Moon Rise, Moon Set

Activity A5

Grade Level: 4–12

What's This Activity About?

Children (and many adults) are surprised to discover that the Moon can be seen in the sky during the day. This activity helps students create a physical model to determine where the Moon and the Sun are in relation to each other, and when the Moon can be seen in our skies. It builds on the modeling activities A3 and A4.

What Will Students Do?

Students will work in pairs using a Styrofoam ball to represent the Moon and a light bulb to represent the Sun. One student will hold the Moon so that it shows the required phase, while the other student will play the role of the rotating Earth. Students will investigate whether and where the Moon is visible in the sky for each phase, make a table of lunar rise and set times, and estimate the time on Earth from the position of the Sun in the Earth's sky.

Tips and Suggestions

- Be sure to allow enough time for students to play with the model and get familiar with the ideas and terms.
- Students will often have difficulty with determining time from their model. You may want to discuss how to tell local time roughly from the position of the Sun in the sky; i.e. sunrise is when the Sun is just coming up in the East, noon is when the Sun is highest in the sky, etc. You may want to stress that in telling time, they need to focus their attention only on the Sun and Earth.
- Students playing the Earth will sometimes rotate in the wrong direction and thus misinterpret what time an observation is being made. Help students remember in which direction they should turn by suggesting that the "Earth" students hold out their arms, and label their left hand "east" and their right hand "west". Students then always rotate to their left or to the east. (The Earth rotates west to east, which is why the Sun appears to move from east to west.) Reinforce this direction by suggesting that the "Moon" students also revolve around the Earth in the same direction.
- Sometimes it can help to sketch what students need to do in this activity on the blackboard, before they start.
- You can measure your students' understanding by posing further problems for them:

  A. One special day, school is dismissed at noon. As you go home, you see the Moon setting. What phase must the Moon be in if it is setting around noon?

  B. One morning, you wake up just as the Sun is about to rise. You turn around, and the Moon is setting on the other side of the sky. What phases is the Moon in?

  C. You and some friends go to a movie just as the Sun is setting. You notice that the Moon is high in the sky, almost over your head, at sunset. What phase is the Moon in?

What Will Students Learn?

Concepts

- Phases of the Moon • Telling Time
- Modeling Motions
- Sky Phenomena

Inquiry Skills

- Observing• Predicting
- Reasoning• Explaining

Big Ideas

- Patterns of change
- Models
- Simulations

Lesson 6: Moon Rise and Moon Set

As the students work with Moon balls, questions may arise as to when you can see particular phases of the Moon. This lesson explores that concept further before students try to answer the riddle and challenges in Lesson 7. Lesson 6 also addresses when the Moon can be seen in the sky. Many students have the pre-conception that the Moon can be seen only at night. Their observations in Lesson 2 should have shown them that you can see the Moon during the day and this lesson reinforces that fact.

Concept

Because the Moon revolves around Earth once a month, there are times during each month that the Moon can be seen in both the nighttime and daytime sky. The approximate time the Moon rises and sets is predictable; it varies during the course of the month and is related to its phase.

Objectives

Students will:

- determine approximately when the Moon will rise and set based on what phase the Moon is in; and,
- understand that it is possible to see the Moon in both the daytime and nighttime sky.

Materials

- Light bulb on a stand or clamp (or lamp with its shade removed)
- Extension cord
- One styrofoam ball or light-colored sphere for each pair of students
- Pencil and paper
- Darkened room

Procedure

Advanced Preparation

It is good to start with a real-life problem to focus student interest. Write on the board or make an overhead (see master at the end of the lesson) of the following scenario: "Your family wants to go fishing early in the morning. Your favorite fishing hole is a long walk from your camp, so you must start walking when it is dark. What phase can the Moon be so you can hike in moonlight? Explain how you determined your answer."

1. As students enter the room ask them to read the statement on the board or screen. Have them respond to the questions in their Astronomy Notebooks. Ask them to also write down when they can see the Moon in the sky and when it rises and sets. Have them share their ideas with the class and list their ideas and reasoning on the board. All ideas and reasons should be considered valid at this point in their exploration.

2. Students should stand around the light bulb so all of them can see it. With the "Sun" light bulb turned on, have students find noon. (Do not hand out Moon balls yet.)

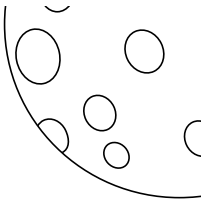
Remember this will be when the student's nose is facing the Sun. Have students put up their horizon blinders (hands on the sides of their heads.) Remind them that they can only see the sky that is in front of them. As Earth spins on its axis counterclockwise (or west to east) new sky will appear in the East, over the students' left hands. Review Lesson 4 "Modeling Moon Phases" to make sure all students understand where the Moon is in its orbit relative to Earth and Sun in order to get different phases.

3. Unlike Lesson 4, not all students will have a Moon ball in this session. In pairs, one student's head will be Earth the other student will hold the Moon ball on a pencil and orbit Earth. Ask the Moon holder to put the Moon in the proper position so that his/her partner sees a full Moon. Students with the Moon will be accustomed to holding it in a position for themselves, so you will need to emphasize the change in procedure and perspective. Check that the Moon holder places the Moon in the proper position opposite the Sun as viewed by the student who is the model Earth.

4. Have the student modeling Earth rotate on his/her axis, noting when the Moon rises and sets and what time on Earth this represents based on where the Sun is in the sky. Give plenty of time for the pairs to explore this problem. Once the student modeling Earth has determined when the full Moon is rising and setting, have him/her record the prediction in his/her Astronomy Notebook. After the first student in the pair has made a prediction, have students switch places and compare results.

5. After they have had sufficient time to determine the rise and set times for the full Moon, ask them to work on the times for the new Moon, first quarter and third quarter. Have them record their predictions for all of these phases in their Astronomy Notebooks. Move among the groups, working with any pairs having difficulty with the activity.

6. Those pairs that finish early may wish to compare results and try to resolve any differences. Once all pairs are done, write their predictions on the board. You should expect answers to vary by several hours based on the natural variations in when individuals see the Moon or Sun appear or disappear in their peripheral vision. Resolve any major discrepancies by having groups with differing solutions model what they did and let the rest of the class determine the best solution. This is very analogous to what happens at a conference or symposium when scientists discuss the varying results from different research groups. The conclusions the students reach should be reasonably close (plus or minus two hours) to the chart below. Note that all results are based on 12 hours of daylight (6 a.m. to 6 p.m.) and 12 hours of darkness (6 p.m. to 6 a.m.).



Phase	When Moon Rises	When Moon Sets
Full Moon *Notes: not visible during the daytime sky, except maybe just before sunset and/or just after sunrise*	around sunset	around sunrise
New Moon *Notes: not really visible since it is a dark Moon, mainly up in the daytime*	around sunrise	around sunset
First Quarter *Notes: visible in the afternoon in the daytime sky*	around noon	around midnight
Third Quarter *Notes: visible in the morning in the daytime*	around midnight	around noon

7. An appropriate assessment question for students to answer in their Astronomy Notebooks would be the question you first wrote on the board or had on the overhead. You might ask them to draw a diagram to justify their conclusions. Once they are comfortable with their answers they will be ready to go on to the riddles and challenges in the next lesson.