Day 3
The Moon

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The Moon

Introduction

The **Moon** is about 4.5 billion years old. Scientists think that a large **asteroid** hit the Earth, and the hot, melted rock thrown into space formed the Moon.

The Moon is Earth's nearest neighbor and our only natural **satellite**. It takes 27 days for the Moon to **revolve** around the Earth — in fact, the Moon's **orbit** around Earth inspired our calendar month. Humans have always been interested in the Moon because it affects our **tides,** we can observe it change throughout the month (the **phases of the Moon**), and we can even see the Moon's many **craters** without a telescope.

On July 20, 1969, two astronauts walked on the **lunar** surface for the first time, part of the three-man American crew of the historic **Apollo 11** mission. We're celebrating the 50th anniversary of Apollo 11 this year!

Questions to guide explorations and experiments

- What is the surface of the Moon like? Where do all the craters come from?
- What are the phases of the Moon? How do they relate to the Moon's orbit?
- How did humans get to the Moon and what was it like when the first astronauts walked on the surface of the Moon?
- How high can I jump on the Moon?
- How do scientists study Moon rocks and other things we've brought back from space?

Books and activities

- **Books:** fiction, nonfiction, and poetry all about our Moon and the Apollo missions
- **Activities:** explore the surface of the Moon, the phases of the Moon, and the historic 1969 Apollo 11 mission.

Children's Books

Fiction

- *A Big Mooncake for Little Star* by Grace Lin (Ages 4-8)
- *City Moon* by Rachael Cole (Ages 4-8)
- *I Love You, Michael Collins* by Lauren Baratz-Logsted (Ages 9-12)
- *Imani's Moon* by JaNay Brown-Wood (Ages 6-9)
- *The Man in the Moon* by William Joyce (Ages 6-9)
- *A Moon of My Own* by Jennifer Rustigi (Ages 6-9)
- *The Moon Over Star* by Dianna Hutts Aston (Ages 6-9)
- *Music for Mister Moon* by Philip C. Stead (Ages 4-8)
- *Owl Moon* by Jane Yolen (Ages 4-8)
- *Starry River of the Sky* by Grace Lin (Ages 9-12)
- *Thanking the Moon* by Grace Lin (Ages 4-8)
- *There Was an Old Martian Who Swallowed the Moon* by Jennifer Ward (Ages 4-8)
- *Where the Mountain Meets the Moon* by Grace Lin (Ages 9-12)

Poetry

- *Comets, Stars, the Moon, and Mars: Space Poems and Paintings* by Douglas Florian (Ages 6-9)
- *Eight Days Gone* by Linda McReynolds (Ages 4-8)
- *Faces of the Moon* by Bob Crelin (Ages 6-9)
- *A Full Moon Is Rising* by Marilyn Singer (Ages 6-9)
- *Out of This World: Poems and Facts About Space* by Amy Sklansky (Ages 6-9)
- *Thirteen Moons on Turtle's Back: A Native American Year of Moons* by Joseph Bruchac (Ages 4-8)
- *When the Moon Is Full: A Lunar Year* by Mary Azarian (Ages 6-9)

Biography

- *A Computer Called Katherine: How Katherine Johnson Helped Put America on the Moon* by Suzanne Slade (Ages 6-9)
- *Hidden Figures* by Margot Lee Shetterley (Ages 6-9)
- *Margaret and the Moon: How Margaret Hamilton Saved the First Lunar Landing* by Dean Robbins (Ages 4-8)
- *Who Was Neil Armstrong?* by Roberta Edwards (Ages 9-12)

Children's Books

Nonfiction

- *Apollo 13 (Totally True Adventures): How Three Brave Astronauts Survived A Space Disaster* by Kathleen Weidner Zoehfeld (Ages 6-9)
- *Countdown: 2979 Days to the Moon* by Suzanne Slade (Ages 9-12)
- *If You Decide to Go to the Moon* by Faith McNulty (Ages 4-8)
- *If You Had Your Birthday on the Moon* by Joyce Lapin (Ages 6-9)
- *Footprints on the Moon* by Alexandra Siy (Ages 6-9)
- *Go for the Moon: A Rocket, a Boy, and the First Moon Landing* by Chris Gall (Ages 6-9)
- *If You Had Your Birthday Party on the Moon* by Joyce Lapin (Ages 6-9)
- *Lost in Outer Space: The Incredible Journey of Apollo 13* by Tod Olson (Ages 9-12)
- *The Moon Book* by Gail Gibbons (Ages 6-9)
- *Moon! Earth's Best Friend (Our Universe)* by Stacy McAnulty (Ages 4-8)
- *The Moon Seems to Change* by Franklyn Branley (Ages 4-8)
- *Moonshot* by Brian Floca (Ages 6-9)
- *One Giant Leap* by Robert Burleigh (Ages 6-9)
- *What the Moon Is Like* by Franklyn Branley (Ages 4-8)
- *Team Moon: How 400,000 People Landed Apollo 11 on the Moon* by Catherine Thimmesh (Ages 9-12)
- *You Can't Ride a Bicycle on the Moon* by Harriet Ziefert (Ages 6-9)

Space Words

Apollo 11
The historic mission where humans first walked on the Moon.

Asteroid
A rocky space object that can be a few feet wide to several hundred miles wide. Most asteroids in our solar system orbit in a belt between Mars and Jupiter.

Astronaut
A person trained to participate in space flights.

Atmosphere
The layer of gases surrounding Mars, Earth, and other planets, held in place by gravity.

Comet
A frozen mass of gas and dust that orbits the Sun and may form a long, bright tail when it is flying close to a sun.

Command Module (Columbia)
The Apollo 11 spacecraft that orbited the Moon while the Lunar Module was on the lunar surface. "Columbia" was piloted by astronaut Michael Collins.

Crater
Large round holes in the ground. A bowl-shaped cavity caused by an asteroid impact.

Crescent Moon
The Moon as it appears early in its first quarter or late in its last quarter, when only a small arc-shaped section is lit up by the Sun.

Erosion
The wearing away of a planet's surface by wind or water.

Exosphere
The outermost part of the atmosphere of a planet.

Far Side of the Moon
The side of the Moon that always faces *away* from Earth.

Full Moon
When Earth is located between the Sun and the Moon, the Moon appears fully lit up and appears like a bright, full circle.

Gibbous Moon
The appearance of the Moon between a Half Moon and a Full Moon.

Gravity
A force that pulls matter together; a force that "pulls" people and objects towards the ground.

Half Moon
The phase when one-half of the Moon appears lit up.

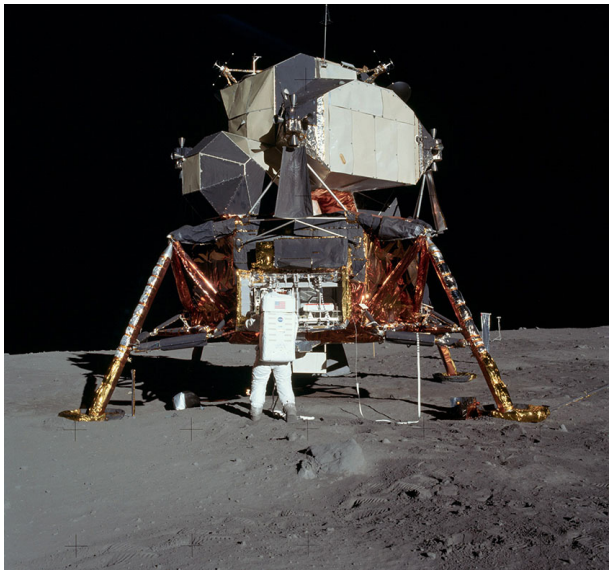
Lunar
Having to do with the Moon, for example, the lunar landscape.

Lunar cycle
The Moon's continuous orbit around the Earth. It takes 27 days, 7 hours, and 43 minutes for our Moon to complete one full orbit around Earth.

Lunar eclipse
When the Moon's reflected light is hidden by the Earth's shadow when the Earth passes between the Moon and the sun.

Space Words

Lunar Module (Eagle)
The Apollo 11 "Eagle" was the first manned space-craft to land on the Moon. It carried two astronauts, Neil A. Armstrong and Edwin E. "Buzz" Aldrin, Jr., the first men to walk on the Moon.



Maria (Seas)
The dark areas of the Moon that can be seen from Earth.

Meteor (shooting star)
The flash of light in the night sky when a small piece of space dirt burns up as it passes through Earth's atmosphere.

Moon
A natural satellite that orbits a larger object. Earth has one Moon, the one we see in the night sky.

Near Side of the Moon
The side of the Moon that always faces towards Earth.

New Moon
When the Moon is between Earth and the Sun, the Moon receives no direct sunlight and appears like a dark circle.

Orbit
The curved path followed by an object in space as it goes around another object; to travel around another object in a single path. The Moon orbits the Earth.

Phases of the Moon
The different ways the Moon looks from Earth over about a month.

Revolve
To move in an orbit or circle around a fixed point. The Earth revolves around the sun.

Rotate
To turn around a center point—or axis, like a wheel turns on a bicycle. The Earth rotates from day to night.

Satellite
An object that orbits another object. A moon is a natural satellite.

Saturn rocket
The vehicle that launched the Apollo 11 spacecraft and astronauts to the Moon for the first historic Moon walk.

Sea of Tranquility
The lunar landing site for the Apollo 11 mission, the first time man walked on the Moon.

Tides
The rising and falling of the surface of the ocean that occurs twice a day, caused by the pull of the Moon and sun.

Waning Moon
Waning means to decrease or diminish. The Waning Moon phase starts after a Full Moon, and is always illuminated on the left.

Waxing Moon
Waxing means to increase. The Waxing Moon phase starts after a New Moon, and is always illuminated on the right.

Activity 1: Lunar Craters

Introduction

A **crater** is a bowl-shaped cavity formed when an **asteroid** from space hits the surface of a moon or planet.

Both the Earth and the **Moon** have been hit by asteroids, **meteors**, and **comets** many times in their 4.5 billion year history. Some of the craters on the Moon are so big that you can see them without a telescope!

An asteroid is more likely to fall toward Earth than the Moon because of our planet's stronger **gravity**. But we can see many thousands of craters on the **lunar** surface and we only know of a few hundred on Earth. Let's learn why!

Supplies

- Photograph of the Moon with craters (provided)
- A large pan or shallow box
- Flour or sand (enough to make a 2-inch deep layer)
- 1 cup powdered cocoa
- Small sieve or flour sifter
- Large trash bag or piece of cloth to place under the crater box
- Different-sized objects to be used as "impactors" such as large and small marbles, golf balls, rocks, other balls of different sizes
- Ruler
- Paper and pencil
- Chair or step stool to stand on
- Cell phone with slow-motion video recording ability (optional)

Activity 1: Lunar Craters

Get kids thinking

The surface of the Moon is full of craters caused by asteroids dropping from space. Once a crater is formed on the Moon, it never disappears or changes because there is no weather or life on the planet. Once something hits the Moon, that event becomes frozen in time! Only a meteor strike could destroy the footprints, and that's not likely!

When an asteroid hits the Earth, the crater it leaves eventually disappears from the surface. That's because the Earth experiences weather — wind, rain, and snow — that over time can "erase" the crater. Plants, animals, and people change the surface of the Earth, too. No wonder there are so many craters on the Moon compared to Earth!

Show the images of the lunar craters (see pages 54-55). **Ask kids:** Describe what you see. What shape are the craters? Can you find some craters sitting on top of each other? Which formed first and which formed later?

Let's get started!

In this activity, kids will experiment with creating their own lunar craters. They'll experience what happens when an object hits another, softer surface and think about how the craters on the Moon were created.

Fill the baking pan with flour, and set it on the ground or floor, with the plastic or cloth underneath (to make clean up easier).

Use the sieve or sifter to put a thin layer of cocoa on top of the flour. This will make the craters easier to see.

Have each child choose an impactor and drop the object straight down into the pan.

Have the kids observe the impact crater. **Ask kids:**

- What color is the surface immediately around the crater?
- How does that compare to the surface of the rest of the pan?
- How far did the flour and cocoa powder spread? Have the kids use the ruler to measure these distances.

Activity 1: Lunar Craters

Next, have the kids try dropping the same ball from a different height (stand on a chair). **Ask kids:**

- What does the resulting crater look like?
- How did the height affect the size and depth of the crater?

Then try dropping balls of different sizes (and weights) from the same height. **Ask kids:**

- What do the resulting craters look like?
- How did the size and weight affect the size and depth of the craters?

Finally, try throwing a ball sideways so it hits the pan at an angle, instead of coming straight down. **Ask kids:**

- How is the resulting impact pattern different from when you dropped the balls straight down?

If needed, smooth out the surface of the pan, and sift a fresh layer of cocoa powder on top.

Do you have a smartphone with a slow-motion camera setting? Try filming your meteorite impacts in slow motion! What do you see when you watch the videos?

Extensions

Scale this project up! Do you have access to a sandbox, a shovel, and some dirt? Create a large pile of loose material: dirt covered with a layer of sand (similar to the flour covered with cocoa powder). Help kids drop a larger ball (a basketball works well) from a higher location, such as standing on a ladder.

More Moon crater activities

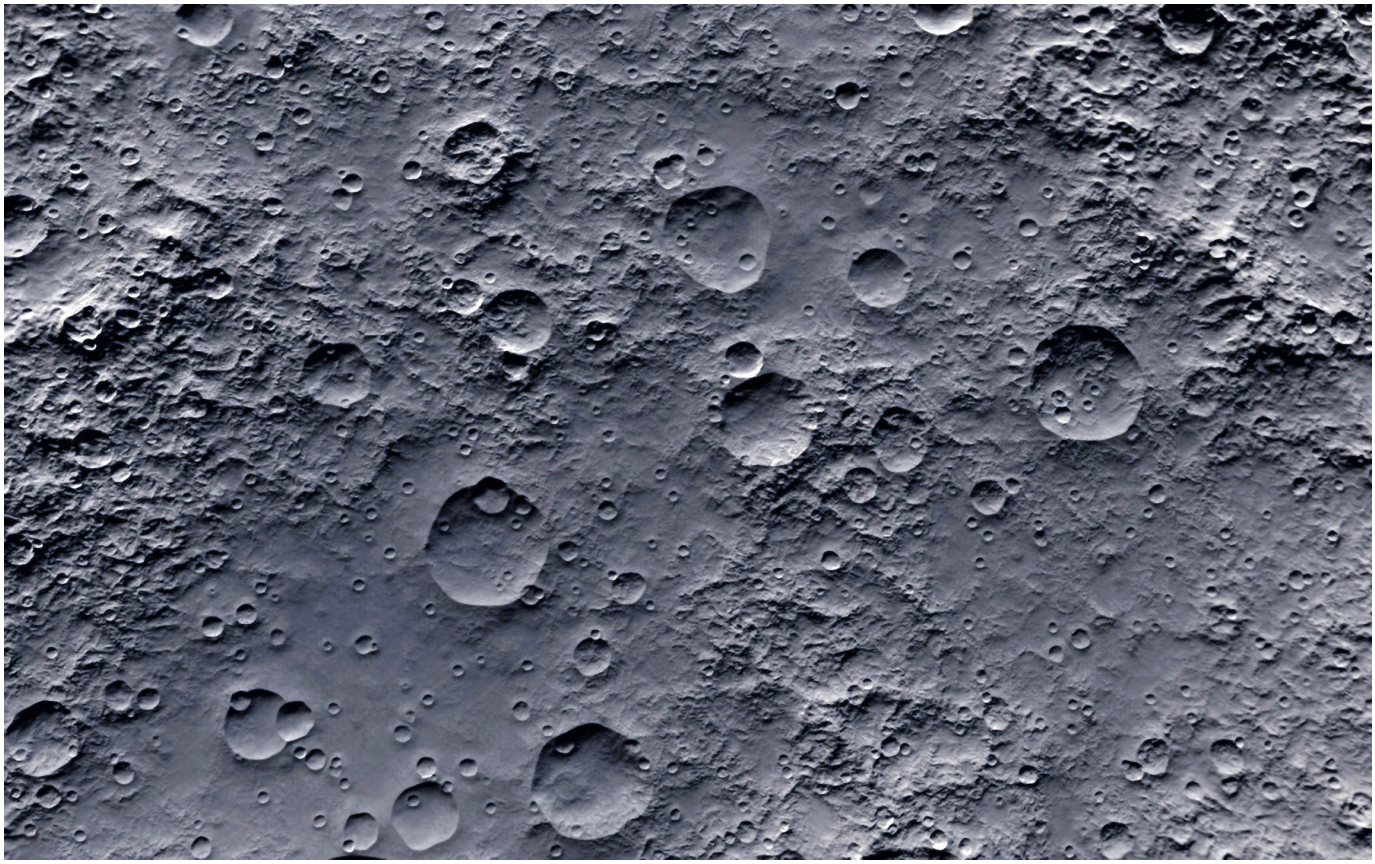
Video: The Moon and Its Craters (PBS Kids, Ready Jet Go!)
https://www.pbslearningmedia.org/resource/ready-get-go-the-moon-and-craters/the-moon-and-its-craters-ready-jet-go/#.XMdBqKR7mUk

How Did the Moon Get Its Craters? (Gift of Curiosity)
https://www.giftofcuriosity.com/how-did-the-moon-get-its-craters-an-art-and-science-activity-for-kids/

Activity 1: Lunar Craters

The lunar surface (Photo © NASA)

Activity 1: Lunar Craters



Close up view of the lunar surface (Photo © NASA)

Activity 2: Phases of the Moon

Introduction

When we look at the Moon over the course of many days, it seems to change its shape — from a full circle to a half-circle to a crescent shape and then gradually back to a full circle again.

The Moon isn't really changing shape — it just appears that way from Earth. Here's why: It takes about four weeks for the Moon to orbit once around the Earth. During this time, the Moon's position in relationship to the Earth and the Sun is constantly changing. As the Moon orbits around the Earth, the part of the Moon that faces the Sun will be lit up. We call the different shapes that are lit up during orbit the "phases of the Moon."

What we sometimes call "moonlight" is really sunlight reflecting off the Moon's surface. The Moon itself puts out no light at all!

Get kids thinking

Invite the kids to describe what the Moon looks like to them and how it changes.

It takes 27 days for the Moon to revolve around the Earth. Talk about how the Moon's phases are an example in nature of a recurring and predictable cycle.

Ask kids: What is the lunar calendar? The lunar calendar is based on the monthly phases of the Moon. Lunar calendars are still used by many cultures for religious festivals and holidays. Examples include Ramadan, Easter, and Chinese New Year.

Show kids the composite photograph of the 8 phases of the Moon (see the next page). Talk about the position of the Earth in relationship to the Moon and why we always see the same side of the Moon (and never the far side).

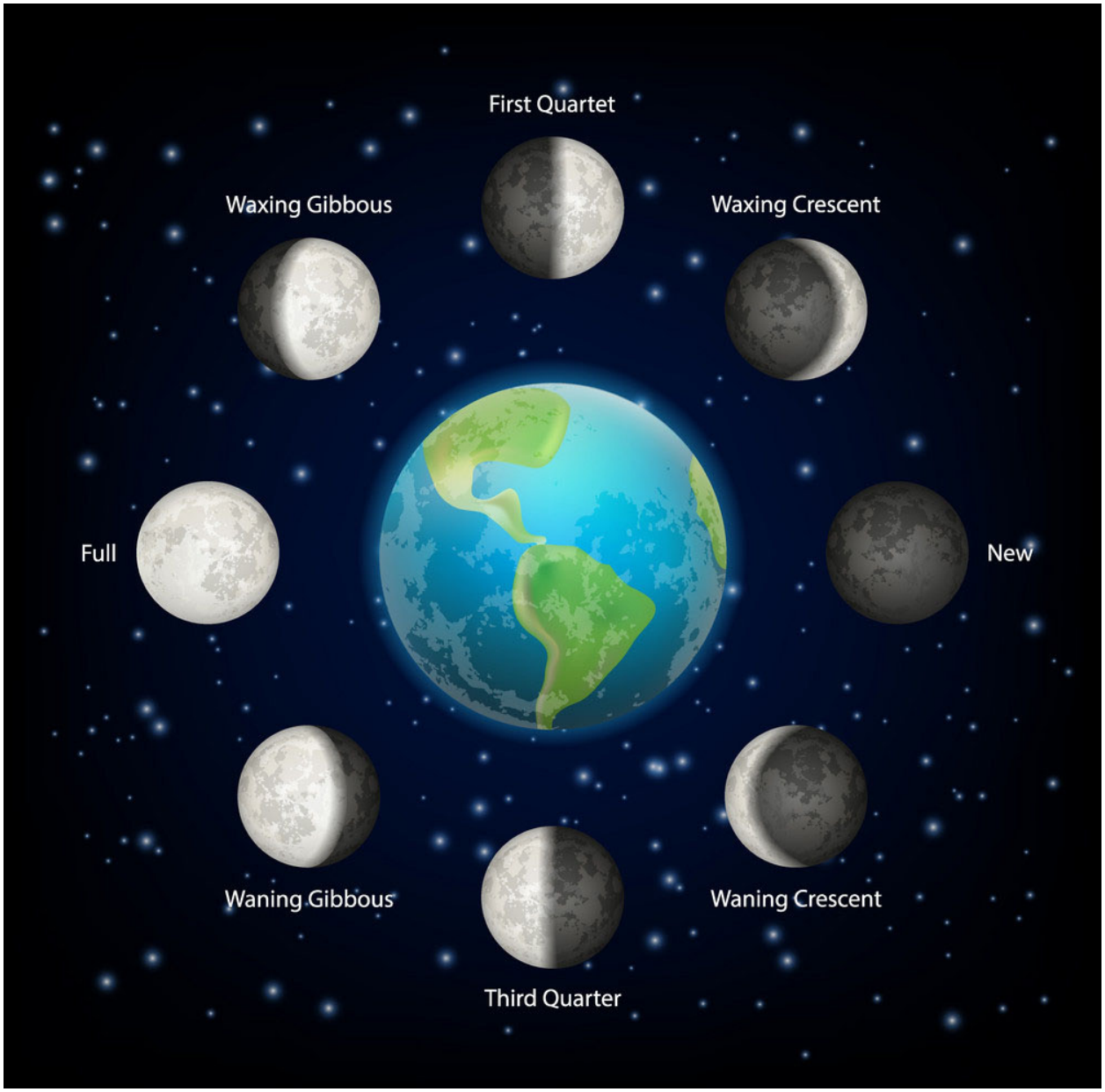
Watch: An animation of the phases of the Moon from NASA's Jet Propulsion Lab: https://www.jpl.nasa.gov/edu/teach/activity/moon-phases/

Ask questions about Moon phases. What makes the Moon shine? How light or dark is it on a full Moon night versus a new Moon/no Moon night? Do you know any stories about the Moon?

Kids can try one or both of these activities to learn about the phases of the Moon.

3

Phases of the Moon



Activity 2: Phases of the Moon Whole Group Activity

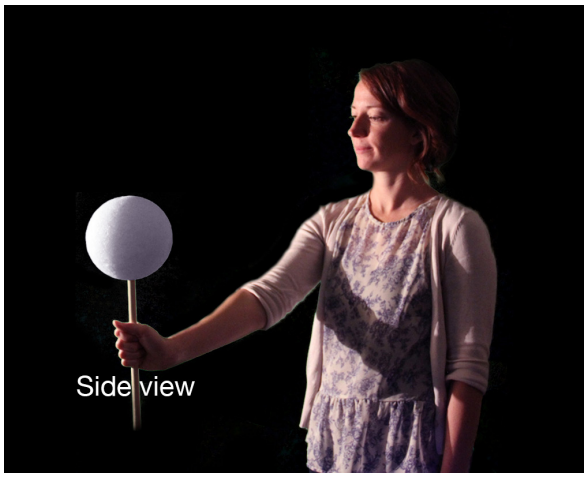
Supplies

- Lamp (at least 100 watts) with the lampshade removed
- Ball (a basketball works well) or white Styrofoam® ball on a stick or pencil

This activity needs a darkened room.

Let's get started!

Try this whole-group demonstration to see the phases of the Moon in action! Before trying this with the kids, watch this video: https://www.youtube.com/watch?v=wz01pTvuMa0



Place the lamp in the center of the room. The lamp is the Sun. Have one of the kids hold the ball in her hand. The ball is the "Moon" and her head is the Earth. Darken the room except for the lamp.

Have the child with the ball (the "Moon") stand several feet away from the lamp. Ask her to hold the ball straight out in front of her and face the lamp. The ball will appear dark because the lighted side of the ball is facing away from her. This position represents the **New Moon**.

The other kids will need to stand right behind her and move with her to see the phases.

Holding the Moon straight in front of her, tell the child to turn her body a little bit to the left. Everyone will see a small crescent of light on the right side of the ball. This is called the **New (Waxing) Crescent**.

Now have the child turn to the left a little more until the ball is half lit up. This is called the **First Quarter Moon**, since the Moon has traveled one-quarter of the way around the Earth.

Activity 2: Phases of the Moon Whole Group Activity

Have the child continue turning around the circle until she is halfway around with her back to the lamp. At this point, the whole ball is lit — that's a **Full Moon**. If the child's head is in the way, she's created a lunar eclipse — just have her raise the ball up a bit to see the Full Moon.

Tell the child to continue slowly around the circle until she returns to where she started, while you name the other Moon phases as they appear.

You can then give other kids a chance to be the Moon and rotate through all the phases.

Activity 2: Phases of the Moon Oreo Cookie Moon Phases

Supplies

- Access to a sink with soap and water or baby wipes for cleaning hands prior to activity
- Bag of Oreo cookies (8 per child, maybe a few extras for breakage or "disappearance"!)
- Popsicle stick for each child for scraping the frosting
- Plates or napkins
- Phases of the Moon template (See pages 62-63)

Let's get started!

Print out copies of the Moon phases template — one sheet for each child. You can choose either of the two templates.

Have children wash their hands or clean their hands with baby wipes before distributing the cookies.

Give each child 8 cookies on a plate or napkin and a clean popsicle stick.

Have each child slowly twist the Oreos to keep most of the frosting on one side when they separate the halves (younger children may need help with this).

Tell the kids use the popsicle stick to scoop away the frosting to illustrate the Moon phases, using the template as their guide.

Have the kids place the cookies in order of how they appear in the sky throughout the month, using the template as their guide.

After everyone has finished their Moon phase display, it's snack time!

Extension

Suggest to kids that together with their parents they look up at the sky tonight — what phase is the Moon in? Kids can share what they observed the next day.

Activity 2: Phases of the Moon

More activities

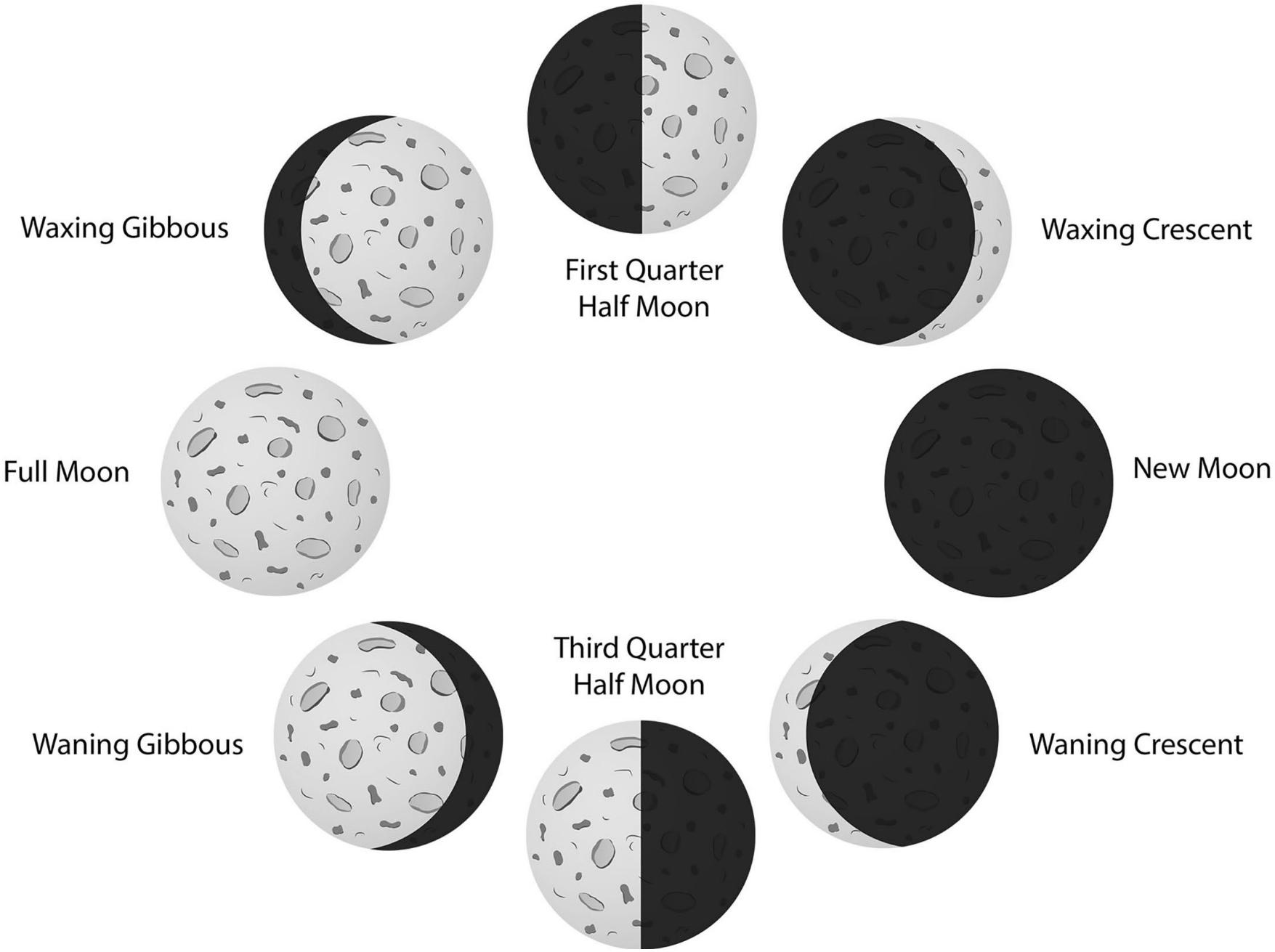
Moon Watch Flip Book (Start With a Book)
https://www.startwithabook.org/sites/default/files/moon-watch-flip-book.pdf
This project takes a full month to complete — great for at home, or summer programs that last more than 4 weeks.

Moon Journal (National Wildlife Federation, Ranger Rick)
https://rangerrick.org/crafts_activities/keep-a-moon-journal/
This project takes a full month to complete — great for at home, or summer programs that last more than 4 weeks.

Moon Phase Transporter (Scholastic)
https://www.scholastic.com/teachers/blog-posts/angela-bunyi/ready-to-edit-teaching-the-moon-phases-seems-to-be-one-of-those-skills-that-is-taught-across-the-grade-leve/

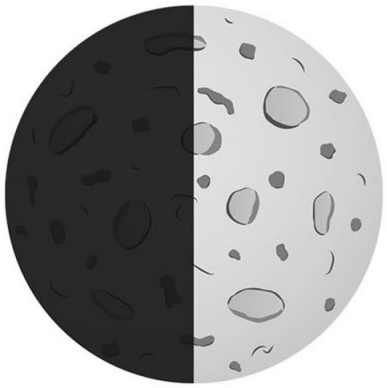
Moon Phases Slider (Teach Beside Me)
https://teachbesideme.com/moon-phases-activity/

Photo © Carla Brown, National Wildlife Federation

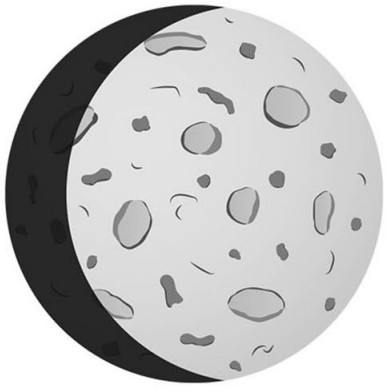

Waxing Gibbous
First Quarter
Half Moon
Waxing Crescent
Full Moon
New Moon
Waning Gibbous
Third Quarter
Half Moon
Waning Crescent

1. New Moon

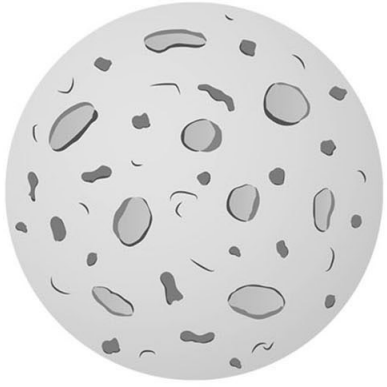
2. Waxing Crescent



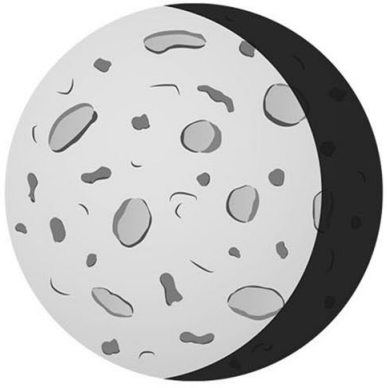
3. First Quarter



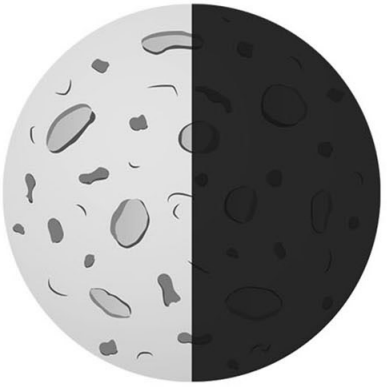
4. Waxing Gibbous



5. Full Moon

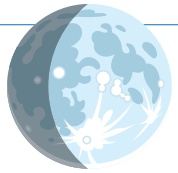


6. Waning Gibbous



7. Third Quarter

8. Waning Crescent



Activity 3: Apollo 11 Landing Humans on the Moon

Introduction

On July 20, 1969, millions of people gathered around their televisions to watch two American **astronauts** do something no one had ever done before. Wearing bulky space suits and back-packs of oxygen to breathe, **Apollo 11** astronauts Neil Armstrong and Edwin "Buzz" Aldrin became the first human beings to walk on the Moon.

After they stepped onto the **lunar** surface, Armstrong said these famous words: "That's one small step for a man, one giant leap for mankind."

Supplies

- Copy of the book *Moonshot: The Flight of Apollo 11* by Brian Floca
- Photograph of the first footprint on the Moon (see large version on page 67)

Get kids thinking

Photo © NASA

Show this photograph to the kids and ask if they know what it is. **It's a very special footprint.** *This is a footprint of man's very first step on the Moon.*

Together, read the picture book ***Moonshot: The Flight of Apollo 11*** by Brian Floca. The book is readily available at public libraries.

Alternative book options:

- *Countdown: 2979 Days to the Moon* by Suzanne Slade
- *One Giant Leap* by Robert Burleigh

The words in *Moonshot* are very simple and expressive; they combine with detailed illustrations to tell the incredible story of how we landed men on the Moon for the first time. It will give the kids a sense of what it felt like from the point of view of the astronauts as well as all the new technology that made it possible.

Activity 3: Apollo 11 Landing Humans on the Moon

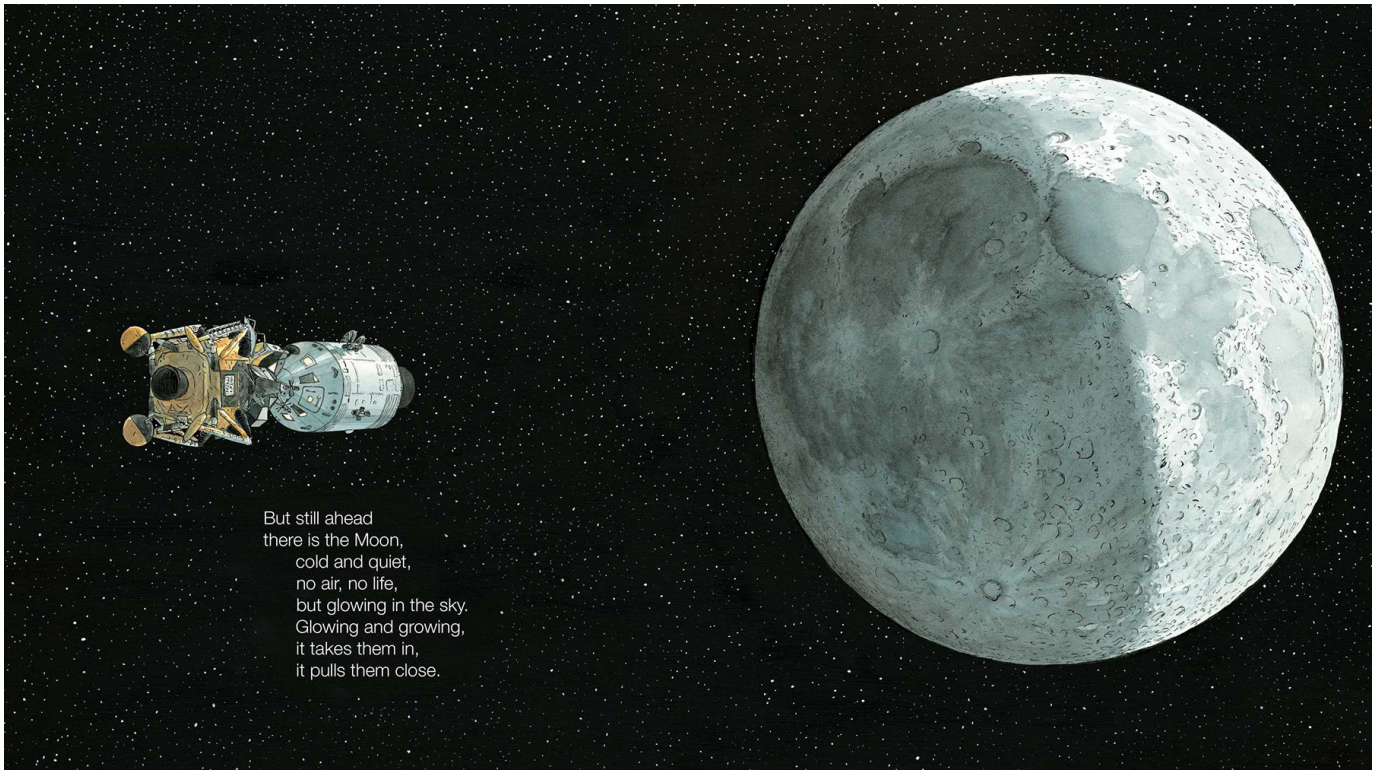
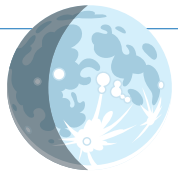


Illustration © Brian Floca

Let's get started!

After reading *Moonshot* together, have a group discussion about the book. Here are some suggestions for questions you can ask to get kids talking:

- What kind of spaceships did the Apollo astronauts need to land on the Moon and safely return to Earth?
- What do you think it felt like when the **Saturn rocket** lifted into the air?
- What did the astronauts experience while they were riding in the spaceship? Why does everything float?
- Some things went wrong during the landing. What did the astronauts do?
- What was it like to walk on the Moon?



Activity 3: Apollo 11 Landing Humans on the Moon

- How do the illustrations in the book help you understand how the astronauts feel?
- The sky looks dark, blank, and starless on the Moon? Can you guess why? Tell the kids that when you see the daytime blue sky on Earth you're seeing sunlight scattering off the air (atmosphere). There's very little atmosphere on the Moon, so nothing to scatter the light, so the sky appears black.
- What do you think everyone who watched the landing felt when they saw a man on the Moon for the first time?
- How might a visit to the Moon change the way you see our planet Earth?
- What do you think it would be like to travel in to space? Would you like to go to the Moon?
- Why is exploring the Moon — and space — important?

Footprints frozen in time

Return to the photo of the footprint. Tell kids that this footprint will be there for millions of years! **Ask kids:** Do you have a theory about why? If the kids are stuck, remind them what they learned about craters and why they never disappear on the Moon — because there is no wind, rain, plants, or animals to erase them. Only a meteor strike could destroy the footprints, and that's not likely!

More activities

Build a Moon Habitat (NASA Space Place)

https://spaceplace.nasa.gov/moon-habitat/en/

Video: Lunar Lander Challenge (Janet's Planet)

https://www.youtube.com/watch?v=s_jwiFZHEzU&list=UU0J0BQqvNIBBIg5dCwbEnyg

First footprint on the Moon

Apollo 11 astronaut Neil Armstrong's first footprint on the Moon, July 20, 1969
(Photo © NASA)

Activity 4: How High Could You Jump on the Moon?

Introduction

Gravity is an important scientific concept, but one that is difficult to understand, even for adults. Having children use their own bodies to test gravity, and then compare how they would perform against gravity on the Moon is a great jumping off point for understanding that the effects of gravity are different in different parts of our solar system.

Supplies

- Large colored markers
- Measuring tape
- Chart paper, adhesive (PostIt® style) if possible
- Blue masking tape
- Small ball or beanbag (optional)

Get kids thinking

Ask kids: What is gravity? Does anyone know how gravity affects us on Earth? Kids might say: "It's what pulls you back down to Earth when you jump up." Or "It's what keeps us on the ground."

Gravity is a force that "pulls" people and objects towards the ground.

Do you think gravity on the Moon is the same, stronger, or weaker than it is on Earth? After a few guesses, if you can, show them this NASA video of an astronaut jumping on the Moon (https://www.youtube.com/watch?v=g5aPoRtF2vw) and then have them guess again.

The Moon's gravity is weaker than the Earth's — in fact it is 1/6th as strong as on Earth. When you're on the Moon, you are 1/6th as heavy. So if you weigh 75 pounds on Earth, you would only weigh about 12 pounds on the Moon. But your muscles are as strong as they are on Earth, so you can jump 6 times farther!

See Your Weight on Other Worlds: https://www.exploratorium.edu/ronh/weight/

Activity 4: How High Could You Jump on the Moon?

Using the same force of a jump on Earth, you could rise 10 feet off the ground and stay in the air for about 4 seconds.

Here's How High You Could Jump on Other Worlds in The Solar System: https://www.sciencealert.com/here-s-how-high-you-could-jump-on-other-worlds-in-the-solar-system

Let's get started!

Make the jumping chart ahead of time

Tape or stick two pages of the chart paper on the wall, one above the other so that they make one long sheet. The highest point of the top piece should be higher than any of your kids can jump, and the bottom of the lower sheet should be no higher than your shortest child's head. (You may need a third sheet of paper to cover this range.)

Place a long piece of tape alongside the paper and label it with inches, from the floor to the top of the chart paper. This will help you quickly determine how high each student jumped in this activity, rather than having to measure after each jump.

In this jumping challenge, kids will see how high they can jump, and then calculate how high that jump would be on the Moon!

The jumping challenge!

Each child who wishes to try should get a turn to jump. For kids who have difficulty jumping, you can challenge them to throw a ball or beanbag up as high as they can, and measure that distance instead. You can also try a standing long jump, using the masking tape to measure out lengths on the floor.

Activity 4: How High Could You Jump on the Moon?

1. Have a child stand facing the chart paper on the wall, holding a marker.
2. Ask the child to reach his hand over his head, as high as he can, and make a mark on the paper with the marker. This is the child's starting point.
3. Tell the child to take a small step back (no running starts!), bend his knees and jump as high as he can, making a mark on the paper at the highest point.
4. Have the child measure the distance between his starting mark and his jumping mark. This is how high he jumped. Have him write down his measurement.
5. After every child who wants to try has had a turn to jump, have your students calculate how high their jump would have been on the Moon by multiplying their measurement by 6.

For older children, encourage them to do the math on paper. For younger children who have not yet learned how to multiply, you can use a calculator. The resulting Moon jump measurement is how high their feet would be off the ground if they had jumped on the Moon. You can have each child record this height on the paper on the wall, measuring from the floor to their Moon jump measurement.

Ask kids:

- Were you surprised by the results?
- Could anyone jump over their own head on the Moon, or farther than their own height?
- Who jumped the highest/farthest?
- What do they think it would be like to walk on the Moon?
- What would it be like to play basketball, soccer, or another sport?

Reinforce the idea that the reason they can jump higher on the Moon is because gravity is weaker there; and the reason that they can't jump as high on Earth is because gravity is stronger.

Activity 5: Astronaut Glove Box

Introduction

Apollo astronauts have brought back more than 800 pounds of Moon rocks and soil to Earth. We are still studying the rocks and soil to learn more about the origins of the Moon and the Earth. One recent and surprising discovery is that most of the craters on the Moon came from a single, catastrophic event.

A scientist at NASA still remembers handling her first Apollo sample decades ago, wearing three sets of gloves and working in a nitrogen-filled glove box. "Just to pick it up was really exciting," she says, "because I was picking up a piece of the Moon."

Supplies (for each glove box)

- Large cardboard box for examining rocks
- Utility knife (adults only)
- Rubber gloves (small size for small hands)
- Duct tape
- Small plastic bowls (optional)
- Magnifying glass
- Small ruler
- Rocks of various sizes and shapes
- Plastic wrap
- Clipboard and paper
- Pen or pencil

Moon rock from Apollo 14 mission, 1971 © NASA

Get kids thinking

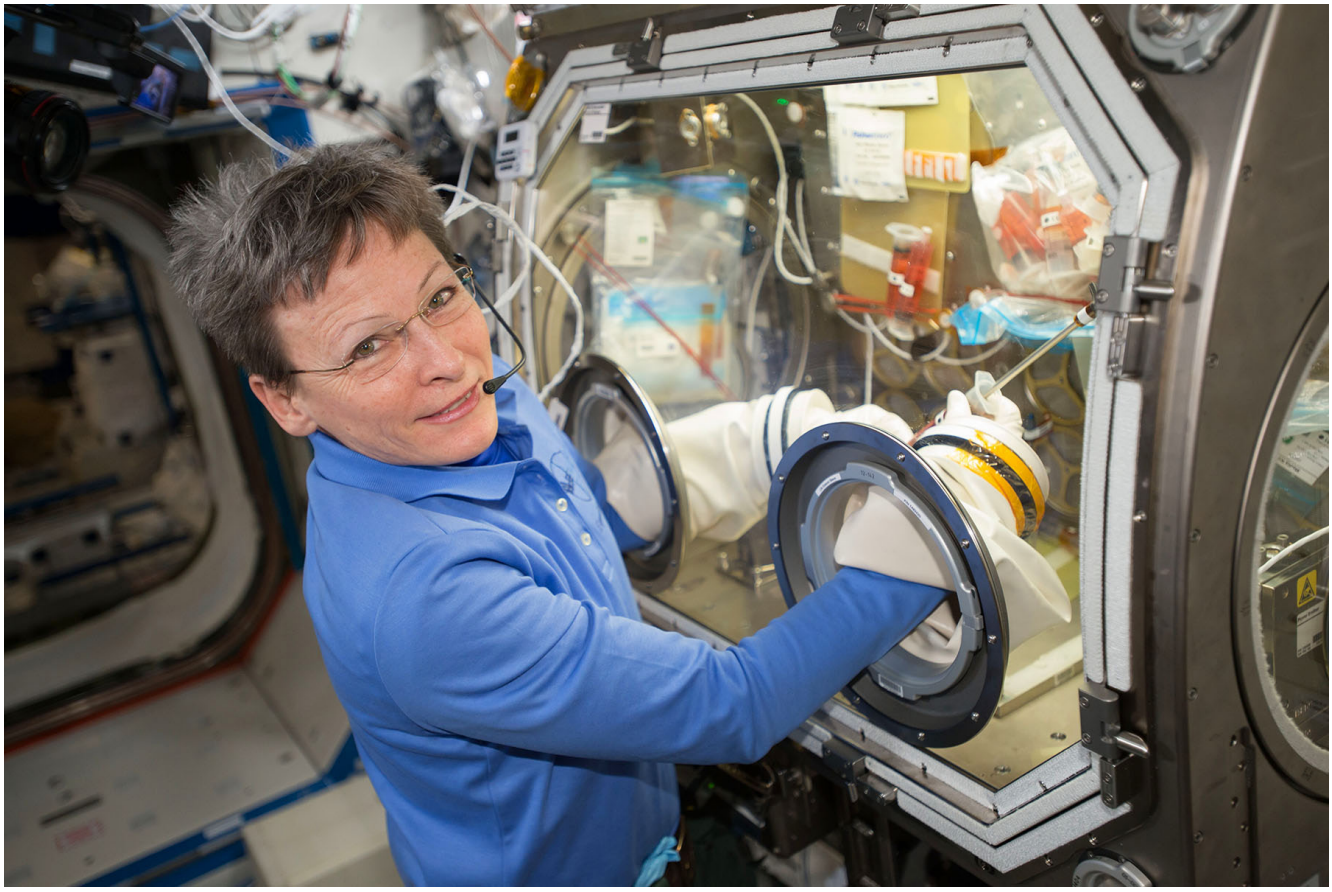
We didn't know anything about the Moon rocks when we first collected them. Could they cause disease in humans or be dangerous in some other way?

Activity 5: Astronaut Glove Box

Scientists who study the Moon rocks use a special sealed glove box to handle, measure, and perform tests. **Ask kids:** Why do you think it is important to use a glove box?

Using a sealed box keeps human hands away from objects that may be harmful to us, and it also protects objects that may be damaged if touched directly by human hands.

Scientists living and working on the International Space Station also use glove boxes for all kinds of experiments in space. Here's a photograph of Commander Peggy Wilson doing a study on bone cells:



Destiny Lab on the International Space Station © NASA

Activity 5: Astronaut Glove Box

Let's get started!

In this activity, kids will get a chance to examine "Moon rocks" using a glove box, and record what they observe.

Adults can build the glove box ahead of time, or if you have a small group you can let the kids help with the construction.

Step one should be done by adults only: First, cut the lid flaps off of the cardboard box. Then cut two round holes on both sides of the box — holes large enough for kids to fit their hands through but small enough that you can tape the gloves to them (see next step).

Place the gloves through the holes you've cut, and position them for little hands — and make sure to put the left glove in the left hole and the right glove in the right hole! Tip: If you point the thumbs inwards and slightly up the hand position will feel more natural to the kids.

Use duct tape to form a complete seal on the outside of the box where the gloves went in. **Ask kids:** why is a complete seal so important to scientists and astronauts?

Fill the box with rocks, magnifying glass, and the optional small plastic bowls (for sorting rocks into categories by size, color, roughness, etc.).

Cover the top of the box with plastic wrap and seal with duct tape.

Have kids observe the rocks feel the rocks with their hands, measure the rocks, and sort into the bowls. While two kids are manipulating the rocks, two other kids can be taking notes about what their lab partners are seeing in the glove box. Then switch places.

Writing About the Moon

Writing helps kids process and solidify new knowledge and gives them an opportunity to use new vocabulary and concepts. Offer one or more of these prompts or questions to get your Space Rangers writing.

Spin a tall tale

Tall Tales feature a larger-than-life, or superhuman, main character who solves a problem in a funny and fantastical way.

Ask kids: have you read any Tall Tales or know any Tall Tale characters? How about Paul Bunyan, huge lumberjack who eats 50 pancakes in one minute and dug the grand canyon with his axe.

You might want to read a Tall Tale so kids can become familiar with that kind of story. Here are a few we recommend:

- *Paul Bunyan* by Steven Kellogg
- *Sally Ann Thunder Ann Whirlwind Crockett* by Steven Kellogg
- *American Tall Tales* by Mary Pope Osborne
- *John Henry* by Julius Lester
- *Swamp Angel* by Anne Isaacs

In this writing activity, kids will spin a tall tale about a conquering hero or heroine on a new frontier — the Moon! Even though a tall tale isn't true, the story should be told as if your hero's adventures really happened. Remember what you have learned about the Moon so you'll have some interesting facts to exaggerate!

Option: Kids can develop their Tall Tale as a comic strip.

Writing About the Moon

Imagining the lunar landscape

Look at the photo of the lunar landscape (see page 76). Select one of the places on the Moon that sounds interesting to you. Sea of Rains? Ocean of Storms? Archimedes? Imagine what it would be like to be there. Think about how the air feels, what colors you see, what the landscape features feel like.

Write a **cinquain poem** about your lunar landscape.

Cinquain (pronounced sin-cane) is a five-line poem that uses descriptive words about the natural world. A cinquain poem doesn't rhyme. The structure for a cinquain looks like this:

Line 1: One word title, a noun that identifies your topic

Line 2: Two adjectives that describe your topic

Line 3: Three "ing" verbs that describe action

Line 4: A phrase that describes something about your topic

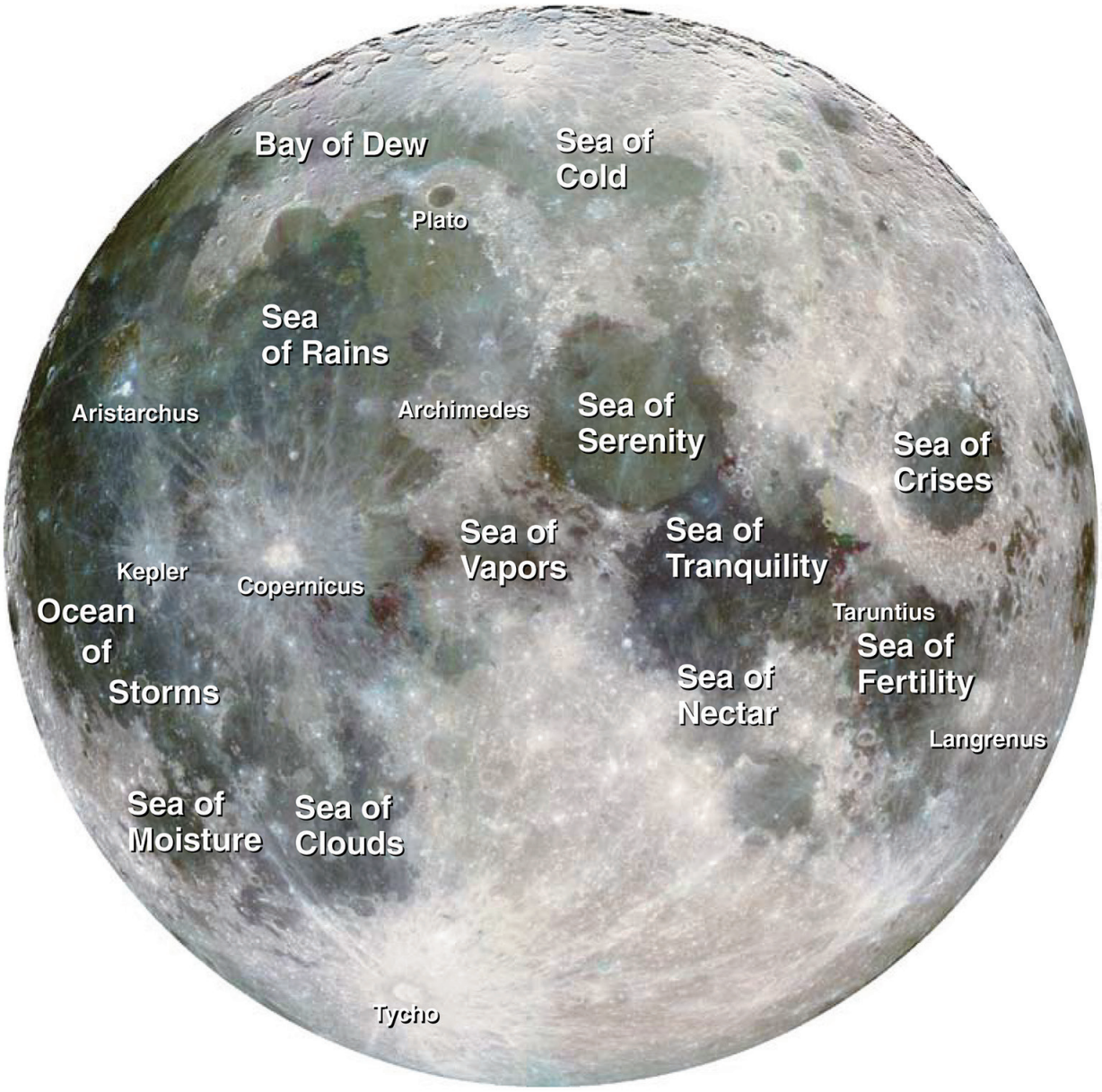
Line 5: A noun that is a synonym or another way to name your topic

Example:

tree
white, tall
reaching, bending, fluttering
leaves and twigs in the wind
aspen

Option: Write a descriptive paragraph about your place in the lunar landscape. Use interesting words! Add a drawing of what your lunar landscape looks like.

The lunar landscape



Writing About the Moon

Design a Moon mission patch

Did you know? A unique patch is designed for every NASA mission!

Following the tradition set by earlier missions, astronauts Neil Armstrong, Buzz Aldrin and Michael Collins — the **Apollo 11** crew — were given the task of designing their mission patch. This patch was important because the mission was so historic!

Here's the patch they designed:

The eagle represents both the United States and the **Lunar Module** and the olive branch is there as a symbol of peace.

Writing About the Moon

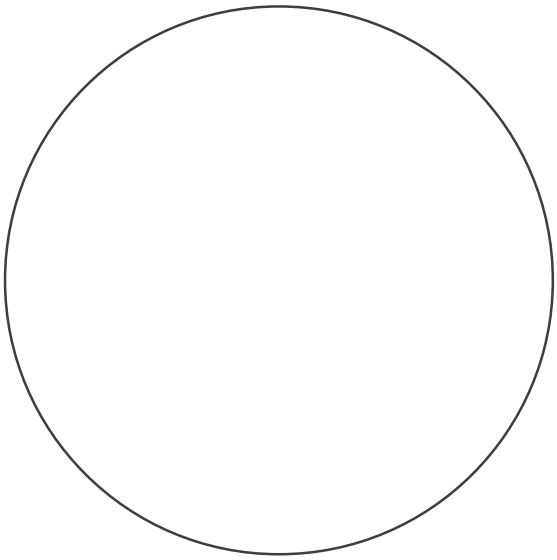
Here are more examples of NASA mission patches:

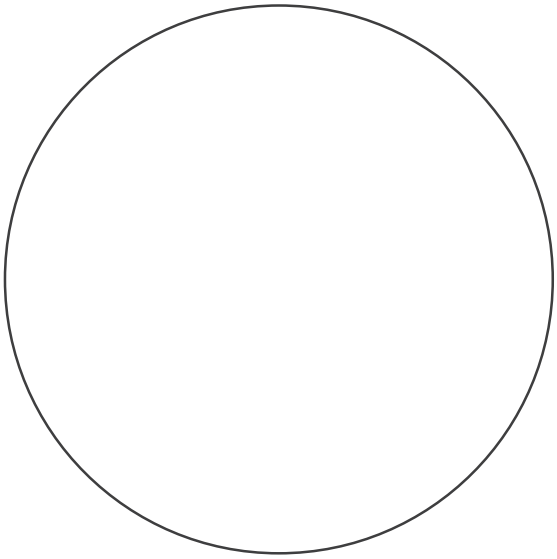
Tell kids to imagine that they are astronauts going on a new mission to the Moon — Apollo 18. Their challenge is to design their own mission patch.

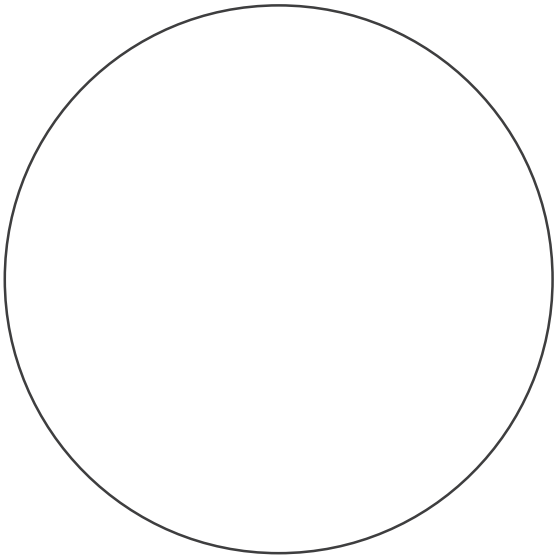
Encourage kids to think about the elements they want on the patch and what they mean. Have kids make a few sketches, then choose their final idea and draw the patch in pencil first, then fill in with color.

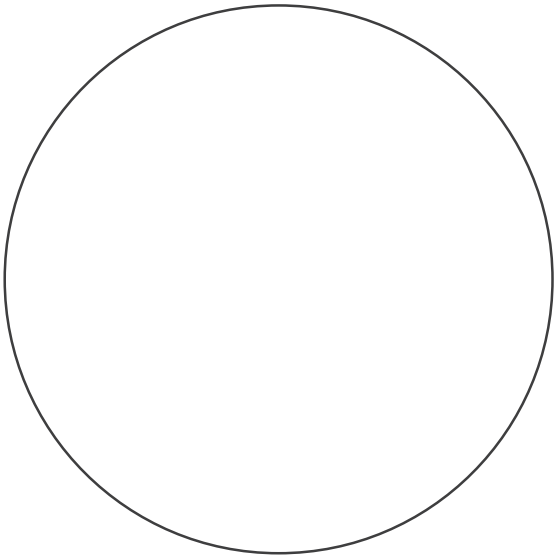
Blank templates are provided on the next page.

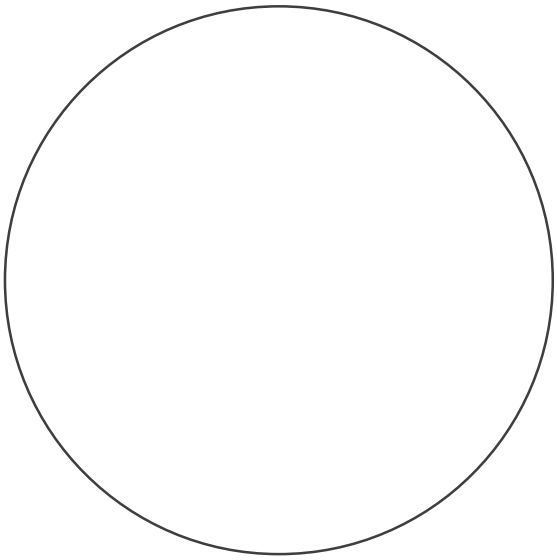
Space mission patch design

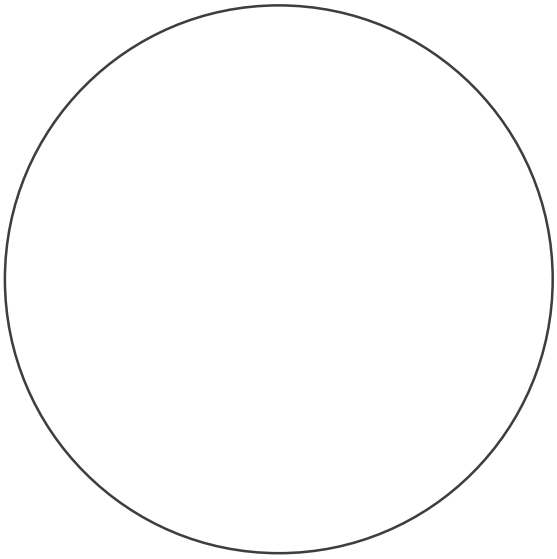












Kid-friendly Websites and Apps

Websites

Video: Story Time from Space
https://storytimefromspace.com/

Video: Moon 101 (National Geographic)
https://video.nationalgeographic.com/video/101-videos/00000164-b3ea-d247-ab67-b7e-a483e0000

Video: Apollo 11, The First Moon Walk (National Geographic Kids)
https://www.youtube.com/watch?v=CbTaDOuSePk

The Moon Landing (National Geographic Kids)
https://kids.nationalgeographic.com/explore/history/moon-landing/

Earth's Moon: interactive map of the Moon (NASA)
https://moon.nasa.gov/

Moon Trek (Jet Propulsion Lab)
https://trek.nasa.gov/moon/

International Observe the Moon Night (NASA)
https://moon.nasa.gov/observe-the-moon/annual-event/overview/

Lunar Tunes (NASA)
https://moon.nasa.gov/galleries/lunar-tunes/infographic/

Video: Lunar Eclipse (NASA)
https://apod.nasa.gov/apod/ap190120.html

Apollo Program (Smithsonian National Air and Space Museum)
https://airandspace.si.edu/explore-and-learn/topics/apollo/apollo-program/

Historic Space Suits (NOVA)
https://www.pbs.org/wgbh/nova/space/historic-space-suits.html

3

Kid-friendly Websites and Apps

Educational apps

NASA (Apple)
https://www.commonsensemedia.org/app-reviews/nasa

Solar System Explorer (Android)
https://www.commonsense.org/education/app/solar-system-explorer

Britannica Kids: Solar System (Apple) $
https://www.commonsensemedia.org/app-reviews/britannica-kids-solar-system

Solar System (Apple) $
https://www.commonsensemedia.org/app-reviews/solar-system-for-ipad

This is my Spacecraft – Rocket Science for Kids (Apple) $
https://www.commonsensemedia.org/app-reviews/this-is-my-spacecraft-rocket-science-for-kids

Simple Rockets (Android, Apple) $
https://www.commonsensemedia.org/app-reviews/simplerockets

Bean Bag Kids Apollo 11(Apple) $
https://www.commonsensemedia.org/app-reviews/bean-bag-kids-apollo-11