-moon?

F A and B
G A and C
H B and C
J B and D

3. In which situation could a solar eclipse be occurring?

A A
B B
C C
D D