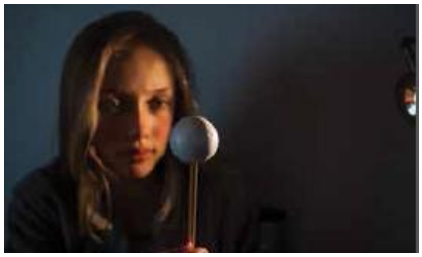
Moon Modeling

For many students, this modeling activity can be the key to a better understanding of how the Moon's orbit around Earth causes changing shapes.



Materials (per child)
Lamp with shade removed
Foam balls (1 per student)
Pencil (1 per student)
Dark room (the darker, the better)

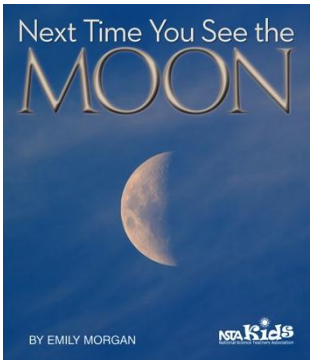
Next Generation Science Standards
ESS1.A. The Universe and Its Stars
Patterns of the motion of the Sun, Moon, and stars in the sky can be observed, described, and predicted. (1-ESS1-1)

ESS1.B Earth and the Solar System
The orbits of Earth around the Sun and of the Moon around Earth, together with the rotation of Earth about an axis between its north and south poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the Sun, Moon, and stars at different times of the day, month, and year.

Procedure
Darken the room—the darker, the better. Give each student a pencil and a foam ball. Explain that the foam ball, stuck on the end of a pencil, is a model of the Moon; the lamp is a model of the Sun; and the students' heads represent Earth. Before the guided activity below, give students time to explore the model and test different ideas about what causes Moon phases. Next, guide students through the following activity to model how the Moon changes shape.

1. With their faces toward the lamp, students hold the balls slightly above their heads so that they have to look up a little to see them. In this position, students cannot see the lighted side of the ball. This is called a *new Moon*.
2. Tell students to turn their bodies slightly to the left while still looking at the ball and holding it a little above their heads. They should turn until they see a tiny sliver of the lighted side—a *crescent Moon*. Ask,
    - Where does the Moon's light come from? (The light is coming from the Sun and is reflected off the Moon.)
    - Some people think that the Moon phases are caused by the Earth's shadow. How does this model disprove that misconception? (The shadow of my head, which represents the Earth, is nowhere near the Moon in this position. It is behind me.)
3. Instruct the students to keep turning to the left and soon they will see more of the lighted half of the ball. This is called a *quarter Moon.*
4. Have them turn a little more and almost all of the ball will be lit. This is called a *gibbous Moon*.
5. Students can keep turning until they see all the lighted half of the ball. This is a *full Moon*.
6. As students continue to turn in the same direction, they will see less and less of the lighted part of the ball. First they will see a gibbous Moon, then a quarter Moon, then a thin crescent Moon, and finally they will be back to the new Moon.
7. Tell students that the shapes they have observed in this activity are called the *Moon phases*.
8. Have students go through the orbit several times. Ask them to chorally respond with the name of each phase as it is modeled.
9. Point out that no matter where they are in the Moon's orbit, half of the Moon is always lighted by the Sun. Sometimes we see the whole lighted half from Earth (full Moon), sometimes we see almost

all of the lighted half (Gibbous Moon), sometimes we see half of the lighted half (quarter Moon), sometimes we see only see a tiny sliver of the lighted side (crescent Moon), and sometimes we can't see any of the lighted half (new Moon). The portion we see from Earth depends on where the Moon is in its orbit around the Earth.



After this modeling activity, read *Next Time You See the Moon* with your students. Refer to the model throughout the reading where the text and photographs connect.

After reading, ask students to apply some of the vocabulary from the book to the model, such as:

- W*axing* and *waning*, which are explained on pages 22 and 23. Students should realize that when they begin at new Moon and orbit the Moon to the left, they are seeing the waxing phases. One easy way to remember this is the following rhyme: If the light is on the right, the Moon is getting bright. This means that if the crescent is on the right side of the Moon, we will be seeing more and more of it each day. The Moon is waxing. After a full Moon, we see less and less of the lighted side each day. The Moon is waning.
- *First quarter Moon*, which applies to the half of the lighted side they see after a new Moon. (The light is on the right.)
- *Third quarter Moon*, which applies to the half of the lighted side they see after a full Moon. (The light is on the left.)

Read the note on the very last page of the book that says, "Note: The order of the Moon phases pictured in this book and the explanations shared apply to Earth's Northern Hemisphere." Ask students how they think the Moon would be appear differently in the Southern Hemisphere compared to the Northern Hemisphere. Use the Moon Connections "Moon Calendar," which allows you to switch between the Southern and Northern Hemispheres when viewing Moon calendars. Students will notice that the Moon phases are opposite in the Southern Hemisphere and Northern Hemisphere. For example, when we see a **waxing** crescent Moon that appears lit on the right in the Northern Hemisphere, our friends in the Southern Hemisphere are seeing a **waxing** crescent Moon that appears lit on the left. Show students several more examples using the Moon calendar. Then ask,

- Why do you think this happens?
- Aren't we all looking at the same Moon whether we are in the Northern Hemisphere or Southern Hemisphere?

Allow students some time to think, explore, and share their ideas. Then, draw a **waxing** crescent Moon on the board that is lit on the right. Have students bend over to look at it upside down. They will notice that it is still a crescent Moon, but from upside down the light is on the left side of the Moon. Explain that in the Northern and Southern Hemispheres, we are looking at the same Moon, but "upside down" from one another. Explain that both hemispheres would see more of the lighted side of the Moon in the coming days because it is **waxing**, but the light will appear on opposite sides. Check for understanding by asking a few questions, such as,

- If we see a **waning** gibbous Moon in the Northern Hemisphere, what phase will people in the Southern Hemisphere see? (***waning*** *gibbous Moon, but the light will be on the opposite side*)

- If we experience new Moon in the Northern Hemisphere, what phase do people in the Southern Hemisphere experience? (***new*** *Moon*)
- If we see a **waxing** gibbous Moon today in the Northern Hemisphere, we can expect to see more and more of the lighted side in the coming days until it is finally a full Moon. What will the Southern Hemisphere see in the coming days? (*They will also see more and more of the lighted side in the coming days because the Moon phase is* ***waxing****, but the light will appear on the opposite side of the Moon. They will observe a full Moon on the same day we observe a full Moon in the Northern Hemisphere.*)