Moon Log

Overview

This is the first part of an activity in which students begin to understand the phases of the moon. In this part, students observe and record the moon's appearance for a month. Because this activity requires a month of data gathering, you will need to begin with it in order to have time to analyze the observations later, in the unit titled "Phases of the moon." Beginning this activity at the right time will require planning in order for the class to begin viewing at times of day when the moon is visible. Throughout this guide, all information in italics is a "teacher tip."

North Carolina Essential Science Standards

6.E.1.1 Explain how the relative motion and relative position of the sun, earth and moon affect the seasons, tides, phases of the moon, and eclipses.

Background

Few 6th grade students have observed natural occurrences over an extended period of time. The moon is an excellent subject for this because, although it is familiar, few people pay close attention to it. For example, some people are not aware that the moon can be seen both day and night. Having students observe the moon early in this unit allows them to find the pattern in the lunar cycle for themselves. Once they see the pattern, they can begin to understand why it occurs.

The best time to view the moon with classes throughout the day is about 5 days after the new moon, during the waxing crescent. Newspapers or the internet have current moon phases. A source for the teacher (not students) is www.stardate.org/nightsky/moon, with a moon phase calendar for the year. It is critical for students to actually go outside to look at the moon, and allowing them to use the internet at this time to record moon phases will be counter-productive. Table 1 shows moonrise and moonset times for each phase. For example, the second row in Table 1 shows that during the waxing crescent, the moon is visible in the east in the morning, is highest around noon, and is still visible in the west in the afternoon. Starting with the waxing crescent allows students to observe the moon together during class, then, as the days pass, watch it on their own as it becomes fuller later in the day. If it is inconvenient to start during the waxing crescent, you can start during the waning crescent, but after several days, the moon will no longer be visible.

If students cannot observe the moon for a few days due to bad weather, it will not pose a problem as long they observe for a full month. A month of observations allows students to identify a pattern in the shape changes and to speculate about what they would have seen under clear skies. At this point it is appropriate to let students check their ideas using the internet.

PHASE	RISES	EAST	HIGHEST	WEST	SETS
New Moon	sunrise	morning	noon	afternoon	sunset
Waxing Crescent	just after sunrise	morning	just after noon	afternoon	just after sunset
1st Quarter	noon	afternoon	sunset	evening	midnight
Waxing Gibbous	afternoon	sunset	night (p.m.)	midnight	night (a.m.)
Full Moon	sunset	night (p.m.)	midnight	night (a.m.)	sunrise
Waning Gibbous	night (p.m.)	midnight	night (a.m.)	sunrise	morning
3rd Quarter	midnight	night (a.m.)	sunrise	morning	noon
Waning Crescent	just before sunrise	morning	just before noon	afternoon	just before sunset

School hours | Outside school hours

Table 1. Viewing times for moon phases.

Materials

Materials for the whole class

- * Large piece of newsprint or bulletin board paper.

Materials for individual students

- 1 copy BLM 1, Moon Log
- *Science notebook

** supplied by the teacher*

Preparation

Make one copy of BLM 1 Moon Log for each student.

Procedure

Moon Log

1. Ask *when* students see the moon *[at night, during the day, sometimes not visible]*.
2. Ask *where* students see the moon *[on the horizon, high up in the sky, etc.]* Accept all answers, but try to get students to refer to a specific landmark.
3. Ask students what the moon looks like *[a circle, a crescent, a fat blob]*.
4. Hand out Moon Logs and explain how to fill them in. Discuss the need to observe the moon at different times of day.
5. If the moon is visible (see Table 1), take students outside and have them fill in their first observation.
6. Gaps in logs due to weather or moon phase *[new moon can be left blank for now]*.

7. Consider asking students to include other information, either in their logs or in their notebooks such as:
    - Location of the observation (for example, a sketch of the observation area, including landmarks such as trees, buildings, the horizon, a few major constellations [Big Dipper, Cassiopeia, Orion, etc.], and compass points north, south, east, west).
    - Times of sunrise and sunset from a newspaper weather page or website.
    - Times of moonrise and moonset from a newspaper weather page or website.

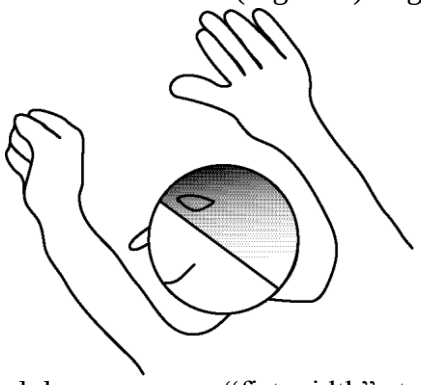
Distance from Sun to Moon

This activity can be added to the moon log observations to help students understand how positions of the moon and sun relate to moon phases, and make the whole unit more meaningful.

Start the activity when both moon and sun are visible (see Table 1). You can make morning observations when the moon is in the third quarter (6-7 days after the full moon). For afternoon observations, wait another day or two.

Procedure

1. Hold one hand over the sun or stand so that the sun is just barely in the shadow of a building. (**Never look directly at the sun, even for a second.**)
2. Form a fist with the other hand and hold your arm out straight. Hold it so that the wide part of your fist is toward the sun (Figure 1). Figure 1.



3. Move your arm toward the moon, one "fist width" at a time, and count the number of fist-widths between the sun and the moon. This takes practice, but after a few trials, students should get consistent results. Smaller fists are usually attached to shorter arms, so the number of fist widths is usually consistent among students, regardless of the students' varying sizes. If someone's results differ from the group average by more than 3-4 fists, check to see if they need help.
4. Ask students to record the number of fist widths between the sun and moon in their moon logs or science notebooks with the moon shape and date. Gather the class average for the moon shape and date to use later on. Repeat this each class period until you have 5-6 measurements.
5. After the class has 5-6 measurements, draw a sun and the moon shapes so that the whole class can see them. Write the average number of fist widths between the sun and moon by each shape (Figure 2). Figure 2 shows what students might see if this activity is begun after a full moon. In this figure, the first two moon shapes

observed (and farthest from the sun) are from nighttime observations. Only the three measurements closest to the sun could be made during the school day. To duplicate the results in Figure 2, you will need to make two measurements yourself in the two evenings before students begin this activity during the school day. For evening measurements, use a convenient landmark to mark where the sun disappeared below the horizon at sunset, and measure number of fist widths between that point and the moon.

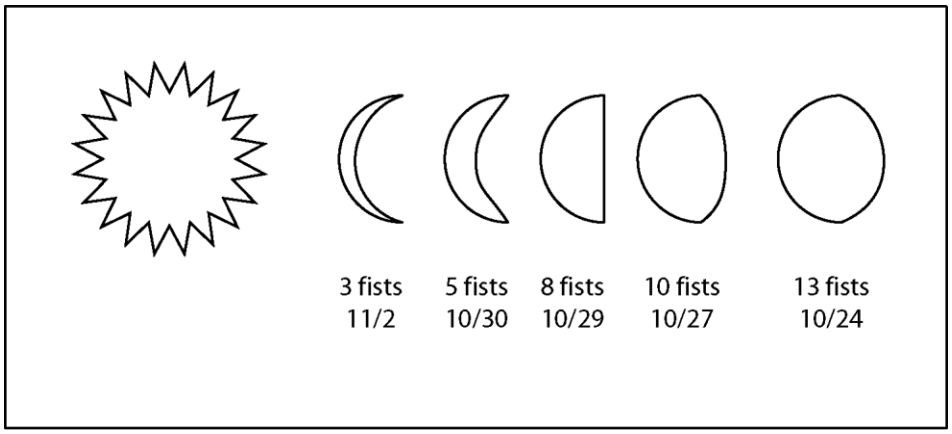


Figure 2.

6. Ask students to record any patterns they see. In the example above for a waning moon, students should be able to conclude that:
    - Each day, the moon moves closer to the sun.
    - As the moon moves closer to the sun, its shape appears thinner.
    - The lighted side of the moon is always on the side toward the sun.
7. Similar observations can be made as homework starting 2-3 days after the *new moon*, observing at sunset. Students will count fist-widths between the point where the sun sinks below the horizon and the waxing crescent moon. They should observe that:
    - Each day, the moon moves further away from the sun.
    - As the moon moves away from the sun, it gets ‘fatter.’
    - The lighted side of the moon is always on the side toward the sun.

Reflection/Discussion

Here are questions and statements to guide students in their reflection/discussion:

- Does the moon make its own light or does that light come from somewhere else? If from somewhere else, where?
- How does the shape of the moon seem to change throughout a month?

- How does the distance between the sun and moon change throughout a month? See if students have any ideas about why this distance changes. Accept any ideas, and let them know that they'll find out why this occurs later in the unit.
- Which part of the moon shape always seems to be facing the sun?

Assessment

Moon Logs

- Have students made a sufficient number of observations?
- Are sketches in a reasonable order? For example, the full moon should be preceded and followed by sketches of waxing and waning gibbous moons.

Distance from Sun to Moon

In a short writing assignment, have students describe the patterns they see in their data. You might want to allow them to use their notebooks as source material. This will reinforce the value of keeping a science notebook. Some questions they should answer:

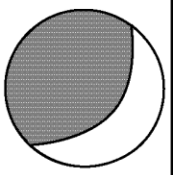
- How does the distance between the moon and sun change as the phases of the moon change? [As the moon wanes from full, it moves closer to the sun. As it waxes from new, it moves away from the sun.]
- How does the size of the moon change as it moves toward and away from the sun? [The moon looks like it gets smaller as it moves closer to the sun, and vice versa.]
- Even when the moon is not full, you can see the 'rest' of the moon, though it may be faint. Which part of the moon is closest to the sun? [The lighted part of the moon always faces the sun.]

BLM 1

MOON LOG

Record the date and time of your observation.
Then draw a sketch of the moon, showing its shape and orientation.

Example	
24	7:30 p.m.



Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday