

The Changing Moon

Description

Learners make observations of the Moon each night for a month, model how the Moon changes shape, and illustrate a picture book with scientifically accurate moon phases.

Suggested Grade Levels: 3–6

Lesson Objectives Connecting to the Standards

Content Standard A: Science as Inquiry

K–4: Ask a question about objects, organisms, and events in the environment.

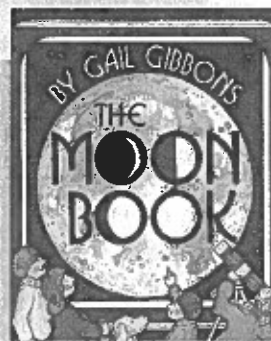
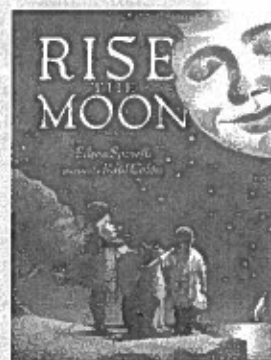
K–4: Use data to construct a reasonable explanation.

5–8: Develop descriptions, explanations, predictions, and models using evidence.

Content Standard D: Earth and Space Sciences

K–4: Understand that objects in the sky have patterns of movement. The moon moves across the sky, and its observable shape changes on a daily basis in a cycle that lasts about a month.

5–8: Understand that most objects in the solar system are in regular and predictable motion. Those motions explain such phenomena as the day, the year, phases of the moon, and eclipses.



Featured Picture Books

Title *Rise the Moon*
Author Eileen Spinelli
Illustrator Raul Colon
Publisher Dial Books for Young Readers
Year 2003
Genre Story
Summary A variety of people and animals are touched by an enchanting moonlit night.

Title *The Moon Book*
Author Gail Gibbons
Illustrator Gail Gibbons
Publisher Holiday House
Year 1998
Genre Nonnarrative Information

Summary Describes the movement, phases, and exploration of the Moon

Title *Papa, Please Get the Moon for Me*
Author Eric Carle
Illustrator Eric Carle
Publisher Simon and Schuster Books for Young Readers
Year 1986
Genre Story
Summary Monica's father gets the moon for her after it is small enough to carry, but it continues to change in size.

Time Needed

This lesson will take several class periods. Suggested scheduling:

One month before Day 1: **Engage** with read aloud of *Rise the Moon* and **Explore** with Moon Journals

Day 1: **Explain** with Moon Survey, moon modeling, and read aloud of *The Moon Book*

Day 3: **Elaborate** and **Evaluate** with *Papa, Please Get the Moon for Me* retelling

Day 4: **Evaluate** with Moon Phases Quiz

Materials

- White foam balls (1 per student) Opaque foam balls work best, but they can be difficult to find. Plain foam balls can be rolled in white latex paint to make them more opaque.
- Pencils (1 per student)
- Lamp (lampshade removed so light is given off in all directions)
- Optional: CD of night animal sounds

Student Pages

- Moon Journal
- Moon Survey
- The Moon Book Extended Anticipation Guide
- Phases of the Moon
- *Papa, Please Get the Moon for Me* Retelling Book
- Moon Phases Quiz

Engage

Read Aloud

Introduce the author and illustrator of *Rise the Moon* to the students. If you like, set the mood for this poetic book by turning down the lights and playing a CD of night animal sounds. Then read the book aloud.



Questioning

After one time reading through the book, turn back to some pages that interest you and model the questioning skills of a good reader. You can demonstrate how to interact with the text by placing sticky notes on the corresponding pages with these questions (or just large question marks) on them:

- ? Does the Moon really pull the ocean?
- ? Where does the Moon's light come from?
- ? Is the Moon only visible at night?
- ? I wonder what makes the Moon look different sometimes?

Explore

Moon Journal

Invite students to tell you what they are wondering about the Moon. Ask students how they might find the answers to some of their questions. Discuss that scientists find answers by means such as making careful observations of things, doing experiments over and over, and communicating with other scientists.

Tell students that they are going to find out more about the Moon by observing it every evening for a month. Give each student a copy of the Moon Journal. Ask them to look at the Moon each night and draw what it looks like (if it can be seen). You can also keep a daily bulletin board of the moon phases for that month. Check www.stardate.org for monthly moon calendars.

Students often have the misconception that the Moon gets larger and smaller. Empty circles on the Moon Journal student page are provided so that students can darken the areas of the Moon that are not lighted. This method of recording moon phases takes into account that the entire Moon is present, even if some of its surface cannot be seen.

Discuss students' observations throughout the month using some of the questions that follow.

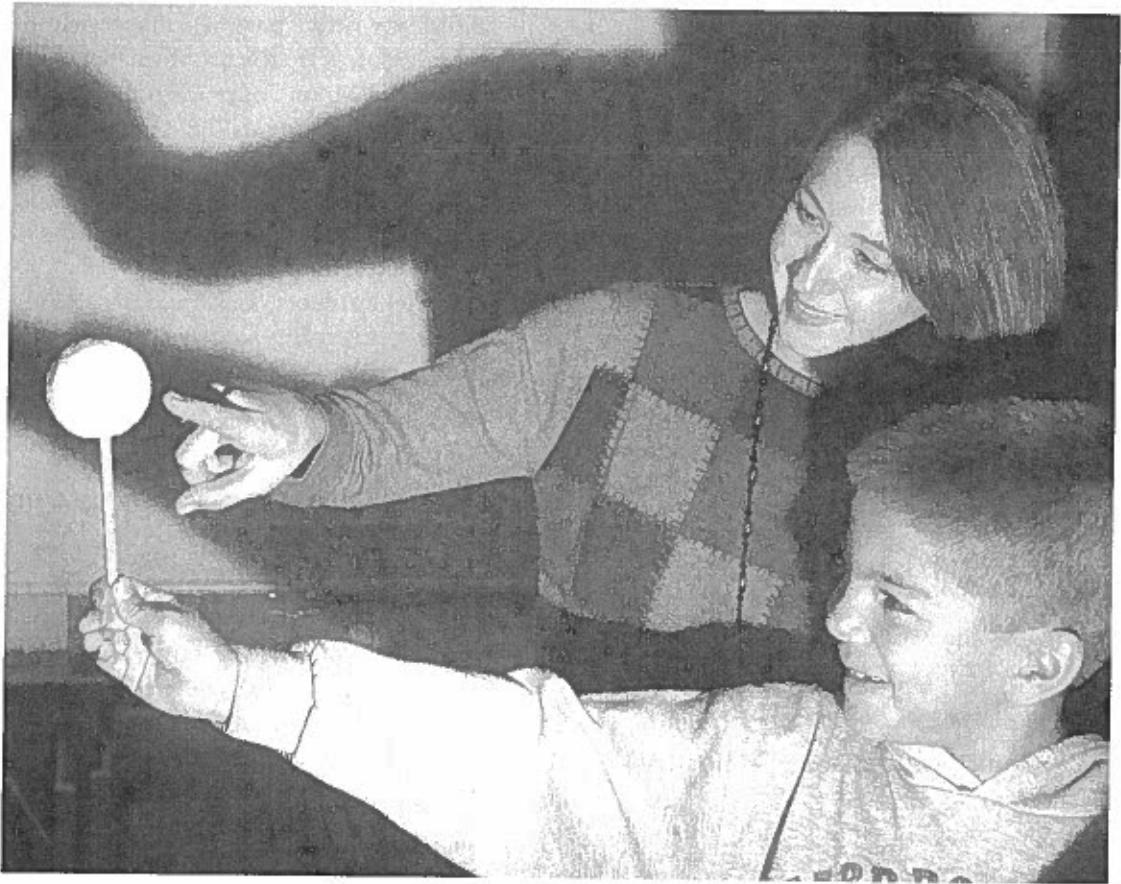
- ? Was the Moon the same shape each time you saw it?
- ? Was the Moon the same color each time you saw it?
- ? Did you see the Moon every time you looked for it?
- ? Was the Moon in the same place in the sky each time you saw it?
- ? On a cloudy night, how can you tell if the Moon is still there?
- ? What did the Moon look like on the first night of your journal? What did the Moon look like on the last night of your journal?
- ? When you look at your journal, do you see any patterns?

Explain

Moon Survey, Moon Modeling, and Read Aloud

The day before this activity, assign the Moon Survey student page to students as homework. In this assignment, they record the responses of three people to the question: What causes the Moon to look different each night?

Have students take out their completed Moon Survey student page and discuss the results of their surveys before they begin the next activity. Ask the following questions as you discuss the surveys:



MODELING THE MOON PHASES

- ? How did people feel about answering the question on the survey?
- ? What are some of the answers you received?
- ? Are there any answers that you think are wrong? Why?
- ? What do you think is the correct answer to the question on the survey?

Moon Modeling

Now that students have heard a lot of different ideas people have about why the Moon looks different from night to night, tell them that they can find the answer to the question using a model.

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 their 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 *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 theory? (The shadow of my head, which represents the Earth, is nowhere near the Moon in this position. It is behind me.)
- ? 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*.
- ? Have them turn a little more and almost all of the ball will be lit. This is called a *gibbous moon*.
- ? Students can keep turning until they see all the lighted half of the ball. This is a *full moon*.
- ? 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*.
- ? Tell students that the shapes they have observed in this activity are called the *moon phases*.
- ? Have students go through the rotation several times. Ask them to chorally respond with the name of each phase as it is modeled.
- ? 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.

You may want to challenge students to use the foam ball and lamp model to develop an explanation for how lunar and solar eclipses occur.

After the activity, ask students these questions.

- ? How does the pattern of the phases you observed in your Moon Journal compare to the pattern of the phases you observed in the model? (The patterns observed in one month with the journal are the same as the pattern observed in one orbit of the Moon in the model.)

Tell students that scientists often use their observations in combination with models to develop explanations of scientific events. Ask

- ? What explanations can we develop from our month of moon observations and the moon modeling activity we just did? (The moon phases occur in a regular pattern. The orbit of the Moon around the Earth causes the phases.)

Next, have students go back to their Moon Survey to see if anyone they surveyed had the correct explanation for the cause of moon phases. Encourage them to use the moon phases model to show the people they surveyed how the Moon appears to change shape.



Determining Importance

Have students complete the "Agree/Disagree" section of the Moon Book Extended Anticipation Guide. Then take students to a reading

corner (or have them put their papers away). Tell them that you will be reading a nonfiction book, *The Moon Book*, to find the answers to the questions on the anticipation guide. Have students signal (raise their hands) when they hear an answer to one of the questions from the anticipation guide. After you read, they can fill in the "Explanations from the Reading" section of the anticipation guide and write their explanations of whether their choices were right or wrong. When students finish, go over each question and ask students to share their answers.

Give students the Phases of the Moon student page. Have them use the information they learned from the moon phases model and *The Moon Book* to label and order the moon pictures. The correct sequence for moon phases is as follows: new moon, crescent moon, quarter moon, gibbous moon, full moon.

Elaborate & Evaluate

Papa, Please Get the Moon for Me Retelling



Determining Importance

Introduce the author and illustrator of *Papa, Please Get the Moon for Me*, and read it once just for fun. Then tell the students that you are going to read it again for a different purpose. Explain that this book was not written as a science book, but you would like them to listen for anything that might be scientifically incorrect. Ask them to think back to the things they have learned about the Moon, and if they see a picture or hear something in the book

they think is incorrect, they should raise their hands and explain their reasoning. Responses might include:

- A ladder could not reach the Moon.
- The Moon cannot talk.
- The moon phases don't change the way they are pictured in the book.
- The Moon is too big to carry.

Tell students that Eric Carle didn't write *Papa, Please Get the Moon for Me* as a science book, so it's all right if isn't scientifically accurate. Tell students they are going to use his ideas as a basis for a book that *is* scientifically accurate. Pass out copies of the *Papa, Please Get the Moon for Me Retelling Book* and have students illustrate the story and label the correct moon phases in their drawings. When students are finished illustrating and labeling, they should cut out each page separately and staple the pages together in order.

Evaluate

Moon Phases Quiz

Give students the Moon Phases Quiz. The answers follow.

1. A. Sun
B. Moon
C. Earth
2. c. The Moon revolves around the Earth.
3. e. gibbous moon
4. a.
5. b. new moon, crescent moon, first quarter moon, gibbous moon, full moon

Inquiry Place

See "Teaching Science Through Inquiry," Chapter 3, for an example of how one teacher chose to use this Inquiry Place in her classroom.

Choose one of the following questions to investigate or have students brainstorm "investigatable" questions about the Moon:

- ? Does the speed of a meteorite affect the size of the crater it makes?
- ? Does the size of a meteorite affect the size of the crater it makes?
- ? Does the weight of a meteorite affect the size of the crater it makes?
- ? Does the shape of the meteorite affect the shape of the crater it makes?

You can choose one of these questions for a whole-class investigation, students can select a question to investigate as a class, or groups of students can vote on the question they want to investigate as teams. After they make their predictions, they can design an experiment to test their predictions. Students can present their findings at a poster session.

More Books to Read

Branley, F. M. 1987. *The Moon seems to change*. New York, NY: HarperTrophy.

Summary: Easy-to-read text and simple diagrams explain how the Moon seems to change, and includes how to model the changing moon phases using a pencil, an orange, and a flashlight.

Branley, F. M. 2000. *What the Moon is like*. New York, NY: HarperTrophy.

Summary: Photos and information gathered by the Apollo space missions are used to describe how the Moon's composition, terrain, and atmosphere differ from Earth's. Apollo landing sites are identified and operation of a future moon colony is depicted.

Pollock, P. 2001. *When the Moon is full: A lunar year*. New York, NY: Little, Brown, and Company.

Summary: This lunar guide describes the 12 moons according to Native American tradition in short verse and beautifully detailed hand-colored wood cuts. A question-and-answer section includes information about the Moon's surface, an explanation of a lunar eclipse, and the true meaning of a blue moon.

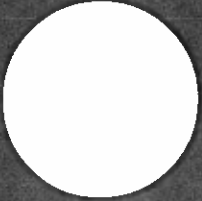
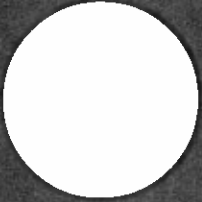
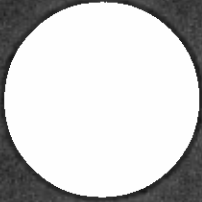

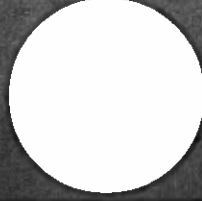
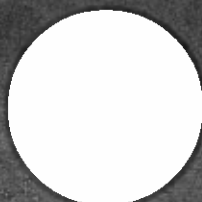
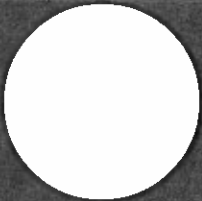
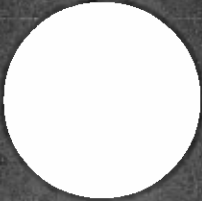
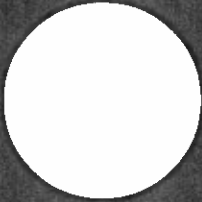
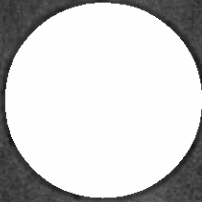
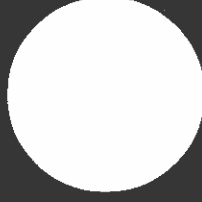
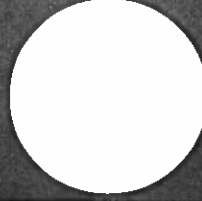
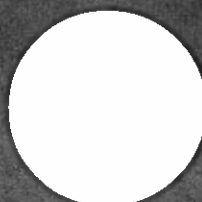
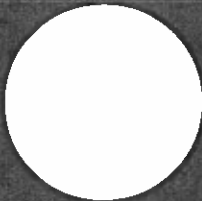
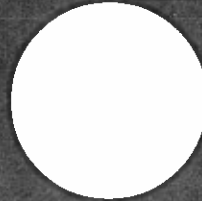
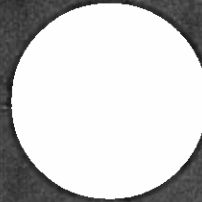
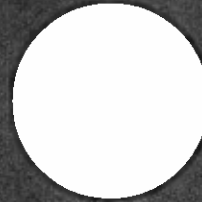
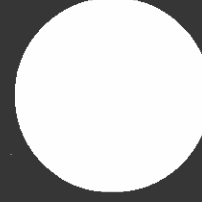
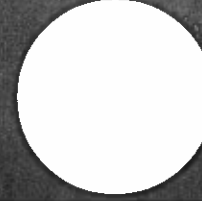
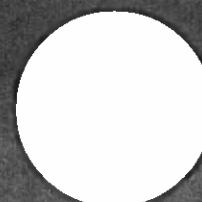
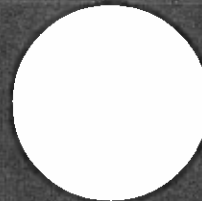
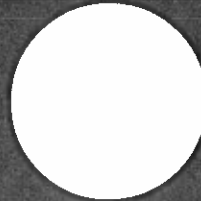
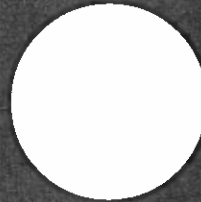
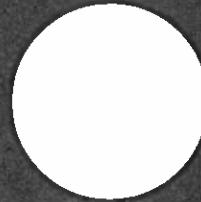
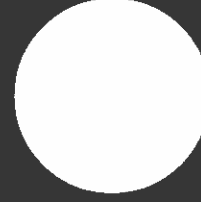
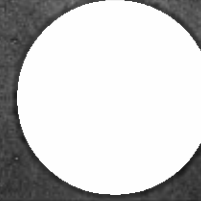
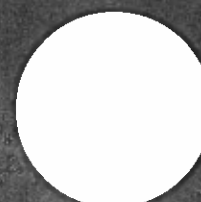
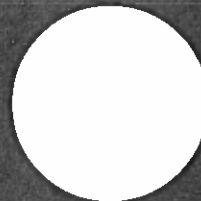
Simon, S. 2003. *The Moon*. New York, NY: Simon & Schuster.

Summary: From Apollo 11's first landing to the mystery of moonquakes and the genesis of craters, this introduction to our nearest neighbor in space describes the Moon and its relationship to Earth. Includes full-color photography and an informative text.

Name: _____

Moon Journal

Dates of Observation _____

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						
						
						
						

Name: _____

Moon Survey

Ask three people the following question and record their answers on the lines below.

What causes the Moon to look different each night?

1st Person

2nd Person

3rd Person

Name: _____

The Moon Book

Extended Anticipation Guide

- | | Agree | Disagree |
|--|--------------------------|--------------------------|
| 1 The Moon produces light. | <input type="checkbox"/> | <input type="checkbox"/> |
| 2 The Moon takes about one year to travel around Earth. | <input type="checkbox"/> | <input type="checkbox"/> |
| 3 The same side of the Moon is always facing Earth. | <input type="checkbox"/> | <input type="checkbox"/> |
| 4 The Moon's pull on the oceans is strong enough to cause tides. | <input type="checkbox"/> | <input type="checkbox"/> |

Explanations from the reading:

- _____

- _____

- _____

- _____

Name: _____

The Moon Book

Extended Anticipation Guide Answer Key

Agree Disagree
(answers will vary)

- | | | |
|---|--------------------------|--------------------------|
| 1 The Moon produces light. | <input type="checkbox"/> | <input type="checkbox"/> |
| 2 The Moon takes about one year to travel around Earth. | <input type="checkbox"/> | <input type="checkbox"/> |
| 3 The same side of the Moon is always facing Earth. | <input type="checkbox"/> | <input type="checkbox"/> |
| 4 The Moon's pull on the oceans is strong enough to cause tides. | <input type="checkbox"/> | <input type="checkbox"/> |

Explanations from the reading:

- 1** The Moon reflects light from the Sun.
- 2** The Moon takes about one month to travel around Earth.
- 3** The Moon rotates once in its revolution, which results in the same side always facing Earth.
- 4** The Moon's pull is strong enough to cause tides.



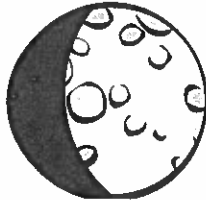
Phases of the Moon

Directions: Write the name of each moon phase on the line. Then cut out the cards and put the moon phases in order. Start with the new moon.

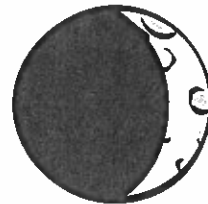
New Moon
Quarter Moon
Full Moon
Gibbous Moon
Crescent Moon



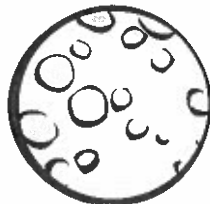
Moon Phase:



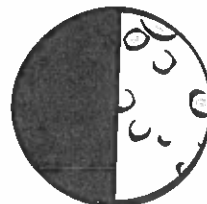
Moon Phase:



Moon Phase:



Moon Phase:

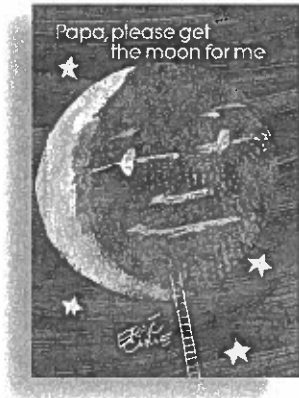


Moon Phase:

Name: _____



Papa, Please Get the Moon for Me Retelling Book



By Eric Carle

Retold by

1

Before Monica went to bed she looked out of her window and saw the full moon. The moon looked so near. "I wish I could play with the moon," said Monica to her Papa. But no matter how much she stretched, she could not touch the moon.

2

"The moon is much too big and too far away to play with," said her Papa. "But you can play in the light reflected off the moon." So every night before she went to bed Monica jumped and danced in the moonlight.

3

But the moon seemed to get smaller and smaller each night, until finally it disappeared altogether.

Name: _____



Papa, Please Get the Moon for Me

Retelling
Book cont.

4

Then, one night, Monica
saw a thin sliver of the
moon reappear.

5

Each night the moon
seemed to grow ...

6

and grow ...

7

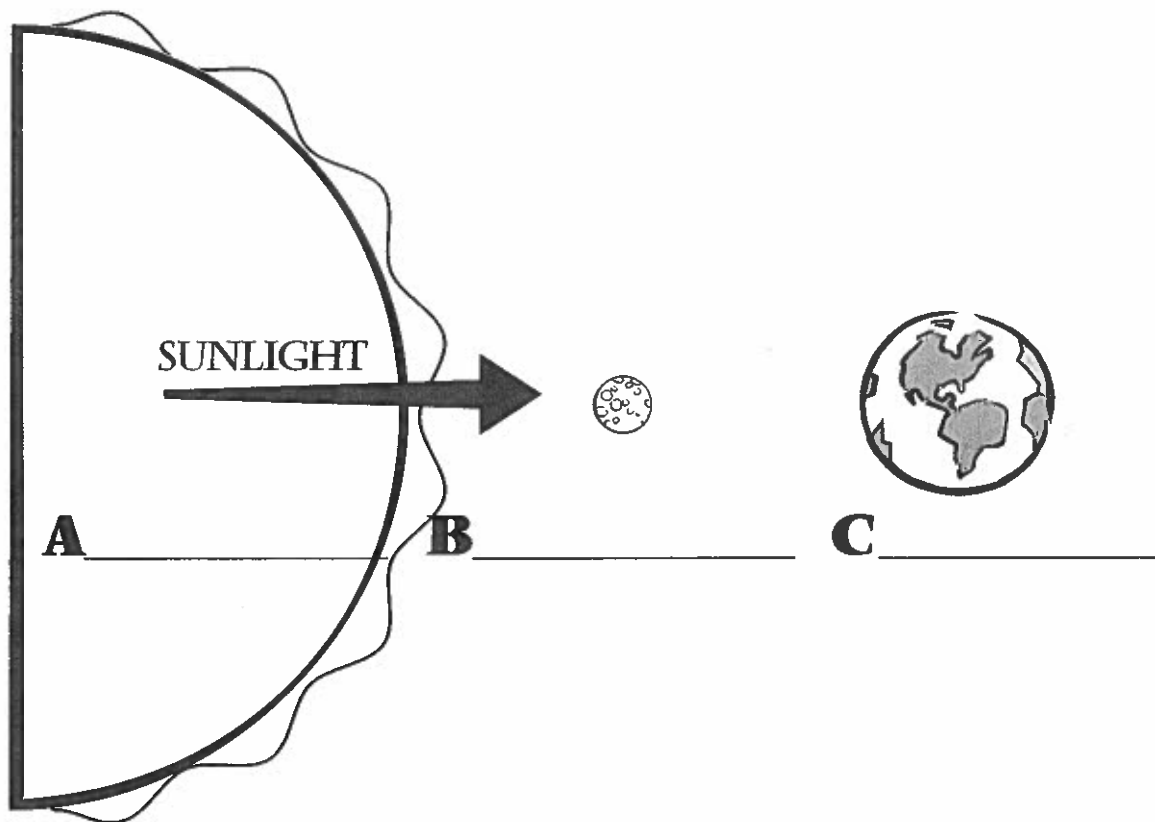
... until it was full again.



Name: _____

Moon Phases Quiz

1 Look at the picture below. Label each object using the words Earth, Moon, or Sun. (Picture is not to scale.)



2 The phases of the Moon occur because:

- a** Clouds cover part of the Moon.
- b** The Earth's shadow falls upon the Moon.
- c** The Moon revolves around the Earth.



Moon Phases Quiz cont.

3 Vonda keeps a journal of the moon phases she sees each night. Tonight she observes a gibbous moon. What moon phase can Vonda expect to see in about one month?

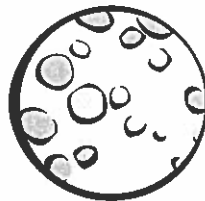
- a** full moon
- b** crescent moon
- c** gibbous moon



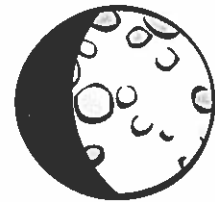
4 The pictures above show phases of the Moon, taken four nights apart. Which of the pictures below shows the Moon four nights later?



a



b



c

5 Which of the following states the correct order of the moon phases?

- a** new moon, first quarter moon, gibbous moon, crescent moon, full moon
- b** new moon, crescent moon, first quarter moon, gibbous moon, full moon
- c** new moon, full moon, first quarter moon, crescent moon, gibbous moon