

ATMOSPHERES & LUNAR ROVERS EXPLORATION

Teachers Guide

The Atmospheres and Lunar Rovers Exploration Lesson is part of the Rover Driving Academy Program which provides students with the ability to become part of a lunar research team, operating a remote rover to explore a simulated lunar landscape, investigate areas of interest, and identify lunar features.









ABOUT THE PROGRAM

The Rover Driving Academy Program is a captivating educational program specifically designed for students in grades 6-9. It offers an in-depth exploration of lunar science and space missions, covering a variety of exciting topics such as lunar geology, crater formation, lunar phases, tidal locking, space travel, lunar landings, and rover operations. The program consists of multiple lessons, each with a distinct theme, allowing students to gain a comprehensive understanding of these subjects. The highlight of the Rover Driving Academy is the opportunity for students to actively participate in a learning experience where they become part of a team that operates a real lunar rover in a simulated lunar environment.

LESSON PLAN - ATMOSPHERES AND LUNAR ROVERS EXPLORATION

Grades 6-9 Approximately 1 hour

Discover the synergy between Earth's and the Moon's atmospheres and their impact on lunar rovers. Designed for grades 6-9, this 1-hour session explores atmospheric layers, lunar phases' significance, and rover challenges.

LEARNING OUTCOMES

- Understand the key components and functions of Earth's atmosphere and the Moon's lack of atmosphere.
- Explore the impact of atmospheres on the operation of lunar rovers.
- Recognize the significance of diverse perspectives in space exploration.

INTRODUCTION – 5 MINS

• Introduce the topic of Earth's and the Moon's lack of atmosphere.

EARTH'S ATMOSPHERE – 8 MINS

- Explain the atmospheric layers of Earth.
- Discuss the unique characteristics of each layer and their relevance in space exploration.

MOON'S LACK OF ATMOSPHERE - 8 MINS

- Explain the Moon's lack of atmosphere.
- Discuss the unique characteristics of the lack of atmosphere on the Moon.

ROVER IMPACT – 8 mins

 Discuss - How does the lack of atmosphere impact operations of a rover on the Moon?

GROUP ACTIVITY - 30 MINS

- Divide participants into small groups, assigning each group a specific atmospheric layer to research.
- In their groups, students will create a presentation highlighting their assigned atmospheric layer and its connection to lunar rover mission planning.

DISCUSSION – 5 MINS

WRAP UP - 5 MINS



INTRODUCTION – 5 MINS

Introduction to Earth's Atmosphere and the Moon:

- Earth is surrounded by invisible layers called atmospheres that impact the air we breathe, the weather we experience, and the levels of radiation and paths of materials from space to Earth's surface.
- The Moon, unlike Earth, lacks these protective layers, making it a challenging yet fascinating destination for exploration, particularly for lunar rovers.

Purpose of Understanding Atmospheres:

- Understanding atmospheres is crucial for comprehending how lunar rovers function.
- The absence or presence of an atmosphere significantly influences the movement and communication of lunar rovers on the Moon's surface.

Goals for Today's Lesson:

- 1. Understanding Earth's Atmosphere:
 - Explore the composition of Earth's atmosphere, the layers surrounding the planet, and their role in maintaining suitable conditions for life.
- 2. Exploring the Moon's Unique Conditions:
 - Investigate the Moon's distinct lack of atmosphere and its implications for lunar exploration.
- 3. Connecting Atmospheres and Lunar Rovers:
 - Establish a connection between Earth's atmosphere, the Moon's absence of atmosphere, and the operational challenges faced by lunar rovers.
- 4. Highlighting the Importance:
 - Discuss the significance of considering atmospheres in mission planning for scientists, engineers, and space explorers.





	LEARNING OBJECTIVES
	Understanding Earth's Atmosphere Exploring the Moon's Unique Conditions Connecting Atmospheres and Lunar Rovers Highlight the Importance of All of It
MISSION CONTROL	

INTRODUCTION – 5 MINS

Conclusion:

By the end of the lesson, students are expected to understand Earth's atmosphere, the unique conditions of the Moon, and the crucial role atmospheres play in the operation of lunar rovers.



EARTH'S ATMOSPHERE - 8 MINS

- Troposphere:
 - Closest to Earth's surface, where weather occurs.
 - Essential for human survival, containing breathable air.
 - Challenges in space exploration due to weather and turbulence during launches.
- Stratosphere:
 - Contains the ozone layer, absorbing harmful UV radiation.
 - Crucial for managing UV exposure in space missions.
- Mesosphere:
 - Extreme cold temperatures.
 - Role in meteor disintegration, not directly relevant to lunar exploration.

EARTH'S ATMOSPHERE – 8 MINS

- Thermosphere:
 - ISS orbits here; low air density, high temperatures.
 - Challenges for spacecraft reentry, requiring heat shields.
- Exosphere:
 - Outermost layer transitioning into space.
 - Sparse gas particles; satellites and spacecraft orbit here.





MOON'S LACK OF ATMOSPHERE – 8 MINS

- Vacuum:
 - Moon's surface is a vacuum; no air or atmospheric pressure.
 - Humans can't breathe; sound doesn't travel.
 - How does this influence transmission of commands to rover vehicles?
- Extreme Temperatures:
 - No atmosphere to trap heat, leading to extreme temperature variations.
 - Daytime temperatures over 100°C; nighttime temperatures around -150°C; that means the rover's components are subjected to a lot of change.
- No Weather:
 - Absence of weather phenomena like clouds, rain, or storms.
 - Stable environment for lunar missions; challenges for resource generation.
- No Protection:
 - Lack of atmospheric shielding exposes the Moon to solar and cosmic radiation.
 - Lunar rovers and equipment must withstand radiation exposure.
- Dusty Surface:
 - Covered in lunar regolith (dust and small rocks).
 - Affects rover mobility and equipment function.

MISSION CONTROL





ROVER IMPACT – 8 mins

• Discuss - What impact does the lack of atmosphere have on operating a lunar rover on the Moon?





GROUP ACTIVITY – 30 MINS

- Divide participants into small groups, assigning each group a specific atmospheric layer to research.
- In their groups, students will create a presentation highlighting their assigned atmospheric layer and its potential relevance to lunar rovers.

Step 1: Group Formation

Begin by organizing the participants into smaller groups. Depending on the size of your class or participants, you can create groups of 3-5 students each. Ensure that there's a diverse mix of students in each group to encourage collaboration and diverse perspectives.

Step 2: Assign Specific Atmospheric Layers

Explain to the groups that they will be researching different atmospheric layers. These layers exist in Earth's atmosphere, and each group will focus on one of them.

You can assign specific layers such as the troposphere, stratosphere, mesosphere, thermosphere, and exosphere. These layers are organized based on altitude, and each has unique characteristics.

Step 3: Provide Research Materials

Equip each group with the provided research materials that explain the properties and significance of their assigned atmospheric layer.

Ensure that each group has access to the materials that highlight the key properties and impacts of their assigned layer on Earth and space exploration.

Step 4: Guidance and Research

Encourage the groups to dive into their research. They should explore the specific properties of their atmospheric layer, such as temperature, composition, and characteristics of any unique phenomena that occur in that layer.

Emphasize that they should also investigate how their assigned atmospheric layer impacts space exploration, including any challenges or advantages it presents.

Step 5: Presentation Preparation

Instruct each group to prepare a presentation based on their research findings. The presentation should be concise and informative, highlighting the most important aspects of their atmospheric layer and its relevance to space exploration, especially lunar rover missions.

Step 6: Presentation Delivery

Allow each group a designated time to present their findings to the rest of the class. This can include explanations, visuals, and any interesting facts they've discovered during their research.

Encourage group members to engage with questions and discussions from their peers after their presentations.

Step 7: Group Discussion

After all groups have presented, facilitate a group discussion. Encourage students to compare and contrast the different atmospheric layers and their roles in space exploration.

Highlight the interconnectedness of these layers in Earth's atmosphere and how they collectively influence our planet's environment.







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DISCUSSION – 5 MINS

WRAP UP - 5 MINS





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