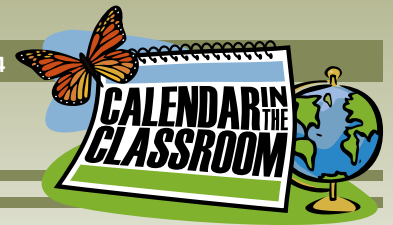




Moon Phases



Overview

Students develop an understanding of the moon phases through home observations and class activities as they create a moon phases chart by tracing vanilla wafer cookies that have been nibbled to represent the apparent moon shapes they have observed in the sky.

Background

Moon Phases

We see the moon because it is reflecting sunlight somewhat like a mirror. As the Earth orbits around the sun, the moon is orbiting around the Earth. It takes the moon about 4 weeks (a month) to orbit Earth and during this trip the moon reflects varying amounts of light.

As the moon orbits Earth it is sometimes between the Earth and the Sun. The moon is not reflecting any light toward the Earth and the bright sunlight obscures our view of the moon. This phase is called the new moon. On the *Minnesota Weatherguide Environment™ Calendar* the new moon is shown as a dark circle.

Each night as the moon moves a little farther in its orbit, we can see a small sliver of moon reflecting sunlight. This is called a crescent moon. As the moon continues along its orbit more and more of the moon is reflecting sunlight (waxing). Sometimes we may even see it during the day. About a week after new moon, we can see what looks like a half-moon – it is a quarter of the way around the Earth so it is also called the first quarter moon.

Each night more of the moon's surface reflects sunlight so it looks like it is increasing in size. Now the moon is about 2 weeks into its orbit and it is on the side of the Earth where the sun can light all of the moon surface that we can see. This is called the full moon.

Time:

Day 1: 30 minutes
Day 2: 45 minutes
Day 3: 30 minutes

Skills:

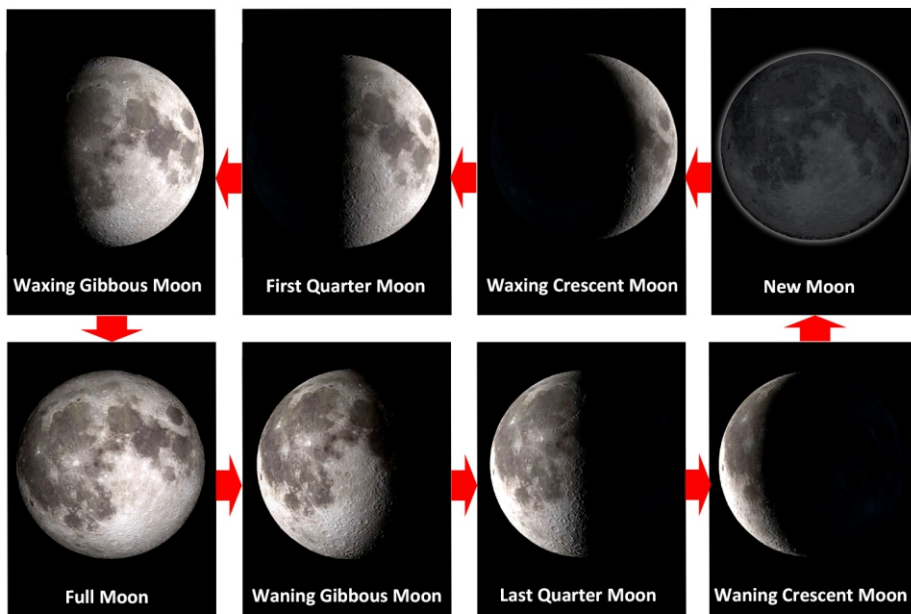
Observing
Recording
Data collecting
Forecasting

Vocabulary:

crescent moon
first quarter moon
full moon
gibbous moon
lunar cycle
new moon
waning crescent
waning gibbous
waxing crescent
waxing gibbous

Materials Needed:

- *Minnesota Weatherguide Environment™ Calendar*
- White board/document camera
- Blank & calendar paper
- Pencils
- Vanilla Wafers (1 box/5 students)
- Chart paper
- Markers
- *The Moon Book* by Gail Gibbons
- Moon Phases Calendar
- Moon Phases Worksheet
- Letter to Parents



As the moon continues to orbit, it appears smaller and smaller (waning) until it is again dark – a new moon. And the cycle repeats.

The Activity

Day 1

Warm Up

(If possible, do this activity a week before the full moon. You will have time to send home a letter to parents, explaining the unit of study and requesting that they help their children observe the upcoming full moon – and make observations throughout the next lunar month.)

1. Today is exciting because students will become astronomers – scientists who study the universe beyond the Earth! You will be studying the moon that orbits our Earth.
2. Use a chart to record what students know (or think they know) about the moon.
3. Read *The Moon Book* by Gail Gibbons. After reading, discuss what students learned and add to or modify the list on your chart.
4. Show the class the *Minnesota Weatherguide Environment™ Calendar* and the current month page. Explain to the students that they will be starting to track the moon and its phases over the next month. Show and discuss the sketches of the moon throughout the month. Take time to also have students count the days in a lunar cycle.
5. Have students take home a letter to parents requesting family involvement as the students spend some time at home observing the night-time moon. A draft letter is included in this lesson – or better yet – have the class work together to draft a persuasive letter for parents.

Day 2

Learn and Create Moon Phase Sketches

1. Review the moon chart created earlier with the students.
2. Take out the *Minnesota Weatherguide Environment™ Calendar* and point out the shaded moon pictures in the date boxes.
3. Introduce and teach each moon phase name and definition. Keep these on a chart (use all vocabulary from key words section).
4. Show students pictures of moon phases in one or more of the books and resources listed below.
5. Students now get a chance to draw the moon phases by tracing cookies. Each student will be showing the moon phases by eating the shaded parts of the moon, which is a vanilla wafer.
6. Pass out copies of the “Moon Phases” worksheet found below for each of your students. The worksheet includes a short explanation regarding the number order of moon phases (1-8) that corresponds with the counterclockwise path the moon follows as it travels (revolves) around the Earth. Read that sentence with your students so they can develop an understanding of why the worksheet is numbered as it is. (Consider having students draw arrows between each box so students can visually see how the moon phases change as the moon follows the counterclockwise path from box #1 to box #2 and so on, finishing with an arrow from box #8 back to box #1. The drawing of arrows may be done at the beginning of the lesson or at the end of the lesson.)
7. Give a box of Vanilla Wafers to each group/table of students. Each student removes only one cookie at a time. Model this process with them so they know exactly what to do for each phase.
8. Take out a new cookie. Trace it just like it is in box #1. Shade the entire circle in. This is called a New Moon. It is the “dark of the moon” because the moon is between the Earth and the sun and we cannot see any of the lighted half of the moon. Because the moon is completely shadowed they may eat the entire cookie. Label the moon phase.
9. Take a new cookie from the box. Nibble along the left side of the cookie until you have a thin crescent shaped like a backwards “C”. Trace the shape into box #2. Label this the Waxing Crescent Moon. When you have finished tracing, you may eat the remainder of the cookie. (Waxing means it appears to be increasing in size.)
10. Take a new cookie from the box and bite it in half. Trace the right half into box #3 and label it First Quarter Moon.

11. Take another cookie from the box and carefully nibble off a small about from the left side of the cookie and trace the shape in box #4. Label this shape the Waxing Gibbous Moon.
12. Tell them to take out one of the cookies, trace this whole cookie in box #5. This represents the Full Moon. Have students record the name of the moon phase in the box. This cookie may not be eaten yet.
13. Model how to carefully nibble off the right edge of the moon cookie to produce a Waning Gibbous Moon. Trace this cookie shape in box #6. Record the moon phase name in the box. (Waning means that the moon appears to be getting smaller in size. Obviously, the size remains the same, but less of the moon surface is being illuminated.)
14. Continue to model biting the cookie before letting students do it. Now they should nibble until they have only a half of a cookie left to trace. This is called the Last Quarter Moon. Trace the cookie shape into box #7 and label the drawing. This should be positions so the left half of the moon is being traced.
15. Nibble the half cookie until it is shaped like a letter “C”. Trace the cookie shape into box #8. This is a Waning Crescent Moon. You may now eat the remainder of this cookie.
6. Double check to make sure that all students have labeled each of the boxes with the proper names as well as drawn in the proper moon shape.
17. Ask: What will the moon look like in the next phase after the Waxing Crescent Moon?
(It will be a New Moon again.)
18. Bring students together at the end of the activity to review the changes in the moon phases.
19. Hang the student charts up in the classroom so that students can visibly see them for at least a week. At the end of the week, send the charts home with a note informing families of what their students have been learning.

Day 3

Moon Calendars

1. Introduce blank calendars to the students and explain that they are going to track the moon phases for one month and compare their findings to the *Minnesota Weatherguide Environment™ Calendar*.
2. Point out to students that the moon does not rise and set at the same time each day. Tell students that they can find the rise time of the moon on the *Minnesota Weatherguide Environment™ Calendar* or on the internet. Have them look for times when the moon is visible during the day. It is easy to make their moon sketch on those days.
3. Explain that this is a month long homework assignment. Students are to take the calendars home and observe the moon each night (or day). Distribute the Moon Phases Calendar sheets and help students fill in the dates of the lunar cycle you will be observing as you model on your whiteboard or by using a document camera. For example if today is Tuesday, March 15th, find the first Tuesday on the sheet and write in a 15 then continue and number the dates for the rest of the calendar. Remind students to write their names at the top. Now for each date, list the time during the day or night that the moon rises and sets. Students will have to make their observations some time during that period. The last day on the calendar is the day that these homework calendars are due back to school.
4. Model how to make an observation. Show students that they are to draw what the moon looks like in each date box. Model an example of an observation. Record the time, draw a sketch of the moon, shading it, and label it with the correct moon phase.
5. Send the Moon Phases Calendar sheets home with the Moon Phases Letter to Parents so that parents are informed of the assignment and can help their student at home. (To add a “persuasive writing” component to this lesson, have students write the letter that goes home to parents.)
6. Throughout the month discuss with students how their observations are coming along and what they are finding.
7. When the month of recording and observing is over the students will bring their calendars back to school. Students can then compare their findings with other students' and also with the *Minnesota Weatherguide Environment™ Calendar*.

Wrap-up and Assessment

Questions for Discussion

- Does the moon change or stay the same? The moon appears to change in shape as it revolves around the earth. The changes seen in the moon are called moon phases.

- Is there a pattern to the way the moon seems to change? The moon has a continuous cycle of change from the new moon phase, it appears bigger and bigger each day because more and more of the moon's surface is illuminated by the sun until it is a full moon. Then the moon appears smaller each day because less and less of the surface is illuminated until it is a new moon again.
- How long does it take the moon to go from one new moon to another new moon? The lunar cycle is about one month or a little more than four weeks (29.5 days). Our word "month" came from the word "moon."

Extensions

Teach about each month's full moon. Explain how a full moon appears as an entire circle in the sky. In Native American and folk cultures the full moon has different names, depending on the time of year and the phenological happenings. The lesson "Ojibwe and Lakota Moons" examines the names of the full moons throughout the calendar year.

Resources

- Branley, F.M. *Moon Seems to Change*.
 Brenner, M. *Abe Lincoln's Hat* (Lincoln won a law case because he knew moon phases!)
 Fowler, A. *So That's How the Moon Changes Shape!*
 Gibbons, G. *The Moon Book*.
 Olson, G. M. *Phases of the Moon*.
 Twist, C. *The Moon*.
 Wood, Doug *Rabbit and the Moon*
Minnesota Weatherguide Environment™ Calendar
 online: <https://jeffersfoundation.org/programs/calendar-in-the-classroom/>

Minnesota State Academic Standards

3-D Science Standards

Science Practices:

2. Developing and Using Models
3. Plan and Carry Out Investigations
4. Analyzing and Interpreting Data
7. Engage in Argument from Evidence
8. Obtaining, Evaluating and Communicating Information

Crosscutting Concepts:

1. Patterns
2. Cause and Effect: mechanism and explanation
4. Systems and System Models

Disciplinary Core Ideas:

ESS1: Earth's place in the universe

3rd Grade: Record observations of the sun, moon, and stars and use them to describe patterns that can be predicted

Math Standards:

Grade	Strand	Anchor Standard	Code	Benchmark
3	Data Analysis	Data Sciences: Identify, formulate and investigate statistical questions by collecting data considering cultural perspectives, analyzing and interpreting data and communicating the results.	3.1.1.5	Critically analyze data visualizations, including frequency tables, bar graphs, picture graphs or number line plots having a variety of scales to support a claim and solve situations. (MP1, MP3)

Month, Day, Year

Dear Parents:

We have been studying the moon and its phases. We have learned the names of each phase and what the moon looks like at each phase. Now it is time for us to study the moon in the sky. As a bridge to what we have been learning in class, we have asked students to look for the moon in the sky when they are at home. To make the moon observations, take your child outside during the evening (most nights this is when it is convenient and easy to see the moon) and observe. To help you plan, your child has a Moon Phases Calendar (attached) showing the times when the moon is visible for each date. Take a few minutes to enjoy the night sky together. Talk about what you see. If it's clear, you will see stars too and you might want to point out a constellation or two, planets, and finally the moon. Discuss the changes in the night sky and in the moon from the previous nights.

If you don't see the moon during your time due to clouds, you might want to look again during the day. If clouds persist, record that day as "Cloudy."

Have your child record his or her moon observation on the Moon Phases Calendar (attached) each night. To make a complete entry your child needs to fill in the time, draw and shade the moon, and label what phase the moon is in. Bring the calendars back to school in one month for discussion and comparisons. Thanks for your help!

(Example Observation)

Date

8:00 pm

First Quarter Moon



Moon Phases Worksheet

Name _____


4	3	2	1
5	6	7	8

Moon Phases: The moon travels (revolves) around the Earth in a counterclockwise pattern. Thus, the boxes are numbered to show the order the phases are observed as described in the directions of this lesson (for Day 2).

Moon Phases Calendar

Name _____ Moon cycle from _____ to _____.

1. Record the time of each observation.
2. Draw and shade what the moon looks like each day or night.
3. Write the name of the phase the moon is in for each observation.

(Example)
14

8:30pm First Quarter Moon

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday