

BOOK STATS

GRADE LEVEL EQUIVALENT: 4-6

AGES: 10-12

LEXILE MEASURE: 760L

GUIDED READING LEVEL: W

PAGES: 48

GENRE: INFORMATIONAL SCIENCE BOOK

SUBJECT/THEME: MARS, SPACE, SCIENTISTS

Dear Teacher,
Mission: Mars is an engaging introduction to Mars exploration. This teaching guide highlights rich CCSS and STEM connections, and helps set the stage for a classroom full of thought-provoking discussions and exciting projects. Prepare your students for an out-of-this-world experience!

Teaching the Book with Common Core State Standards

COMMON CORE STATE STANDARDS	READING	WRITING	SPEAKING & LISTENING	LANGUAGE
GRADE 4	RI.4.1 RI.4.3 RI.4.4 RI.4.7	W.4.2 W.4.3	SL.4.1 SL.4.3 SL.4.4 SL.4.5	L.4.4 L.4.6
GRADE 5	RI.5.1 RI.5.3 RI.5.4 RI.5.7 RI.5.8	W.5.2 W.5.3	SL.5.1 SL.5.3 SL.5.4 SL.5.5	L.5.4 L.5.6
GRADE 6	RI.6.1 RI.6.3 RI.6.4 RI.6.7	W.6.2 W.6.3	SL.6.1 SL.6.3 SL.6.4 SL.6.5	L.6.4 L.6.6

STEM CONNECTIONS : See page 6 of this guide for related activities

SCIENCE	This book highlights what it takes to survive on Mars. Have students discover the challenges of Mars's climate, terrain, and more.
TECHNOLOGY AND ENGINEERING	Introduce students to the book's detailed diagrams, showcasing the latest in space innovations.
MATH	Book is filled with opportunities for students to calculate distances and weights of objects.

OVERVIEW Book Summary

Mission: Mars is more than just a book; it's an amazing journey of discovery for young readers who become recruits to join the greatest space mission of the century. Author Pascal Lee introduces himself as the Training Director for Future Mars Explorers, and he gears readers up for their basic training mission with fact-packed, high-tech information. Organized into the six phases of training—Discover Mars, Prepare for Launch, Navigate Space, Gear Up for Survival, Explore the Red Planet, and Plan a New World—the book delivers a payload of space science. The accessible, high-interest text accompanies a rich variety of diagrams, lists, maps, graphs, sidebars, illustrations, and technical drawings. The book's twenty-first-century format challenges young readers to think like scientists and to stretch their minds out into space—to Mars, our new frontier of exploration.

Look Ahead! Keep students excited about future missions to Mars.

2013 MAVEN

This NASA orbiter will obtain critical measurements of the Martian atmosphere to help understand dramatic climate change on the Red Planet over its history.

2016 EXOMARS ORBITER

The European Space Agency's ExoMars program is a series of missions designed to understand if life ever existed on Mars.

2016 INSIGHT LANDER

NASA's next mission will be a fixed lander that will study the interior of the Red Planet from its surface.

2020 ROVER MISSION

Building on the success of *Curiosity's* landing, NASA has announced plans for a new robotic science rover.

2035 MISSION

NASA's proposed plan for human exploration of Mars.

About the Author: Pascal Lee

Dr. Pascal Lee is internationally respected for his scientific work about Mars, Mars's moons, and asteroids, as well as for his visionary research advancing the human exploration of Mars. He is the cofounder and chairman of the Mars Institute, a planetary scientist at the SETI Institute, and director of the

NASA Haughton-Mars Project at NASA Ames Research Center. He holds an ME in Geology and Geophysics from the University of Paris, and a PhD in Astronomy and Space Sciences from Cornell University.

In addition to his space research, Pascal Lee is a helicopter pilot and instructor and an accomplished artist.

GET READY TO READ

Pre-Reading Activities

Mars: A Quick Quiz Engage students' interest and probe their knowledge base about Mars with the following true-or-false questions. Write the questions on chart paper or a whiteboard and read each aloud to students.

1. Mars is called the Purple Planet. (False)
2. Mars is the fourth planet from the Sun and Earth's neighbor in space. (True)
3. Mars is all land with no oceans or seas. (True)
4. The first human walked on Mars in 1969. (False)
5. Right now, a rover named *Curiosity* is exploring the surface of Mars. (True)

You may want to tally and record students' answers on chart paper or the whiteboard to return to after reading the book.

Countdown Provide students with a multimedia introduction to the book by going to

mars.jpl.nasa.gov/msl/multimedia/videos/index.cfm?v=34

Project the video that shows the countdown and launch of the *Curiosity* rover to Mars on November 26, 2011. Discuss with students what they noticed about the reporting of the scientist narrating the countdown.

Preview and Predict Ask students to preview page 3 of the book, which introduces students to the approach and contents of the book. Ask students to describe the role they will be playing as readers, how the book is divided, and who Pascal Lee is. Explain that most of the book is a factual explanation of a mission to Mars but, in places, Pascal Lee speaks directly to readers (for example, at the bottom of page 3 and the top of page 5).

Vocabulary

Science Domain-Specific Words Explain to students that a number of science words are set in bold type in the text and defined in the glossary on page 48. Ask students to watch for the words as they read the book. Encourage them to look for clues in the text around the words plus in the illustrations; then suggest that they check the meanings of any words they don't know in the glossary.

Big Question

Critical Thinking Ask students to think about this question as they read and be ready to answer it when they have finished the book. Write the question on chart paper or have students write it in their reading journals.

What do you think is the biggest challenge facing a human mission to Mars?

AS YOU READ

Reading the Book

Modeled Reading

Project pages 4-5 on a whiteboard to model for students how to approach the text and text features in the book. If you have the Storia version, you can plug it into a Smart Board. Begin by pointing out the heading at the top of page 4: Phase 1: Discover Mars. Explain that this is like a chapter heading. Read the message from Pascal Lee, the training director, at the top of page 5 next. Go on to read the first chunk of text, “Where’s Mars in Space?” and then connect the text with the illustration of the solar system. As you read the remaining text chunks on the spread, point out the illustrations that accompany them, making connections between the words and pictures.

Paired or Independent Reading Suggest that students read the book independently or with a partner. Chunk the book for them into the six phases in the table of contents. After reading each chunk, have students discuss their reactions and questions with a partner. Bring the class together to help them make connections in the text and between the text and illustrations.

Reading Informational Text: CCSS Focus

Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

Mission: Mars provides rich opportunities to support CCSS.ELA-Literacy.RI.

This scientific and technical text is full of relationships between events, ideas, and concepts that are either explicitly or implicitly stated. Guide students to identify the following relationships as they read the text: cause/effect, problem/solution, compare/contrast, and sequence of events.

For this book, focus in particular on the problem/solution relationships discussed in the text. Remind students that a problem/solution relationship is a connection between a challenge, or problem, and the way it is solved, or solution. Model for students how to identify the problem and solution in the text “Microbe Detective” on page 9.

Model: On page 9, the author explains how scientists might find tiny life-forms on Mars. He poses the problem as a question: “Might there be extremophiles hiding on Mars, too?” How might this problem be solved? The text states: “You need to check out places on Mars where there is, or once was, liquid water.” Later in the text, the author explains that in extreme climates on Earth, scientists have found microbes by splitting open rocks. Then he asks: “Would we find signs of life on Mars if we cracked open some rocks?”

As they read the book, ask students to find more examples of problem/solution relationships in the text. Some are explicitly stated, as on pages 18-19 in the discussion of radiation and microgravity under “Life Aboard Your Mars Ship.” Others are more implicit, as on pages 22-23 in the discussion of “Pit Stop at Phobos.”

AFTER YOU READ

Post-Reading Activities

Vocabulary Review

Discuss each vocabulary word with students in relation to the scientific theme of Mars exploration. Then duplicate and distribute Your Mars Mission: Crossword on page 7 of this guide. Ask students to complete the puzzle, referring to the glossary on page 48 for definitions as necessary.

Answer Key

ACROSS

- Extremophile
- Microbe
- Vapor
- Impact Crater
- Analog
- Gravity
- Lava
- Rover

DOWN

- Speed of Light
- Asteroid
- Comet
- Terraform
- Cargo
- Magma

Academic Discussion

Lead students in a discussion of these questions about the book.

1. Author's Purpose Give an example from the text of how the author informs the reader. (He explains the multistep operation of launching a human exploration of Mars.) Give an example of how he persuades the reader. (He encourages the reader to consider being a member of the exploration team.) Give an example of how he entertains the reader. (He uses clever headings like Phobos Phobia.)

2. Recognizing Relationships What is an example of a problem that Mars explorers would encounter, and how could it be solved? (Mars has sharp rocks. Wearing a pair of gaiters would help keep the pants on spacesuits from getting shredded by the rocks.)

3. Illustrations and Text Features Give an example of a drawing or diagram that helped you understand a concept described in the text. (Sample answer: The cutaway diagram of the inside of the Mars spaceship helped me visualize how people would live and work.)

Questions to Share

Encourage students to share their responses with a partner or small group.

1. Text-to-Self Which part of a journey to Mars would you find most challenging or scary? Would you volunteer for a mission?

2. Text-to-World How does the research that goes into preparing humans to go to Mars help contribute to society?

3. Text-to-Text Compare this book to another science book that you have read about space. How did they each help you understand difficult concepts?

Big Question

Critical Thinking Give each student an opportunity to answer the big question. Encourage students to support their answers with details and evidence from the text. Tell them there is more than one right answer.

What do you think is the biggest challenge facing a human mission to Mars?

Knowledge Across the Disciplines

Challenge your class with these extension and cross-curricular activities.

Text-Based Writing

Mars Explorer's Log Assign students to write a scientific log through the viewpoint of a mission member on a trip to Mars. They should base their writing on information from the *Mission: Mars* text. For example, they might write log entries describing the launch of their ship to Mars (pages 14-17); life aboard the Mars ship on the journey (pages 18-19); the landing on Mars (pages 24-25); or exploring the planet (pages 34-43). Encourage them to use as many scientific details as possible in their log. After completing the logs, have students compare their logs with a partner's log.

Speaking and Listening

Terraforming: the Debate Pascal Lee takes Mars exploration far into the future with a discussion of terraforming—transforming Mars into another Terra, another Earth. Is this a good idea for the future of the Red Planet? Or is it a bad idea made up by Earthlings who want Mars to be like their home? Ask students to choose a side of the debate and then develop arguments to support their stance. Encourage them to use evidence and facts from the text to back up their argument.

Geography

Mars Coordinates Ask students to use the Mars map on pages 34-35 to plot a course that visits each of the Seven Wonders of Mars. Challenge them to create the most efficient route through the Seven Wonders (bearing in mind that Mars is actually a globe), beginning and ending at the picture of the Mars rover at (G-H, 7). Direct them to list their route in order of stops, naming each of the wonders and its map coordinates. For students who want to learn more about the geography of Mars, suggest they go to this site to check out a map of Mars:

google.com/mars/

More exploration opportunities await at NASA's site. Students can enter the Mars Map Room and check out the Red Planet.

beamartian.jpl.nasa.gov/welcome

History

Space Exploration Time Line Encourage students to research the history of space exploration by constructing a time line of major space firsts and discoveries. Ask students to choose between ten to twelve highlights to feature in their time lines. If possible, have them create the timeline using technology and historical photographs. Here are two excellent websites for students to use to begin the project:

science.nationalgeographic.com/science/space/space-exploration-timeline/

and

npr.org/2011/01/26/4748778/timeline-american-space-program

STEM Connections

Use these activities to give students practice in STEM thinking and skills.

Science

What Will It Take to Live on Mars? To reinforce the concepts in *Mission: Mars* as well as other science concepts regarding Mars exploration, visit this site:

mars.jpl.nasa.gov/imagine/students/

NASA has gathered various activities and articles about Mars especially designed for students. The introductory slideshow, “What Will It Take to Live on Mars: Understanding Martian Resources and Environmental Constraints,” details the problems and challenges of exploring and living on the Red Planet.

Technology and Engineering

Delve into the Diagrams *Mission: Mars* is full of fascinating diagrams with detailed drawings of space engineering and technology. Ask partners to choose a diagram to study in depth. Options include:

- “Life Aboard Your Mars Ship” (pages 18-19) Ask students to identify the parts of the ship, their purpose, and how they solve problems of prolonged space travel.
- “Suit Up!” (pages 26-27) Ask students to identify each part of the illustration in relation to the text that describes it. Have them discuss the problems the various elements of the spacesuit solve.
- “Hab Sweet Hab” (pages 28-29) Ask students to identify the purpose of the “Hab” and then examine its parts and how they solve the problems of living on Mars.
- “Four-Wheeling on Mars!” and “The Mars Camper” (pages 30-33) Have students identify how each part of the vehicles helps explorers move about the planet and survive as they do it.

Math

Gravity on Mars Ask students to reread the information on page 6 about the relationship between weight on Earth and weight on Mars as a result of Mars’s reduced gravity. Then challenge them to create a chart of comparative weights of objects on Earth and on Mars. These might include objects that might be taken along on a Mars mission as well as their own weight. Check their math using this site:

nasa.gov/audience/forkids/kidsclub/text/clubhouse/Astro-Matic_3000.html

Navigation to Mars For advanced students, encourage them to read the article at the following site. It discusses how the NASA navigation team calculates a precise landing on Mars.

marsrovers.jpl.nasa.gov/spotlight/navTarget01.html

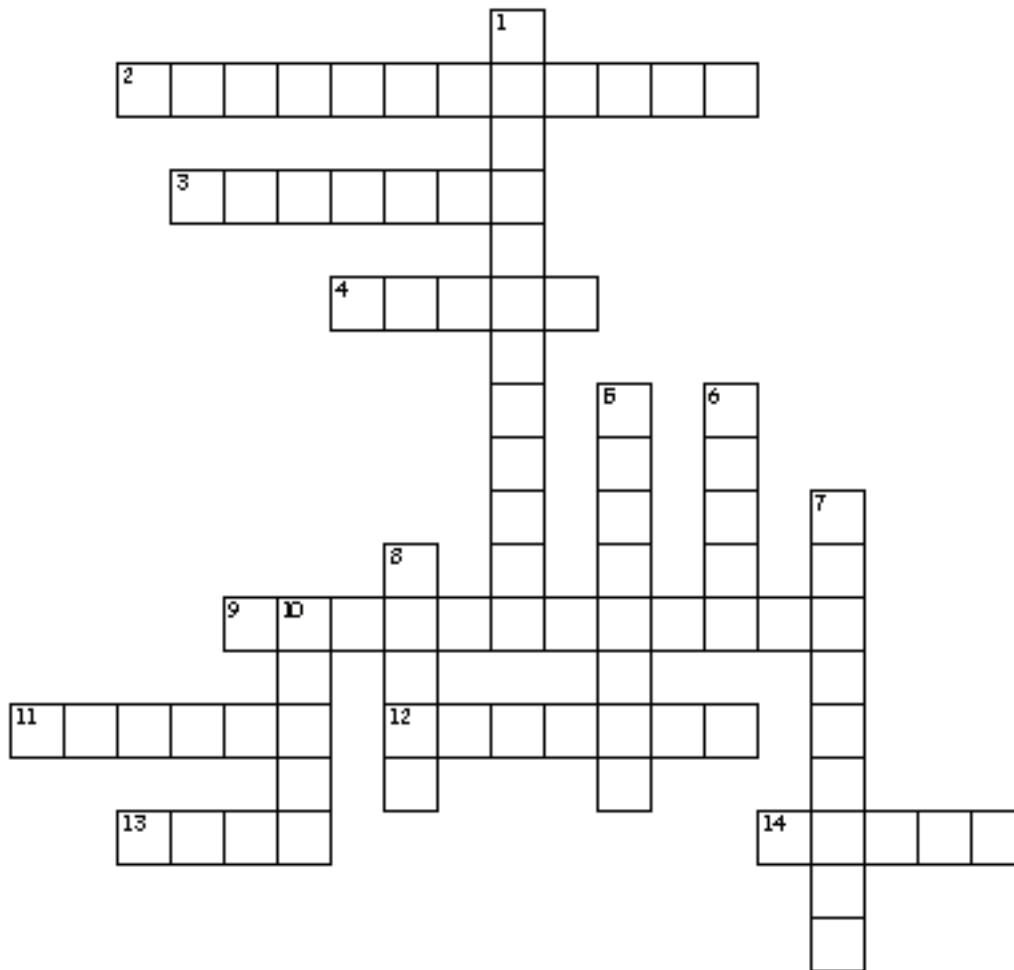
Big Activity

Your Mars Mission: Solve a Problem Problem Solved Challenge students to put together their problem-solving skills with the information they’ve learned about Mars. Explain that they will choose a problem or challenge regarding Mars exploration. Then they will create a tool or invention that will solve the problem. Duplicate and distribute page 8 of this guide. Go over the directions with students and clarify the assignment. When completed, have students post their STEM projects in the classroom, or present them to the class using technology.

Name: _____

YOUR MARS MISSION: CROSSWORD

Directions: Use the clues below to fill in the crossword puzzle.



Across

2. Microbe that thrives in environments that would be considered extreme for most other forms of life
3. Organism, or form of life, that is tiny
4. Gas phase of a substance
9. Bowl-shaped hole in the ground formed by an asteroid or a comet hitting a planetary body
11. Environment or site on Earth that is similar in some way to environmental conditions or sites on another planet
12. Force of attraction between two or several bodies
13. Melted rock that flows out of a volcano and onto the surface of a planetary body
14. Exploration vehicle that moves across the surface of a planetary body

Down

1. The fastest known speed in nature
5. Small rocky or metallic body that orbits the Sun
6. Dirty lump of ice that orbits the Sun
7. Transform a planetary body into another Earth
8. Goods transported onboard a vehicle
10. Melted rock that's underground

Name: _____

MARS MISSION: PROBLEM SOLVED

Directions: Choose one of the following problems to investigate. Then come up with a drawing of a tool or an invention that can solve the problem. Give it a name and explain how it works.

Problems:

- You've traveled to Mars, and you really miss playing your favorite sport from Earth. Come up with a solution that will allow you to play the sport under Mars conditions.
- Your parents say you're too young to drive an ATV. But you want to be able to get around Mars by yourself. Design a non-motorized mode of transportation that you could use on the surface of Mars.
- You decide you want to take a pet to Mars. Design the technology necessary for a pet to survive on Mars.

Drawing of Solution:

Name of your tool or invention: _____

How it works and solves the problem: _____
