

Possible Art Modifications:

There are many ways that I could modify this lesson to include an arts element. My first thought is to add a visual arts component, where students will create models of the moon, or model the moon phases using the visual arts. There is also room for theatre to be used, in that students can create a dramatic representation of the moon phases. Dance could be used to, again, represent the moon phases in some way. During all of these art modifications students can be analyzing which method would be best and learning about details of the given art chosen.

Topic: - Lunar Cycle/Moon Phases

Grade Level - 5th

Time - 2-3 class periods (depending on length of period) plus a week for observing the night sky

Objectives

- Write observations of the night sky for a week
- Observe the changes of the moon in the sky
- Create a model of the phases of the moon using a flashlight, and two foam balls (representing earth and the moon)
- Correctly name and order the lunar phases (new, waxing crescent, first quarter, waxing gibbous, full, waning gibbous, third quarter, waning crescent)
- Calculate the approximate length of the lunar cycle using data on moon phases found on the internet
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Standards

Science Practices

1. Developing and using models
2. Planning and carrying out investigations
3. Analyzing and interpreting data
4. Using mathematics and computational thinking
5. Constructing explanations (for science) and designing solutions (for engineering)
6. Obtaining, evaluating, and communicating information

Crosscutting Concepts

Patterns. Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.

Science Content Standards

ESS1.B

By the end of grade 5. The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily and seasonal changes in the length and direction of shadows; phases of the moon; and different positions of the sun, moon, and stars at different times of the day, month, and year.

Math Standards

CCSS.MATH.CONTENT.4.MD.A.2

Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

CCSS.MATH.CONTENT.5.MD.A.1

Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.

Materials

- 8 - Styrofoam balls (about 12 cm diameter)
- 8 - Styrofoam balls or golf balls (about 3 cm diameter)
- 8 - Meter tapes
- 8 - Flashlights
- Computer for each student
- Copy Paper
- Science Notebooks
- Moon Calendar – 1 for class – calendar that can be written on for the whole class to see - use copy attached to blow up into poster size for class
- Night Sky Observation Sheet (for each student)
- Picture of moon phases (preferably on computer to show on SMART Board) - attached
- Markers or Crayons

Engage

This part of the lesson will take place about 1 week before the rest of the lesson. It should be on a day when the moon is visible during daytime hours.

1. Ask students what other natural objects they can see in the sky (they will have just completed an investigation about the sun and shadows). Guide them into thinking about night sky objects, specifically the moon and stars.
2. Discuss with students what they already know about the moon and stars. Ask them how we could learn more about the moon.
3. If no one suggests it, present the idea of observing the moon, just like they did the sun. Tell them they will observe the moon to see what they can learn about it.
4. Take students outside into schoolyard and have them describe what they can see. Point out the moon in the sky. Students should take note of its shape and its position in the sky. Return to the classroom.
5. In the classroom, have all students draw a picture of the moon in their science notebook and to describe it. Ask for a volunteer to draw it on the board. Discuss observations.
6. Introduce the moon calendar (the teacher should have started the moon calendar about 3 weeks before the lesson, so students can see the whole lunar cycle on it when the next part of the lesson begins). Tell students that you have been observing and drawing the moon for a number of weeks and that they will continue to observe and draw the moon for the coming week on the calendar. We want to see how the moon changes over time.
7. Give students a copy of the Night Sky Observation sheet. Students will observe the night sky, record their observations, and draw a picture of the moon each night for a week. This will lead into the next part of the lesson.

Explore

1. A week after the first part of the lesson students should have completed Night Sky Observation sheets and the class should have a complete Moon Calendar (with a full lunar cycle presented). Have a class discussion on student observations with anyone wishing to share their notes.
2. Lead the students into talking about the moon and how it appeared to change during the week. Reference the moon calendar, as well, for a more complete look at how it changes over the course of a month. Ask students if they know why it changes shape, or how.

Modeling the Lunar Cycle

- Take any and all answers for why this occurs. Tell students that this is called the moon goes through phases and is caused by the sun, earth, and moon working together.
3. Explain to students that today they will attempt to model the movement of the moon and the moon phases or lunar cycle. They will be given a flashlight to represent the sun, a large foam ball to represent earth and a smaller foam ball (or golf ball) to represent the moon. They will use these objects to figure out a working model for why the moon appears to change shape in the sky.
 4. Students will write the focus question in their notebook, “Why does the shape of the moon change in the sky?” While working, students will write observations, questions, and draw their model.
 5. Group students into groups of 4, with each group receiving one set of materials. Give final behavior guidelines (on task, working together, etc.) and allow students times to model the lunar cycle. Circulate around the room to provide assistance and guidance, as needed.

Explain

1. Bring students together after most groups have successfully created a model of the earth/sun/moon relationship causing the moon phases. Ask student groups to explain how they built their model. Construct a class model using larger objects to represent the sun/moon/earth with class input on how objects should be arranged.
2. Ask students to explain why the moon changes shape in the sky (using their models as evidence). Allow students time to formulate ideas in small groups then bring them to a group discussion. You want to work out with the students that the moon goes through phases due to the revolution of the moon around the earth and its position in relation to the sun. The moon is illuminated by the sun, with different percentages of the moon visible depending on the position of both the sun and moon. When the sun and moon are on opposite sides of the earth then there is a full moon. When they are on the same side then we have what is called a new moon. Demonstrate this using the model constructed for the class. Discuss and model with students.
3. Explore the idea of why the moon can be seen during the day. Use the model to show the locations of the sun and moon in relation to the earth for when the moon would be visible during day light hours.

Modeling the Lunar Cycle

4. Present the phases of the moon to students, using pictures on the SMARTboard (new, waxing crescent, first quarter, waxing gibbous, full, waning gibbous, last quarter, waning crescent). Begin with new moon then work through until you reach new moon again. Name each phase while showing the pictures. Explain to students that the moon phases always follow the same order, then repeat. Have students write down moon phase names and draw a picture for each in their notebook while presenting them.

Elaborate/Extend

1. Review the moon phases briefly, and the modeled earth/sun/moon system when students are done writing in their notebooks.
2. Ask students if they know how long it takes for the moon to go through one lunar cycle (from new moon to new moon). Brief discussion using evidence from moon calendar and night sky observation sheets. Have students make predictions for how long they think it takes the moon to go through one cycle, using evidence.
3. Introduce students to moon data websites. Go through information found and how to use and navigate the sites.
 - a. <https://www.timeanddate.com/moon/usa/philadelphia>
 - b. <https://www.timeanddate.com/moon/phases/usa/philadelphia>
4. Give students the task of calculating the approximate length of a lunar cycle. They will use the websites to gather data then make an educated hypothesis using this data to present to the class. Students will also find the approximate amount of time (or an average amount of time) the moon is visible on a daily basis. All record keeping and observations will be written in science notebooks.
5. Distribute computers and allow students some time to investigate. Circulate and assist, as needed.
6. After ample time is given, bring students back together to discuss their findings. Ask students to present their ideas, using the data found as their evidence. Clarify, if needed. Students should come to the conclusion that the lunar cycle takes about 28 days (or a month), and that the moon is visible for different amounts of times during the cycle. Relate the word month to the length of the lunar cycle.

Evaluate

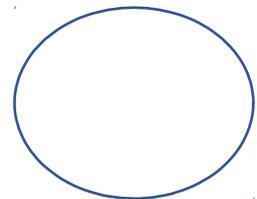
Modeling the Lunar Cycle

1. Review the lesson with students. Ask them to explain or demonstrate why the moon changes appearance in the sky. Quickly model the moon/earth/sun system and lunar cycle. Have students name the moon phases (in order) and describe each one. Finally, review the length of the lunar cycle.
2. The next day, give students paper and ask them to draw the moon phases, in order, and to label them. Students will also answer the question, how long is one lunar cycle?

Night Sky Observations

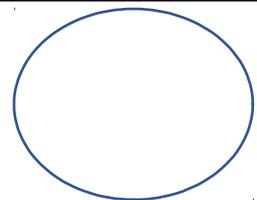
Night 1

What do you see? Draw the moon in the circle.



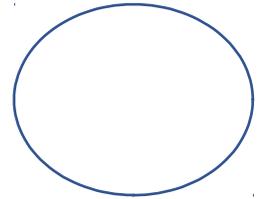
Night 2

What do you see? Draw the moon in the circle.



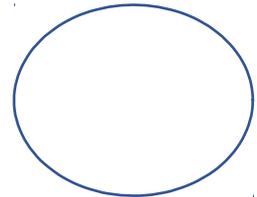
Night 3

What do you see? Draw the moon in the circle.



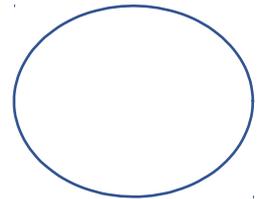
Night 4

What do you see? Draw the moon in the circle.



Night 5

What do you see? Draw the moon in the circle.



Moon Calendar

Sunday Monday Tuesday Wednesday Thursday Friday
Saturday

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Image from:
<http://www.astronomy.ohio-state.edu/~pogge/Ast161/Unit2/Images/moonphase.gif>

