

## Lesson 2

# Earth's MOON

### ESSENTIAL QUESTIONS



How does the Moon move around Earth?



Why does the Moon's appearance change?

### Vocabulary

maria p. 22

phase p. 24

waxing phase p. 24

waning phase p. 24



## Launch Lab



SC.8.E.5.9

15 minutes

### Why does the Moon appear to change shape?

The Sun is always shining on Earth and the Moon. However, the Moon's shape seems to change from night to night and day to day. What could cause the Moon's appearance to change?



### Procedure

- 1 Read and complete a lab safety form.
- 2 Place a **ball** on a level surface.

- 3
- 4 Make a drawing of the ball's appearance.
- 5 Stand behind the ball, facing the flashlight, and repeat step 4.
- 6 Stand to the left of the ball and repeat step 4.

### Data and Observations

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### Think About This

1. What caused the ball's appearance to change?

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2. **Key Concept** What do you think produces the Moon's changing appearance in the sky?

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### Florida NGSS

**LA.8.2.2.3** The student will organize information to show understanding or relationships among facts, ideas, and events (e.g., representing key points within text through charting, mapping, paraphrasing, summarizing, or comparing/contrasting);

**SC.8.E.5.4** Explore the Law of Universal Gravitation by explaining the role that gravity plays in the formation of planets, stars, and solar systems and in determining their motions.

**SC.8.E.5.9** Explain the impact of objects in space on each other including:

1. the Sun on the Earth including seasons and gravitational attraction
2. the Moon on the Earth, including phases, tides, and eclipses, and the relative position of each body.

**SC.8.N.1.1** Define a problem from the eighth grade curriculum using appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.





## Inquiry Two Planets?

1. The smaller body is Earth's Moon, not a planet. Just as Earth moves around the Sun, the Moon moves around Earth. What changes do you think are caused by the Moon's motion around Earth?

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SUBMIT SHOW ANSWERS CLEAR

## Seeing the Moon

Imagine what people thousands of years ago thought when they looked up at the Moon. They might have wondered why the Moon shines and why it seems to change shape. They probably would have been surprised to learn that the Moon does not emit light at all. Unlike the Sun, the Moon is a solid object that does not emit its own light. You only see the Moon because light from the Sun reflects off the Moon and into your eyes. Some facts about the Moon, such as its mass, size, and distance from Earth, are shown in **Table 1**.

Click below.

abc

**Active Reading** 2. **Point Out** Underline the reason you are able to see the Moon.

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**Table 1 Moon Data**

Mass	Diameter	Average distance from Earth	Time for one rotation	Time for one revolution
1.2% of Earth's mass	27% of Earth's diameter	384,000 km	27.3 days	27.3 days

### Active Reading

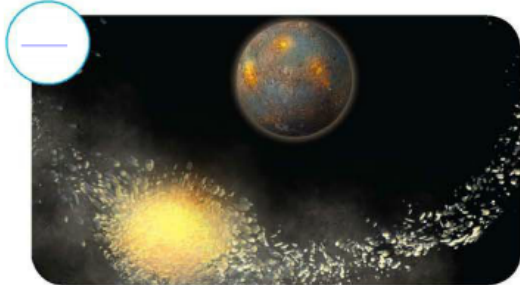
## FOLDABLES<sup>®</sup> LA.8.2.2.3

Use two sheets of paper to make a bound book. Use it to organize information about the lunar cycle. Each page of your book should represent one week of the lunar cycle.



**Figure 9** The Moon probably formed 4.5 billion years ago when a large object collided with Earth. Material ejected from the collision eventually clumped together and formed the Moon.

**Active Reading** 3. **Sequence** Put the images in the correct sequence describing the formation of the Moon by writing 1, 2 or 3 in the circles.



The particles gradually clump together and form the Moon.



An object the size of Mars crashes into the semi-molten Earth about 4.5 billion years ago.



The impact ejects vaporized rock into space. As the rock cools, it forms a ring of particles around Earth.

## The Moon's Formation

The most widely accepted idea for the Moon's formation is the giant impact hypothesis, shown in **Figure 9**. According to this hypothesis, shortly after Earth formed about 4.6 billion years ago, an object about the size of the planet Mars collided with Earth. The impact ejected vaporized rock that formed a ring around Earth. Eventually, the material in the ring cooled and clumped together, forming the Moon.

## The Moon's Surface

The surface of the Moon was shaped early in its history. Examples of common features on the Moon's surface are shown in **Figure 10**.

**Craters** The Moon's craters were formed

when objects from space crashed into the Moon. Light-colored streaks called rays extend outward from some craters.

Most of the impacts that formed the Moon's craters occurred more than 3.5 billion years ago, long before dinosaurs lived on Earth. Earth was also heavily bombarded by objects from space during this time. However, on Earth, wind, water, and plate tectonics erased the craters. The Moon has no atmosphere, water, or plate tectonics, so craters formed billions of years ago on the Moon have hardly changed.

**Maria** The large, dark, flat areas on the Moon are called **maria** (MAR ee uh). The maria formed after most impacts on the Moon's surface had stopped. Maria formed when lava flowed up through the Moon's crust and solidified. The lava covered many of the Moon's craters and other features. When this lava solidified, it was dark and flat.

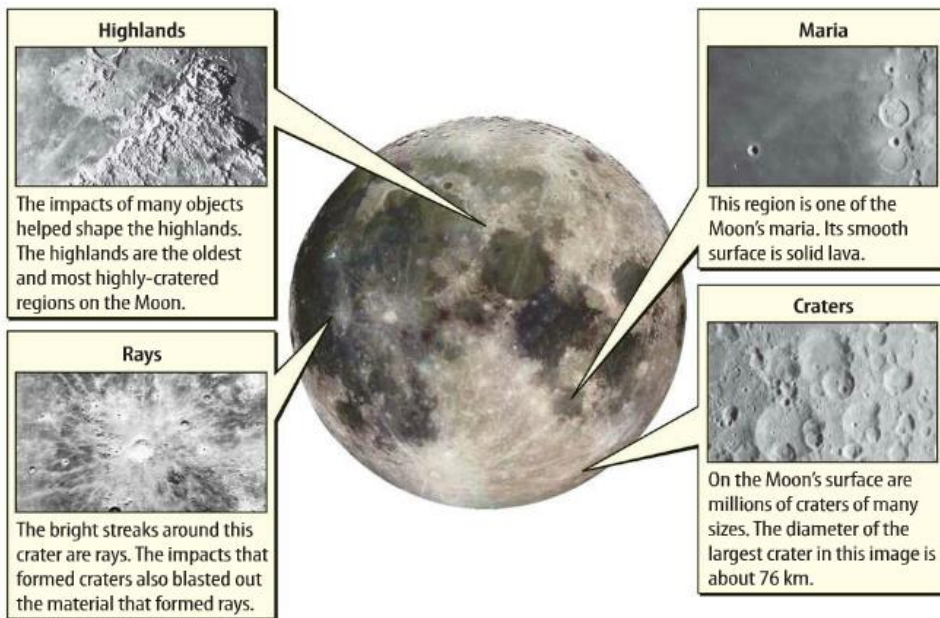
**Active Reading** 4. **Recall Underline** How did maria form on the Moon's surface?

**Highlands** The light-colored highlands are too high for the lava that formed the maria to reach. The highlands are older than the maria and are covered with craters.

Click below.

abc





**Figure 10** The Moon's surface features include craters, rays, maria, and highlands.

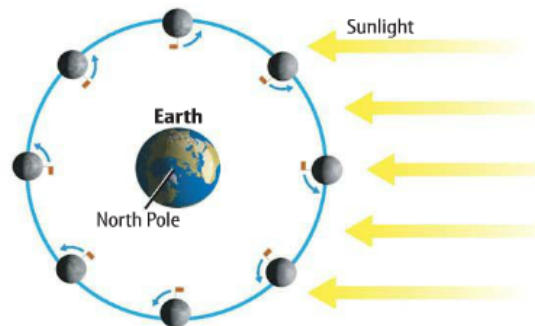
## The Moon's Motion

While Earth is revolving around the Sun, the Moon is revolving around Earth. The gravitational pull of Earth on the Moon causes the Moon to move in an orbit around Earth. The Moon makes one revolution around Earth every 27.3 days.

**5. NGSSS Check Explain Underline** What produces the Moon's revolution around Earth?  
5C.8.E.5.4, 5C.8.E.5.9

The Moon also rotates as it revolves around Earth. One complete rotation of the Moon also takes 27.3 days. This means the Moon makes one rotation in the same amount of time that it makes one revolution around Earth. **Figure 11** shows that, because the Moon makes one rotation for each revolution of Earth, the same side of the Moon always faces Earth. This side of the Moon is called the near side. The side of the Moon that cannot be seen from Earth is called the far side of the Moon.

SUBMIT SHOW ANSWERS CLEAR



**Figure 11** Many people think the Moon has a dark side and a light side. Half of the Moon is always in sunlight, but the lit portion changes as the Moon rotates and revolves around Earth.

**6. Visual Check Apply** Why does the same side of the Moon always face Earth?

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SUBMIT SHOW ANSWERS CLEAR



Click below.

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Inquiry

LAB STATION

Try It!

**MiniLab** How can the Moon be rotating if the same side of the Moon always faces Earth? at connectED.mcgraw-hill.com



### Apply It!

After you complete the lab, answer the question below.

1. Write an analogy to explain how the same side of the Moon is always facing Earth.

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### SCIENCE USE V. COMMON USE

#### phase

**Science Use** how the Moon or a planet is lit as seen from Earth

**Common Use** a part of something or a stage of development

## Phases of the Moon

The Sun is always shining on half of the Moon, just as the Sun is always shining on half of Earth. However, as the Moon moves around Earth, usually only part of the Moon's near side is lit. *The lit part of the Moon or a planet that can be seen from Earth is called a phase.* As shown in **Figure 12**, the motion of the Moon around Earth causes the phase of the Moon to change. The sequence of phases is the lunar cycle. One lunar cycle takes 29.5 days or slightly more than four weeks to complete.

7. **NGSSS Check** **Identify Underline** what produces the phases of the Moon. **SC.8.E.5.9**

Click below.

abc

### Waxing Phases

During the **waxing phases**, more of the Moon's near side is lit each night.

**Week 1—First Quarter** As the lunar cycle begins, a sliver of light can be seen on the Moon's western edge. Gradually the lit part becomes larger. By the end of the first week,

the Moon is at its first quarter phase. In this phase, the Moon's entire western half is lit.

**Week 2—Full Moon** During the second week, more and more of the near side becomes lit. When the Moon's near side is completely lit, it is at the full moon phase.

### Waning Phases

During the **waning phases**, less of the Moon's near side is lit each night. As seen from Earth, the lit part is now on the Moon's eastern side.

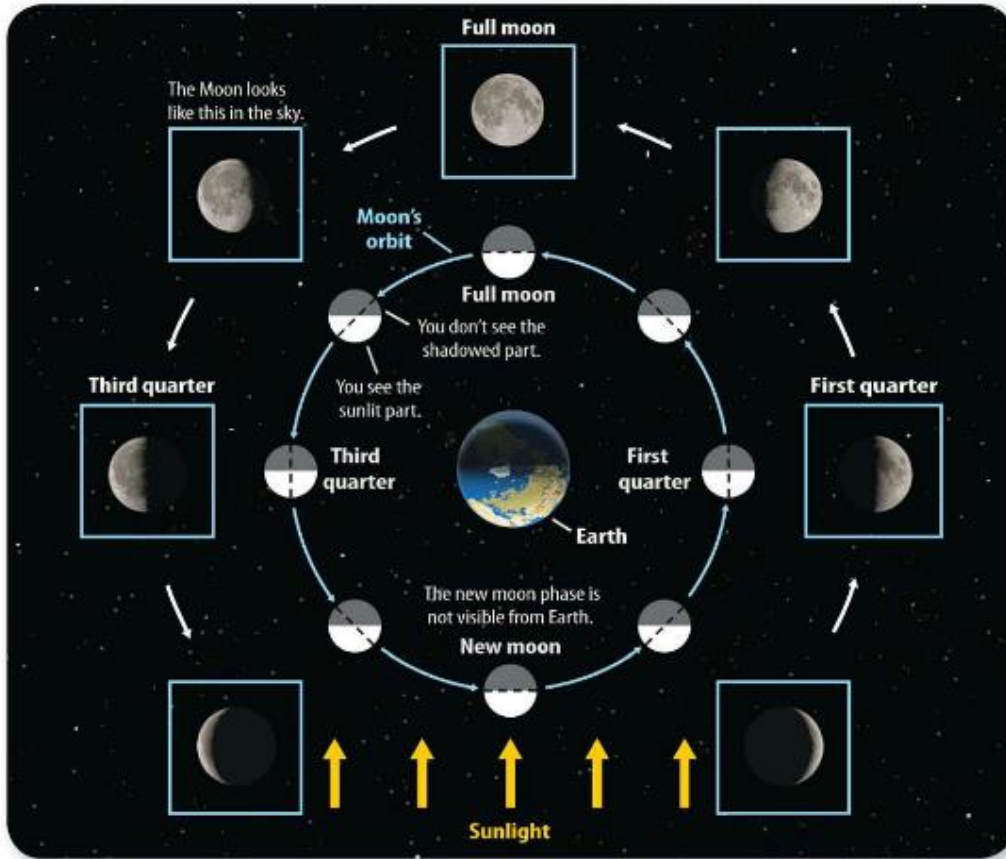
**Week 3—Third Quarter** During this week, the lit part of the Moon becomes smaller until only the eastern half of the Moon is lit. This is the third quarter phase.

**Week 4—New Moon** During this week, less and less of the near side is lit. When the Moon's near side is completely dark, it is at the new moon phase.



## The Lunar Cycle

**Figure 12** As the Moon revolves around Earth, the part of the Moon's near side that is lit changes. The figure below shows how the Moon would look at different places in its orbit.



## The Moon at Midnight

The Moon's motion around Earth causes the Moon to rise, on average, about 50 minutes later each day. The figure below shows how the Moon looks at midnight during three phases of the lunar cycle.

First quarter	Full moon	Third quarter
		
At midnight, the first-quarter moon is setting. It rises during the day at about noon.	The full moon is highest in the sky at about midnight. It rises at sunset and sets at sunrise.	The third-quarter Moon rises at about midnight, about six hours later than the full moon rises.



## Lesson Review 2

### Visual Summary



According to the giant impact hypothesis, a large object collided with Earth about 4.5 billion years ago to form the Moon.



Features like maria, craters, and highlands formed on the Moon's surface early in its history.



The Moon's phases change in a regular pattern during the Moon's lunar cycle.

### Use Vocabulary

- 1 The lit part of the Moon as viewed from Earth is a(n) \_\_\_\_\_.
- 2 When the lit side of the Moon appears to be getting larger, the lunar phase is described as \_\_\_\_\_.
- 3 When the lit side of the Moon appears to be getting smaller, the lunar phase is described as \_\_\_\_\_.

### Understand Key Concepts

- 4 Which phase occurs when the Moon is between the Sun and Earth?  
 (A) first quarter                       (C) new moon  
 (B) full moon                               (D) third quarter
- 5 **Reason** Why does the Moon have phases?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### Interpret Graphics

- 6 **Organize Information** Fill in the table below with descriptions of the lunar surface. **LA.8.2.2.3**

Crater _____ _____ _____ _____	Ray _____ _____ _____ _____
Maria _____ _____ _____ _____	Highland _____ _____ _____ _____

### Critical Thinking

- 7 **Reflect** Imagine the Moon rotates twice in the same amount of time the Moon orbits Earth once. Would you be able to see the Moon's far side from Earth? **SC.8.E.5.9**

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