

IT TAKES PERSEVERANCE!

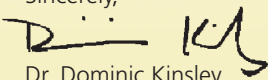
Dear Educator,

The planet Mars, an object of fascination since the ancients first observed its reddish hue in the skies, received its latest visitor when the NASA rover Perseverance landed on February 18, 2021, bringing with it the potential of becoming the first spacecraft to find evidence of past life on another planet.

Let Snoopy, a seasoned space traveler himself, take your students on Perseverance's exciting mission to seek signs of ancient life on Mars with this standards-based STEAM and language arts program for grades 3-6. Along the way, your students will practice perseverance as they use critical-thinking skills to solve problems in these easy-to-implement activities. Developed by the curriculum specialists at Young Minds Inspired as part of a unique partnership between NASA and Peanuts Worldwide, the activities can be taught remotely or in the classroom and include extensions the whole family can enjoy.

Please share this program with other teachers at your school. And let us know your opinion of the program by visiting ymiclassroom.com/feedback-snoopy-perseverance. We look forward to your comments and suggestions.

Sincerely,



Dr. Dominic Kinsley
Editor in Chief
Young Minds Inspired

Program Objectives

- Fuel STEAM learning and interest in space
- Raise awareness of NASA's Mars mission with the Perseverance rover and instill enthusiasm for NASA's future space endeavors
- Reinforce STEAM and language arts skills

Target Audience

Students in grades 3-6 and their families

How to Use This Program

Download, photocopy, and distribute the three reproducible activity sheets to all students, or share the PDFs through your school's digital platform if you're connecting with students remotely. Prepare the materials for each activity and preview videos in advance. Have students share their completed sheets with their families so that they can do the activities at the bottom of each sheet together. Visit ymiclassroom.com/snoopy-perseverance for standards alignment.

**Activity 1
The Red Planet**

In this activity, students will explore Mars to help them learn why scientists study it and to better understand the amazing feat of landing a rover on Mars.

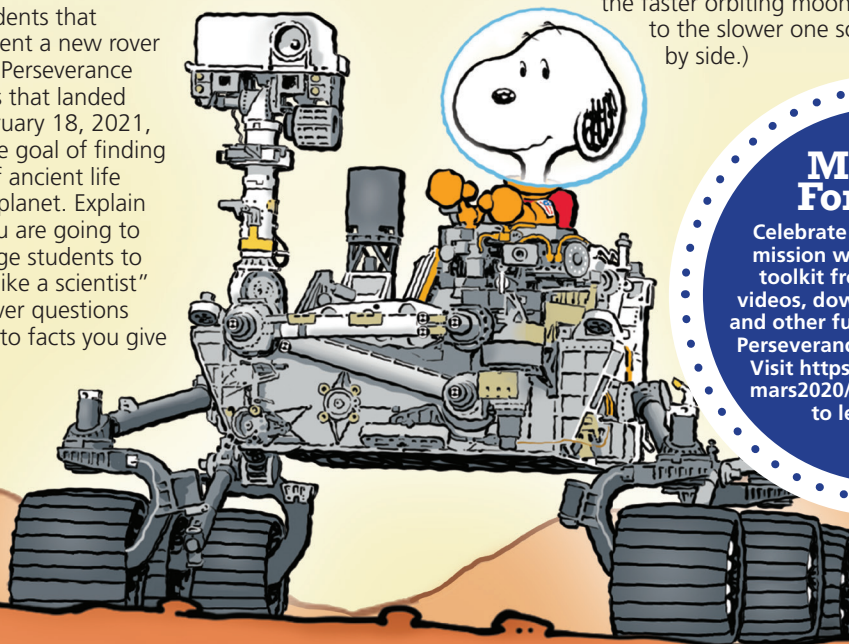
Materials needed: Activity sheets, pencils, paper for posters, art supplies

Ask students to share aloud what they know about Mars. Explain that the red planet has ignited the imagination of millions of sky gazers over the centuries, especially astronomers. Because Mars is one of Earth's closest neighbors in the Solar System, scientists have been able to send orbiters, landers, and rovers there since the first "flyby" in 1965. The final goal is to take that first human step on the planet's surface.

Tell students that NASA sent a new rover named Perseverance to Mars that landed on February 18, 2021, with the goal of finding signs of ancient life on the planet. Explain that you are going to challenge students to "think like a scientist" to answer questions related to facts you give

them about Mars. Have students work in small groups to come up with their ideas. Note that this activity is not meant for them to guess the correct answer, but rather to problem-solve and use logic to help spark a discussion about Mars. After students share their ideas, give them the correct answers. You may wish to write the numbers in question 1 on the board to help students see that the numbers are large and the distance is very far.

1. NASA is working to send humans to Mars. The distance from Earth to Mars changes depending on where the planets are in their orbits. It can range from a minimum of 33.9 million miles to a maximum of 249 million miles (or 54.6 million kilometers to 401 million kilometers). How long do you think it will take to get there? (**Answer:** About 6 to 8 months)
2. Before scientists can send humans to Mars, they need to learn more about it. That's why they have been sending rovers that can move over the surface of Mars. What might a Mars rover collect? (**Answer:** Photos, mineral samples, data on chemical composition and weather, etc.)
3. Mars is very cold. The average temperature is -80 degrees Fahrenheit or -62 degrees Celsius. How do you think astronauts will stay warm when they are on Mars? (**Answer:** Specially designed space suits, generators) To learn more, visit <https://www.nasa.gov/feature/jpl/nasas-perseverance-rover-will-carry-first-spacesuit-materials-to-mars>.
4. The sediment on Mars might be able to grow plants with the addition of bacteria and organic matter. This means humans could potentially grow food on Mars. But the cold temperatures, lack of water, and atmospheric pressure could be a problem. How can scientists keep the plants warm and watered? (**Answer:** Greenhouses, perhaps solar heaters or generators, hydroponics)
5. Mars has two moons, named Deimos and Phobos. Both are smaller than Earth's moon and they orbit the planet at different speeds. Do you think humans on Mars will ever be able to see both moons in the sky together? Why or why not? (**Answer:** Yes, because the faster orbiting moon will eventually catch up to the slower one so they can be seen side by side.)



Mission Forward!

Celebrate the Perseverance mission with a free landing toolkit from NASA. Watch videos, download free posters and other fun items, and follow Perseverance's mission results. Visit <https://mars.nasa.gov/mars2020/timeline/landing/> to learn more!!

Now distribute the activity sheet. Have students use what they learned during the discussion to complete the puzzle. Then have them write about what they think it would be like to be the first human to set foot on Mars.

Answers: Part 1: **Across** – 2. red; 4. million; 7. rovers; 8. parachute. **Down** – 1. Deimos; 3. eighty; 5. nutrients; 6. months. Part 2: Answers will vary.

Extension: Have students view the picture of Mars at https://www.nasa.gov/sites/default/files/thumbnails/image/edu_mars-two-moons.png and other images from <https://www.nasa.gov/topics/moon-to-mars>. What do they notice about the planet's colors and textures? What art medium would they use to depict them? Provide students with paper and supplies such as oil pastels, watercolors, or crayons, and have them create a travel poster that includes a concise, motivational slogan, such as: *Roam with the rovers. Visit Mars!*

Activity 2 Mission to Mars

In this activity, students learn about the significance of the name given to the rover Perseverance and its mission to Mars.

Materials needed: Activity sheets, pencils, paper

Tell students that Perseverance's mission on Mars is to seek signs of ancient life by collecting samples of rocks and sediment for possible return to Earth and to learn more about Mars through instruments that will measure and send data back to Earth for scientific study.

Then explain that NASA held a naming contest for the rover. Students in grades K-12 were invited to write a short essay explaining why the name they chose would be good for a Mars rover. The winner was a seventh-grader. Show students the video at <https://www.nasa.gov/press-release/virginia-middle-school-student-earns-honor-of-naming-nasas-next-mars-rover> and then discuss what it means to persevere.

Tell students that scientists have had to persevere to find ways to reach Mars. One of the problems they had to solve was how to land rovers there. A rover like Perseverance descends at a high speed but must land gently on the surface. How is it done? Share this video that shows the process: <https://mars.nasa.gov/resources/25473/perseverance-arrives-at-mars-feb-18-2021-mission-trailer/>.

Now distribute the activity sheet. Ask students to read the paragraph in Part 1 about how millions of people sent their name to Mars on Perseverance. Then have students write about a time when they persevered through something. When they are finished, ask student volunteers to share their stories.

In Part 2, have students visit <https://mars.nasa.gov/mars2020/mission/science/landing-site/> in small groups or individually to learn about the region of Mars called Jezero Crater, Perseverance's landing site. Remind them to watch the video, answer the questions on the sheet, and then write their own questions that can be used to quiz their classmates.

Answers: Part 1 answers will vary. Part 2: **1.** Five years. **2.** The crater likely collected water in the past, making it more likely to contain evidence of life. **3.** The sediment on the crater floor, the shores of the ancient lake, the crater rim. **4.** Signs of ancient life.

Extension: Following the engineering design process, NASA scientists have used what they've learned from previous Mars rovers — Sojourner, Opportunity, Spirit, and Curiosity — to help define the design and mission of the Perseverance rover. Have students visit <https://mars.nasa.gov/mer/> to learn more about the other Mars rovers. Group students in small teams and assign them each a rover or have them work alone to do research and learn how each rover mission has helped define the mission of Perseverance.

Activity 3 Engineered for Exploration

In this activity, students take a closer look at the components of Perseverance that help the rover's mission. They will also learn about the tiny helicopter called "Ingenuity," which hitched a ride to Mars strapped to the belly of the rover with the goal of achieving the first powered flight on Mars.

Materials needed: Activity sheets, paper, paper clips

Ask students to consider how they would use their bodies if they were digging for fossils.

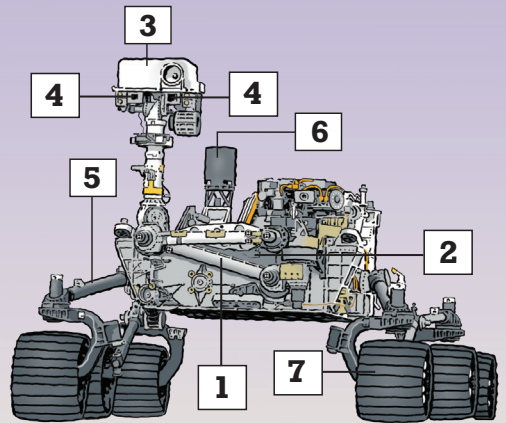
Let them share and discuss their ideas. For example, their legs carry them to the digging site, their eyes help them see where to dig, their fingers grasp the tools, and their arms work to use the tools. Explain that the Mars rover

Perseverance was designed to have its own "body parts" work together to collect and analyze rock and sediment samples that will hopefully be sent back to Earth.

Since Perseverance isn't a human, its body parts look a little different from ours. Show students the interactive 3-D model of Perseverance found at <https://mars.nasa.gov/mars2020/spacecraft/rover/>. Click on various components and talk about each one. How do the components work together to help Perseverance complete its mission?

Distribute the activity sheet. For Part 1, ask students to match Perseverance's components with the description of what each specific part does.

Answers:



In Part 2, have students read a brief paragraph about Ingenuity, its goal, and how it got its name. Then have them follow the directions to create their own paper helicopters, following the engineering design process to modify and improve their design. Answers will vary.

Extension: Have students imagine they are charged with naming and designing a future Mars rover. What would be the significance of its name? What would it look like? What tools would it have? Students can also create a logo to represent the name.

Resources

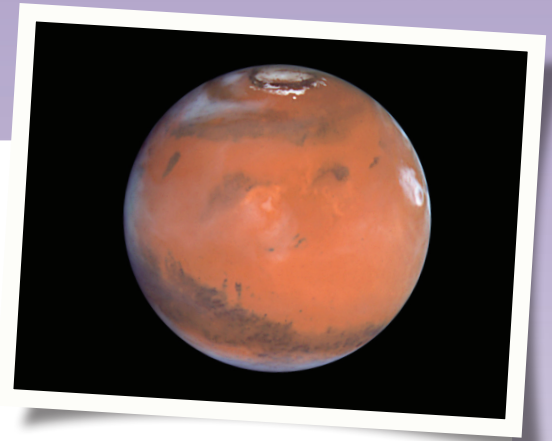
Mars Overview: <https://solarsystem.nasa.gov/planets/mars/overview/> and <https://www.nasa.gov/audience/forstudents/5-8/features/nasa-knows/what-is-mars-58.html>

Mission Toolkit: <https://mars.nasa.gov/mars2020/timeline/landing/>

YMI Program Site: ymiclassroom.com/snoopy-perseverance



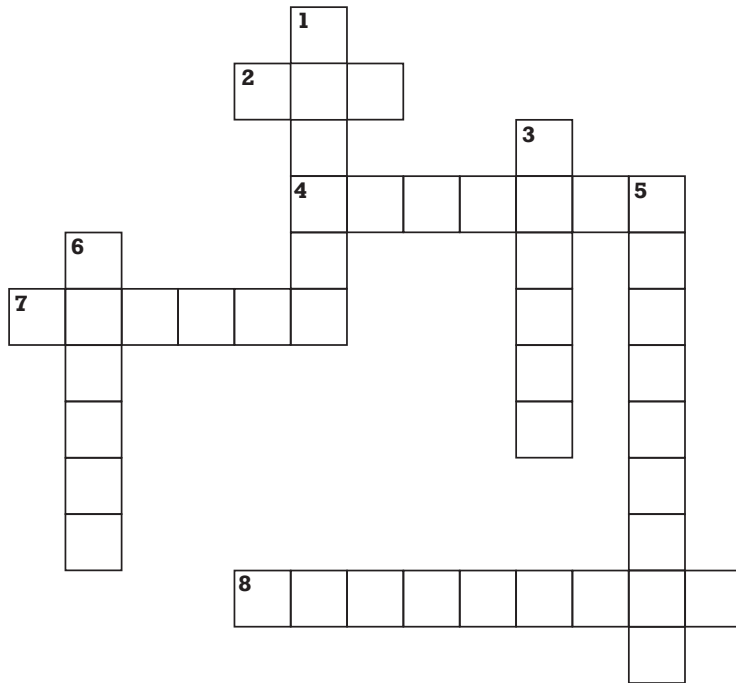
The Red Planet



Part 1: As a seasoned space traveler, Snoopy is excited to think about the discoveries that NASA's new rover Perseverance might make after landing on Mars on February 18, 2021.

How much do you know about Mars? Use your knowledge to complete this crossword puzzle.

Word Bank			
rovers	months	parachute	Deimos
million	eighty	nutrients	red



Across

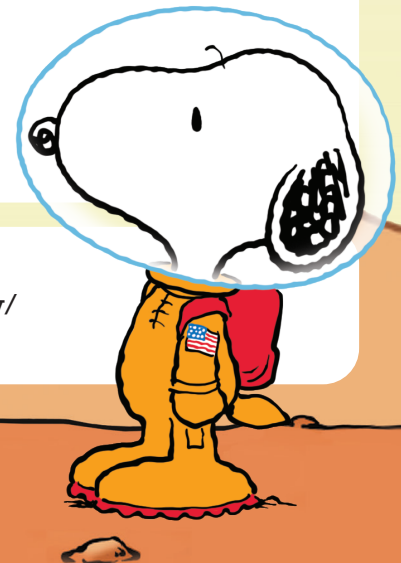
- 2. Mars is sometimes called the _____ planet.
- 4. The distance from Earth to Mars ranges from 33.9 to 249 _____ miles.
- 7. Scientists have sent orbiters, landers, and _____ to Mars.
- 8. The Perseverance rover uses a _____ to help it land.

Down

- 1. Mars has two small moons named _____ and Phobos.
- 3. The average temperature on Mars is _____ degrees below zero Fahrenheit.
- 5. With the addition of bacteria and organic matter, the sediment on Mars might become soil that could contain enough _____ to grow plants.
- 6. It will take astronauts about seven or eight _____ to get to Mars.

Part 2: Neil Armstrong famously said, "That's one small step for a man, one giant leap for mankind" when he first stepped on the moon. Imagine you are the first human to set foot on Mars. What would you say? What do you think it would be like to live and work there? Write your thoughts below.

Families: Explore Mars together! Visit <https://solarsystem.nasa.gov/planets/mars/overview/> to learn more about Earth's fascinating neighbor, and <https://mars.nasa.gov/mars2020/> for more about Perseverance and its mission.



Mission to Mars

Part 1: The Perseverance rover is equipped with many different scientific tools. It's also carrying something else — the names of millions of people! Even Snoopy has gotten in on the fun, adding his name to the list in hopes that one day he can travel there in person. As a part of NASA's "Send Your Name to Mars" campaign, everyone who signed up received a boarding pass and the ability to track their "frequent flier miles" as Perseverance soared through space to Mars.



Perseverance is the latest Mars rover. It's named after a quality that helps a person keep doing something even though it's difficult or challenging. The quality of perseverance is embraced by all scientists and astronauts who follow the steps of the engineering design process — ask, imagine, plan, create, experiment, and improve. Do you recall a time when you persevered to achieve something? Perhaps it was learning to ride a bike or whistle, or maybe the first time you finished a thick book or a huge jigsaw puzzle.

Get "mission ready" by writing about how you have persevered through something difficult. Did you follow the steps in the engineering design process? Summarize your experience below, then share it with your classmates.

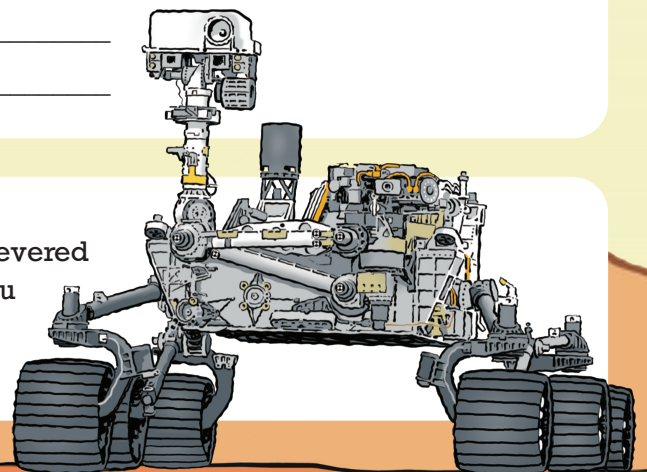
Part 2: Visit <https://mars.nasa.gov/mars2020/mission/science/landing-site/> to learn more about the Jezero Crater, Perseverance's landing site. What is its significance? Watch the video on the page, then answer the questions below and create some of your own.

1. How long did it take for NASA scientists to choose the landing site? _____
2. Why did they choose the Jezero Crater? _____
3. Which parts of the crater will the rover explore? _____
4. What is NASA hoping to find in or around the crater? _____

Now, write two questions of your own that can be answered with the information found on the Perseverance landing site page.

1. _____
2. _____

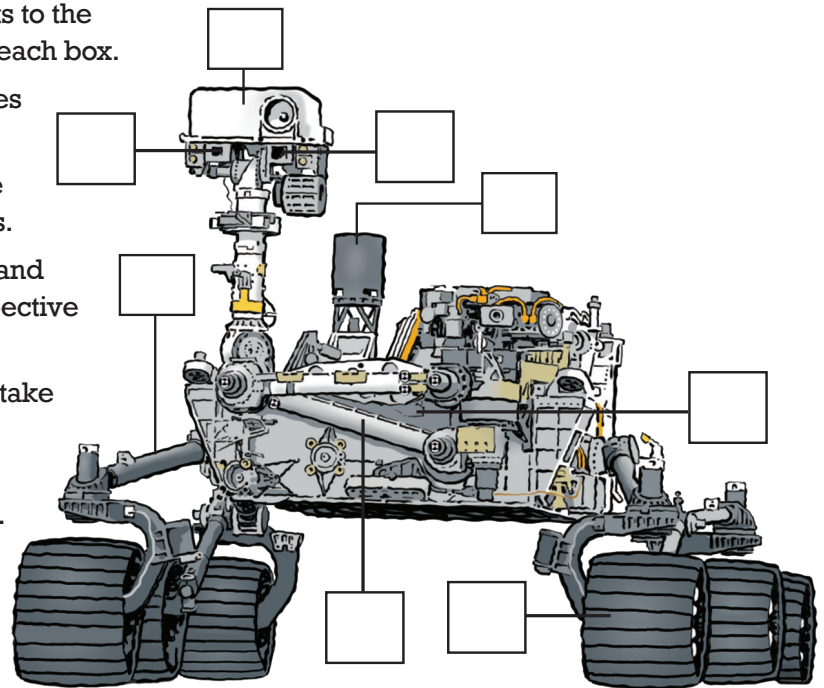
Families: What do you and a Mars rover have in common? Perseverance! Talk with your children about how you have persevered through difficult situations as a family, and how that has made you stronger. Then, learn more about Perseverance's mission by visiting <https://mars.nasa.gov/mars2020/>.



Engineered for Exploration

Part 1: Meet Perseverance! Match its components to the descriptions below. Write the correct number in each box.

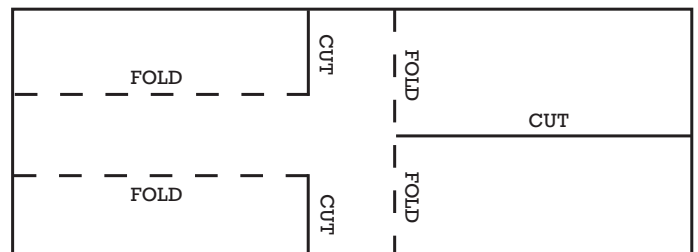
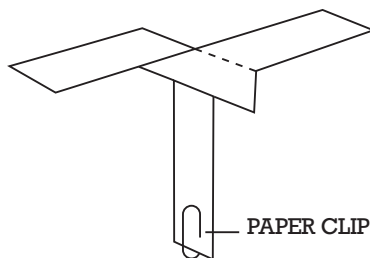
1. **Arm:** The arm helps the scientists grab samples of Martian rocks and sediment.
2. **Body:** The rover body carries and protects the computer, electronics, and instrument systems.
3. **Mast:** The mast elevates key camera systems and sensors, giving the rover a human-scale perspective on its environment.
4. **Mastcam-Z:** These are the main cameras that take color pictures and videos of Mars.
5. **Suspension:** The “rocker-bogie” suspension system allows the wheels to go over obstacles.
6. **UHF Antenna:** The Ultra-High Frequency Antenna transmits data to Earth using Mars orbiters overhead.
7. **Wheels:** The wheels are made of aluminum, with cleats for traction and curved titanium spokes for springy support.



Part 2: On the underside of Perseverance, snuggled tightly to its belly, is a small helicopter named Ingenuity. The helicopter is designed to see how well a robotic aircraft could fly in the bone-chillingly cold, thin atmosphere of Mars. If its test flights are successful, this tiny but strong robot can teach NASA a lot about future flights on Mars.

You can make and test your own tiny helicopter. Just follow this pattern. Then experiment! Follow the engineering design process — ask, imagine, plan, create, experiment, and improve. Add paper clips for weight. Make the body longer or shorter. Change the shape of the blades. “Launch” your helicopter from just over your head for each test.

Persevere! Which design flew the best? Write and draw your results on a separate sheet of paper.



Families: Meet the high school student who named the Ingenuity. Learn more about her and the tiny helicopter by visiting <https://www.jpl.nasa.gov/news/qa-with-the-student-who-named-ingenuity-nasas-mars-helicopter/>.

