This segment will have students ask questions about technological advances to determine details about stars and planets. They will evaluate various models of the solar systems to determine strengths and limitations and they will analyze data and develop a model regarding day and night, orbit and tilt, and seasonal changes. Students will also develop a model to describe the repeating pattern of the phases of the moon.	
Student Science Performance	
Grade or course Fourth	**Title:**
Topic: Earth Science and Space Science	Stars, Planets, and Moon

Performance Expectation for GSE:

S4E1. Obtain, evaluate, and communicate information to compare and contrast the physical attributes of stars and planets.

a. Ask questions to compare and contrast technological advances that have changed the amount and type of information on distant objects in the sky.
b. Construct an argument on why some stars (including the Earth's sun) appear to be larger or brighter than others.
(*Clarification statement*: Differences are limited to distance and size, not age or stage of evolution.)
c. Construct an explanation of the differences between stars and planets.
d. Evaluate strengths and limitations of models of our solar system in describing relative size, order, appearance and composition of planets and the sun.
(*Clarification statement:* Composition of planets is limited to rocky vs. gaseous.)

S4E2. Obtain, evaluate, and communicate information to model the effects of the position and motion of the Earth and the moon in relation to the sun as observed from the Earth.

a. Develop a model to support an explanation of why the length of day and night change throughout the year.
b. Develop a model based on observations to describe the repeating pattern of the phases of the moon (new, crescent, quarter, gibbous, and full).
c. Construct an explanation of how the Earth's orbit, with its consistent tilt, affects seasonal changes.

S4P1. Obtain, evaluate, and communicate information about the nature of light and how light interacts with objects.

c. Plan and carry out an investigation utilizing everyday materials to explore examples of when light is refracted.
(*Clarification statement:* Everyday materials could include prisms, eyeglasses, and a glass of water.)

Performance Expectations for Instruction:

- The International Space Station (ISS) is orbiting Earth.
- Compare and contrast technological advancements used to gather information about distant objects in the sky.
- Formulate questions about technological advancements used to gather information about distant objects in the sky.
- Determine why some stars appear larger or brighter than others.
- Compare and contrast the relative size and composition of stars and planets.
- Evaluate the strengths and limitation of various models of the solar system.
- Analyze data to support the claim that the length of day and night change throughout the year.
- Collect and analyze data about the phases of the moon.
- Explain that the Earth is in orbit and the tilt affects seasonal changes.
- Develop a model to explain why the length of day and night change throughout the year.
- Develop a model (2D or 3D) to describe the repeating pattern of the phases of the moon.

Additional notes on student supports	
Materials Internet access Books about the solar system Pictures of various models of the solar system Images of various models NASA.gov access to videos, lessons, and multimedia Simulations of Earth, Moon, and Sun: globe, thin rod (pencil, bamboo skewers or dowels), Styrofoam balls, light source such as uncovered lamp or flashlight Index cards, butcher paper, markers **Additional Resource:** *Sun As a Star Guide*	
Students will continuously obtain, evaluate, and communicate information. This is not a linear process. Students will communicate through writing and discussions to allow for formative assessment. This benefits the teacher, student, and whole group to guide instruction to clarify misconceptions or extend content.	
Engaging Learners	**Phenomenon** SpaceX CRS-12 Launches to the ISS. The SpaceX Falcon 9 rocket lifts off at 12:31 p.m. EDT, with the Dragon cargo module on its journey to the International Space Station. Dragon will deliver more than 6,400 pounds of research equipment, cargo and supplies to the space station during SpaceX's 12th commercial resupply services mission to the space station for NASA. Where is the edge of the Solar System? Good for an introduction and discussion about our Solar System
	Obtaining Students watch the launch and generate questions about space, our solar, system, and the International Space Station.
	Evaluating *Why do we study space? What benefits are there to studying space? What can scientist learn from studying our Solar System? What are some topics that scientist can explore by studying space?* *Students will engage in a conversation and come up with their best answers.*
	Communicating Students will share their thinking about studying space. Student ideas are recorded for further reflection. *Teacher Notes: Include topics such as technology and models (past and present); stars, planets, and moon (relative size, composition, order, appearance).*
Exploring	*Obtaining* Students will research the different types of technology used to gather information about distant objects in the sky. One such technology is the telescope. Here is a link to a summary about the invention of the telescope, the Hubble telescope today, and a handout for students to imagine what telescopes will look like in the future: Telescopes What questions are they asking? Are they asking the same questions? What do they need to know to compare and contrast the two inventions? As a precursor to the light unit, telescopes help students observe refracted light. Refracted Light

	Have students design other ways to do optical tricks using refracted light to share with each other. Have them note how the light bends as it goes through various liquids or lenses.
Engaging	**Phenomenon:** NASA Connect segment explains how scientists use satellites to predict weather. The segment explores the Afternoon Constellation, or the collection of satellites known as the 'A' Train as well as weather balloons, weather stations and local weather observers. NASA Weather Instruments *Communicating* There are several other methods of studying space and our solar system other than telescopes, such as the International Space Station, exploratory spacecraft, rovers, satellites, etc. Have students find out about different inventions that give us a closer look. This video gives students an idea of how weather satellites have changed: Weather Satellites: Past, Present and Future. Technology Share a thon - working in pairs, students can use research to produce a timeline of this technology. (A roll of butcher block paper makes a great timeline.) Block off the timeline in 50-year increments and have students add pictures and information to their blocks. Continue the blocks into the future so that students can imagine what will happen in 50 or 100 years. Post the timeline where other students can view it.
Evaluating	Students will determine the similarities and differences in stars and planets including size and distance from Earth. (A diagram is helpful for compare and contrast.) In their research, they will need to include a discussion of relative size, order, appearance and composition of planets and the sun. A chart is helpful for students to organize their thoughts. Comparing Planets and Stars Organizer Planets: 10 Need to Know Things ***Phenomenon*** Most models of the solar system are wrong! Have students check multiple sources to determine how the pictures are not to scale or give wrong impressions of how vast our solar system is. Solar System Student will obtain information about the physical attributes of the sun and planets using the Planet and Sun Organizer. Models of our solar system *Teacher Notes: Models can be 2d or 3d. We are looking at pictures of models. Students are not expected to make a model of the solar system or of the planets.*
Exploring	**Phenomenon** Day and Night on the International Space Station An astronaut explains, “We orbit the Earth about once every 90 minutes. During the orbit of the Earth we are in daylight for about 45 minutes and darkness for about 45 minutes. That means the sun will rise and set 16 times a **day**.” NASA

	Can you imagine having a complete day and night every hour and half? How is that possible? Talk with your neighbor and develop a design to show how this happens. Students will research about the length of day and night and why it changes throughout the year on Earth. A protractor can measure a 23-degree angle, but you can have them relate the angle to 1:00 on the clock. Have students simulate the Earth's turning around its axis with the tilt and experiencing how the different latitudes of the Earth will receive different amounts of light during the year. 1. Have students use a light source and a turning globe to simulate how the Earth turns counterclockwise from day to night and night to day. Remind them that on Earth this happens every 24 hours. 2. Students put a bamboo skewer or pencil through the middle of a Styrofoam ball. 3. Explain that the "Earth" does not change its tilt as it goes around the sun during the year or turns to day and night. *Teacher Notes: watch to see that students don't wobble the ball back and forth as they turn it. They should keep the tilt throughout the simulation.* 4. Place an uncovered lamp or use a flashlight for them to see the changes of light as the tilted stick moves around the light. Help students distinguish between the Earth turning around its axis as day/night (24 hours) and the Earth turning around the light source as a year (365 days). After information is gathered, the students will relate this to Earth's tilt and its effect on seasonal changes. The longer the day gives the land a longer time to heat. The longer the night gives the land a longer time to cool. This affects our weather and our seasons. It's All About the Earth's Tilt Have students sketch what they now know about what causes day and night and what causes the differences during the year.
Engaging	**Phenomenon** Have students use their moon calendars that they have charted since the beginning of the year. Blank Calendar for Moon Phases Have them discuss what they notice about the patterns and the location of the moon through their charting. Did they notice the moon during the day or only at night? Moon Phase Facts Moon Phases and Time of Day NASA-- The Moon An activity to simulate how we see the reflected light of the sun on the moon requires a bamboo skewer or pencil and sphere such as a Styrofoam ball or handball. Students can just hold up any sphere in front of them as they turn, but the skewer or pencil helps students minimize their own shadows. How to View Moon Phases *Teacher Notes: Use questioning and journaling to look for the misconception that the Earth's shadow causes the moon phases. The Earth's shadow causes an eclipse not a phase. Repeated modeling in 2D and 3D with their explaining to their neighbor will help students understand.*
	Evaluating

	Have students make quiz index cards of moon phases to check each other's understanding. They can make cards of the phases and have other students figure out the correct order, ask questions about the phases, or ask others to find out what is wrong or missing in a picture.
	Formative Assessment of Student Learning
Explaining Finalizing Model	*Evaluating* Students can then participate in a gallery walk to see the advancements made in space study by viewing the timelines.
	Communicating Formative assessment of students' abilities to compare and contrast technology used to study space is helpful in finding where to spend time in instruction and discussion.
Elaborating Applying Model to Solve a Problems	**Phenomenon** What are some problems with space travel and space exploration? The future of human space exploration. NASA 360 - The Future of Human Space Exploration Have students add to the blocks on the butcher paper timeline to imagine the future of space exploration and list what is needed (including careers) to achieve these explorations. Post the timeline for discussion and comments.
	Obtaining Students formulate questions about tools and technology for future space exploration.
	Evaluating Formatively assess students as they discuss topics related to study.
	Communicating Group discussion about the future of space exploration.
Evaluation	***Assessment of Student Learning***
	Students will develop a model to explain why the length of day and night change throughout the year. Evaluation should be based on students understanding of revolution and rotation of the Earth. Using the chart/calendar of the moon phase observations, students will predict the next phases based on their model. They will describe the repeating pattern of the phases of the moon.
SEP, CCC, DCI	**Science Essentials**
Science and Engineering Practices	• Asking questions • Planning and carrying out investigations • Developing and using models • Constructing explanations • Engaging in argument from evidence • Obtaining, evaluating, and communicating information
Crosscutting Concepts	• Patterns • Scale, Proportion, and Quantity • Systems and System Models
Disciplinary Core Ideas	From *A Framework for K-12 Science Education:* • **ESS1.A: The Universe and Its Stars** • **ESS1.B: Earth and the Solar System** • **PS4.C: Information Technologies and Instrumentation**

	• **PS4B: Electromagnetic Radiation**

Make the connection from space (atmosphere etc.) to weather for the smooth transition to the next unit.
https://climatekids.nasa.gov/why-earth/

Additional Supports for struggling learners:		
The following supports are suggestions for this lesson and are not the only options to support students in the classroom. These supports target students that struggle with science material, this lesson or a previous lesson. These are generalized supports and do not take the place of IEP accommodations as required by each student's Individualized Education Program.		
General supports for the following categories:		
Reading: 1. The teacher can have students match letters prior to reading to remind them of the alphabet. 2. The teacher can have students identify words that they know in the text as the class reads. 3. The teacher should remind students to use strategies when they are reading.	Writing: 1. The teacher can provide practice for students in the area of writing both in context and practicing just letters. 2. The teacher can provide a sentence starter for the students. 3. The teacher should continually give encouragement to the students. 4. The teacher can provide constructive positive feedback during the writing process to help students understand the expectations.	Math: 1. Provide students with opportunities to interact with numbers. 2. The teacher can provide manipulatives to allow the students to count and interact with materials.
Supports for this specific lesson if needed:		
Performance expectations for instruction: 1. The teacher should provide information to students in various formats to reach as many students as possible. 2. The students should be given adequate time to complete each part of the lesson. 3. The students should be allowed to express their knowledge in various formats. 4. The teacher should be sure to provide multiple ways for the students to communicate their knowledge of the material.		
Engage: 1. The teacher should consider showing the videos more than once as needed for students to make observations. 2. The teacher should consider providing question stems to the students to assist in generating questions. 3. The teacher should have clear and consistent guidelines for discussion. These guidelines should help		

students feel more comfortable and be more likely to participate in the class discussion.

4. The teacher should keep a record of student ideas on the board for students to look at as they move through the lesson.
5. The teacher should be sure to provide multiple ways for the students to communicate their knowledge of the material. These formats could include writing, drawing, labeling images or designing a presentation.
6. Students may need additional time to complete their assignment.

Exploring:

1. The teacher should consider providing students with resources to use in their research.
2. The teacher should consider reading aloud or using text-to-speech for students that are struggling with reading to access the material in the telescopes handout.
3. The teacher should consider having students observe a telescope. This could be done using a telescope in person or using a video.
4. The teacher should be sure to provide multiple ways for the students to communicate their knowledge of the material. These formats could include writing, drawing, labeling images or designing a presentation.
5. The teacher should have students draw what they see as they observe light moving through liquids.
6. Students may need additional time to make observations.

Engaging:

1. The teacher should consider showing the video more than once as needed to have students make observations.
2. The teacher should consider having students ask questions about the different weather instruments that NASA maintains.
3. The teacher should consider providing students a list of methods of studying space and resources that they can use to research the different methods.
4. The teacher should use intentional and flexible grouping to group students. Best practice is to use data to drive student grouping.
5. The teacher should consider giving students a timeline template for students to use as they make their timeline.
6. The teacher should be sure to provide multiple ways for the students to communicate their knowledge of the material. These formats could include writing, drawing, labeling images or designing a presentation.
7. The teacher should consider having multiple formats for students to share their work. These formats could include the use of technology, gallery walk or presenting.

Evaluating:

1. The teacher should have clear and consistent guidelines for class discussion. These guidelines should help students feel more comfortable and be more likely to participate in the discussion.
2. The teacher should consider providing students with resources to use in their research.
3. The teacher should consider using guiding questions to assist in the students determining what is wrong with models and images of the solar system.
4. The teacher should consider filling in some of the planet attributes in the organizer to assist students in gathering the information.

Exploring:

1. The teacher should consider reading aloud, using text-to-speech or using a video to help students understand how the international space station orbits the earth.
2. The teacher should have clear and consistent discussion guidelines. These guidelines should help students feel more comfortable and be more likely to participate in the discussion.
3. The teacher should use intentional and flexible grouping to group students. Best practice is to use data to drive student grouping.
4. The teacher should have clear and consistent group work guidelines. These guidelines should help students feel more comfortable working with their peers in groups.
5. The teacher should consider providing groups with resources that they can use in their research.
6. The teacher should be prepared to repeat directions as needed.
7. The teacher should use guiding questions to assist students in correctly modeling the light and globe model.
8. The teacher should consider having students sketch what they see as they move the globe and the light.
9. The teacher should consider a formative assessment. Then re-teach, review or enrich as needed.

Engaging:

1. The teacher should provide students with a way to access the moon phases even if they are not able to record them for homework.
2. The teacher should have clear and consistent guidelines for discussions. These guidelines should help students feel more comfortable and be more likely to participate in the discussion.
3. The teacher should be prepared to repeat directions as needed.
4. The teacher should consider providing students with a manipulative to put the moon phases in order.
5. The teacher should consider a formative assessment. Then re-teach, review or enrich as needed.
6. Students may need additional time to complete the assignment.

Explaining:

1. The teacher should consider using multiple share formats. These formats could include using technology, gallery walk or presenting.
2. The teacher should consider having students revise their timelines as needed.
3. Students may need additional time to complete the assignment.

Elaborating:

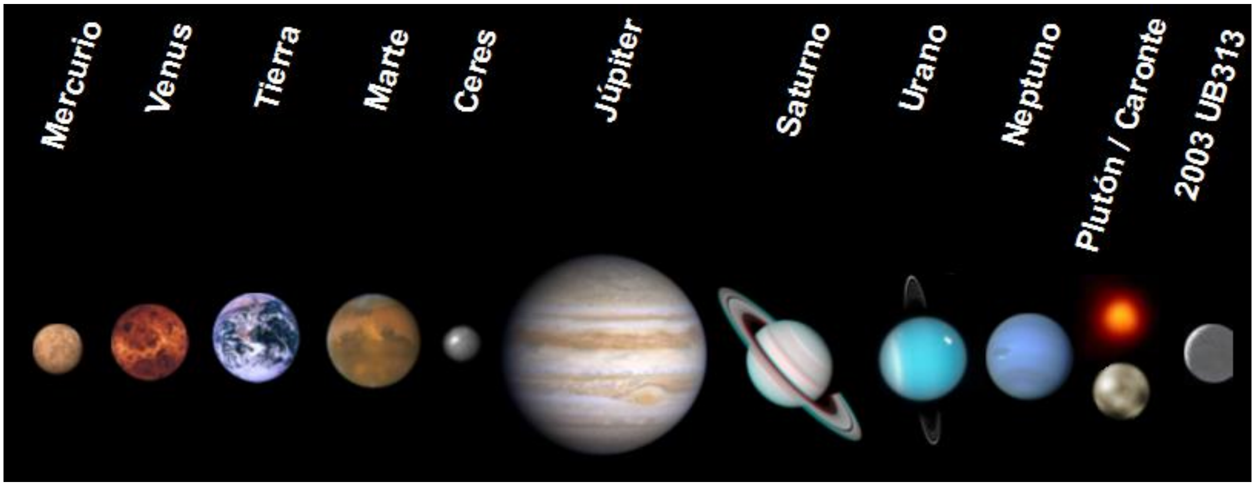
1. The teacher should be sure to provide multiple ways for the students to communicate their knowledge of the material. These formats could include writing, drawing, labeling images or designing a presentation.
2. The teacher should have clear and consistent guidelines for discussion and feedback. These guidelines should help students feel more comfortable and be more likely to participate in the discussion and accept feedback.
3. The teacher should consider providing question stems to students to assist in generating questions.

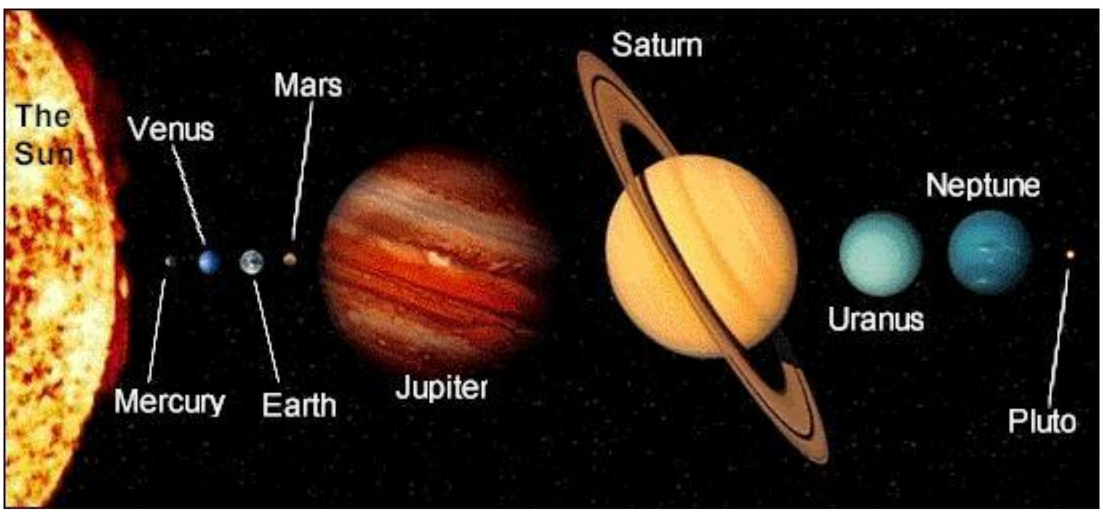
Evaluating:

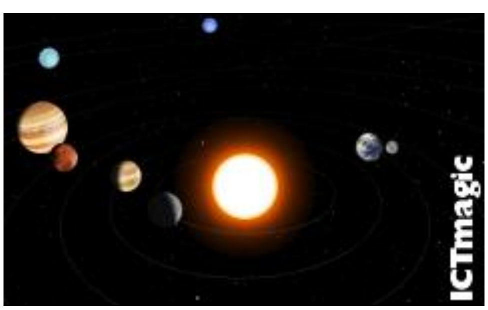
1. Students may need additional time to complete their assignment.
2. The teacher should be sure to provide multiple ways for the students to communicate their knowledge

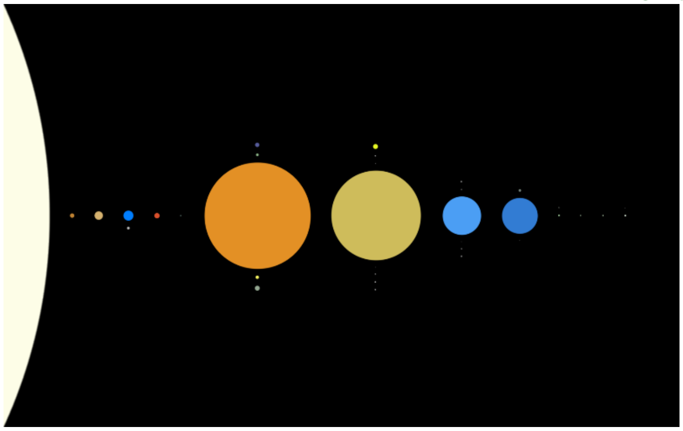
of the material. This could include labeling images, drawing pictures, writing or verbally explaining.

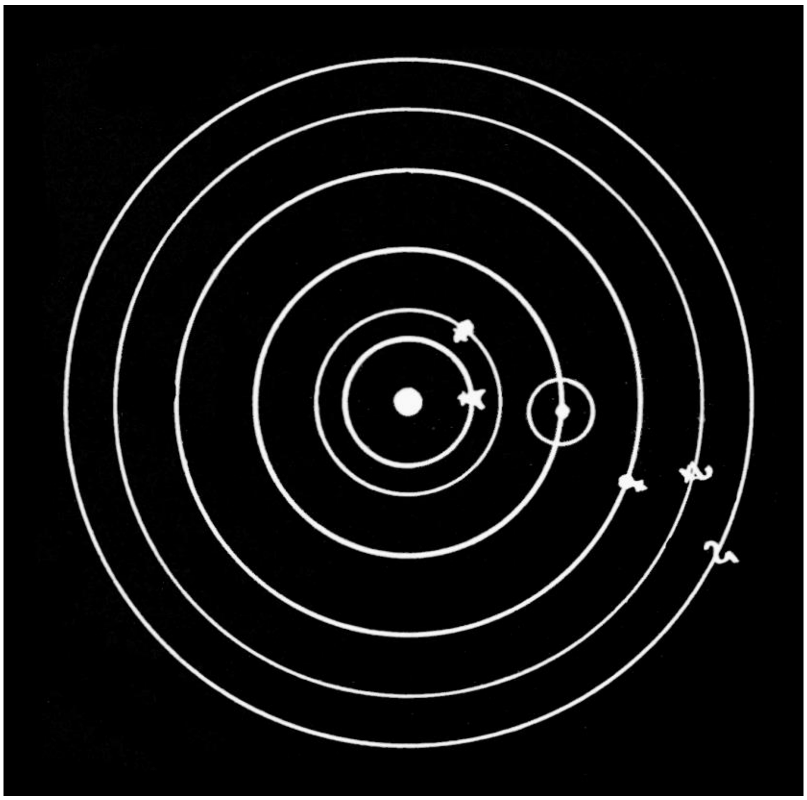
Solar System Models



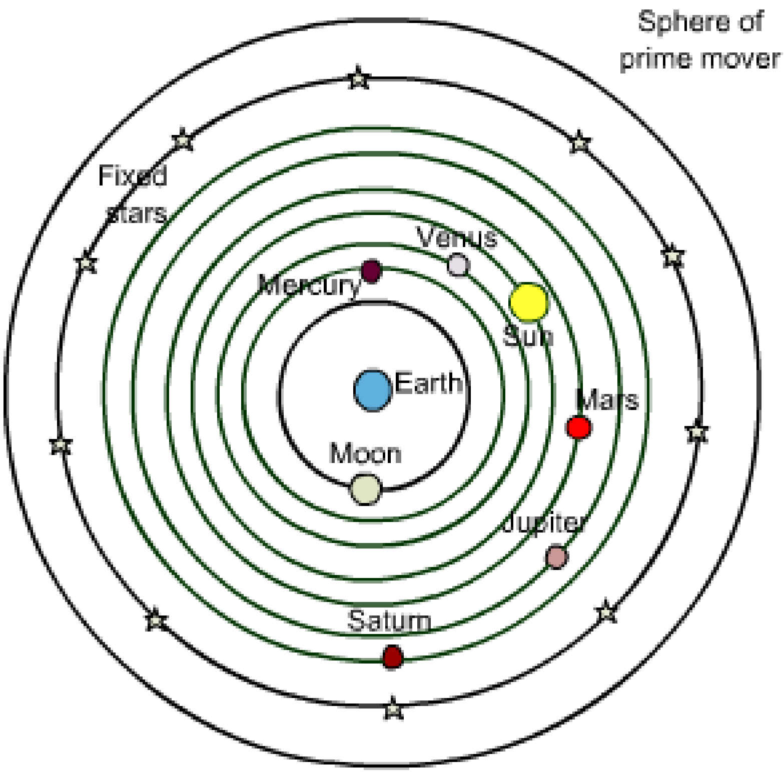








Georgia Department of Education
November 2019



Return to Instructional Segment

Telescopes Before

The telescope is one of humankind's most important inventions. The simple device that made far away things look near gave observers a new perspective. When curious men pointed the spyglass toward the sky, our view of Earth and our place in the universe changed forever.

But who invented the telescope? The answer remains a mystery today. It is highly probable that as glassmaking and lens-grinding techniques improved in the late 1500s, someone held up two lenses and discovered what they could do.

The first person to apply for a patent for a telescope was a Dutch eyeglass maker named Hans Lippershey (or Lipperhey). In 1608, Lippershey tried to lay claim on a device with three-times magnification. His telescope had a concave eyepiece aligned with a convex objective lens. One story goes that he got the idea for his design after observing two children in his shop holding up two lenses that made a distant weather vane appear close. Others charged at the time that he stole the design from another eyeglass maker, Zacharias Jansen.

In 1609, Galileo Galilei heard about the "Dutch perspective glasses" and within days had designed one of his own — without ever seeing one. He made some improvements on his initial design and presented his device to the Venetian Senate. The Senate, in turn, set him up for life as a lecturer at the University of Padua and doubled his salary, according to Stillman Drake in his book "Galileo at Work: His Scientific Biography" (Courier Dover Publications, 2003).

Galileo's ink renderings of the moon: the first telescopic observations of a celestial object.Credit: NASA

Galileo was the first to point a telescope skyward. He was able to make out mountains and craters on the moon, as well as a ribbon of diffuse light arching across the sky — the Milky Way. He also discovered the sun had sunspots, and Jupiter had its own set of moons.

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of Earth and our place in the universe changed forever.

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Telescopes Now: The Hubble Space Telescope

The Mission Operations Room during Servicing Mission 4.

NASA's Goddard Space Flight Center is home to the Hubble Space Telescope Operations Project, the government's team of technical managers and scientists who oversee all aspects of the Hubble mission. Under its direction, an integrated group of civil servants and contractors at Goddard collectively known as the operations team is responsible for Hubble's mission operations—those functions of the mission that operate together to assure the health, safety, and performance of the spacecraft. Examples include monitoring and adjusting the spacecraft's subsystems (e.g., power, thermal, data management, pointing control, etc.), flight software development, sustaining engineering of the control center hardware and software, and systems administration of the network and ground system components.
Credits: NASA

Telescopes of the Future

How do you think telescopes will change and improve as technology develops? Sketch your thinking and write a short paragraph explaining their abilities.

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Return to Instructional Segment

Refraction of Light

Light rays usually travel in straight lines, but when they pass from one material to another they can be forced to bend (change direction and continue on a new straight path). The bending is called refraction. It happens because light travels at different speeds in different materials. If light rays travel through air and enter a denser material, such as water, they slow down and bend into the more dense material. Light rays moving into a less dense material, such as from water to air, speed up and bend outwards. Light rays bend or refract if they enter a glass block at an angle. When they pass from air into glass, they bend inwards and slow down. They travel in a straight line through the glass at an angle to their original direction. As they pass out from the glass into air, they bend outwards and speed up again.

Disappearing Coin Trick

In this experiment we will make a coin disappear. For this simple trick you will need two transparent glasses and two coins. First place a coin on the table and place the first glass on its top. Place the other coin inside the second glass. Now start pouring water in the first glass and you'll see the coin actually disappears. Now pour water in the second glass with the coin sitting. In the second case you will still be able to see the coin. In both cases you have to observe from the sides of the glass and not from its top. Why does the coin in the first glass disappear? This is because of refraction of light. In the first case when the coin is under the glass, the light has to go from air to the glass and then inside the water because the coin is under the glass. Because of the refractive index of air is much less than that of glass, the light completely bends around the coin and so you cannot see it. In the second case the light does not bend so much, and you are able to see the coin. This is the science behind this disappearing coin trick.

Magnify with an bubble in a tube of water.

Use a small thin jar (such as a preform bottle or an olive jar) with a tight-fitting lid. Fill the jar almost full of water leaving a small space of air at the top. Put the lid on tightly so there are no leaks. Turn the bottle on its side and put it over a sheet of printed paper. When you look through the water portion at a printed page, the words appear larger. If you look through the air bubble portion of the jar, the words appear smaller. The different shapes the light travels through cause the differences in how we see the words.

Pencil in a Glass

Pour water into a clear cup. Place a pencil in the water and look through the side of the cup. The pencil looks bent because the light travels through the liquid differently than through the air above the water. Try other liquids to see the difference.

Return to Instructional Segment

Comparing Planets and Stars

Choose a planet and a star to compare their relative size, order, appearance and composition.

Star choices include Sirius, Betelegeuse, Arcturus, Rigel, Alpha Centuri (our closest star other than our sun), etc.

Name	Relative Size	Order from Earth	Appearance	Composition
Earth	7926 miles in diameter	Same	Blue Green planet of land and water with clouds in the atmosphere	Land made of soils and rocks with water in oceans, rivers and lakes. It is surrounded by air with water vapor that form clouds and weather.
Our Sun	864,000 miles in diameter	92.96 million miles	A bright yellow ball in the day sky	bright, hot ball of hydrogen and helium that is 10,000 degrees Fahrenheit

Name	Relative Size	Order from Earth	Appearance	Composition

Return to Instructional Segment

Planets of Our Solar System: 10 Need-To-Know Things

1. What is it?

Our solar system is made up of the sun and everything that travels around it. This includes eight planets and their natural satellites such as Earth's moon, dwarf planets such as Pluto and Ceres, asteroids, comets and meteoroids.

2. Sun-Centered

The sun is the center of our solar system. It contains almost all of the mass in our solar system and exerts a tremendous gravitational pull on planets and other bodies.

3. Age

Our solar system formed about 4.6 billion years ago.

4. Can Stand On Them

The four planets closest to the sun -- Mercury, Venus, Earth, and Mars -- are called the terrestrial planets because they have solid, rocky surfaces.

5. Can't Stand on Them

Two of the outer planets beyond the orbit of Mars -- Jupiter and Saturn -- are known as gas giants; the more distant Uranus and Neptune are called ice giants.

6. Beyond Neptune

Most of the known dwarf planets exist in an icy zone beyond Neptune called the Kuiper Belt, which is also the point of origin for many comets. Ceres is the exception. It is in the main asteroid belt.

7. Hard to Breathe

Many objects in our solar system have atmospheres, including planets, some dwarf planets and even a couple moons. But none of them are suitable for humans.

8. Spiral Galaxy

Our solar system is located in the Orion Arm of the Milky Way Galaxy. There are most likely billions of other solar systems in our galaxy. And there are billions of galaxies in the Universe.

9. Taking Measure

We measure distances in our solar system by Astronomical Units (AU). One AU is equal to the distance between the sun and the Earth, which is about 93 million miles (150 million km).

10. Going the Distance

NASA's twin Voyager 1 and Voyager 2 spacecraft are the first spacecraft to explore the outer reaches of our solar system. The solar system lithograph set is by far the most downloaded file on this site. The set features images of the planets, the sun, asteroids, comets, meteors and meteorites, the Kuiper Belt and Oort Cloud, and moons of the solar system.

Return to Instructional Segment

Planets and Sun Organizer

Student will obtain information about the physical attributes of the sun and planets. They will use this information to evaluate the strengths and limitations of various models of the solar system.

	Relative Size	Order	Appearance	Composition (rocky vs gaseous)	Other Interesting facts
Sun					
Mercury					
Venus					
Earth					
Mars					
Jupiter					
Saturn					

Uranus					
Neptune					

Return to Instructional Segment

Night on the International Space Station

The International Space Station's Destiny Laboratory at "night" shortly before the Expedition 47 crew entered its scheduled sleep period. The space station experiences 16 sunrises and sunsets every day which can alter the crew's circadian rhythm and disrupt sleep patterns. Lights are turned off and windows are covered to give the interior of the station a nighttime environment during sleep cycles.

Return to Instructional Segment

Moon Phase Calendar

Draw the current moon phase for each day of the month. You can use news media or direct observation for this information. First fill in the month, year, and date. If the drawing is from a direct observation, put a checkmark in the box.

MONTH ____________________ YEAR __________

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY

Return to Instructional Segment

Moon Phase Facts

There are 8 major phases that the moon goes through.

- A *new moon* is when the Moon cannot be seen because we are looking at the unlit half of the Moon. The *new moon* phase occurs when the Moon is directly between the Earth and Sun. A solar eclipse can only happen at new moon.
- A *waxing crescent moon* is when the Moon looks like crescent and the crescent increases ("waxes") in size from one day to the next. This phase usually is only seen in the west.
- The *first quarter moon* (or a *half moon*) is when half of the lit portion of the Moon is visible after the *waxing crescent* phase. It comes a week after new moon.
- A *waxing gibbous moon* occurs when more than half of the lit portion of the Moon can be seen and the shape increases ("waxes") in size from one day to the next. The *waxing gibbous* phase occurs between the first quarter and full moon phases.
- A *full moon* is when we can see the entire lit portion of the Moon. The *full moon* phase occurs when the Moon is on the opposite side of the Earth from the Sun, called opposition. A lunar eclipse can only happen at full moon.
- A *waning gibbous moon* occurs when more than half of the lit portion of the Moon can be seen and the shape decreases ("wanes") in size from one day to the next. The *waning gibbous* phase occurs between the full moon and third quarter phases.
- The *last quarter moon* (or a *half moon*) is when half of the lit portion of the Moon is visible after the *waning gibbous* phase.
- A *waning crescent moon* is when the Moon looks like the crescent and the crescent decreases ("wanes") in size from one day to the next.
- An *old* moon is a moon with only a tiny bit of the moon seen in the corner, about to turn into a *new moon*.

Return to Instructional Segment

Moon Phases and Time of Day

Phase	Rises	In Eastern Sky	Highest in Sky	In Western Sky	Sets
New	Sunrise*	Morning*	Noon*	Afternoon*	Sunset*
Waxing Crescent	Just after sunrise*	Morning*	Just after noon*	Afternoon*	Just after sunset
First Quarter	Noon	Afternoon	Sunset	Night	Midnight
Waxing Gibbous	Afternoon	Sunset	Night	Midnight	Night (am)
Full	Sunset	Night (p.m.)	Midnight	Night (a.m.)	Sunrise
Waning Gibbous	Night	Midnight	Night	Sunrise	Morning
Third Quarter	Midnight	Night	Sunrise	Morning	Noon
Waning Crescent	Just before sunrise	Morning*	Just before noon*	Afternoon*	Just before sunset*

*Times that the moon isn't visible because it is too close to the Sun.

Return to Instructional Segment