



Living on Mars

Grade 7

Middle School Science
Anne Williard, New York, NY

BIG IDEAS

- Students will use excerpts from *The Martian* and NASA data to explore what it would be like for humans to live and grow food on Mars. Students research, plan, and present aspects of a crewed mission to Mars.

EDUCATION STANDARDS

NGSS Performance Expectation(s)

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
<p>Analyzing and Interpreting Data</p> <p>Analyze and interpret data to determine similarities and differences in findings.</p>	<p>ESS1.B: Earth and the Solar System</p> <p>The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.</p>	<p>Scale, Proportion, and Quantity</p> <p>Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.</p>
<p>Obtaining, Evaluating, and Communicating</p>	<p>MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.</p>	<p>Cause and Effect</p> <p>Cause and effect</p>

<p>Information</p> <p>Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-LS4-5)</p>		<p>relationships may be used to predict phenomena in natural systems. (MS-LS3-2)</p>
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ELA Standards:

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-3)

WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS1-5)

Math Standards:

MP.2 Reason abstractly and quantitatively. (MS-ESS1-3)

MEASURABLE STUDENT LEARNING OBJECTIVES

- SWBAT use a science fiction text to explore life and agriculture on another planet.
- SWBAT compare Mars and Earth.
- SWBAT explain how life in space affects the human body.
- SWBAT research, plan, and present aspects of a manned mission to Mars.

MATERIALS NEEDED

- Copies of *The Martian* and or scanned excerpts
 - [Student guide / note catcher](#) for watching *The Martian*
- Optional: potatoes, soil, plant pots

ENGAGING CONTEXT/PHENOMENON

Students may be familiar with the 2015 film *The Martian*, based on the 2011 novel of the same name by Andy Weir. In the film and the novel, astronaut Mark Watney is stranded on Mars and has to use his ingenuity and knowledge of science to survive. In one memorable sequence, he uses his training in botany to grow potatoes.

DATA INTEGRATION

NASA data will help students understand how the conditions on Mars affect the ability of Earth plants such as potatoes to grow there. NASA data will also help students understand how the long journey to Mars and time on the Red Planet would have affected Mark Watney's body.

- [NASA Life Sciences Portal](#)
- [NASA Mars](#)

TEACHER BACKGROUND KNOWLEDGE

Teachers should have a [basic familiarity with *The Martian*](#) (click the link for LitCharts summary). Teachers should also have an awareness of the basic needs of plants (soil, water, and sunlight), as [this Twinkl video explains](#). NASA also did a great study with astronauts (and twins!) Mark Kelly and Scott Kelly which demonstrated ways in which extended time in space affects the body; this [NASA video from 2019](#) explains more.

DIFFERENTIATION OF INSTRUCTION

- Present information in multiple modalities (ex: videos and images, hands-on experiments, text)
- Chunking texts or presenting videos with pause points
- Sentence starters, guided (fill in the blanks) notes
- Glossary in English and the student's home language for multilingual learners

REAL-WORLD CONNECTIONS FOR STUDENTS

Knowledge of how organisms (both plants and humans!) respond to life in space can help us better understand how they work on Earth.

POSSIBLE PRIOR or MISCONCEPTIONS

- There definitely is (or definitely is not) life outside of Earth
- Space travel and spending time in space are low-risk activities for the human body
- Mars is “Earth’s twin”--the two planets are very similar

LESSON PROCEDURE

5E	Details of 5E Lesson Implementation
<p><u>Engage</u></p> <p>Anchoring phenomena:</p> <p>Growing potatoes on Mars</p>	<p>Procedure:</p> <ol style="list-style-type: none"> 1. Gather student responses about life on other planets, specifically Mars. What do living things need to survive? Does Mars have those things? 2. Show clips from <i>The Martian</i> (Watney is stranded on Mars and Watney grows potatoes). 3. Students discuss: do you think Mark Watney’s Martian agriculture is scientifically accurate? <p>Modifications:</p> <ul style="list-style-type: none"> • Subtitles / closed captions turned on for the film • Sentence starters or bullet points to help students respond to the questions in the video guide. <p>Standards Addressed:</p> <p>MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.</p> <p>Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS3-2)</p> <p>Formative/Summative Assessments:</p> <ul style="list-style-type: none"> • Students use evidence, reasoning, and prior knowledge to draw conclusions about whether growing potatoes on Mars

	<p>could be completely science fiction, some day science fact, or a bit of both.</p> <p>Resources:</p> <ul style="list-style-type: none"> ● Student guide / note catcher for watching <i>The Martian</i> ● <i>The Martian (2015)</i> - available on most streaming services and many public libraries
<p><u>Explore</u></p> <p>What do potatoes need to grow?</p>	<p>Procedure:</p> <ol style="list-style-type: none"> 1. Students discuss - what do plants need to survive? Could plants get the food, water, and sunlight they need on Mars? 2. Students gather more information by reading a NASA article, “Growing Plants in Space.” Students compare and contrast different methods such as Veggie, Advanced Plant Habitat, and Biological Research in Canisters. 3. Optional: Students use starter potatoes, toothpicks, and water to plant potatoes. This YouTube video from SciShow Kids has more directions and explains the process. 4. More information can be found in this article, “Growing Potatoes in a Home Garden” from University of Maryland Extension. <p>Modifications:</p> <ul style="list-style-type: none"> ● If time is limited, teacher can demonstrate potato planting using pre-prepared spuds or play the video to show how potatoes would be grown ● Adapt the NASA article text to suit the reading level of students (free LLMs such as Claude.AI can help with this; paid tools like Lexile Analyzer can also be useful) <p>Standards Addressed:</p> <p>RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-3)</p> <p>MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.</p>

	<p>Formative/Summative Assessments:</p> <ul style="list-style-type: none"> ● Students are able to explain the basic needs of plants ● Students are able to compare different ways NASA scientists grow plants in space <p>Resources</p> <ul style="list-style-type: none"> ● “Growing Plants in Space.” from NASA ● Grow Your Own Potatoes from SciShow Kids ● “Growing Potatoes in a Home Garden” from University of Maryland Extension.
<p><u>Explain</u></p> <p>Comparing Mars and Earth</p>	<p>Procedure:</p> <ol style="list-style-type: none"> 1. Students explore Mars Facts from NASA to learn more about the fourth planet in our Solar System. 2. Students compare Mars and Earth through the lens of the needs of plants and people: sunlight, oxygen, soil, and temperature. 3. Students revisit their earlier claims from the Engage phase of the lesson. Could Martian potatoes be science fiction or science fact? More information about “space spuds” can also be found in this video from the International Potato Center (CIP). <p>Modifications:</p> <ul style="list-style-type: none"> ● Chunking text or playing the video with pause points ● Multilingual glossary <p>Standards Addressed:</p> <p>Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-LS4-5)</p> <p>Formative/Summative Assessments:</p> <ul style="list-style-type: none"> ● Students determine similarities and differences between

	<p style="text-align: center;">Mars and Earth</p> <p>Resources:</p> <ul style="list-style-type: none"> ● Mars Facts from NASA ● Can potatoes really grow on Mars from the International Potato Center (CIP) on YouTube
<p><u>Elaborate</u></p> <p>How does space travel affect the human body?</p>	<p>Procedure:</p> <ol style="list-style-type: none"> 1. Students discuss: how is life in Space (or on another planet) very different compared to life on earth? Responses may include: there is less gravity, greater exposure to harmful radiation, you have to bring all of your food and supplies with you, etc. 2. Students watch the NASA Youtube video Living and Working in Space: Twins Study and discuss: how can NASA and other space agencies use the knowledge gained from this mission? What do you still want to know? 3. Students use NASA's Living in Space resource to explore different aspects of space life: food, health, exercise, gardening, hazards, and how all of this research could help humans eventually live on Mars. 4. Students select a focus area. <p>Modifications:</p> <ul style="list-style-type: none"> ● Chunking text or playing the video with pause points ● Multilingual glossary ● Leveling text as needed using free LLMs such as Claude.AI or paid tools like Lexile Analyzer <p>Standards Addressed:</p> <p>Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS3-2)</p> <p>ESS1.B: Earth and the Solar System - The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.</p>

	<p>Formative/Summative Assessments:</p> <ul style="list-style-type: none"> • Students can produce a brief summary of a text distinct from prior knowledge or opinion <p>Resources:</p> <ul style="list-style-type: none"> • Living and Working in Space: Twins Study - NASA • Living in Space - NASA
<p>-</p> <p><u>Evaluate</u></p> <p>Planning for a Mars mission</p>	<p>Procedure:</p> <ol style="list-style-type: none"> 1. Students choose an aspect of a Mars mission to focus on: food, crew selection, getting there (travelling to Mars), in flight, on arrival (terraforming / surviving on the surface of Mars), communications (between Mars and Earth), and preparing for the worst. Additional topics of interest may be chosen by the teacher and students. 2. Students will research and prepare a briefing for “Congress” (the class) about aspects of a Mars mission. This outline includes possible questions to frame student research. 3. If time permits, students revise their presentations in response to clarifying and probing questions from the class. <p>Modifications:</p> <ul style="list-style-type: none"> • Provide a “dossier” (hard copy or online folder) of appropriate resources for students to use in their research • Students may use the CRAAP test to rate any sources they find through their own Internet or library searches • Pre-screen clarifying and probing feedback to help groups select the most actionable questions to respond to. <p>Standards Addressed:</p> <p>WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS1-5)</p> <p>Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and</p>

	<p>methods used, and describe how they are supported or not supported by evidence. (MS-LS4-5)</p> <p>MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.</p> <p>ESS1.B: Earth and the Solar System - The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.</p> <p>Formative/Summative Assessments:</p> <ul style="list-style-type: none"> ● Student research and notetaking ● Presentations ● Revisions <p>Resources:</p> <ul style="list-style-type: none"> ● Mission briefing - questions to frame student research ● CRAAP test ● clarifying and probing questions
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REFERENCES

- CIP International Potato Center. (n.d.). *Potatoes on Mars with NASA*. Annual Report 2016. <https://cipotato.org/annualreport2016/stories/mars-potatoes/>
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- NASA. (2024, November 21). Living in space. NASA. <https://www.nasa.gov/humans-in-space/living-in-space/>
- Weir, A. (2016). *The Martian: Classroom edition*. Ballantine Books.