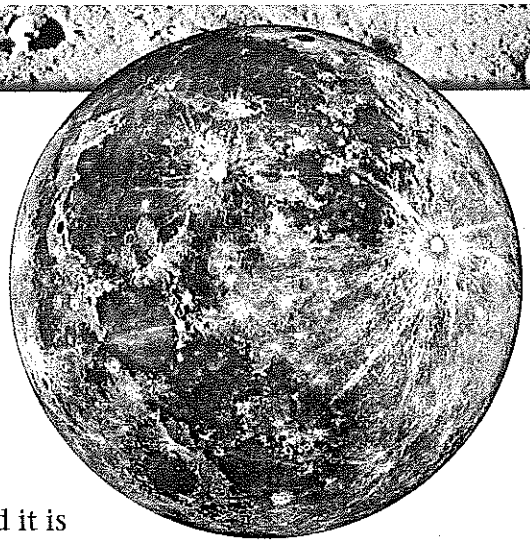
What Is the Moon Like?



▲ **Figure 15** We can see many of the Moon's surface features with our eyes alone or with a simple telescope. The dark areas are smooth, flat plains, and the light areas are hills and mountains.

The Moon is Earth's closest neighbor in space and it is Earth's natural satellite. The distance between Earth and the Moon varies during the Moon's orbit, but on average the Moon is about 384,000 kilometers (about 238,600 miles) from Earth. The diameter of the Moon is about 3,475 kilometers (about 2,159 miles), which is about one-fourth the diameter of Earth. The word *lunar,* meaning "of the moon," comes from *luna,* the Latin word for moon. The lunar surface is rocky and cold, but scientists hypothesize that, long ago, the Moon may have had more volcanic activity than it does today.

Maria and Highlands

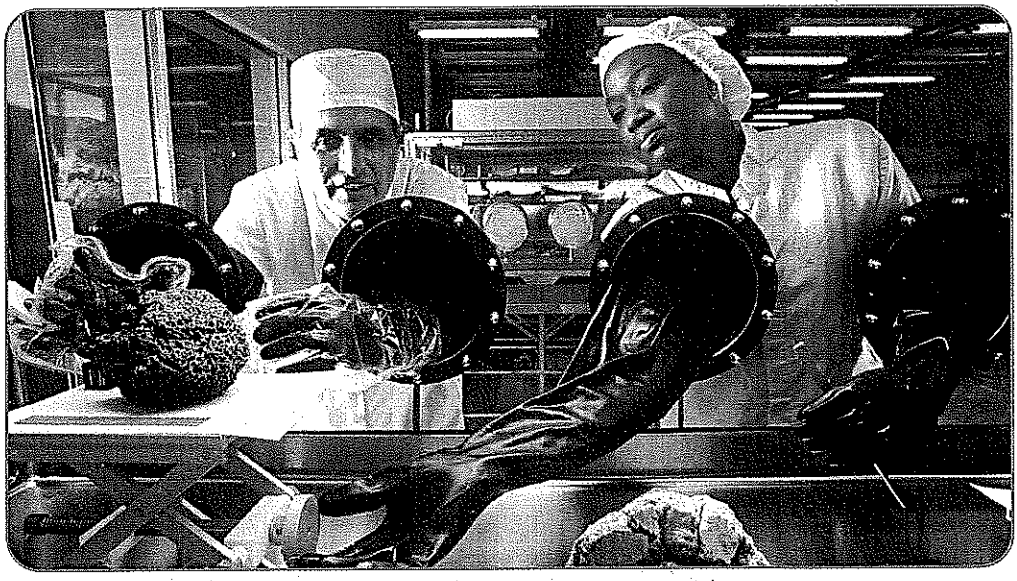
We can see the Moon's surface clearly because the Moon does not have an atmosphere as Earth does. When we look at the Moon, we can see dark and light patches (Figure 15). The dark patches on the Moon are called **maria.** Long ago, people thought that the dark areas on the Moon were oceans, and *maria* is a Latin word that means "seas." The maria are actually smooth, flat plains that formed long ago, when lava from the Moon's interior rose up through cracks and filled low-lying areas left by very large asteroid impacts on the Moon's surface. The light patches on the Moon's surface are hilly areas called **highlands.**

READ TO UNDERSTAND

- How do meteorites shape the Moon's surface?
- Why does the same side of the Moon always face Earth?
- What causes the phases of the Moon?

VOCABULARY

maria	phases
highlands	waxing
crater	waning



◀ **Figure 16** We can study lunar rocks to learn more about the Moon's geology and history. Geologic evidence suggests that the Moon formed when a giant space object, perhaps as large as Mars, struck Earth. The impact broke off chunks of Earth and flung them into orbit. Eventually the pieces stuck together and formed the Moon.

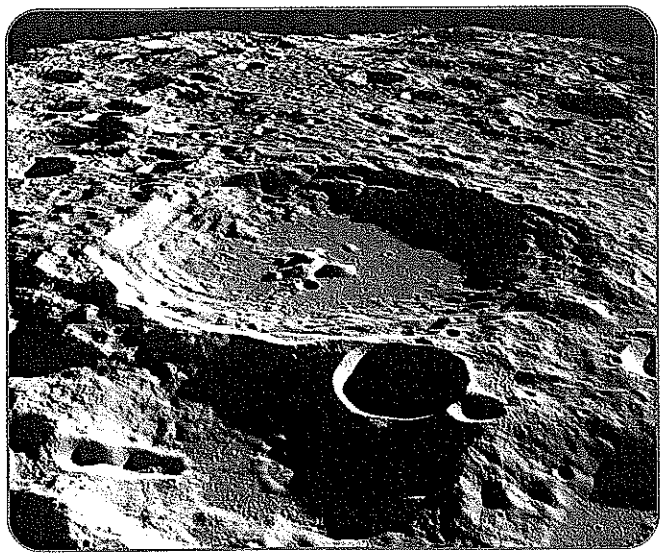
Craters

Over time, the impacts of meteorites have formed bowl-shaped depressions called **craters** in the Moon's surface (Figure 17). The Moon has no atmosphere to protect it from meteoroids, so it has millions of craters. Most are less than 15 kilometers (about 9.3 miles) across.

Because the Moon has no wind or water, its craters do not wear away as they would on Earth. Once a crater forms, it stays the same for a very long time. Craters that formed billions of years ago can still be seen. The Moon's highlands have many more craters than the maria do. By observing the Moon's surface, we can see that some craters have light-colored streaks or rays extending outward from their rims. When a meteorite impact forms a crater, rock particles are blasted away. These particles often settle in rays that spread out from the crater.

Exploring the Moon

As long as people have looked into the sky, the Moon has been an object of curiosity and study. The earliest scientists learned many things about the Moon just by observing it from Earth with their eyes alone. The first measurements of the Moon's size and distance from Earth were made more than 2,000 years ago. Galileo Galilei of Italy was the first person to view the Moon through a telescope. In 1609 he observed and accurately described the Moon's mountains and craters.



▲ **Figure 17** This photograph of Moon craters was taken by the *Apollo 11* astronauts in 1969. The largest crater shown is about 80 kilometers (about 50 miles) in diameter.

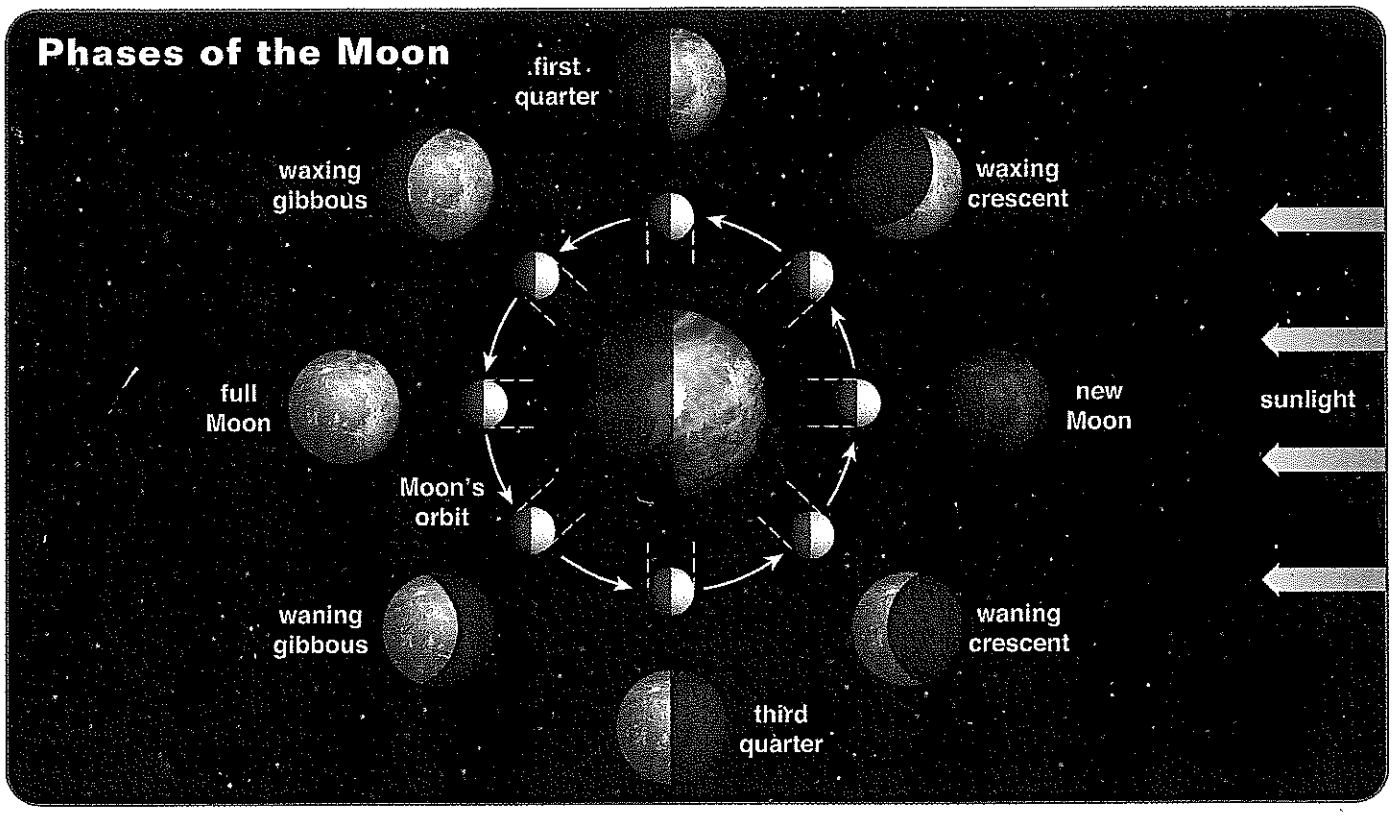
Most of what we know about the Moon, however, comes from data gathered in the last 50 years. In 1957 the former Soviet Union launched *Sputnik,* the world's first artificial satellite. Two years later, the Soviet spacecraft *Luna 3* photographed the far side of the Moon. During the next decade, the Soviet Union and the United States launched dozens of lunar missions. These were uncrewed attempts to orbit or fly by the Moon or to land probes on its surface. The missions were part of a race to put a human on the Moon.

The race ended on July 20, 1969. On that day, the U.S. spacecraft *Eagle,* the lunar module from *Apollo 11,* landed on the Moon's Sea of Tranquility. Astronaut Neil Armstrong climbed down the ladder of the module and became the first human to walk on a space object other than Earth. Eleven other astronauts have walked on the Moon since then, the last in 1972. These explorers collected data and rock and soil samples that are still helping scientists learn about the Moon and the history of our solar system.

Moon Phases

Just as Earth rotates on its axis and revolves around the Sun, the Moon rotates on its axis and revolves around Earth. The Moon rotates once every 27.3 days. It takes the same amount of time, 27.3 days, for the Moon to revolve once around Earth. So a Moon "day" is the same length of time as a Moon "year." Because the Moon's rotation and revolution take the same amount of time, the same side of the Moon always faces toward Earth.

The Moon does not produce light of its own. We can see the Moon because the Sun's light reflects off the Moon's surface. As with Earth, the half of the Moon that faces the Sun



▲ Figure 18 The Moon passes through a cycle of eight phases during one revolution around Earth. Our view of the Moon changes as we see more or less of the Moon's sunlit side. The outer ring of the diagram shows the view of the Moon during each phase, as viewed from Earth. The inner ring of the diagram shows how the Moon is lighted by the Sun, as viewed from space. The dashed lines indicate the part of the Moon that is visible from Earth.

is lighted, and the other half is dark. From Earth we can see only the lighted part of the Moon that is facing toward Earth at any one time. We cannot see the part of the Moon that is facing away from Earth, no matter whether it is lighted or dark.

As the Moon orbits Earth, we can see different amounts of the Moon's lighted side. Because of this, the Moon's shape appears to change from day to day in a predictable way. We call the Moon's cycle of changes the **phases** of the Moon (Figure 18).

At the *new Moon* phase, the Moon is lined up between Earth and the Sun. All of the Moon's lighted side is facing the Sun, and all of the Moon's dark side is facing Earth. So we see no Moon at all. As the Moon revolves around Earth and away from the Sun, we see a bit more of its lighted side each night and we say the Moon is **waxing.** A few days after the new Moon, we see a thin, *waxing crescent* Moon. Soon we are able to see one-half of the lighted side of the Moon (one-quarter of the whole Moon). This phase is called the *first quarter* Moon. A few days later we can see three-fourths of the lighted side, called the *waxing gibbous* Moon. Eventually we can see the whole round disk of the Moon's lighted side, called the *full Moon.*

Each day after the full Moon, we see less and less of the Moon's lighted side, and we say the Moon is **waning.** The Moon passes through the *waning gibbous* phase. When it reaches the *third quarter* phase, we once again see only half of the lighted side of the Moon. As the Moon continues to wane, we see the *waning crescent* Moon. A few days later, the cycle begins again with a new Moon.

The lunar cycle takes 29.5 days. This is slightly longer than the 27.3 days the Moon takes to orbit Earth, because while the Moon is orbiting Earth, Earth is also moving forward in its orbit around the Sun.