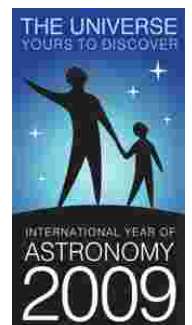


FACES of the MOON



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Teacher's Guide





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FACES of the MOON

Bob Crelin • Illustrated by Leslie Evans

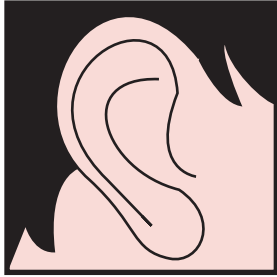
Charlesbridge

Teacher's Guide

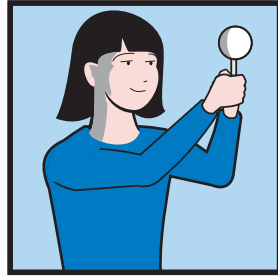
Northern Hemisphere edition
Bob Crelin



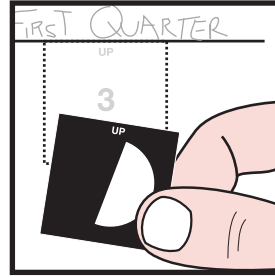
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Listen



Do



Chart



Review

UNDERSTANDING THE PHASES OF THE MOON

A fun, four-stage classroom unit for understanding the Moon's phases (2–3 class periods)

Objectives

Students will be able to do the following:

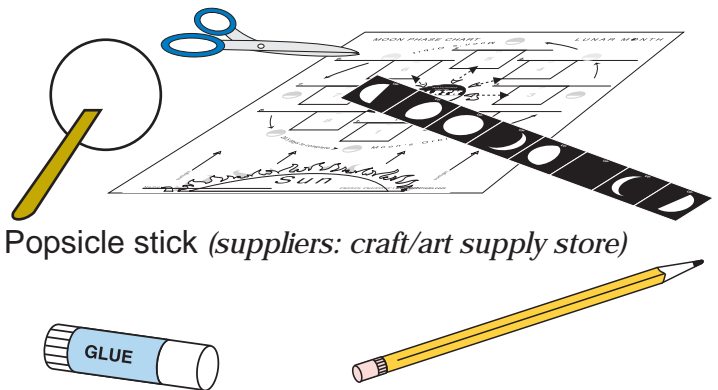
- 1) Model how the relationship of our Earth, Moon, and Sun creates moon phases.
- 2) Chart the sequence and names of the eight primary Moon phases.
- 3) Identify each Moon phase by its appearance.
- 4) Identify the Moon's position in orbit during each primary phase.

Materials you will need:

- Copy of the book *Faces of the Moon* by Bob Crelin (Charlesbridge)
- Room that can be darkened, with enough open floor space to fit students standing in a circle
- Bare light bulb on a stand (example: a floor lamp with shade removed)
- Earth globe
- Extension cord
- *Moon Orbit Spin Chart* (included)
- Paper fastener

Each student will need:

- Pencil or pen
- 2"–4" (5–10 cm) Styrofoam ball mounted on a Popsicle stick (*suppliers: craft/art supply store*)
- *Moon Phase Chart* (included)
- Strip of eight *Phase Squares* (included)
- Scissors
- Glue stick



NOTE: Before starting this unit, make paper photocopies of the Moon Phase Chart and the Phase Squares. Cut the Phase Squares into strips of the eight lunar phases. Photocopy the Moon Orbit Spin Chart on heavier card stock paper and assemble using a paper fastener.

Advanced preparation

The introduction (Stage 1) is brief and a prelude to the hands-on classroom activity (Stage 2). Making the following preparations before starting will allow the students to move easily between the steps while retaining concepts and terminology.

For best results, choose a room that can be made completely dark when the lights are turned off (dark window coverings can help). Clear the floor space of obstacles and place a tall lamp with bare bulb (the brighter, the better) in the center of the room. Use an extension cord if necessary. Covering or taping down the lamp/extension cord will help to prevent students from tripping on it. For the hands-on demonstration, make sure that there is plenty of space for the students to stand and form a circle (with elbow room) around the lamp (see Figure 1 on page 3). Desks are not required. Students can sit on the floor during the introduction (Stage 1) and while constructing their charts (Stage 3). Have materials, including photocopies of the Moon Phase Chart and Phase Square strips, ready to hand out to students.



Listen

Stage 1 • Introduction

(run time: approximately 5–10 minutes)

In storytelling fashion, students sit, listen, and look as the basic concepts and terms used throughout the lesson are introduced.

Concept: *The Moon cycle*

Read aloud the first two verses on pages 2–3 of *Faces of the Moon*:

"Do you wonder, when you see the Moon..."

Explain that the word "month" comes from "Moon." Long ago, a month represented the time it took to complete one cycle of the changing Moon phases (approximately 29.5 days). Today, we call this a "lunar month," compared to our modern "calendar month."

Concept: *Moon phases as light and shadow*

Read aloud the next two verses on pages 4–5:

"Each changing face (or lunar phase)..."

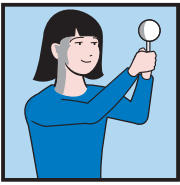
Explain that we are able to see the Moon from Earth because the Sun's light shines on it. The sunlit part of the Moon makes the phase, or shape, of the Moon that we see (the rest of the Moon is in shadow).

Concept: *Earth's relationship to the Moon and Sun*

Read aloud the next two verses on pages 6–7:

"For as she orbits Earth in space,"

Explain that the sunlit part of the Moon changes because we are watching from the surface of Earth as the Moon moves in orbit around our planet. The changing Moon phases have been given names that describe their appearance, and their place in the phase cycle.



Do

Stage 2 • Modeling the Phasing Moon

(run time: approximately 20–30 minutes)

After a brief explanation of the activity, students participate by following the step-by-step directions of the instructor, and by learning about each phase from the book.

Explain to the class that by building a model of the Moon's orbit, we can demonstrate *why* we see the changing phases of the Moon.

To make a model of the Moon phases, we will need three "players" from our solar system. Ask students to identify who these players are. (Answer: Moon, Sun, and Earth)

Show the items that represent each player:

- The Styrofoam ball on the Popsicle stick for the Moon
- The light bulb on the stand for the Sun
- The globe for Earth (for now)

Briefly review (and demonstrate) with students the basic orbital motions of these players:

- Earth orbits around the Sun.
- The Moon orbits around Earth.

It helps to visually demonstrate these motions by walking the globe (Earth) in a counterclockwise "orbit" around the light bulb (Sun), while circling the Styrofoam ball (Moon) counterclockwise around the globe.

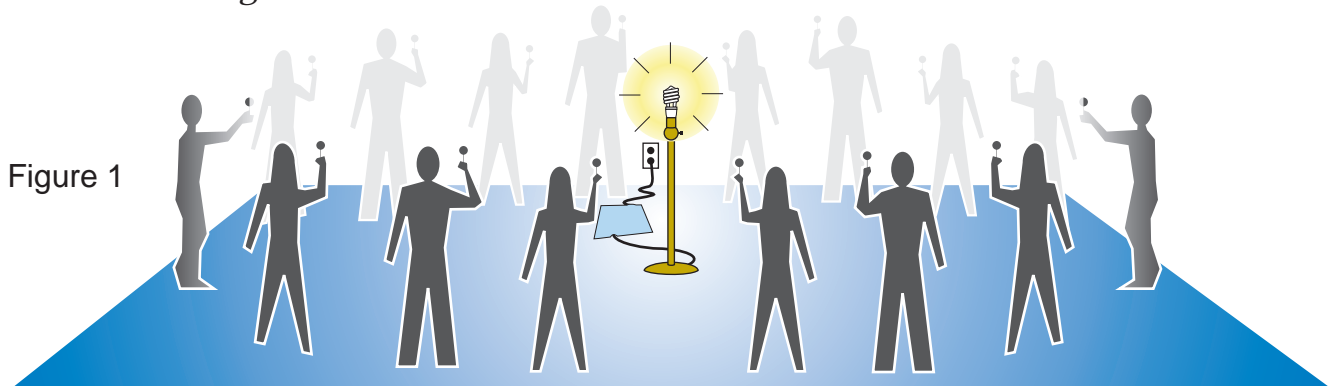


Figure 1

The Hands-on Activity*

*Elements of this exercise are based on an Astro-Adventures learning activity, Dennis Schatz and Doug Cooper • pacsci.org

Turn on the light bulb "Sun" in the center of the room. Turn off all other room lights.

For safety, remind students not to touch the hot light bulb.

Have each student get a Styrofoam Moon ball on a stick. Have the students stand and form a circle around the light bulb Sun (see Figure 1). *Tip: Students should leave elbow room between themselves for easier movement during the demonstration.*

Explain that the globe will *not* represent Earth in the activity, because as we learned earlier, we watch the Moon phases change from Earth's surface. Instead, *each student's head will represent Earth* for the demonstration. Because their eyes are set in their head, they can watch the changing appearance of the Moon from their "Earth."

Stage 2 • Modeling the Phasing Moon, *continued*

Have the students place their hand on their left shoulder. This represents their “eastern” side. Explain that, during the demonstration, they will turn towards the east, or left, side to simulate the Moon’s counterclockwise orbital motion around Earth (see Figure 2).

Explain to the students that they will demonstrate the Moon’s orbit in step-by-step movements, following your direction.

Introduce the assembled **Moon Orbit Spin Chart** (Figure 3) to the students. Point out the parts of the chart that represent their head, their Styrofoam Moon ball, and the light bulb Sun. Show how the orbit circle has eight numbered stops that represent the eight primary Moon phases. When modeling the “orbit,” students will pause together at each stop (see Figure 4 on page 6). At each stop, they will observe the appearance of their Moon ball, and listen to a rhyme that names and describes this Moon phase.

Show the students the Orbit Spin Chart dial set at stop #1 (as shown in Figure 3). Ask them to position themselves and their Moon as shown on the chart. *Each student should hold their Moon out in front of their head and face the light bulb Sun.*

Figure 2

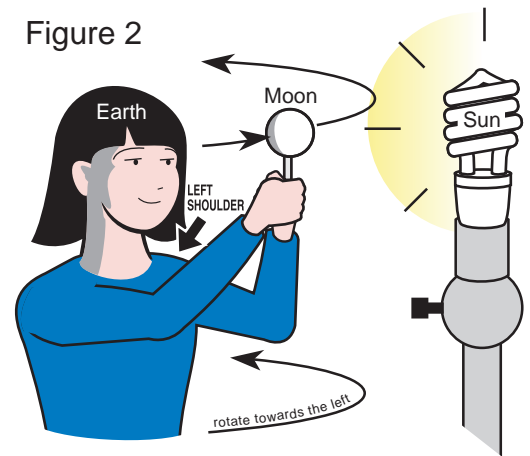
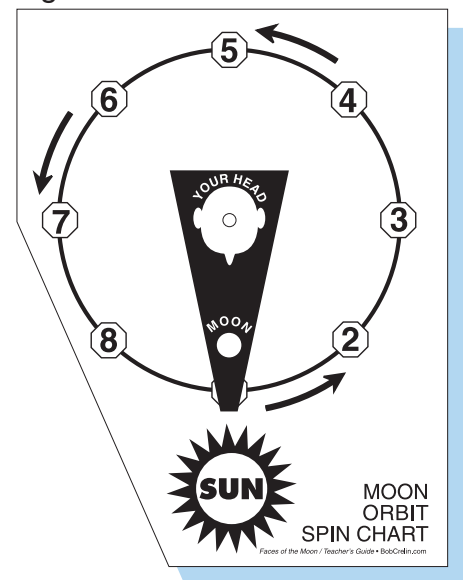


Figure 3



1 Stop #1 - New Moon

Remind students that it is the Sun’s light shining on the Moon that shows us the phase we see. Ask them how much sunlight they see on their Moon in position #1. They should see *no sunlight*, because the shadowed side of the Moon is facing their “Earth” (their head). Ask if anyone knows what phase this is. (Answer: New Moon)

Read aloud page 8 of *Faces of the Moon* (stanza describing this New Moon phase):

"The Moon's first phase, we call it NEW..."

After reading the New Moon stanza, have the class say, "New Moon" together.

2 Stop #2 - Waxing Crescent

Explain that, together, the students will now begin to rotate, stopping at each phase around the Moon's orbit. Hold the Orbit Spin Chart up for all to see, and move the dial from stop #1 (New Moon) to stop #2 (Waxing Crescent). Ask the students to turn to the east (left) as shown on the chart. Once students are in the correct position, ask them to look at their Moon ball to notice the sunlight illuminating the right edge of it.

Stage 2 • Modeling the Phasing Moon, *continued*

Page 11 of the book shows a die-cut illustration of the Waxing Crescent Moon. Have students compare this illustration to the sunlit crescent on their own Moon ball. Read aloud page 10 (stanza describing the Waxing Crescent phase): *"A few days pass, and Moon's less shy..."* Have the class say, "Waxing Crescent" together.

The term "Waxing"

This is a good point in the lesson to associate the term "waxing" with the apparent growth of the Moon. A great comparison is the old practice of "candle dipping," in which each dip of a candle wick in hot wax would make the candle grow thicker. The growing Moon can be seen as "waxing," like the candle.

3 Stop #3 - First Quarter

Next, move the chart dial to stop #3. Ask the students to rotate to this position. They should notice that the sunlight has "grown" to fill the right half of their Moon ball. Compare the Moon ball with the illustration of the First Quarter Moon on page 13 of the book. Read aloud page 12: *"We notice Moon's FIRST QUARTER phase..."* The class says, "First Quarter" together.

4 Stop #4 - Waxing Gibbous

Continue to stop #4 on the Orbit Spin Chart. The students move accordingly and notice the increasing sunlight on the right side of their Moon ball. Show the Waxing Gibbous illustration on page 15 and read page 14: *"Once she's past First Quarter Moon,..."* The class says, "Waxing Gibbous" together.

5 Stop #5 - Full Moon

Move to stop #5. Make sure that students hold their Moon ball a little above their head in this position so as not to cast a shadow on the ball. If positioned correctly, they should see a Full Moon, without shadow. Pages 17 and 18 portray the Full Moon, and pages 16 and 19 describe it: *"Next comes Moon's most famous phase..."* The class says, "Full Moon" together.

6 Stop #6 - Waning Gibbous

Mention that the Moon has now "waxed" full of sunlight. As students continue on to stop #6 in the orbit, they should notice how the sunlight begins to decrease, or "wane" on their Moon ball. A shadow now begins to "grow" on the Moon's right side, as shown in the illustration on page 20. Read aloud page 21: *"Once past Full, the shadows start..."* The class says, "Waning Gibbous" together.

7 Stop #7 - Last Quarter

Continue to stop #7. The students move and notice that the sunlit part has decreased. Their Moon ball is now lit on the left half. Show the Last Quarter illustration on page 22 and read page 23: *"At Moon's LAST QUARTER of her trip,..."* The class says, "Last Quarter" together.

8 Stop #8 - Waning Crescent

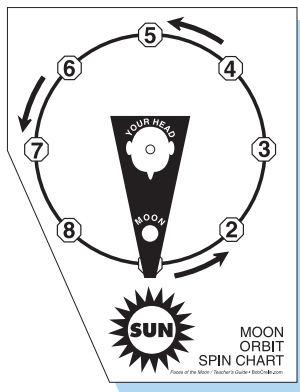
Move the chart dial to stop #8. The students move and compare the crescent of sunlight on their Moon ball to the illustration on page 24. Read page 25 aloud: *"From early dawn to morning blue,..."* The class says, "Waning Crescent" together.

Stage 2 • Modeling the Phasing Moon, *continued*

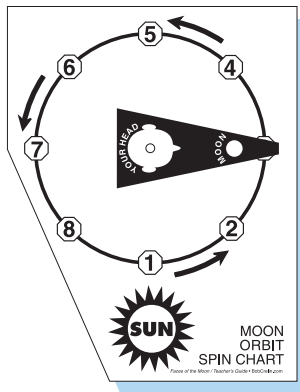
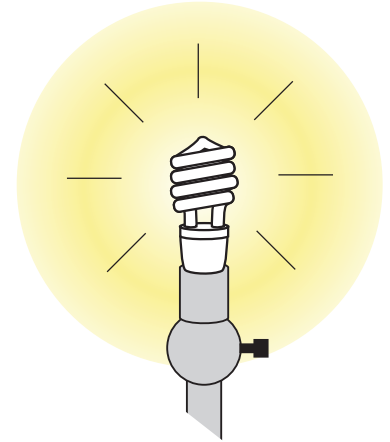
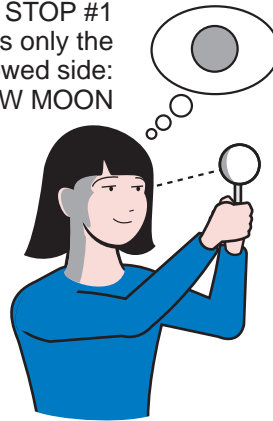
Then move the chart dial—and ask the students to rotate—back to **STOP #1**, where they began their orbit. Read page 27 aloud: *"Then Moon returns where she'd begun..."* Ask the students to tell you all together the name of this phase (New Moon). Remind them that they have just modeled one complete Moon orbit around our Earth. This represents the 29.5-day "lunar month."

To support this visual demonstration of the changing phases, have the students now do an additional complete rotation (in the same direction), turning slowly without stopping this time. Ask them to watch the changing pattern of light and shadow on their Moon ball as they go. Remind them to keep their Moon ball a little above their head to prevent a "head-shadow lunar eclipse" at the Full Moon position.

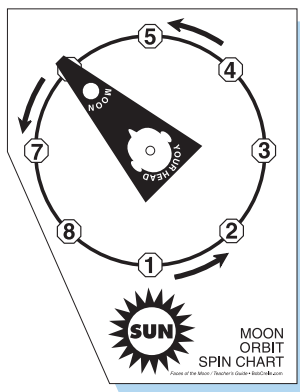
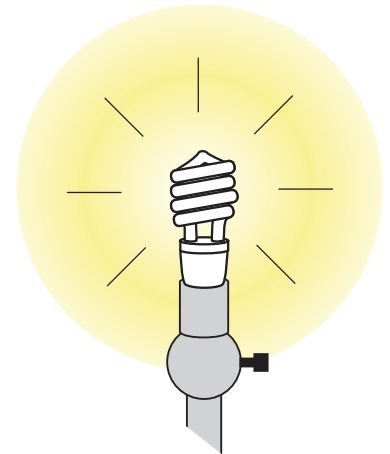
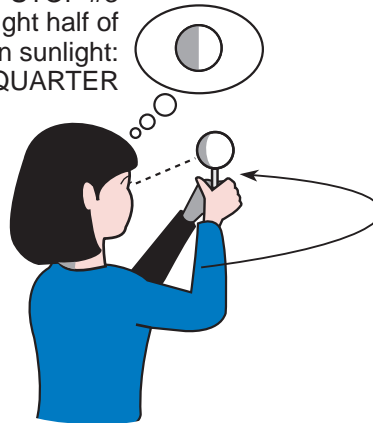
Figure 4



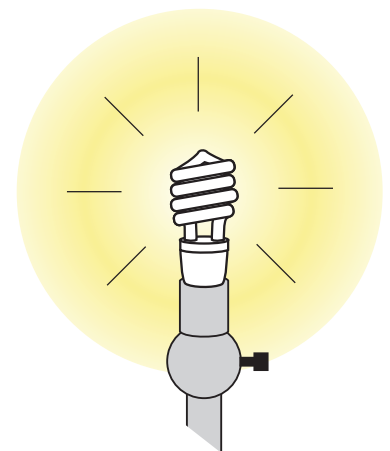
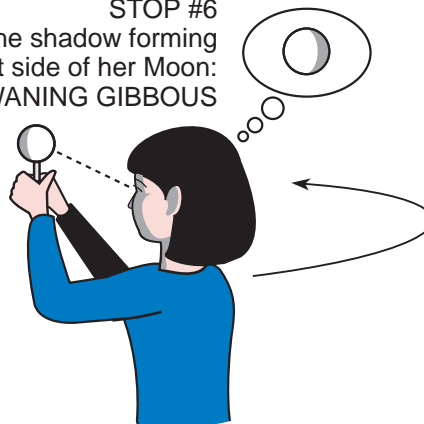
STOP #1
She sees only the
Moon's shadowed side:
NEW MOON

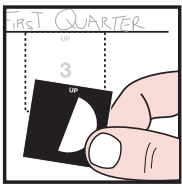


STOP #3
She sees the right half of
her Moon in sunlight:
FIRST QUARTER



STOP #6
She sees the shadow forming
on the right side of her Moon:
WANING GIBBOUS





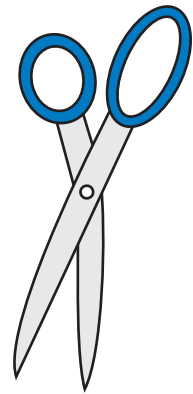
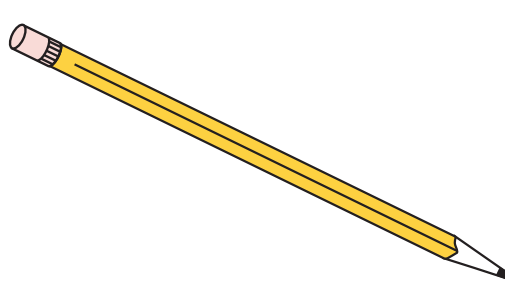
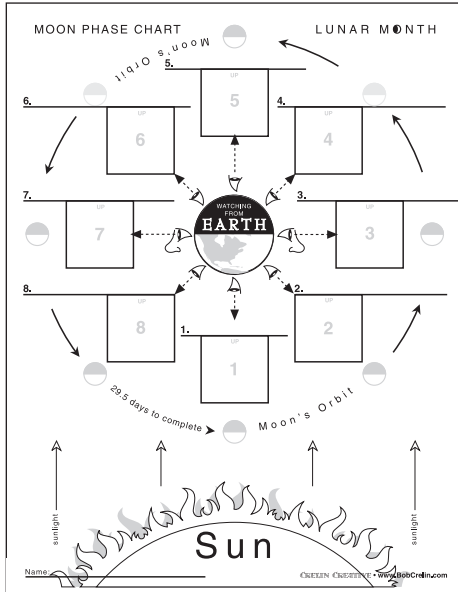
Chart

Stage 3 • Recording Our Observations

(run time: approximately 20–30 minutes)

Students create their own charts to record what they've learned from the hands-on Moon phase activity.

Students can move to their desks, or to a clear spot on the floor, to assemble their Moon charts. Each student will need a pencil or pen, a copy of the Moon Phase Chart, a strip of the eight Phase Squares, a pair of scissors, and a glue stick.



Show the students how the Moon Phase Chart is modeled after the *Orbit Spin Chart* used during the demonstration, with the Sun, Earth and Moon in the same relative positions. Once assembled, the chart will show and name the pattern of Moon phases throughout a lunar month. For best results and participation, ask the students to follow the steps together as a class. A simple mistake, like a reversed Phase Square, can throw off the rest of the phase pattern.

First, ask students to separate the eight Phase Squares by cutting them apart along the white lines. *Before cutting, many students will notice that the phases on the strip are out of sequence.*

Next, ask students to find the box marked #1 on their Moon Phase Chart. Remind students that this is where they began the Moon's orbit in the demonstration. Ask if someone can identify the phase they saw when the Moon ball was in this position, between Earth (their head) and the Sun. (Answer: New Moon)

Ask students to write "New Moon" on the line above box #1. Next ask the class what Phase Square would represent the New Moon phase. (Answer: the blank black square). Instruct students to glue the blank square in box #1. *Tip: For less messy results, direct the students to apply glue to the blank box on the chart, instead of on the back of each Phase Square.*

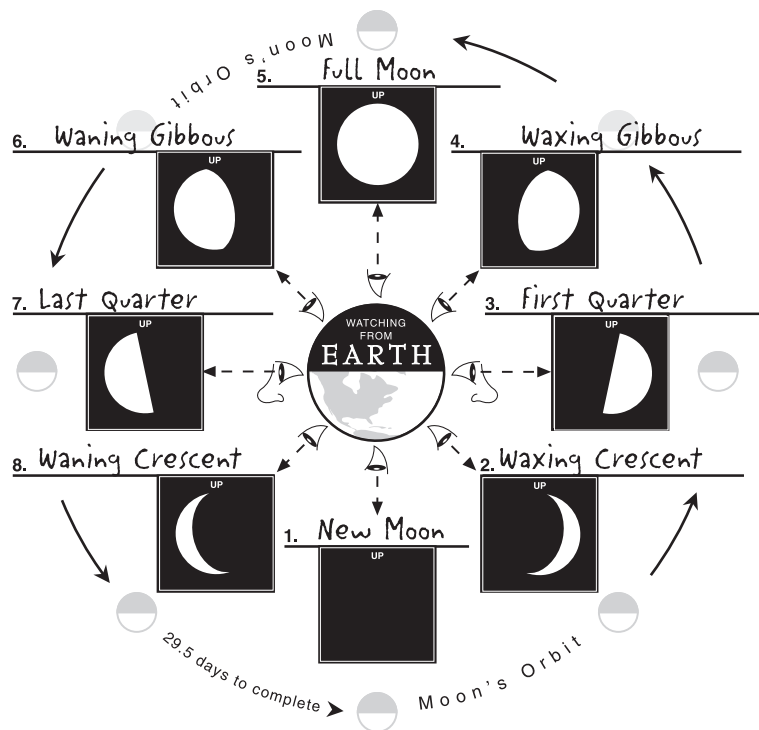
Stage 3, continued

Continue “in orbit” to box #2 on the chart. Ask if someone can identify what phase happens here. (Answer: Waxing Crescent) If there is hesitation, or confusion, give the students clues: “as you turned to your left, the light began to shine on the right side of the Moon ball,” etc.

Once students have identified the Waxing Crescent, have them write the phase name above box #2 and glue the correct Phase Square in place. For each phase, show the corresponding phase illustration from *Faces of the Moon* so students can double-check their Phase Square choice.

Continue this procedure until all eight Phase Squares are correctly glued in place and all of the phase names are labeled (see Figure 5).

Figure 5



Review

Stage 4 • Reviewing What We’ve Learned

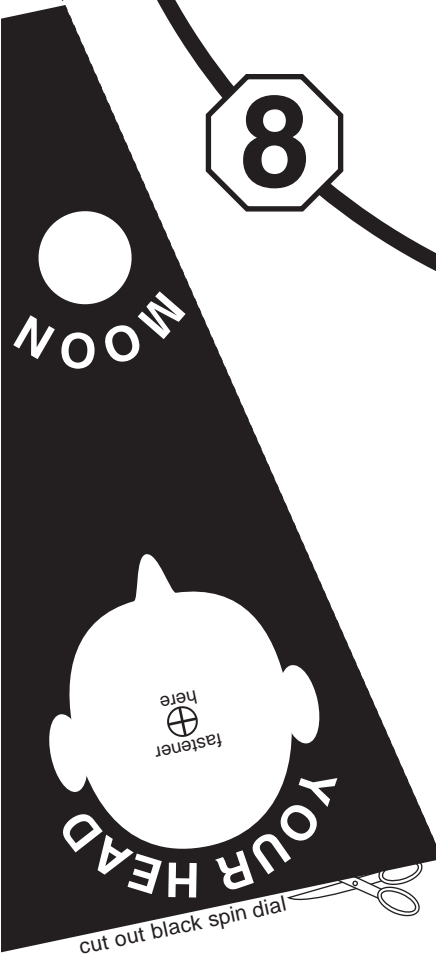
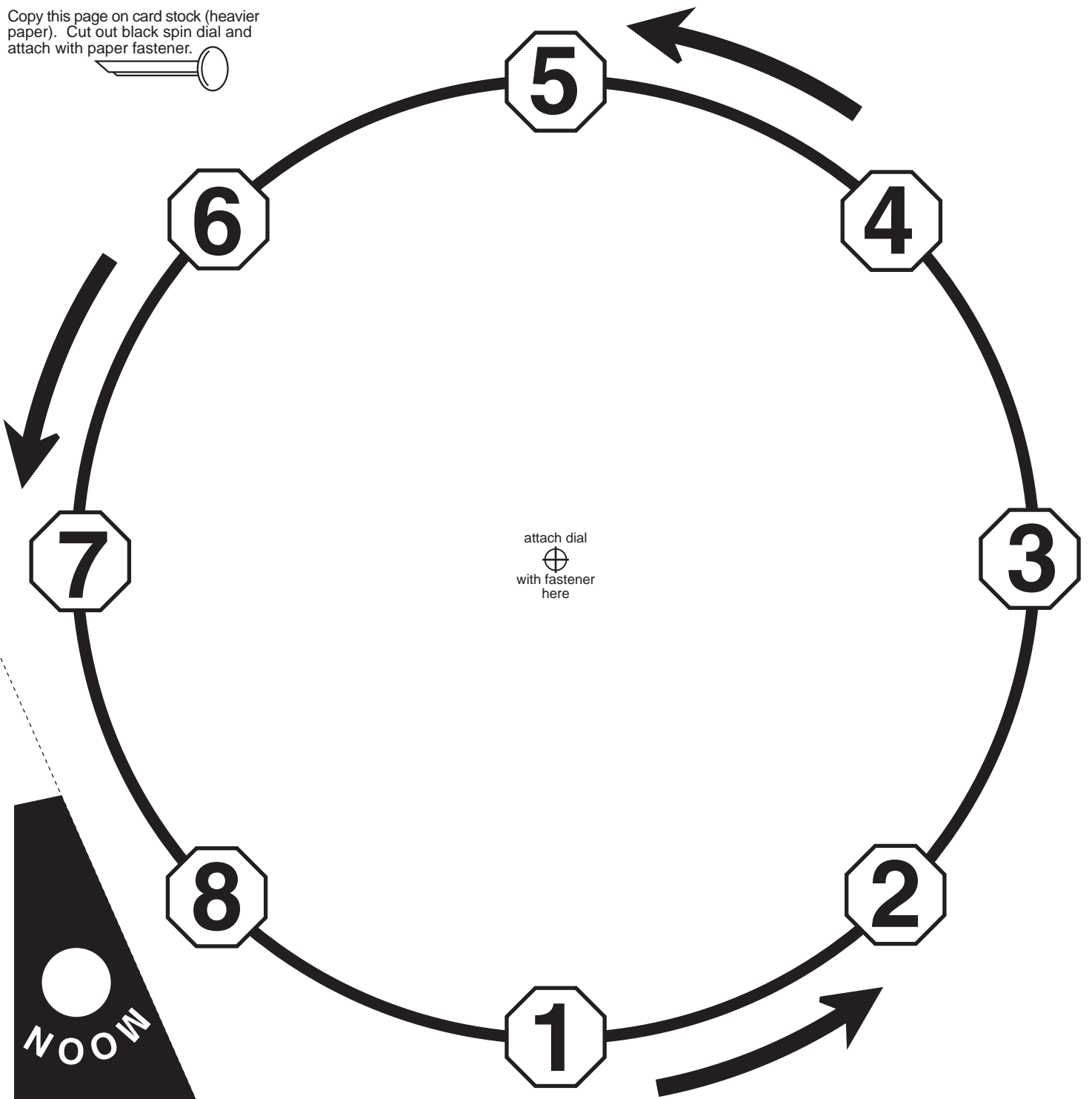
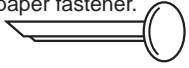
(run time: approximately 10 minutes)

Students now test their Moon knowledge through a fun review exercise.

Ask students to turn their *Moon Phase Chart* over, so they cannot see it. Draw a random Moon phase on the board or a piece of paper and ask if someone can identify the phase by name. Ask students if they can name the phases that would be seen before and after this phase. Once a phase has been correctly identified, ask if someone in the class can move the dial of the *Orbit Spin Chart* to show where in orbit this phase occurs. Continue quizzing the class with random phases until all of the phases and orbital positions have been correctly identified. Allow students to take home the charts to share.

The back of *Faces of the Moon* includes Moon “Memo-Rhymes” which are great reinforcement phrases set in rhyme. Once learned, these Moon facts are rarely forgotten. *Have fun!*

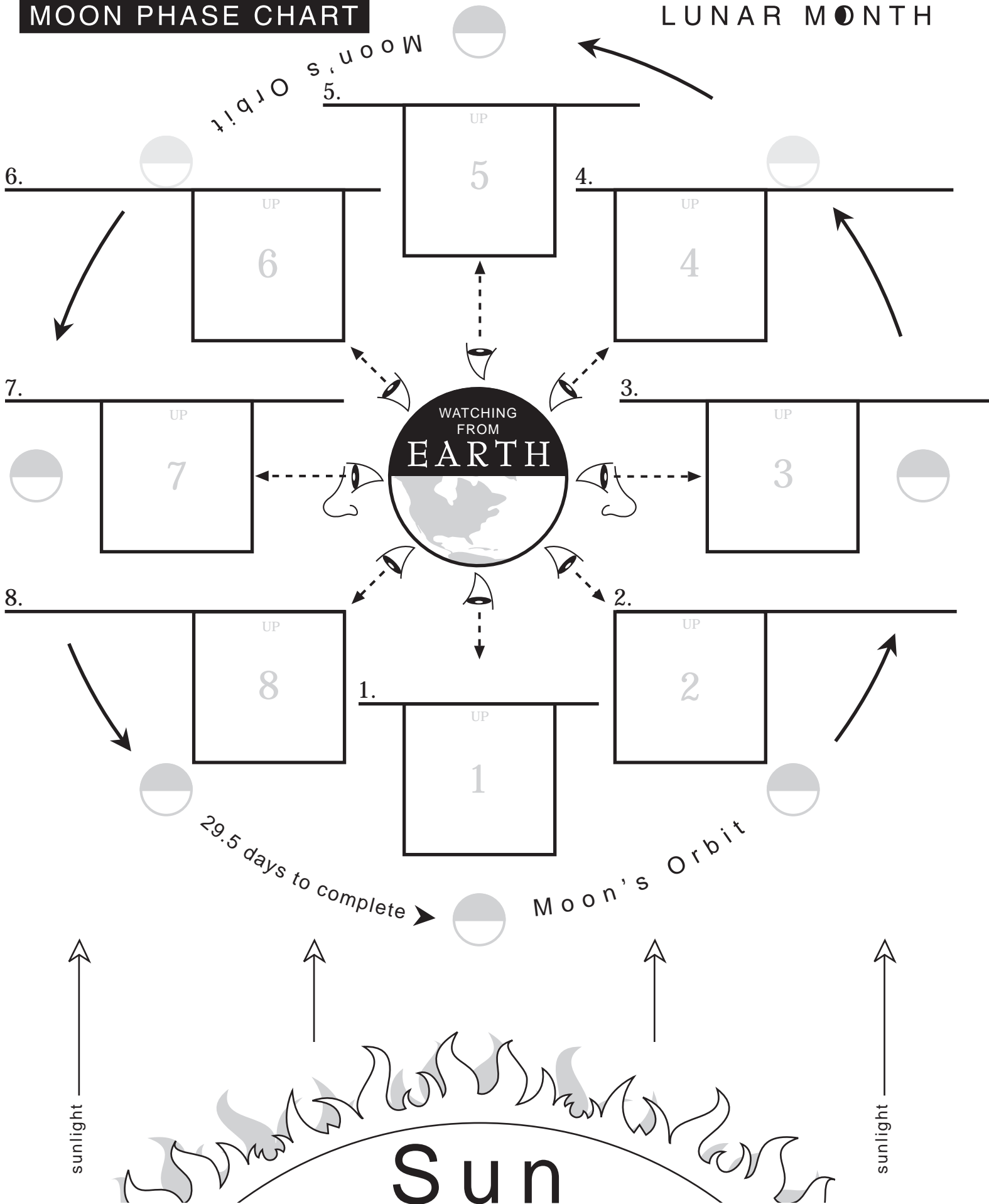
Copy this page on card stock (heavier paper). Cut out black spin dial and attach with paper fastener.



MOON ORBIT SPIN CHART

MOON PHASE CHART

LUNAR MONTH



Name: _____

Phase Squares – cut out strips of the eight Moon phases – one strip per student

