



# Investigating Mars with NASA's Curiosity Rover Data

Grade: 8

Lesson Duration: 45 Minutes

Course Name(s): Earth Science

Lesson Author: Scott Peterson, Mamaroneck, NY

## BIG IDEAS

Students will use real data from NASA's Curiosity Rover and Viking Orbiter missions to explore the geology and climate of Mars, examining the rover's discoveries and understanding Mars' potential to have supported water or life.

## EDUCATION STANDARDS

Science Performance Expectations (or state Science standard):

**MS-ESS1-3:** Analyze and interpret data to determine scale properties of objects in the solar system.

**MS-ESS2-2:** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

<p>Science and Engineering Practices</p> <p><b>Constructing Explanations and Designing Solutions</b></p> <p>Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.</p> <ul style="list-style-type: none"> <li>Construct a scientific explanation based on valid and reliable evidence</li> </ul>	<p>Disciplinary Core Ideas</p> <p><b>ESS2.A: Earth's Materials and Systems</b></p> <ul style="list-style-type: none"> <li>The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future.</li> </ul>	<p>Crosscutting Concepts</p> <p><b>Scale Proportion and Quantity</b></p> <ul style="list-style-type: none"> <li>Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.</li> </ul>
--	---	---

<p>obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe nature operate today as they did in the past and will continue to do so in the future.</p>	<p><b>ESS2.C: The Roles of Water in Earth's Surface Processes</b></p> <ul style="list-style-type: none"> <li>Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations.</li> </ul>	
<p><b>ELA/Literacy -</b>  <b>RST.6-8.1</b>  Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS2-2)  <b>WHST.6-8.2</b>  Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS2-2)  <b>SL.8.5 -</b> Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS2-2)</p> <p><b>Mathematics -</b>  <b>MP.2</b> Reason abstractly and quantitatively. (MS-ESS2-2)  <b>6.EE.B.6</b>  Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS2-2)  <b>7.EE.B.4</b>  Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS2-2)</p>		

## MEASURABLE STUDENT LEARNING OBJECTIVES

Students will be able to analyze and interpret data from NASA's Curiosity Rover mission to describe the geological features and atmosphere of Mars.

Students will compare the climate of Mars to Earth, explaining the potential for water and life on Mars based on real data.

## MATERIALS NEEDED

Computers or tablets with internet access  
NASA's Curiosity Rover data (Provided)

Projector/Smartboard  
Student handouts with guided questions

## ENGAGING CONTEXT/PHENOMENON

The lesson will start with a brief video from Curiosity's mission, showcasing Mars' landscape and Gale Crater. Students will discuss what they know about Mars and its exploration. The phenomenon centers around understanding how Mars' landscape and Atmosphere informs scientists about its potential to have supported life.

## DATA INTEGRATION

Students will use real data from NASA's Curiosity Rover, including atmospheric composition, physical features, and the presence of ice caps, to analyze Mars' geological history and climate. They will interpret this data to hypothesize about Mars' ability to support life.

## TEACHER BACKGROUND KNOWLEDGE

Teachers should have a basic understanding of NASA's Curiosity mission, the geological processes on Mars, and how to navigate the Mars Exploration Program's data. Familiarity with key scientific terms related to planetary geology is essential.

## DIFFERENTIATION OF INSTRUCTION

**For advanced students:** Provide additional data on methane levels and the significance of organic molecules.

**For students needing support:** Offer a simplified version of the data and provide additional guidance during the exploration phase.

## REAL-WORLD CONNECTIONS FOR STUDENTS

This lesson connects space exploration to the broader understanding of life beyond Earth. The ongoing search for water and life on Mars aligns with real-world efforts to discover habitable planets, and Curiosity's mission exemplifies the collaboration between scientists and engineers to achieve this goal.

## POSSIBLE PRIOR or MISCONCEPTIONS

Students may believe that Mars is too cold and barren to have ever supported life.

They might assume that the presence of water automatically means life existed on Mars.

## LESSON PROCEDURE

5E	Details of 5E Lesson Implementation (Visit <a href="#">BSCS</a> to learn more about the 5E instructional model)
<b><u>Engage</u></b>	<p><b>Lesson Objective:</b> Students will be able to analyze and interpret data from NASA's Curiosity Rover mission to describe the geological features of Mars.</p> <p><b>Standards Addressed:</b> MS-ESS1-3</p> <p><b>Materials &amp; Resources:</b> <a href="#">Video from NASA's Curiosity mission</a></p> <p><b>Procedure:</b> Show a video or image of Mars from Curiosity's mission. Ask students to brainstorm what they think the rover is looking for on Mars. Discuss the significance of finding water on another planet.</p> <p><b>Formative Assessment:</b> Assess prior knowledge based on student responses.</p> <p><b>Modifications:</b> Provide closed captioning and descriptions from the video and simplified explanations for students who may need them.</p>
<b><u>Explore</u></b>	<p><b>Lesson Objective:</b> Students will compare the surface features of Mars to Earth, explaining the potential for water and life on Mars based on images captured by Curiosity.</p> <p><b>Standards Addressed:</b> MS-ESS1-3</p> <p><b>Materials &amp; Resources:</b> NASA images, <a href="#">Student worksheet</a></p> <p><b>Procedure:</b> Students compare Mars' landscape to Earth, discussing similarities and differences. They hypothesize what Mars' geological features suggest about its potential to support life.</p> <p><b>Summative Assessment:</b> Completed worksheets with comparisons and hypotheses.</p> <p><b>Modifications:</b> Provide sentence starters or examples to guide students in forming their hypotheses.</p>

<p><b><u>Explain</u></b></p>	<p><b>Lesson Objective:</b> Students will compare photographs taken by NASA's Curiosity Rover on Mars with photographs of Earth to explain the potential for water and life on Mars based on their observations.</p> <p><b>Standards Addressed:</b> MS-ESS2-2</p> <p><b>Materials &amp; Resources:</b> <a href="#">Student worksheet</a></p> <p><b>Procedure:</b> Students share their findings in a class discussion, focusing on the presence of clouds. Discuss how this informs scientists about Mars' climate and whether or not life could be supported.</p> <p><b>Formative Assessment:</b> Evaluate student participation in discussion and claim with supporting evidence from the photographs.</p> <p><b>Modifications:</b> Allow students who struggle with speaking to write down their explanations or present in small groups.</p>
<p><b><u>Elaborate</u></b></p>	<p><b>Lesson Objective:</b> Students will compare the atmospheric composition of Mars to Earth, in order to make a claim for the potential for water and life on Mars based on real data.</p> <p><b>Standards Addressed:</b> MS-ESS1-3, MS-ESS2-2</p> <p><b>Materials &amp; Resources:</b> <a href="#">NASA's Curiosity Rover data</a></p> <p><b>Procedure:</b> Students will work in pairs to analyze Mars' atmospheric data and compare it with Earth's atmospheric data, and atmospheric measurements.</p> <p><b>Formative Assessment:</b> Worksheets with observations and responses.</p> <p><b>Modifications:</b> Simplify tasks for students who need extra guidance and offer support through paired work.</p>
<p><b><u>Evaluate</u></b></p>	<p><b>Lesson Objective:</b> Students will compare the ice caps of Mars to Earth, explaining the potential for water and life on Mars based on observations.</p> <p><b>Standards Addressed:</b> MS-ESS2-2</p> <p><b>Materials &amp; Resources:</b> <a href="#">Student worksheet</a></p> <p><b>Procedure:</b> Students write a paragraph explaining how the presence of water could have supported life on Mars and the importance of Curiosity's mission and how its data has expanded our understanding of Mars.</p> <p><b>Summative Assessment:</b> Reflection paragraphs and participation in class discussions.</p> <p><b>Modifications:</b> Provide graphic organizers or prompts for students who need additional help structuring their reflections.</p>

## REFERENCES

*NASA. (n.d.). Mars Science Laboratory – Curiosity rover. NASA Science.*  
<https://science.nasa.gov/mission/msl-curiosity/>

*NASA. (2019, November 12). With Mars methane mystery unsolved, Curiosity serves scientists a new one: Oxygen. NASA.*  
[https://www.nasa.gov/missions/with-mars-methane-mystery-unsolved-curiosity-serves-scientists-a-new-one-oxygen/#:~:text=The%20results%20SAM%20spit%20out,%25%20carbon%20monoxide%20\(CO\).](https://www.nasa.gov/missions/with-mars-methane-mystery-unsolved-curiosity-serves-scientists-a-new-one-oxygen/#:~:text=The%20results%20SAM%20spit%20out,%25%20carbon%20monoxide%20(CO).)

*Next Generation Science Standards. (n.d.). Next generation science standards.*  
<https://www.nextgenscience.org/>