Sample Pages for CHALLENGE THE

PALMETTO ACHIEVEMENT CHALLENGE TEST

❖ *2007 EDITION* ❖

FOURTH GRADE SCIENCE

This series of books were written specifically for South Carolina.
They cover all the strands in the South Carolina Curriculum.

CONTEMPORARY PUBLISHING COMPANY OF RALEIGH, INC.

CPC

6001-101 Chapel Hill Road, Raleigh, NC 27607 • (919) 851-8221
www.contemporarypublishing.com

Astronomy

Standard 4-3: The student will demonstrate an understanding of the properties, movements and locations of objects in the solar system.

Look at the sky on a moonless night and count the **stars**. How many do you see? Far too many to count! There are millions of stars in the universe, and our Sun is just one of them. In fact, as stars go, ours is only average in size. It's hard to imagine our Sun as average because it is a constant powerhouse in our daily lives. Our Sun seems large to us only because it is so close.

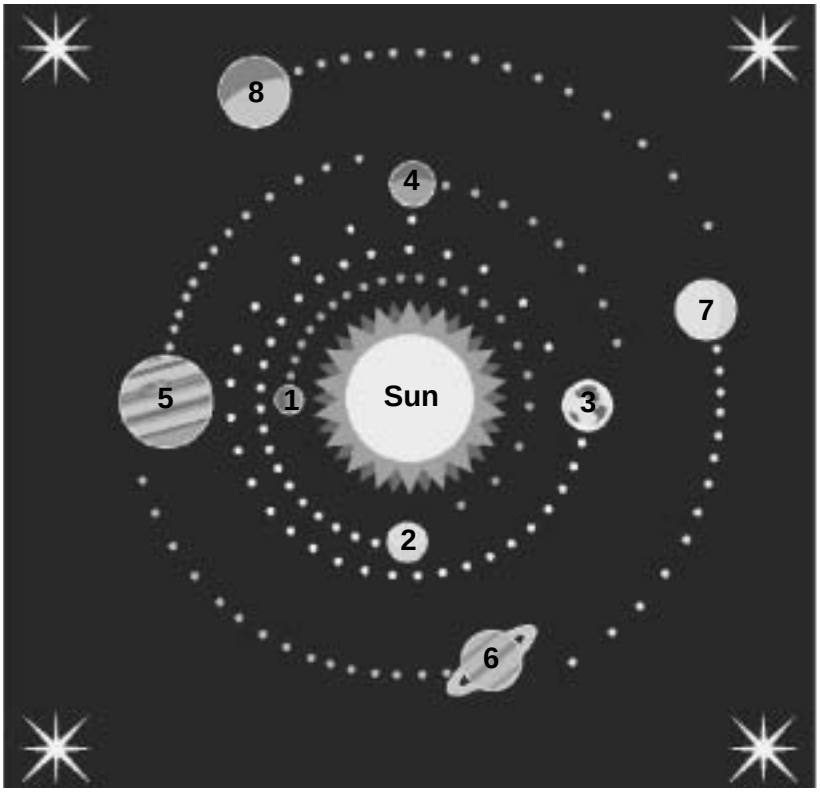
The nighttime sky is filled with stars.

Stars such as the Sun are not solid like planets. Stars are made of very hot gases that explode. Our Sun is like a hydrogen bomb that explodes continuously. It shines with the light produced by a furnace buried deep inside its core. At its surface, the Sun's temperature is thought to be about 6000 °C. Toward its center, however, it is thought to be more like 15 billion °C. In comparison, the Earth is just a cold rock.

Our Solar System

Indicator 4-3.1: Recall that Earth is one of many planets in the solar system that orbit the Sun.

Our **solar system** consists of the Sun, eight planets and their moons. The eight planets are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. For many years, astronomers believed there to be nine planets in our solar system. However, in August 2006, at an international meeting, astronomers decided to demote Pluto to a dwarf planet, and remove it from the original list of nine planets. It was determined that Pluto's orbit around the Sun overlaps with Neptunes orbit, thus not meeting all the requirements to be a planet.



The position of the planets in our solar system.

1. **Mercury**
2. **Venus**
3. **Earth**
4. **Mars**
5. **Jupiter**
6. **Saturn**
7. **Uranus**
8. **Neptune**

Look at the figure to see the positions of the planets compared to that of Earth. Mercury is the planet closest to the Sun and Neptune is the farthest away. Earth is the third- closest planet to the Sun.

Planets

Indicator 4-3.2: Compare the properties (including the type of surface and atmosphere) and the location of Earth to the Sun, which is a star, and the Moon.

As far as we know, Earth is the only planet that can support life. It is close enough to the Sun for warmth, but not so close that the oceans are vaporized. Our liquid water, unique atmosphere, and dynamic weather patterns provide the conditions necessary for a wide variety of plant and animal life.

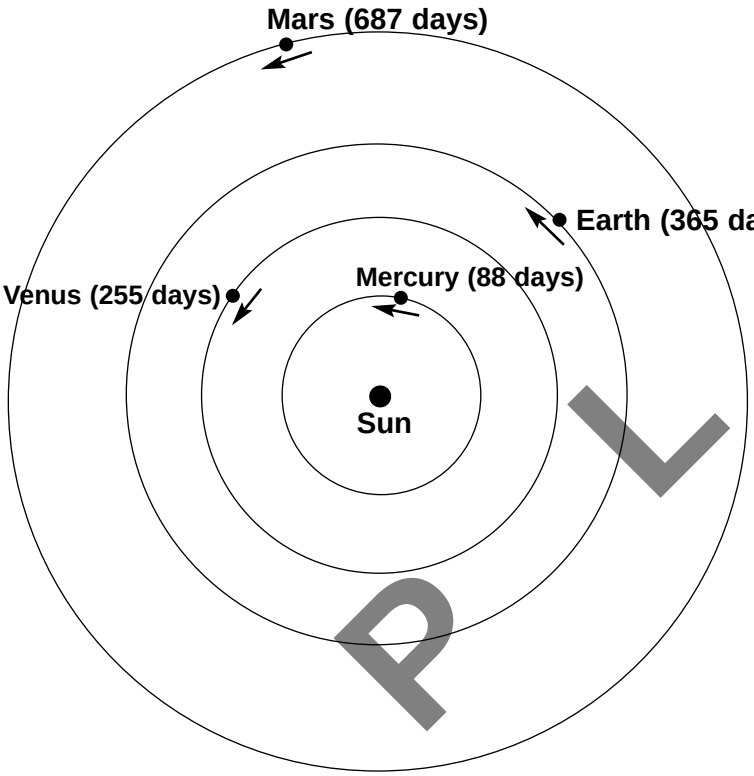
Comparing the Other Planets to Earth

Planet	Size	Number of Moons	Time to Orbit Sun	Time to Rotate on Axis	Distance from the Sun
Mercury	less than 1/2 the size of Earth	0	88 days	59 days	2/5 the distance of Earth to the Sun
Venus	almost the same size as Earth	0	8 months	243 days	7/10 the distance of Earth to the Sun
Earth		1	1 year	1 day	150,000,000 km
Mars	1/2 the size of Earth	2	1.9 years	25 hours	1.5 times the distance of Earth to the Sun
Jupiter	11 times the size of Earth	16	12 years	10 hours	5.2 times the distance of Earth to the Sun
Saturn	9 times the size of Earth	18	29.5 years	11 hours	9.5 times the distance of Earth to the Sun
Uranus	4 times the size of Earth	?	84 years	17 hours	19.2 times the distance of Earth to the Sun
Neptune	4 times the size of Earth	8	165 years	16 hours	30 times the distance of Earth to the Sun

Planet	Atmosphere	Surface
Mercury	Thin mixture of helium (95%) and hydrogen	Dusty surface of plains, cliffs, and craters similar to our moon
Venus	Carbon dioxide (95%), nitrogen, sulfuric acid, and traces of other elements	A rocky, dusty, waterless expanse of mountains, canyons, and plains, with a 200-mile river of hardened lava
Earth	Nitrogen (78%), oxygen (21%), other gases. Only planet with a breathable atmosphere	Earth is made up of water (70%), air, and solid ground. It appears to be the only planet with water
Mars	Carbon dioxide (95%)	Canyons, dunes, volcanoes, and polar caps of water ice and carbon dioxide ice. Blood-red color comes from iron-rich dust.
Jupiter	Whirling clouds of colored dust, hydrogen, helium, methane, water, and ammonia. The Great Red Spot is an intense windstorm larger than Earth.	A hot ball of gas and liquid
Saturn	Hydrogen and helium	Liquid and gas
Uranus	Little is known	Hydrogen, helium, and methane
Neptune	A liquid layer covered with thick clouds and with constant, raging storms	Hydrogen, helium, methane, and ammonia

ORBITS

All of the planets in our solar system, including Earth, **orbit** the Sun. An orbit is a path that one object takes when revolving around another object. Each planet orbits the Sun at a specific distance. This distance depends on how far away the planet is from the Sun. Mercury, which is much closer to the Sun than Earth, completes an orbit in only 88 days. The table compares the locations and movements of other planets to the Earth.



The length of time for an orbit depends on the planet's distance from the Sun.

Planets do not orbit the Sun in a perfect circle. Instead, the orbits are slightly flattened circles called **ellipses**. An ellipse is a slightly egg-shaped circle. Planets remain in orbit around the Sun because of the Sun's gravitational force.

REVIEW

1. Put the planets in order from smallest (1) to largest (8).

_____Earth	_____Mercury	_____Saturn
_____Jupiter	_____Neptune	_____Uranus
_____Mars	_____Venus	

2. Put the planets in order according to how long it takes them to orbit the Sun (1 = shortest, 8 = longest).

_____Earth	_____Mercury	_____Saturn
_____Jupiter	_____Neptune	_____Uranus
_____Mars	_____Venus	

3. Why does the Sun look different to us than other stars?

_____

_____

4. Why do you suppose that Earth is the only planet that can support life?

_____

_____

5. Pluto was at one time named the ninth planet. Explain why it has been demoted to dwarf planet status.

_____

_____

6. Infer the difference in temperature of Mercury and Neptune. Explain your inference.

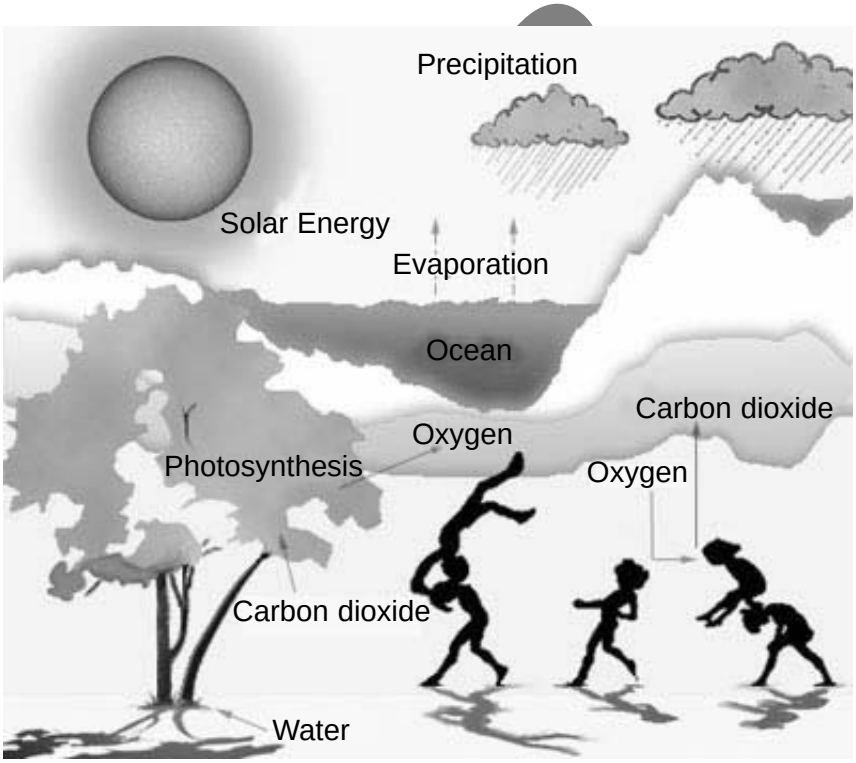
_____

_____

The Sun

Indicator 4-3.3: Explain how the Sun affects the Earth.

As the Earth orbits the Sun, **energy from the Sun** provides us with heat, light and the ability for producers to make their own food through photosynthesis. This energy from the sun is the basis of all food chains and critical to our survival here on Earth.



The energy from the Sun makes life on Earth possible

The Earth's Movements

Indicator 4-3.5: Explain how the rotation of Earth results in day and night.

Day and Night

At any given moment, half of the Earth's surface is lit by the Sun. This half of the Earth is experiencing daytime. The other half of the Earth is in the shade and is experiencing nighttime.

From the Earth, it appears that the Sun rises in the sky.

The Earth rotates once on its axis every 24 hours. This means that every spot on Earth experiences one daytime and one nighttime every 24 hours. We call the arrival of daytime "sunrise" and the arrival of nighttime "sunset." However, the Sun is not really rising or setting. It is standing still while the Earth spins. Let's look at what really happens.

Go into a dark room with a globe and a flashlight. Shine the flashlight on the globe. Notice that only half of the globe is lit at any one time. Slowly turn the globe on its axis. Imagine the Sun rising and setting on different parts of the Earth as you turn the globe.

REVIEW

1. As the Sun sets on South Carolina, find a country on the globe where the Sun is rising. When it is noon in South Carolina, what time do you think it is in this country?

2. What is the movement that turns day into night?

3. Which of the following causes nighttime?

   a. a part of the Earth being out of the Sun
   b. the Earth spinning on its axis
   c. a part of the Earth being in the shade
   d. the Sun turning off

4. At any one moment, how much of the Earth is in the Sun?

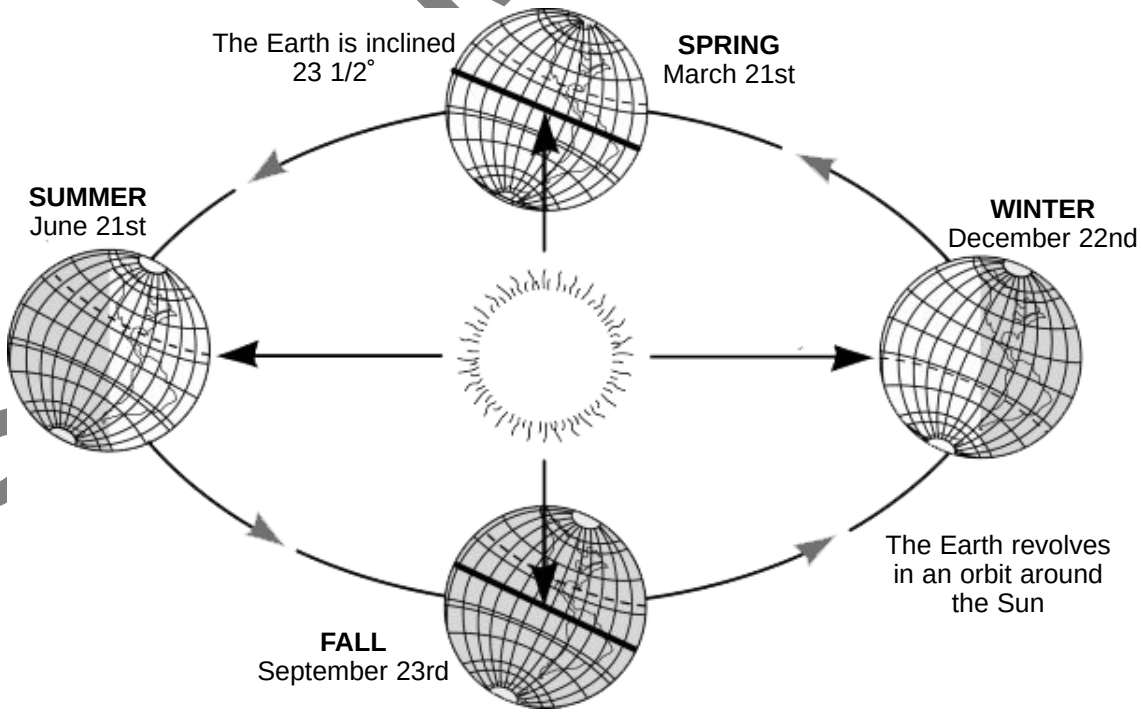
5. How often does the Earth spin on its axis?

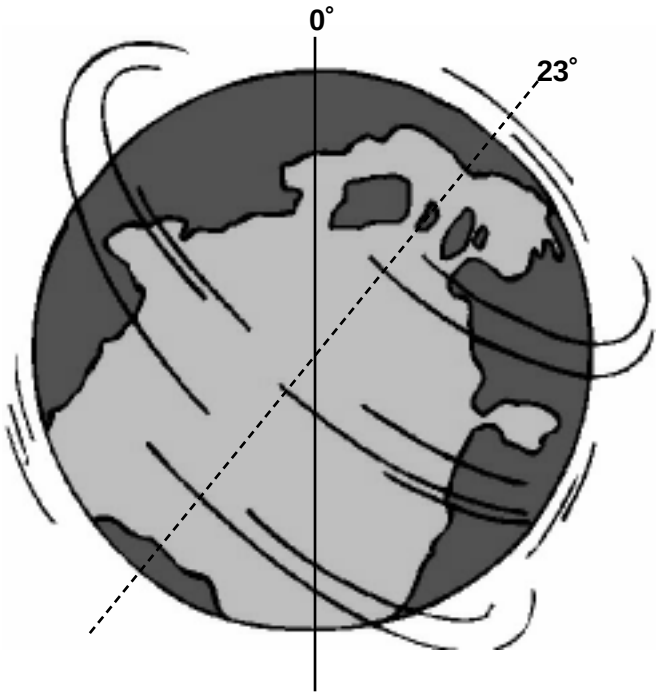
6. In what part of the sky does the Sun appear to rise? In what part does it appear to set?

The Seasons

Indicator 4-3.4: Explain how the tilt of the Earth's axis and the revolution around the Sun results in the seasons of the year.

The Earth's axis is not parallel to the Sun. Instead, it is tilted 23 degrees. A tilted Earth means that one half, or hemisphere, of the Earth is always tilted toward the Sun. This hemisphere receives more direct sunlight and is warmer than the half that is tilted away from the Sun. The warmer hemisphere is experiencing summer. In South Carolina we live in the northern hemisphere. This hemisphere is tilted toward the Sun in June and is then experiencing summer. Six months later, in December, the northern hemisphere is tilted away from the Sun. In December we experience winter. But the southern hemisphere is tilted toward the Sun in December. Summer is just beginning there. If you lived in Argentina, you could be swimming outside in January!





The Earth sits on a 23 degree tilt.

The tilt of the Earth also causes changing patterns in sunrise and sunset. The Sun does not always rise and set in exactly the same place. In the summer, the Sun rises and sets a little farther north than in winter. This results in a longer day. In addition, the Sun rises very high in the sky at noon in the summer. During the winter the Sun rises and sets more southward. This results in a shorter day. The Sun does not rise very high at noon during the winter.

REVIEW

1. While you experience winter, infer some activities that children your age may participate in on the bottom half of the globe.

2. About what time of day does the Sun rise in December?

3. About what time of the day does the Sun set in December?

4. About how many hours of daylight are there in December?

_____

5. Contrast the number of daylight hours in December to the number of daylight hours in July.

_____

6. What do the seasons result from?

_____

_____

7. When it is summer in the southern hemisphere, what season do you experience?

_____

8. The Earth is tilted at 23 1/2˚. What affect does this tilt have on Earth?

_____

_____

9. Think of the four seasons. What is the position of the northern hemisphere related to the sun?

Spring _____ Summer _____

Fall _____ Winter _____

10. Why are each of the seasons about three months long?

_____

_____

Time

Indicator 4-3.7: Interpret the change in the length of shadows during the day in relation to the position of the Sun in the sky.

We use clocks or watches to tell us when to get up, eat meals, go to school, and go to bed. Before the invention of the clock, however, people had to use the **tools provided by nature**. They measured their lives by the movements of the Sun and stars. Their methods remain with us. Let's look at how early civilizations measured time.

The **sundial** is one of the earliest devices used to tell time. Sundials make use of shadows. A shadow is a dark, shaded area cast by an object blocking the Sun's light. As the Sun crosses the horizon, the length and direction of the shadow changes.

A sundial uses shadows to tell time.

Think of a sundial as a stick pointing straight into the air. At noon, when the Sun is directly overhead, the shadow cast by the stick is very short. As the Sun moves across the sky, the shadow becomes longer and gradually moves in a clockwise direction. The shadows on a sundial are classified as occurring before or after the shortest noontime shadow. This is the origin of the terms a.m. and p.m., which stand for the latin words ***a**nte **m**eridiem* (before the shortest shadow, or meridiem) and ***p**ost **m**eridiem* (after the shortest shadow).

Every day the Sun appears to rise on the eastern horizon. In reality, however, your spot on the Earth is beginning to turn toward the Sun, leaving the shadow of nighttime behind. As the day progresses, the Sun appears to rise in the sky until it is almost directly overhead at noon. However, this is actually your spot on the Earth coming directly in line with the full force of the Sun's rays. In other words, you are now facing the Sun. As the day wears on and the Earth continues to rotate, the Sun appears to move westward and eventually drop out of the sky. This is your spot on the Earth spinning away from the Sun and rounding into nighttime once more.

More than 4,500 years ago, people in the United Kingdom set up a remarkable observatory called **Stonehenge**. Stonehenge is an elaborate circular system of rocks built by ancient astronomers and priests. It helped its ancient builders use the movements of the stars and planets as a calendar.

These are the remaining rocks of Stonehenge.

REVIEW

1. Make a list of all the devices you can use to tell time.

2. What devices would you use to measure just a few minutes?

3. Describe how a sundial is used to tell time.

4. Where do the terms a.m. and p.m. come from?

5. What was Stonehenge used for?

Indicator 4-3.6

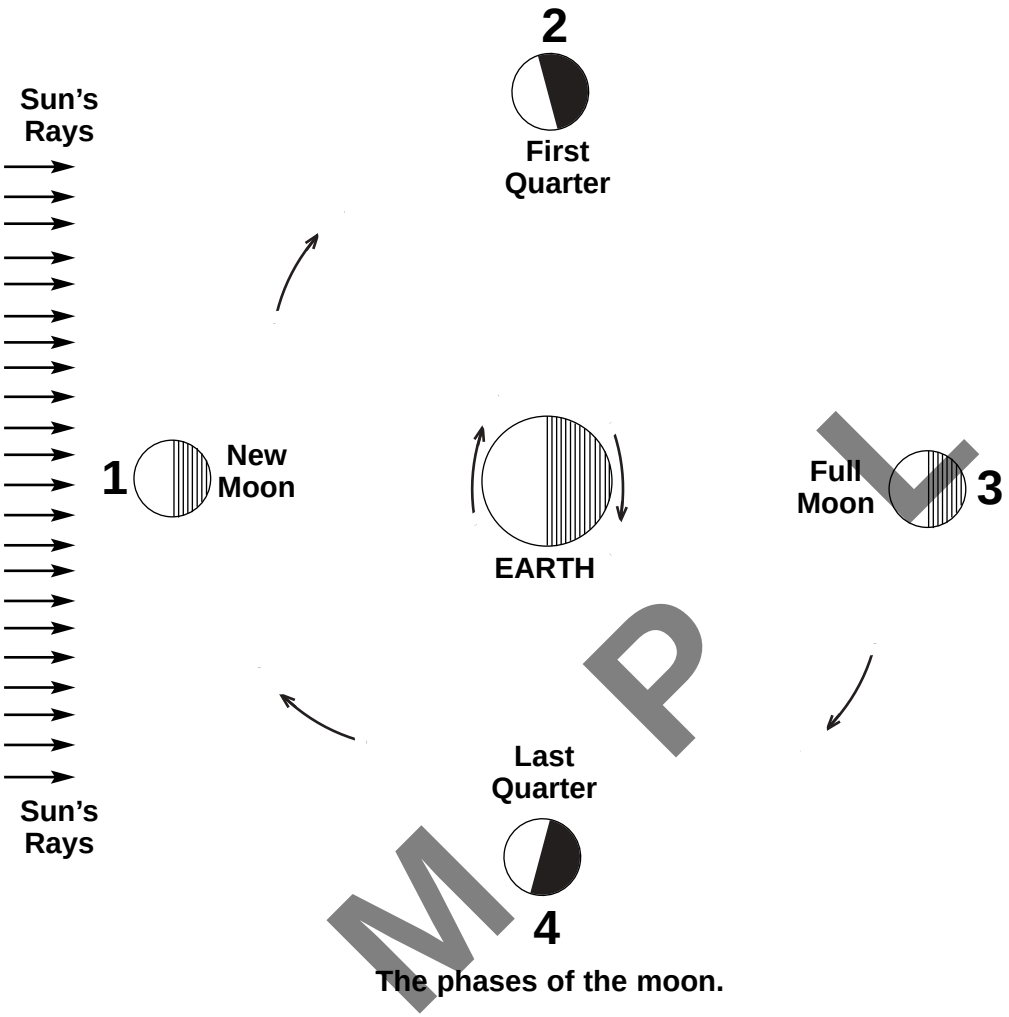
The Moon and Its Phases

Indicator 4-3.6: Illustrate the phases of the Moon and the Moon's effect on ocean tides.

Have you ever noticed that the moon appears to change shape? Some nights it's a full, bright ball, other nights it's only a sliver. Actually, the moon doesn't change shape at all. What changes is our view of the moon as it revolves around the Earth every 29 1/2 days. In addition, the moon does not shine from its own light. Instead, the moon **reflects**, or bounces back, the light from the Sun. This reflection, combined with the moon's orbit around the Earth, makes it appear as if the moon changes shape. The changes we see are called the **phases of the moon**.

During the **new moon** (1), the side of the moon that faces the Earth is unlit and shadowed. This marks the beginning of the moon's orbit around the Earth. When the moon is one quarter of the way around its orbit (2), only one-half of its lit side faces Earth. This is called the **first quarter moon**.

The **full moon** appears when the lit side of the moon fully faces the Earth (3). At this point, the moon is halfway around its orbit. Finally, when only one-half of the lit side of the moon again faces the Earth (4), the moon is in its **last quarter**. Here, the moon is three-quarters of the way around its orbit. When the moon completes its orbit, there is another new moon.



The phases of the moon.

When there is a new moon, you see no moon at all. This is because the side of the moon that is lit by the Sun faces away from the Earth. However, a few days later, you can spot a tiny sliver of the moon. This is called a **crescent moon**. You see the crescent because a tiny fraction of the lit side of the moon now faces the Earth. The sliver gets bigger and bigger as you see more and more of the lit side of the moon. Soon you see the first quarter moon. The next major change is the big, bright full moon. As the moon continues on its orbit you see less and less of its lit side. The moon passes through the last quarter phase and then you see moon slivers again. Eventually the moon completes its orbit and begins again with a new moon. A new orbit and set of moon phases begins.

The moon appears to change shape as it orbits the Earth.

TRY THIS!

Recreate the phases of the moon using the following objects:

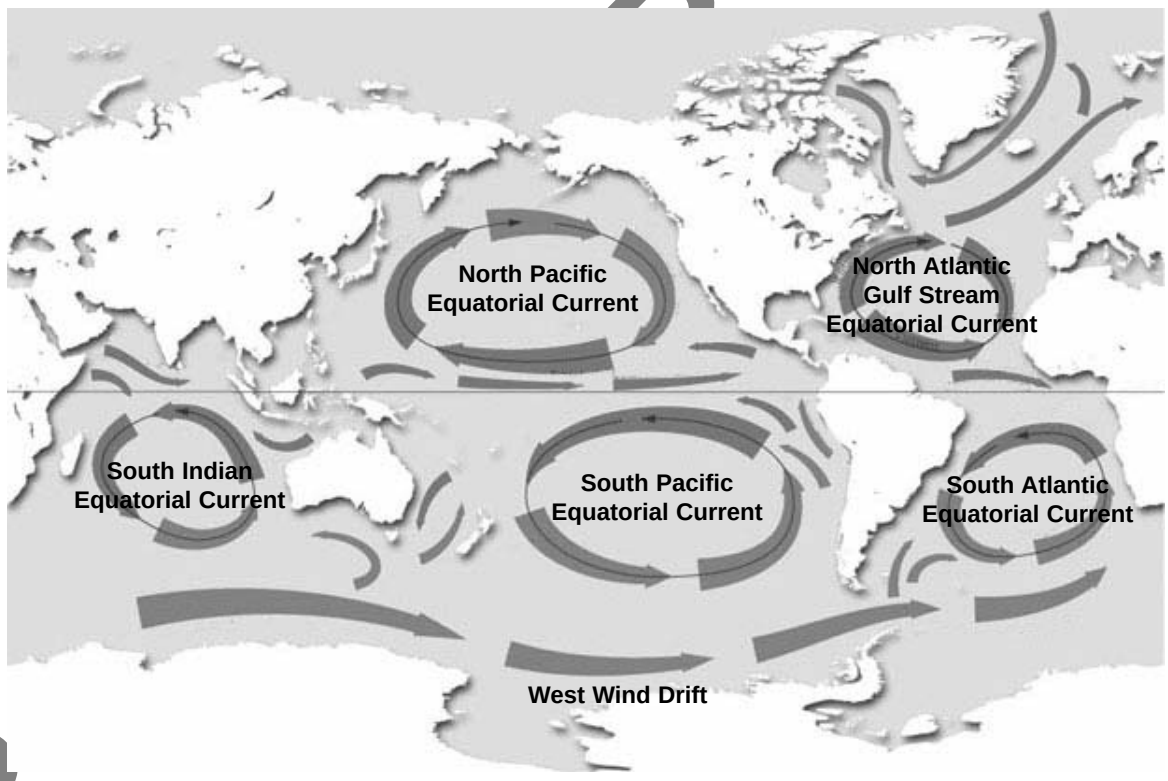
- orange
- pencil
- flashlight
- dark room
- friend

Spear the orange with the pencil. Hold the pencil like it is the torch on the Statue of Liberty. Have your friend hold the flashlight and stand facing you on the other side of the room. Turn off the lights. Have your friend point and shine the flashlight on the side of the orange that faces away from you. This is like the new moon. The side of the moon that faces the Earth (you) is in a shadow. Pretend you are the Earth spinning on its axis. Slowly turn in one spot while observing the changing pattern of light on the moon (orange). Describe what you see.

OCEAN CURRENTS

When you think of the ocean you might think of one giant pool of water. It might surprise you to learn that giant rivers of water flow through the ocean. These rivers are called **ocean currents**. Ocean currents move more water than the largest rivers on land. There are warm water currents and cold water currents. Warm ocean currents get their power from three main sources:

1. heat from the Sun
2. strong winds
3. the spinning of the Earth on its axis



Ocean currents are like massive rivers within water.

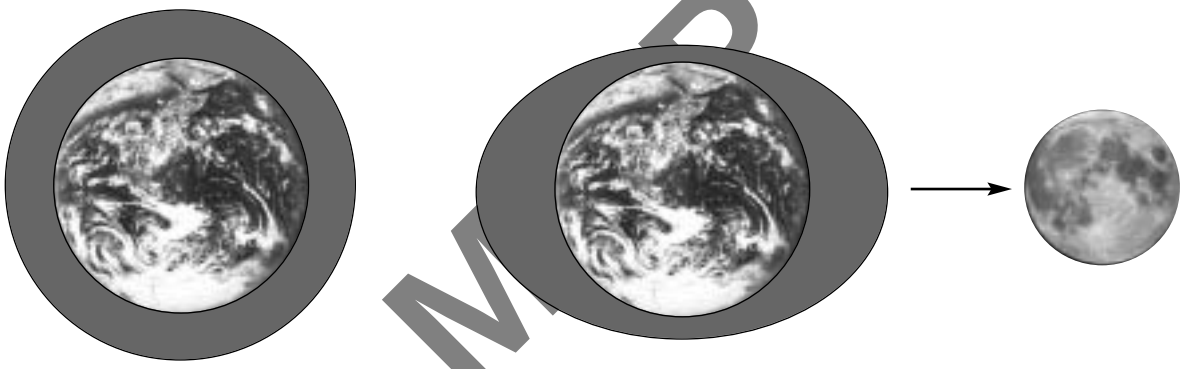
When water at the ocean's surface is heated by the Sun, it **expands**, or spreads out. Steady winds push the water, making it flow. The spin of the Earth causes the water to flow in certain directions.

TIDES

Ordinary waves are caused by the wind. **Tides**, on the other hand, are giant, slow-moving waves caused by the moon. Tides result in water level changes at the shoreline. Most beaches experience two high and two low tides each day.

June 10				June 11				June 12			
High Tide		Low tide		High Tide		Low tide		High Tide		Low tide	
A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
7:34	8:10	1:38	1:40	8:37	9:15	2:47	2:45	9:41	10:20	3:52	3:49

Tide Table for Charleston, South Carolina



Earth and Ocean with NO moon

Earth's Oceans influenced by the gravitational pull of the Moon

The moon is held close to the Earth by the pulling force of gravity. As the moon orbits the Earth, its gravity tugs at the Earth. This tug causes the surface of the ocean to bulge outward. This bulge causes high tides. The bulge follows the moon, and as the moon continues its orbit, the ocean left behind experiences a low tide.

REVIEW

1. Describe what you are seeing when observing the full moon.

2. Why does the moon appear to change shape as it orbits the Earth?

3. What is the major force that causes tides?

4. Draw and label the phases of the moon you would see in a 29 1/2 day cycle.

5. How does the spin of the Earth affect ocean currents?

6. What would happen to the ocean if there were no moon?