

MISSION TO THE MOON!

FRAMEWORK

- I. Scientific and Engineering Practices
- II. Cross-Cutting Concepts
- III. Physical Sciences

SKILLS/OBJECTIVES

- Articulate why there are different phases of the moon
- Identify the names of the different phases of the moon
- Individually construct the phases of the moon in the correct order (out of Oreos!)
- Identify what gravity is, and why there is “less” gravity on the moon than on Earth
- Experience the feeling of less gravity through the use of MOON BOOTS!

MATERIALS

- 20 Styrofoam balls
- 20 pencils
- Moon boots
- Oreos
- Paper plates
- Knives

NOTES

Give all students a number at the beginning of the lesson. After the first activity, take them out 2 at a time to try out the moon boots. Give the part three explanation to each pair of students as you take them out if you feel like that will work better.

BACKGROUND

- Brief introduction about how the moon looks different to us depending on when we look at it in the sky. Why is this? Explain that the moon is not changing sizes; it is the shadows that change and that is what we see.
 - Prompt students with questions about whether or not they know that the moon revolves around the earth.
 - For simplicity, assume that the source of light is always coming from the right (even though the Earth also revolves around the sun)
- The moon in the diagram is shown in 8 stages during 1 revolution around the earth. This revolution takes about 30 days to complete.

Activity # 1	Phases of the Moon
Materials	<ul style="list-style-type: none"> • 20 Styrofoam balls • 20 pencils
Worksheet	N

- Split into 2 groups: Olders and Youngers (hopefully we will be able to have 2 light sources)
- Each student receives 1 Styrofoam ball with a pencil stuck in it to hold it.
- Tell students to pretend that their head is the Earth. Students should hold the Styrofoam ball with their arms extended out and on the same level as their head.
 - Phase of the moon (MOST OF THIS INFORMATION IS FOR INSTRUCTORS TO LEARN. YOU WILL NEED TO SIMPLIFY THIS A LOT FOR STUDENTS. **MOST LIKELY ONLY DO NEW MOON, FULL MOON, 1ST AND 3RD QUARTER.**
 - **New Moon:** When the moon is positioned between the earth and sun. The three objects are in approximate alignment. The entire illuminated portion of the moon is on the backside of the moon, the half that we cannot see.
 - **Full Moon:** The earth, moon, and sun are in approximate alignment, just as the new moon, but the moon is on the opposite side of the earth, so the entire sunlit part of the moon is facing us. The shadowed portion is entirely hidden from view.
 - **First quarter** and **third quarter** moons (both often called “**half moon**”) happen when the moon is at a 90 degree angle with respect to the earth and sun. So we are seeing exactly half of the moon illuminated and half in shadow.
 - The phases in between the four major moon phases should be fairly easy to visualize, as the illuminated portion gradually transitions between them.
 - An easy way to remember and understand these lunar phase names is by breaking out the defining 4 words: crescent, gibbous, waxing, and waning.
 - “Crescent” refers to the phases where the moon is *less* than half illuminated.
 - “Gibbous” refers to phases where the moon is *more* than half illuminated.
 - “Waxing” essentially means ‘growing’ or expanding in illumination.
 - “Waning,” means ‘shrinking’ or decreasing in illumination.
 - After the new moon, the sunlit portion is increasing, but less than half, so it is **waxing crescent**. After the first quarter, the

sunlit portion is still increasing, but now it is *more* than half, so it is **waxing gibbous**. After the full moon (maximum illumination), the light continually decreases. So the **waning gibbous** phase occurs next. Following the third quarter is the **waning crescent**, which wanes until the light is completely gone -- a new moon.

- COMPETITION:
 - Instructor calls out a phase of the moon (probably only use the 4 major phases (new, full, 1st/3rd quarter), and students must position themselves in the correct location with their own Styrofoam ball. Then FREEZE.
 - Instructors go around and check to make sure students are displaying the correct phase on their own moon.
 - We can do multiple rounds of this (give them 5 seconds, then 3 seconds etc).
 - Eliminate students who have it displayed incorrectly. Play until there is 1 student left.
 - The winner can receive a small prize (first turn using the moon boots?)

Activity # 2	Oreos!
Materials	<ul style="list-style-type: none"> • Oreos • Paper plates • Knife
Worksheet	N

- Instructors should split up all the Oreos ahead of time – all Oreos should be split in half with all of the frosting on one side.
- Students put in groups of 2. Each pair will receive a paper plate with the phases of the moon already labeled on the plate. We can label all 8, and tell them to do the major 4 if that is enough.
- Each pair will be given 4 Oreos (or more if they can do more of the phases), and a plastic knife.
- Students should use their knife to scrape away the frosting to create the shape of each moon phase. They must put them in the correct location on the plate.
- Once the instructors check them, students can eat their Oreos.
- Give students an extra Oreo if they get it all correct.

Activity # 3	Gravity/Moon Boots!
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Materials	<ul style="list-style-type: none"> • Moon boots
Worksheet	N

- Either break into small groups or discussion for the whole group: prompt students with questions about gravity.
 - What is gravity? How do we feel gravity? Why do objects come down when you throw them in the air? etc.
- Simple **definition**/explanation of gravity:
 - **“Gravity is a force that attracts all physical objects towards each other”**
 - **The greater the mass of an object (for simplicity, the bigger an object is) the stronger the force of gravity.**
- The Earth is a huge mass and it attracts objects toward it. There is a physical attraction between each student and the earth and you are actually being pulled toward the earth.
- The moon is about $\frac{1}{4}$ the size of Earth, so the moon’s gravity is much less than the Earth’s gravity.
 - This is why astronauts appear to be “floating” when they walk on the moon. There is a weaker pull between the moon and objects on the moon
 - They would feel $\frac{1}{6}$ x lighter on the moon than on Earth. This is because there is less gravity pulling them down.
- We will be demonstrating this effect using MOON BOOTS. Each student will try on the moon boots and get a feel for what it would be like to walk on the moon!

CONCLUSIONS

- Quick review with students what they learned.
- If they want, they can take home their Oreo plates