Moon Phases Content Standard

5.3 Most objects in the solar system are in a regular and predictable motion.

- The positions of the earth and moon relative to the sun explain the cycles of day and night and the monthly moon phases.

Grade Level Expectations:

1. The sun, Earth and its moon are spherical objects that move in two ways: they spin (rotate) and they change positions relative to each other (revolve).

2. The sun is a star that produces light that travels in straight lines away from the sun in all directions. Light from the sun illuminates objects that reflect light, including Earth and its moon. The side of the Earth that is facing the sun experiences daylight; the side of the earth facing away from the sun experiences night. All parts of the Earth experience a cycle that includes both day and night, providing evidence that the Earth is rotating on its axis.

3. The amount of time it takes for the Earth to rotation once on its axis is regular and predictable (24 hours), and is called “a day.” Earth’s rotation makes it appear as if the sun is moving across the sky from east to west.

4. The moon is a rocky object that revolves around the Earth in a circular path called an orbit. The amount of time it takes for the moon to revolve once around the Earth is about 29 days and is called a “lunar month.”

5. Half of the moon is always illuminated by the sun. Phases occur because a different portion of the lit half is visible from the Earth each day as the moon revolves around the earth.

6. The changes in the moon’s phases occur in a regular and predictable sequence. At predictable periods during the lunar cycle, the moon is visible in either the daytime or the nighttime sky.
7. At the beginning of a lunar month, no lit part of the moon is visible from Earth (new moon). As the moon progresses through the first two quarters of its complete trip around the earth, larger portions of the right side of the moon are illuminated each day. When the moon has completed half its trip around the earth, the full moon is illuminated. During the third and fourth quarters of the moon’s trip around the earth, the illuminated portion gradually decreases so only the left side is illuminated and finally no lit portion of the moon is visible from Earth again.

8. Like the sun, the moon appears to rise at the eastern horizon and set at the western horizon due to the Earth’s rotation. From the same place and time, the moon’s position in the sky varies in predictable ways.

**KEY SCIENCE VOCABULARY:** sphere, illuminate, reflect, rotate, day/night cycle (24 hour rotation period), horizon, orbit revolve, month (one lunar cycle), moon phase, new moon

**Expected Performance Task(s):**

**B. 22** Explain the cause of day and night, including the rotation of Earth on its axis.

**B. 23** Describe the monthly changes in the appearance of the moon, based on the moon’s orbit around the Earth.

**Scientific Inquiry, Literacy, and Numeracy**

**B INQ. 1** Make observations and ask questions about objects, organisms, and the environment.

**B INQ. 2** Seek relevant information in books, magazines, and electronic media.

**B INQ. 3** Design and conduct simple investigations.
B INQ. 4 Employ simple equipment and measuring tools to gather data and extend the senses.

B INQ. 5 Use data to construct reasonable explanations.

B INQ. 6 Analyze, critique, and communicate investigations using words, graphs, and drawings.

B INQ. 10 Use mathematics to analyze, interpret, and present data.

Assessment(s):

1. You have been asked by NASA to develop a poster that illustrates the phases of the moon. This will be an educational material offered to elementary schools.

   • Include the following in your illustration: sun, Earth, full moon, new moon, first-quarter moon, third-quarter moon, waxing crescent, waxing gibbous, waning crescent, and waning gibbous. Be sure to label each item.
   • Add 3 important facts about the moon’s cycle to your poster.

2. During this time you will also be asked to individually demonstrate your understanding of a phase of the moon using a lamp, orange, and your body.
Questions I want students to ask at the start of their Inquiry

- What causes a full moon?
- In which direction does the moon travel?
- Where does the moonlight come from?
- Does the moon change size?
- Why does the moon look different on different days?
- Does the moon change shape?
- Why can’t I see the moon on certain nights?
- Where does the moon go during the day?
- How many different phases of the moon are there?
- Is there a predictable pattern to the moon phases?

Pre-Assessment:

(Students will draw and label a diagram using the sun, moon, and earth showing what they know about the phases of the moon.)

Phase 1: Inquiry starter

(Month prior) – A moon calendar will be completed by each student for a full lunar cycle. Students will be given a common calendar, in which they will be asked to sketch their observations of the moon each night. The time of observation should be noted in the box. During this observation period, students will be keeping an “I notice, I wonder” science notebook and discussions will be held every two to three days to share observations and develop vocabulary relevant to moon phases. A large class calendar will be kept. Observations, questions, and vocabulary will be charted.
Also during this month, activities will be held that address GLEs 1-3.

A discussion will be held at the end of the month to help raise questions of moon phases that the students want to investigate.

**Discourse on moon calendar:**

Students will come to circle with their moon calendar and science notebook. The teacher will begin the discourse with the question “What observations can you make from your moon calendars?” The teacher will record discourse.

If necessary, the teacher will include other questions such as:

- Do you notice any patterns on the calendar?
- Based on your calendar, how many phases of the moon do you think there are? What are they?
- Why do you think the different phases occur?
- How long does one complete moon cycle seem to take?
- Where is the moon during the day?

**Below are two choices for Phase 2 of the inquiry.**

**Plan A:** At the end of the discussion, the teacher will say that we will next investigate each phase of the moon more thoroughly.

**Plan B:** At the end of the discussion, the students will return to their seats and brainstorm a question that they would still like to investigate about the moon. These questions will be recorded and written on sentence strips by the students. These questions
will be sorted by the teacher and posted as a gallery walk for the students to investigate as part of Phase 2.

Plan A: Phase 2 Focused Investigations
Day 2

Plan A has a strong emphasis on the process skills of observation, prediction, hypothesis, interpreting data, and drawing conclusions. This investigation is designed to employ a significant amount of higher order thinking. The use of various texts is included after the above skills have been used as fully as possible. Texts are used to support, clarify, and extend students’ findings.

Materials:

- Lamp
- An orange or tennis ball per pair
- Science notebook
- Student moon calendars
- Challenge card for each pair

Challenge: Where in space are the moon phases?

You will need your moon watch calendar and science notebook.
- The lamp represents the sun.
- One person is the Earth.
- The orange/tennis ball is the moon.

Can you use these materials to duplicate the phases of the moon on your calendar?
• Illustrate your findings in your science notebook. Be sure to label the sun, Earth, and each moon phase.
• Record what you notice and what you wonder.

After you have discovered and recorded as much as possible, choose a text to read about moon phases. Compare the text to your findings in order to reinforce or extend your understanding of where these phases occur in space.

**Formative Assessment:** Draw a line of learning in your science notebook. Record any new knowledge or questions you have about phases of the moon.

**Plan B: Phase 2 Focused Investigations Day 2-4**

Teacher will sort and post the questions into 3 categories:
• Calendar patterns
• Research
• Lamp activity

Teacher will introduce the materials:
• Texts
• Computers
• Lamp
• Oranges
• Previous month moon calendars
• Student notebook
• Student calendar
Students will choose the question they want to investigate by reading all the questions and then standing next to the question they want to investigate. When they have a group of 3 wanting to investigate the same question, they are ready to begin planning.

Students will then write their plan on the template provided. Teacher will review plans and students will revise as needed. Next, students will gather needed materials and conduct their investigation.

**Formative Assessment:** At this point in the Inquiry the students will draw a line of learning in their science notebooks. Teacher will pose the question “What new knowledge did you obtain about the moon through your investigation or what new question do you now have?

**Phase 3: Shared Understandings**

**Plan A: Day 3**

- Students will be put into 8 groups, one group for each phase of the moon.
- Each group will plan and practice the following 3 minute share out, using proper science vocabulary:
  - Use of the lamp and orange/tennis ball to demonstrate the location of their phase
  - Explanation of what part of the moon is lit
  - Explanation of what we see from the Earth
  - Explanation of how long the phase lasts
Discourse on moon phases
Students will gather in a circle to discuss what they notice and wonder about forming clear, complete descriptions of their moon phase, especially the difference (if there is one) between what part of the moon is lit by the sun and what we see of the lit part here on Earth. Ideas about the moon changing size or shape will be aired, as well as where the moon goes during the day. There may also be discussion of the direction the moon travels, based on the pattern of the moon phases. This discourse will emphasize interpreting evidence and drawing conclusions.

Revise and finish planning and practice for share out.

Formative assessment:
Students will write a line of learning in their notebooks and note new learning and/or questions.

Day 4:
- 3 minute share outs, as noted above
- Teacher synthesis, recapping major concepts about the effect of the moon’s motion around the Earth and clarifying any remaining misconceptions.
- Explanation of summative assessment and how students can use their notebooks to study for it.

Day 5:
- Summative assessment, as noted above
- Extension activity- using the lamp and tennis ball to create a lunar and solar eclipse
Plan B

Students will plan their share out. They will use their science equipment to demonstrate and explain their conclusions. They will practice for their presentations which will be a total of 5 min. being sure to use the proper science vocabulary appropriate to their investigation.