Moons In Our Solar System

Grade(s): 5th
Lesson Duration: 3, 45-minute class periods
Course Name(s): STEM
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BIG IDEAS

- Students will learn about Earth's moon by comparing it to other moons within our solar system.
- Students will be able to recognize that the moons in space can be similar and different.
- Students will discover the importance of space missions that give us information on celestial bodies.
- Students will acknowledge that the information that we have on space is constantly changing based on new space exploration.

EDUCATION STANDARDS

Science Performance Expectations (or state Science standard):
5-ESS1-1. Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth.
5-ESS1-2. Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

Science and Engineering Practices: *(SEP elements connected to the PEs or standards)*	Disciplinary Core Ideas: *(DCI elements connected to the PEs or standards)*	Crosscutting Concepts: *(CC elements connected to the PEs or standards)*
Planning and Carrying Out Investigations Analyzing and Interpreting Data Developing and using models	ESS1.A: The Universe and Its Stars ESS1.B: Earth and the Solar System	Patterns Scale, Proportion, and Quantity Systems and System Models

Obtaining, Evaluating, and Communicating Information		

State Math or ELA Standards:

5.RI.1.2: Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.
5.RI.1.3: Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a scientific text based on specific information in the text.
5.W.3.7: Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.
5.SL.1.4: Report on a topic or text, present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.
5.SL.2.5: Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.

MEASURABLE STUDENT LEARNING OBJECTIVES

- Students will be able to recognize the Earth's moon and other planets moons.
- Students will be able to understand key characteristics of Earth's moon and other moons in our solar system.
- Students will be able to research using NASA mission data (e.g., Juno, Cassini) to gather information on moons of different planets.
- Students will be able to present their findings in a clear, accurate, and creative way.
- Students will be able to compare Earth's moon with moons from other planets, using characteristics like size, physical features, distance from the home planet, and NASA missions involved in their discovery.
- Students will be able to prove the importance of space exploration and how it aids in our understanding of the solar system.

MATERIALS NEEDED

- Computers
- Art supplies (options will vary based on student presentation choice)
- Projector or Smartboard
- YouTube
- Video clips

ENGAGING CONTEXT/PHENOMENON

- This lesson will use thought provoking questions to begin the lesson. For example:
    - Imagine you are standing on the moon. What does it look like? What does it feel like? What is it made of? How long did it take you to get there?
    - Do other planets have moons? Why or why not?
    - How many other moons do you think there are in our solar system?

    - Imagine that you are standing on a moon of a different planet. What does it look like? What does it feel like? What is it made of? How long did it take you to get there?
    - How did we learn that there are other moons in space?
- Engaging Context
    - Which planet has the most moons in our solar system?
        - Video Link
    - Cassini Mission (Saturn)
    - Juno (Jupiter)
    - Show photos of each of the moons
        - Saturn – Link to moons website
        - Jupiter – Link to moons website
        - Earth – Link to moons website
        - After showing, ask: What do you think this place is like? How is it different from our Moon? How did we get these photos?
    - Do these moons look like anything on Earth?

DATA INTEGRATION

Students will be using data gathered from NASA's moon websites and data from NASA missions such as the Cassini Mission for Saturn and Juno Mission for Jupiter. The data from these sites will provide students with information on the size of the moon, composition, distance from home planet, physical features, and more. Data from these sources also includes visual data like photos and 3D models.

TEACHER BACKGROUND KNOWLEDGE

This lesson requires a strong background and understanding of:

- Earth's moon (facts on size, distance from Earth, physical features)
- Saturn's moons (specifically the "big name" ones like Titan and Enceladus)
- Jupiter's moons (specifically the "big name" ones like Ganymede, Callisto, Io, and Europa)
- General space exploration knowledge (where spacecrafts/missions have traveled, how scientists are collecting data from these space exploration missions in order to learn about space)

DIFFERENTIATION OF INSTRUCTION

This lesson can be adjusted for higher or lower learning levels. Some students may need:

- Scaffolding when researching. Teacher may need to print information on each moon in question or provide books. Alternatively, teachers may allow students to look for information on their own using provided resources.
- Additional help understanding what a moon is.
- Freedom to explore whichever planet's moons they would like.
- To be given a specific planet's moon to study.
- To work in partnerships for additional support.

REAL-WORLD CONNECTIONS FOR STUDENTS

There are several real-world connections for students. Space exploration is a part of our past, present, and future. Space exploration is something that continues to be enhanced through technology and we are learning more about space each day. This lesson focuses on all that we have learned about moons and the data that we are still collecting in order to develop a deeper understanding of these celestial bodies. We also highlight space missions that were created by NASA scientists, engineers, and even astronauts. These are all careers that students could have in the future. This lesson focuses on NASA exploration, but could be adjusted to include different countries

that are exploring space.

POSSIBLE PRIOR or MISCONCEPTIONS

There is the potential for misconceptions. These could include:

- All moons in space look like Earth's moon.
- Only Earth has a moon.
- All planets have the same number of moons as Earth (one)
- You need to land on a moon in order to learn about it.
- Moons can be seen from the home planet.

LESSON PROCEDURE

5E	Details of 5E Lesson Implementation *(Visit BSCS to learn more about the 5E instructional model)*
Engage	**Lesson Objective** *Students will be able to recognize the Earth's moon and other planets moons.* **Standards Addressed** ESS1.A: The Universe and Its Stars ESS1.B: Earth and the Solar System Systems and System Models **Materials & Resources** Projector, Computer **Procedure:** At this phase, the teacher is working to "hook" class. Teacher: Imagine that you are standing on a moon in space. What does it look like? What does it feel like? What is it made of? How long did it take you to get there? Show a picture of Earth's moon and ask: • What are you looking at? What is this? How did we get this photo? Show a picture of one of Saturn's moons and ask: • What are you looking at? What is this? How did we get this photo? Show a picture of one of Jupiter's moons and ask: • What are you looking at? What is this? How did we get this photo? Explain that these are all moons that belong to different planets. Have students turn and talk to a partner and discuss why these moons look similar or different. Teacher: Which planet has the most moons? Receive all guesses and play video. Video Link

	Formative/Summative Assessments Teacher should be calling on a variety of different students and not worrying about "wrong" answers. At this stage, teacher should be concerned about encouraging participation. Teacher should be circulating during turn/talk time, monitoring for understanding. **Modifications** You may need to tell students that these are real images taken of the moons.

Explore	**Lesson Objective**
	• Students will be able to understand key characteristics of Earth's moon and other moons in our solar system.
	• Students will be able to research using NASA mission data (e.g., Juno, Cassini) to gather information on moons of different planets.
	Standards Addressed
	5-ESS1-1. Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth.
	
	ESS1.B: Earth and the Solar System
	
	Planning and Carrying Out Investigations
	
	Analyzing and Interpreting Data
	
	5.W.3.7: Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.
	
	Materials & Resources
	• Computers
	• Internet sites for researching
	  ○ Link to Saturn moons website
	  ○ Link to Jupiter moons website
	  ○ Link to Earth moons website
	• Data set on certain moons (optional)
	
	Procedure:
	During this phase, students will begin doing guided research. For this age level, it is best to place students into small groups then assign each group a moon to research. The suggested groups are:
	• Earth's moon
	• Europa
	• Titan
	• Enceladus

	• Ganymede • Callisto • Io • Europa Each group is responsible for finding the following information on their moon: • Size of the moon • Composition, what is it made of? • Distance from the planet it is orbiting • Physical features of the moon (are there craters? Is there ice? What color is it?) • How did we discover information on this moon? Was there a NASA mission that helped us get this information? • How is your moon different from Earth's moon? While students are working in their groups, monitor for on-task behavior and consistent researching. Make sure to guide students to use the provided websites to find information, assisting to locate data where needed. **Formative/Summative Assessments** You will assess during this phase during quick group check-ins. Skim written research for any incorrect information. **Modifications** During this phase, make sure that students are understanding that their technology is to be used for researching purposes. Also, make sure that students understand that all group members should be working together. Teacher may modify this stage for higher or lower learners. • You may allow students to explore different planets and their moons. • You may provide more or less resources for students to locate data. • You may ask students to search for more or less depending on the grade level.
Explain	**Lesson Objective** • Students will be able to present their findings in a clear, accurate, and creative way. • Students will be able to prove the importance of space exploration and how it aids in our understanding of the solar system. **Standards Addressed** ESS1.B: Earth and the Solar System Obtaining, Evaluating, and Communicating Information 5.SL.1.4: Report on a topic or text, present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace. 5.SL.2.5: Include multimedia components (e.g., graphics, sound) and

	visual displays in presentations when appropriate to enhance the development of main ideas or themes. **Materials & Resources** • Art materials (Let students decide what their presentation will look like based on materials available. Common presentation materials may include poster board, construction paper, tri-fold board, etc.) • Computers **Procedure:** During this phase, students will present their moon research to the class. Allow students to choose how to present their findings and allow for a variety of different types of presentations. Some examples include: Powerpoints, Google Slides, Canva, poster board, video, infographic) Make sure that students highlight the comparison of their moon to Earth's moon. Teacher should be actively involved while students are presenting, interjecting important information and correcting information if needed. **Formative/Summative Assessments** Provide students with a checklist so you can ensure they are incorporating all required research information into their project. That includes: • Size of the moon • Composition, what is it made of? • Distance from the planet it is orbiting • Physical features of the moon (are there craters? Is there ice? What color is it?) • How did we discover information on this moon? Was there a NASA mission that helped us get this information? Watch student presentations and check for accurate information. **Modifications** During this phase, make sure that students in audience are paying attention and are understanding the information from other groups. Teacher may modify this stage for higher or lower learners.

Elaborate	**Lesson Objective** • Students will be able to present their findings in a clear, accurate, and creative way. • Students will be able to compare Earth's moon with moons from other planets, using characteristics like size, physical features, distance from the home planet, and NASA missions involved in their discovery. • Students will be able to prove the importance of space exploration and how it aids in our understanding of the solar system. **Standards Addressed** 5.RI.1.3: Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a scientific text based on specific information in the text. ESS1.B: Earth and the Solar System Analyzing and Interpreting Data Developing and using models Obtaining, Evaluating, and Communicating Information **Materials & Resources** • Art materials (Let students decide what their comparison project will look like based on materials available. Common materials may include poster board, construction paper, tri-fold board, etc.) • Computers **Procedure:** During this phase, students will now take their knowledge of the moons discussed in the presentations to compare Earth's moon with at least 2 other moons in space. Like before, allow students to choose how to present their findings and allow for a variety of different types of presentations. Some examples include: Venn Diagram, a 3D model, essay or written report, Powerpoints, Google Slides, Canva, poster board, video, infographic) Display research presentations around the room so students can easily reference the information that they learned from their classmates. Make sure that students highlight the comparison of their moon to Earth's moon. Teacher should be actively involved while students are creating their comparison project, interjecting important information and correcting information if needed. **Formative/Summative Assessments** Make sure students are comparing the researched data, such as:

	• Size of the moon • Composition, what is it made of? • Distance from the planet it is orbiting • Physical features of the moon (are there craters? Is there ice? What color is it?) • How did we discover information on this moon? Was there a NASA mission that helped us get this information? • How is your moon different from Earth's moon? Watch student presentations and check for accurate information. **Modifications** Teacher may modify this stage for higher or lower learners. One suggestion would be to do the comparison together as a class.
Evaluate	**Lesson Objective** • Students will be able to recognize the Earth's moon and other planets moons. • Students will be able to understand key characteristics of Earth's moon and other moons in our solar system. • Students will be able to research using NASA mission data (e.g., Juno, Cassini) to gather information on moons of different planets. • Students will be able to present their findings in a clear, accurate, and creative way. • Students will be able to compare Earth's moon with moons from other planets, using characteristics like size, physical features, distance from the home planet, and NASA missions involved in their discovery. • Students will be able to prove the importance of space exploration and how it aids in our understanding of the solar system. **Standards Addressed** Obtaining, Evaluating, and Communicating Information 5.SL.1.4: Report on a topic or text, present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace. **Materials & Resources** • Checklist of included information • Paper or computer (for reflection) **Procedure:** During this phase, teacher will evaluate how successful each group was on their research presentation and their creative comparison project. At this grade level, that should be a simple checklist of if they included the required information and if it was accurate. Next, have students write a reflection on what they learned about Earth's moon compared to other

	moons and why space exploration is important to continue. **Formative/Summative Assessments** Make sure students are comparing the researched data, such as: • Size of the moon • Composition, what is it made of? • Distance from the planet it is orbiting • Physical features of the moon (are there craters? Is there ice? What color is it?) • How did we discover information on this moon? Was there a NASA mission that helped us get this information? • How is your moon different from Earth's moon? **Modifications** Teacher may modify this stage for higher or lower learners by making the grading more or less.

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