

# How Big Are Earth, Sun, and Moon?

<p><b>Science Standard I:</b> Students will understand that the shape of Earth and the moon are spherical and that Earth rotates on its axis to produce the appearance of the sun and moon moving through the sky.</p>
<p><b>Objective 1:</b> Describe the appearance of Earth and the moon.</p>
<p><b>Intended Learning Outcomes:</b></p> <ol style="list-style-type: none"> <li>3. Understand Science Concepts and Principles</li> <li>4. Communicate Effectively Using Science Language and Reasoning</li> </ol>
<p><b>Content Connections:</b> Math IV-1</p>

Science  
Standard  
I

Objective  
1

Connections

## Background Information

A star is a ball of hot, burning gases. The sun is the closest star to Earth (about 150,000,000 km/93,000,000 miles) away. Therefore, it looks bigger and brighter to those on Earth than other stars.

Earth spins on an imaginary line called an axis. A complete rotation takes about 24 hours (one day). The part of Earth facing the sun has daylight; the part facing away from the sun has night.

Earth revolves around the sun as it rotates on its axis.

One complete orbit, or revolution, of Earth around the sun takes about 365 days (one year). It actually takes 364 1/4 days to revolve around the sun. One-fourth of a day is equal to six hours. If you take a 24 hour day and divide it by six, you get four. Therefore, an extra day is added to the calendar every four years. Every fourth year is a leap year, which has 366 days.

The moon's diameter is about one-fourth that of Earth's.

## Invitation to Learn

Pass out white boards and markers to each student. Have the students draw what they think exists in space. Walk around the room and assess each drawing. Make a list on the chalkboard of all the different responses. Students erase boards and draw what they think is in the center of our solar system. Again, walk around the room and make assessments. Discuss. Students erase boards and draw what else is out there besides Earth, the moon, and stars. Discuss.

## Instructional Procedures

### Materials

For each group

- Clear glass or beaker

For each student

- White boards
- Markers
- Eraser
- Water
- Rubbing alcohol
- Teaspoon oil
- Moon Boxes: clay, books, sun, moon, Earth orbit, Styrofoam ball three inches in diameter, flashlight, and hand lens or magnifying glass
- Compass

### Materials

- White paper
- 5 1/2 yds. of yarn
- Sidewalk chalk
- Earth and Moon Diagram*

### Where is the sun located in the solar system?

1. Pass out a beaker or clear glass to each group.
2. Fill the beaker half full with water.
3. Tilt the beaker slightly. Gently fill the beaker with rubbing alcohol. The alcohol is less dense than the water and therefore will float on the surface of the water. Slowly add a teaspoon of oil to the beaker. The oil will form spheres where the water and alcohol meet.
4. Questions to ask and discuss: What motion does Earth go through once a year? (It revolves around the sun once every year) Since Earth revolves around the sun, is Earth or the sun the center of the solar system? (Sun.) If the oil spheres represent the planets in the solar system, where would the sun be located? (In the center of the beaker.) How many planets are in our solar system? (Nine.) Like Earth, all the planets revolve around the sun. Do you think it takes all the planets one year (365 days) to make this journey? (No.)

### How big is Earth, moon, and sun?

1. Ask students to estimate the diameter of Earth, sun, and moon.
2. Explain to the students that you are going to help them to understand the sizes of Earth, sun, and moon by making a “scale model;” a model that will be smaller than the real thing, but that will maintain the size relationship between the three objects.
3. Using the *Earth and Moon Diagram* (p. 3-17), show them a circle of paper that is 4" (10 cm) in diameter. This will represent Earth. Now, ask them how big a paper circle you need to represent the moon. Have the students cut out a circle the size they think the moon should be and compare their estimates.
4. Give them the approximate diameters of the real moon and Earth.

*moon, about 2,000 miles (3,250 km)*

*Earth, about 8,000 miles (13,000 km)*

Ask again, “For a 4" paper Earth, how big should we make our paper moon?” If they don’t see the relationship, point out that 2,000 miles is one-fourth as big as 8,000 miles. Therefore, the paper moon should be 1" (2.5 cm) in diameter.

5. Cut out a paper moon of that size.

6. Have students estimate how big to make the sun before reviewing the size of the actual sun.

7. Approximate diameter of the real sun.

*sun, about 800,000 miles (1,300,000 km)*

Have them change their estimates based on this information.

8. How many times bigger will the paper sun need to be than the paper moon of 1"?

800,000 divided by 2,000

is the same as

800 divided by 2 = 400

So....if your paper moon is 1", the paper sun will be 400" (1,000 cm).

400" divided by 36" gives you about 11 yards

You don't have paper big enough to make that circle! Instead, use 5 1/2 yards of string to draw an 11 yard circle with chalk on the playground. Tie one end of the string to a piece of chalk. Have another student hold the other end. The student with the chalk will pull the string tight and draw a circle on the cement. Then, trace the paper Earth and the paper moon with chalk for comparison.

## ***Possible Extensions/Adaptations/Integration***

### **Estimation**

1. Pass out gray or white Styrofoam balls and hand lens to each group. Have students make observations. Explain to the students this represents the moon. The moon is a gray sphere covered with many craters. Read *What the Moon Is Like* by Franklyn M. Branley. Discuss what the moon is like.
2. Color, cut out, and assemble *ABC Moon Book* (p. 3-8) created by Susan Tenhor and Colleen Davis.

## ***Assessment Suggestions***

1. Have students use clay from their moon boxes and make a scale model of Earth and the moon. (Remember, the moon is 1/4 the size of Earth.)
2. Pass out white boards again and have them draw answers to the same questions asked at the beginning of the lesson.

## **Additional Resources**

*The Moon Book*, by Gail Gibbons; ISBN 0613128877

*Handshake in Space*, by Sheri Tan; ISBN 1568995350

*One Giant Leap*, by Dana Meachen Rau; ISBN 0613515765

*What the Moon is Like*, by Franklyn M. Branley; ISBN 0064451852

## **Family Connections**

- Conduct the same experiment at home (water, rubbing alcohol, and oil).
- Check out a moon box to share with family.

### **Moon Boxes**

- Bowl with flour
- Rocks of different sizes
- Flashlight
- Mirror
- Styrofoam ball
- *My Book About The Moon* student activity book (p. 3-15)

How many people have walked on the moon? (Twelve astronauts have walked on the moon, the last in 1972.)

Here are the names of those astronauts listed chronologically by the date of their walk.

### **July 20, 1969**

Neil Armstrong  
Edwin “Buzz” Aldrin

### **Nov. 19, 1969**

Charles (Pete) Conrad  
Alan Bean

### **Feb. 5, 1971**

Alan Shepard  
Edgar Mitchell

### **July 30, 1971**

James Irwin  
David Scott

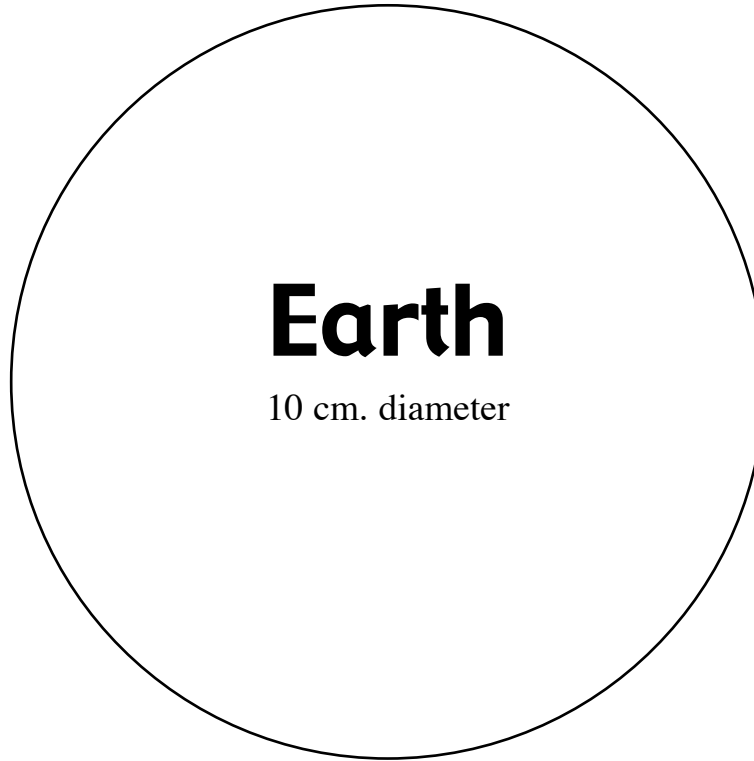
### **Apr. 21-23, 1971**

Charles Duke  
John Young

### **Dec. 11-13, 1972**

Harrison Schmitt  
Eugene Cernan

# ***Earth and Moon Diagram***



# ABC Moon Book

By Susan Tenhor  
and Colleen Davis

**A** is for astronauts like  
Neil Armstrong, the first  
man to walk on the  
moon.

**B** is for blue moon.  
When there are 2 full  
moons in one month,  
The second one is called  
a blue moon.

**C** is for craters on the moon, believed to be created by meteorites crashing onto the moon's surface.

**D** is for dust, which formed on the moon when meteorites crashed into the moon, and broke up pieces of the moon's surface.

**E** is for Earth, our moon's planet. It is four times larger than our moon. From space, it looks blue and white because of its atmosphere.

**F** is for the far side of the moon. It's the side that never faces Earth.

**G** is for gavity, the force that pulls objects in space toward each other. Because the moon is smaller than Earth, it has less gavity.

**H** is for high and low tides. The moon's gravity affects the level of our oceans.

**I** is for illuminate. The moon is illuminated by the sun's light.

**J** is for July, 1969, when astronauts Armstrong and Aldrin walked on the moon.

**L** is for the lunar eclipse. This is when the moon is near its full phase and is blocked in Earth's shadow.

**K** is for Kangaroo hops that astronauts can take on the moon because of the low gravity.

**N** is for new moon. This is when the sun is shining mostly on the side of the moon that faces away from Earth.

**M** is for moon, a natural, rocky object that goes around a planet. Some planets have many moons.

**O** is for orbit, the path an object in space follows as it revolves around another object. The moon orbits Earth. Earth orbits our sun.

**Q** is for quiet. Because the moon has no atmosphere, there is no rain, snow or wind and is always quiet.

**P** is for phases. A phase is part of a cycle. There are four main phases of the moon.

**R** is for rotation, the spinning of an object (planet) around its own axis. The moon only rotates every 28 days (about once a month), Earth rotates every 24 hours (once a day).

**S** is for sphere.  
**S**pheres are round like  
balls. The moon and  
Earth are both spheres.

**T** is for telescope. We  
use telescopes to view  
the moon and our night  
sky.

**U** is for universe. Earth  
and moon are part of  
our vast universe.

**V** is for volcanoes. You  
can see mountains  
made from volcanoes  
and dark patches made  
by lava on our moon's  
surface.

**W** is for waning and waxing crescent moons.

**X** is for extreme temperatures. Day temperatures on the moon reach 230° F. Night temperatures drop to -292° F.

**Y** is for year. In one Earth year, the moon goes around Earth 12 times.

**Z** is for astronaut Buzz Aldrin. He and Neil Armstrong were the first men to land on the moon.

# ***My Book About The Moon Student Activity Book***

Name \_\_\_\_\_

Dear Parent,

Your child has checked out a Moon Box with materials included to conduct some science experiments at home. This kit is provided so that families may be actively involved in doing science together. This kit may be checked out for two days, and then needs to be returned to the classroom.

Please be sure that the flashlight, mirror, Styrofoam ball, bowl of flour, and small rocks are returned with the kit. Your child may keep the *My Book About The Moon* student activity book.

Suggestions for using the kit:

- Reserve 30 minutes for the kit activities during the week.
- Listen to each other.
- Offer assistance only when needed.
- Ask questions such as. . . .
  - **What** happened?
  - **Why** do you suppose that happened?
  - **Where** have you seen this happen before?
  - **What** do you think would happen if . . . . ?
- Accept answers your child gives.
- Enjoy the time together!

## Moon Box Activities

### Moon Phases

- Begin with the Styrofoam ball and pencil. Hold the ball with the X facing you.
- Have someone on the other side of the ball shine the flashlight on it. Do this in a really dark room. You will not see the lighted half of the ball. It is a new moon. Stand on one spot.
- Turn your body counter clockwise a bit while holding the ball in front of you and a bit above your head—always keeping the X toward you. You will see a small part of the lighted half. It is a crescent moon.
- Keep turning, and soon you will see more of the lighted half. It is the a first quarter moon.
- Keep the ball above your head and turn some more. Soon you will see all the lighted half of the ball. The moon is full.
- Keep turning and you will see less and less of the lighted part of the ball. You will see one quarter of it—the third quarter moon. Then you’ll see a thin crescent.
- When you have turned all the way around, you have seen all the phases of the moon.

### Day and Night

**Materials:** ball, flashlight, and a sticker placed on your ball

- Put the sticker on your ball to indicate where you live.
- Place the ball on a table or have someone hold it.
- Shine the flashlight on the ball where the sticker is. Is it day or night?
- Turn the ball counterclockwise until the sticker is away from you. Is it day or night?

Draw a picture of what you just did.

**How Moon Craters are Made**

**Materials:** Bowl of flour and rocks.

- Smooth out the flour with your hand.
- Drop a rock from different heights and record results.

<b>Height in inches</b>				
<b>Draw a picture of your crater.</b>				

What did you learn? \_\_\_\_\_

**What is moonlight?**

**Materials:** flashlight, mirror, Styrofoam ball, three people

- Make a triangle using your three helpers.
- One person will hold the mirror. (moon)
- One person will hold the Styrofoam ball. (Earth)
- One person will hold the flashlight. (sun)
- Turn out the lights. Observe the ball.
- Turn on the flashlight and shine the light on the mirror. Hold the mirror so the light is reflected to the ball.
- The moonlight we see from Earth comes from the sun.

Make a drawing of what you did.