Phases of the Moon

Strand		Interrelationships in Earth/Space Systems
Topic		Investigating phases of the moon
Primary SOL	6.8	The student will investigate and understand the organization of the solar system and the interactions among the various bodies that comprise it. Key concepts include e) the mechanics of day and night and the phases of the moon.
Related SOL	6.1	The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which i) models and simulations are designed and used to illustrate and explain phenomena and systems.

Background Information

As Earth rotates, different sides of Earth face toward or away from the sun, causing day and night, respectively. The phases of the moon are caused by its position relative to the Earth and sun.

As Earth's only natural satellite, the moon has long been an object of fascination and misunderstanding. Over the course of a 28-day cycle (lunar cycle), the moon shows us many different faces (shapes). These different shapes are called *phases,* and they are the result of the way the sun lights up the moon's surface as the moon orbits Earth. The moon can be seen only as a result of the sun's light reflecting off it, because it does not produce any light of its own.

Materials

- Lamp without shade
- Light bulb (preferably clear)
- Tennis ball

Vocabulary

phase, revolution, revolve, rotate, rotation, satellite

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

Introduction

1. Assess students' knowledge of the phases of the moon (taught in grade 4). Be sure to clear up any misconceptions. It is essential that students understand the difference between the terms *revolve* and *rotate* in this context: a celestial body *rotates on its axis* and *revolves around another body*. Have students demonstrate this difference, if necessary.

Procedure

1. Select a student volunteer to be the Earth. Position a bare light bulb, representing the sun, so that the bulb is at the same height as the volunteer's head. Turn the bulb on, and darken the room.

2. Tell students that the volunteer's head represents the Earth, the light bulb represents the sun, and the tennis ball represents the moon. Direct him/her to face the sun (bulb) and hold the moon (tennis ball) in his/her left hand at arm's length directly in front of him/her and slightly overhead. Have the class observe the moon, noting that the sun lights up the half of the moon facing away from the Earth and that the Earth can see only the unlit or dark half of the moon. Tell students that this moon phase is called a *new moon,* and point out that it occurs when the moon is *between* the sun and the Earth. Have student note these facts on paper, noting that in the night sky, the dark half of the moon is not visible.
3. While the Earth is still facing the sun, have him/her move (revolve) the moon around to his/her left side. Ask how much of the moon's surface the Earth can now see lit up. *(one-quarter)* Point out that the moon has now *revolved* one-quarter of the way around Earth, a process that takes approximately one week after a new moon. This phase is known as a *first-quarter moon.* Have students note these facts on paper.
4. To model the next phase, have the volunteer place his/her back to the sun and hold the moon directly in front of him/her but still slightly overhead. Have the class notice that it is this inclined orbit position that allows the Earth to see the full half of the moon facing him/her lit up even when the Earth is between the sun and the moon—that is, Earth's shadow does not fall on the moon. Tell students that when you can see the entire half of the moon lit up, it is called a *full moon.* The moon has now completed half of its revolution around the Earth, which takes about two weeks after a new moon. Have students note these facts on paper.
5. Have the Earth put the moon in his/her right hand and move (revolve) the moon around to his/her right side. Once again, ask how much of the moon's surface the Earth can now see lit up. *(again, one-quarter)* Point out that the moon has now revolved three-quarters of the way around the Earth, a process that takes approximately three weeks after a new moon. This phase is known as a *third-quarter moon.* Have students note these facts on paper.
6. Direct the Earth to face the sun again and hold the moon directly in front of him/her and slightly overhead. Have the class observe the moon, noting that once again, the sun lights up the half of the moon facing away from the Earth and that the Earth can see only the unlit of dark half: another lunar cycle has begun with a new moon. Have student note these facts on paper.
7. Discuss the 28-day lunar cycle, having students refer to their written notes to describe it.

Assessment

- **Questions**
  - What happened as the moon revolved around the Earth?
  - Why did the shadows change?
  - The moon rotates on its axis once every 28 days, and it revolves around Earth once every 28 days. Why do we see only one side of the moon? (Hint: Mark a spot on the ball [moon] and revolve it around you [Earth] without letting it rotate on its axis. What do you observe about the side of the ball facing you? Now, repeat while rotating the ball on its axis at the same rate as its revolution.)

- **Journal/Writing Prompts**
  - Draw and label a diagram to show the positions of the moon and the sun when it is night in Virginia.
- **Other**
  - Have students draw a model showing the positions of the sun, moon, and Earth at each phase.

Extensions and Connections (for all students)

- Have students keep a moon journal, recording the positions and phases of the moon for a pre determined period of time. Have them include dates and seasons.
- Have students research the reasons we do not "feel" revolution and rotation of the Earth occurring.

Strategies for Differentiation

- Use a digital camera to take pictures of the moon in the different phases, and display them on a poster for students to examine.
- Have students access teacher-designated Web sites to find pictures of the moon phases.
- Have students use the newspaper, Internet, or pictures from the digital camera to draw the phase of the moon each day. Have them discuss whether the moon is increasing or decreasing and whether it is at full or quarter size.
- Have students predict the moon phase order using felt templates for full, new, waxing crescent, waning crescent, waxing gibbous, and waning gibbous. Then, have them check the order and reorder if needed, following the lesson.
- Have students use a T-chart or comparison table to compare and contrast the phases of the moon.
- Have students create a timeline to show the 28-day cycle of the moon.
- Have students cut and paste or draw pictures of the lunar cycle and place them in their notebooks.