



Charting the Moon

National Standards>Science>Science as Inquiry

Content Standard A- Science As Inquiry (Grades K-4)

- Ask a question about objects, organisms, and events in the environment
- Plan and conduct a simple investigation
- Employ simple equipment and tools to gather data and extend the senses
- Use data to construct a reasonable explanation
- Communicate investigations and explanations
- Content Standard D- Earth and Space Science
- Changes in the Earth and sky

Kentucky> Science Standards (K-4)

#2 - Earth and Space Science

Objects in the Sky

Changes in Earth and Sky

SC-E-2.3.1

- Weather changes from day to day and over seasons. Weather can be described by observations and measurable quantities such as temperature, wind direction and speed, and precipitation.

Ohio: Science>Academic Content Standards and Benchmarks Grades 3-5:

Earth and Space Science Standard

Benchmark(s)

Grades K-2

C. Observe, describe and measure changes in the weather, both long term and short term.

Grades 3-5:

D. Analyze weather and changes that occur over a period of time.

Scientific Inquiry Standard

Benchmark(s)

Grades K-2

A. Ask a testable question.

B. Design and conduct a simple investigation to explore a question.

C. Gather and communicate information from careful observations and simple investigation through a variety of methods.

Grades 3-5

A. Use appropriate instruments safely to observe, measure, and collect data when conducting scientific investigations.

B. Organize and evaluate observations, measurements, and other data to formulate inferences and conclusions.

C. Develop, design, and safely conduct scientific investigations and communicate the results.

Scientific Ways of Knowing Standard

Benchmark(s)

Grades K-2

A. Recognize that there are different ways to carry out scientific investigations.

Realize that investigations can be repeated under the same conditions with similar results and may have different explanations.

Grades 3-5

A. Distinguish between fact and opinion and explain how ideas and conclusions change as new knowledge is gained.

C. Explain the importance of keeping record of observations and investigations that are accurate and understandable

NOTE: Prior to starting the collection of data during daily meetings, read aloud the first 10 pages of The Moon Book by Gail Gibbons, stopping when the actual phases of the moon are described. Select other sections of the book to read as needed. Fact cards could be written from this information or from other sources.

Objective

Students will observe the changes in the moon daily and record their observations on a chart. They will then act out the moon cycle using their body as the earth and a model of the moon.

Task 1

Materials

- 2-3 inch circles cut from dark and light construction paper to represent the moon and the reflected light of the moon. Cut enough to cover several 28-day cycles of the moon
- Chart paper or a section of the wall large enough to make a circle of these circles
- A circle larger than the moon circles to represent the Earth (label it)
- A half circle large enough to represent the sun (label it)
- Daily weather section of the newspaper or Internet weather site or the Farmer's Almanac
- Tape
- Markers
- Paper for labels of the date and moon phases
- Sentence strips
- File cards with various facts about the moon written on them

Vocabulary

- Full moon
- Third or last quarter moon
- Waxing crescent moon
- New moon
- First quarter moon
- Gibbous moon
- Waning crescent moon
- Revolution
- Reflection

Activity

Teacher will:

- During morning greeting or daily meeting time each day, discuss and share information related to the phases of the moon. Gather this information from the local newspaper, an Internet on weather or daily statistics, or the Farmer's Almanac for that year.

- Cut 2-3 inch circles (at least 28 for each cycle of the moon) from dark construction paper to be used to record the daily appearance of the reflected portion of the moon. Place these circles in a large circle on chart paper or the wall. The Earth should be represented with a larger circle and placed in the center of the 28 circles. Be sure to label the Earth. Off to one side of the chart, add $\frac{1}{2}$ of a circle much larger than the moon and Earth circles, yellow or orange shades, to represent the sun.
- Cut the same size circles as above from yellow or white construction paper. Start collecting daily data with the full moon since it is a complete circle and students could see it. (Most cycles are described in books beginning with the New moon, hence its name. Since there is no reflection to "see" this moon, make the decision based upon your students as to where to start in the cycle. Full or New moons are probably the best starting points, but any point would be appropriate.) Discuss with the students what full means...all parts included or all sections showing, etc. Since you are discussing the full moon add the entire circle to the chart by gluing it directly over the dark circle that is directly opposite of the sun. This circle will be on the opposite side of the chart, not close to the sun.
- Continue in the same manner each day. Follow the pattern of the phases of the moon cycle and cut the light colored paper to represent the reflected light that we see when we look at the moon. You will not necessarily need to do this every day; every 2-3 days would be enough. Label the major phases and the date by each circle. Discuss how the moon seems to change everyday. Ask what if questions...What if we do not observe the moon today, will it still change? What if there were clouds in the sky, would the moon still "be there"? What if we wait a week before looking at the moon again, will it look the same or different? Discuss the changes in shape and size of the reflected sections. Record the questions on sentences strips and post near the moon phases chart. Record guesses and/or answers as they are discovered.
- Each day, share another fact card about the moon. Display it near the chart.
- Encourage the children to look for the moon themselves. During the daily meeting talk about the times that the moon will rise and set so the children know when the moon is visible for them to observe.
- If you miss a couple days, use the data that you have collected to predict and cut light paper to represent what the moon probably looked like on those days.
- After completing a cycle, make predictions as to what will happen next to the moon. Count the number of days that it took for the moon to return to full moon. Completing this activity over extended periods of time or a couple cycles followed by skipping a couple and then coming back to it again will show the students that this cycle continues even when they are not looking for the moon. They might even begin to look for the moon themselves during the "off months."

Task 2

Materials

- A Styrofoam ball or rubber ball for each student about 3 inches in diameter
- A pencil or dowel rod inserted into the ball, use this as a means for holding the ball
- A floor lamp with at least a 100 watt bulb, preferably 200-400 watt bulb, lamp shade removed
- A room that can easily be darkened

Activity

Teacher will:

- Have students act out the moon cycle using their body as the earth and a model of the moon. This activity should follow at least one completed cycle during daily meetings.
- Place a stand lamp with a 100-400 watt bulb in the center of the room, minus its shade. Remind the students to not look directly at the light. Tell them that it represents the sun and they should be cautious about looking directly at the sun as well. You might want to have "sunglasses" available for the students to use if necessary.
- Each student needs a Styrofoam ball or rubber ball with a pencil or dowel rod securely pushed into the ball for a place to hold the ball. This ball will represent the moon. Show the students to hold the stick at about arms length in front of them in one hand. During full moon it will be high above their head and at new moon it will be directly in front of their face. Have them practice moving slowly from the high point to the low point and back to the high point as they turn in a circle. This represents the elliptical motion of the moon through its cycle.
- Tell the students that you will be turning off the classroom lights and only the light in the center will be lit. Remind them that this light represents the sun and the light in the room is being sent from the sun toward them on the Earth.
- Turn the lights off and explain to the students to move counterclockwise to create the path that the moon takes during one revolution around the Earth. Remember that the New Moon will be totally shaded and the Full moon will be totally lit. The reflected light will slowly go away and come back as the students turn with the ball in front of them.
- As the students turn to the phases of the moon, discuss the names for the phases and the changes in the lighted and dark sections of the moon.
- Start with the moon directly in front of them. Discuss that the lighted side is away from them so no light is showing on the moon. This is New Moon (similar to having no moon). Have the students move to their left about $\frac{1}{8}$ the distance of the circle. Observe and discuss the lighted portion of their moon now. The right hand side will be lit in the form of a crescent. The further they turn, the larger the crescent becomes as the moon moves further from the sun. Remember that the moon should also be moving slightly higher until it reaches the full moon phase (half way around the circle).
- When the students have turned $\frac{1}{4}$ around the circle they will see the lighted part is the right half of the moon that they can see. This is first quarter moon. Point out that $\frac{1}{2}$ of the sphere is always lighted with sunlight however the location of the moon only allows them, on Earth, to see a portion of that at certain times, like now. The lighted section will continually change as the moon moves around the Earth. The phases between first quarter and Full moon are called a gibbous moon. The growing lighted section, from New moon to Full moon, is called waxing.
- When the moon reaches directly opposite the sun, the students will have their back to the lamp and the moon will be above their head so that they can see the entire half of the moon that is lit by the sunlight. Discuss that it takes the moon about 2 weeks to get to this point.
- Continue the moon's counterclockwise movement until the moon is $\frac{3}{4}$ of the way around the circle. Between these 2 points the moon is again a gibbous moon however it is now, from full moon to new moon, considered to be

- waning, “growing smaller”. This is last quarter or third quarter moon. Point out that still $\frac{1}{2}$ of the moon is lighted yet on Earth only part of that can be seen, as the moon gets closer to the sun.
- Continuing the movement, the crescent will start larger and get smaller as the circle is completed by returning to directly facing the lamp (sun). Review that this location is called New Moon, no moon, since the lighted section is away from the Earth. This completes the cycle in about 28 days and the cycle begins again immediately.

Task 3

Materials

- Adding machine
- Tape strips about 24 inches long, one per student
- Nine black construction paper circles (per student) about 1.5 inches in diameter, glued in a straight line with spaces between them on the strip
- Ritz crackers, at least 79 per student, allow a few extras for “mistakes”
- Markers, crayons, or pencils
- Elmer’s glue

Activity

Teacher will:

- Have students create a linear representation of the phases of the moon. This activity should follow at least a couple months of collecting data during daily meetings.
- For each student, cut a section of adding machine tape about 24 inches long with eight 1.5 inch black construction paper circles glued onto it in a row. Draw a line under each black circle.
- Review the phases of the moon cycle with the students starting with a Full moon. Refer back to the charts created during daily meetings. As each phase is reviewed, have students eat a section of a Ritz cracker that represents the dark section of the moon. The reflected light section will be what is left of the cracker.
- Glue this onto the black circle. Write the name of the phases on the line under the circle. The black circle will show that the entire moon is still there, but shadowed.
- Continue in this manner until nine phases are included in the line. Predict with the students what phases would happen next. Have several students stand next to each other holding their strips together to show that the pattern continues over and over again.

Performance Assessment

Teacher will evaluate student’s ability to:

- Keep anecdotal notes of comments shared by students during daily meeting time, both those that show understanding and those that show misconceptions. Use the misconceptions to guide the discussion that follows the next day.
- Review the strips to determine student ability to make and label a model representing a cycle.
- Draw a circle on a paper with nine circles about 1.5 inches in diameter placed on the circle. Label and draw in a couple of the circles with New Moon, waxing moon, quarter moon, etc. Label the remainder of the circles, but do not include a picture. Students will complete the circles by coloring in the dark and/or light sections of the phases that is listed. For students having difficulty

- reading the words, read them out loud to the class. Leave the daily meeting time charts on the wall, available for students to use if necessary.
- Discuss The Legend of Sleepy Hollow production with the students making connections between the phases of the moon and the storyline. How would the phases of the moon change the story? What effects in the production were based upon the light from the moon?

Related Resources (Print)

- The Moon Seems To Change by Franklin Branley
- Science Project Ideas About The Moon by Robert Gardner
- Sun Where Do You Go? by Francesca Grazzini
- Spinning Through Space: The Moon by Tim Furniss
- Solar System by Janice VanCleave
- Tales of the Shimmering Sky retold by Susan Milord
- Moongame by Frank Asch

Internet Resources

http://aa.usno.navy.mil/faq/docs/moon_phases.html

- This site gives good background information and links to sites that show the moon phases on selected dates.

www.sciencenetlinks.com/lessons.cfm/BenchmarkD=4&D

- This lesson plan identifies and extends study of moon phases.

www.stardate.org

- Gives monthly moon calendars that are printable for use in the class activity.

www.enchantedlearning.com/subject/astronomy/moon/phases.shtml

www.brainpop.com

- Connect with a short video clip about the moon through science/space/moon.
- Webquest for differentiation based upon student needs.

<http://aldertrootes.wcpss.net/moonwebquest.html>