



Teaching Roundtable Discussions with *Seasons on Mars*

Common Core State Standards for English Language Arts Literacy in Science & Technical Subjects, Grades 6–8

KEY IDEAS AND DETAILS

RST.6–8.2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

CRAFT AND STRUCTURE

RST.6–8.5. Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.

RANGE OF READING AND LEVEL OF TEXT COMPLEXITY

RST.6–8.10. By the end of grade 8, read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently.

Roundtable Discussion

About this strategy. A Roundtable Discussion occurs between a small group of people discussing a shared topic of interest. Roundtable Discussions are a common format for scientists to share work with other scientists. Like all forms of communication, Roundtable Discussions are guided by norms of interaction, such as listening actively and disagreeing productively. When used in the science classroom, Roundtable Discussions provide a structure for small groups to develop the language of science while also practicing leadership skills. In addition, Roundtable Discussions can be used to address scientific misconceptions in a thought-provoking way. For example, many students may believe that Earth's seasons are a result of a change in distance around the Sun instead of the tilt of Earth on its axis. A Roundtable Discussion allows students to confront this idea based on evidence from the article *Seasons on Mars*.

Seasons on Mars

About the article. *Seasons on Mars* introduces students to key concepts about seasons on other planets by comparing the seasons on Earth to those on Mars. NASA scientists have learned about the orbital pattern of Mars and how this orbit impacts seasons on Mars. Like Earth, Mars experiences seasons as a result of the tilt of the planet on its axis. Unlike Earth, Mars does not orbit in a circular pattern, so at different times of the year, Mars is actually closer to the Sun, which impacts temperature. This text includes two illustrations and a data table.

Flesch-Kincaid Grade Level Readability: 5.2; Lexile Framework for Reading: 1030

Getting Ready

- ★ Make one copy of the Roundtable Discussion copymaster for each student.
- ★ Make one copy of the *Seasons on Mars* article for each student.
- ★ Preview the URLs referenced in the teaching instructions.

Disciplinary Literacy in Science

Literacy is an integral part of science. Practicing scientists use reading, writing, and oral communication to explain their findings, conduct research, connect to the work of other scientists, and communicate ideas to a variety of audiences. Situating literacy instruction in a content area, such as science, has several benefits. First, it helps students develop ways of thinking that are characteristic to the discipline. By building background knowledge, science also helps students access high-level content in text that often can be difficult to grasp. Finally, science provides an authentic reason for reading—to better understand the science ideas under study. Reading, like science, can be an act of inquiry when there are genuine questions to be investigated.

AAAS Benchmarks for Scientific Literacy

- ★ **4B/H3** Because Earth turns daily on an axis that is tilted relative to the plane of Earth's yearly orbit around the Sun, sunlight falls more intensely on different parts of Earth during the year. The difference in intensity of sunlight and the resulting warming of Earth's surface produces the seasonal variations in temperature.
- ★ **11C/M6** Cycles, such as the seasons or body temperature, can be described by what their cycle length or frequency is, what their highest and lowest values are, and when these values occur. Different cycles range from many years down to a fraction of a second.
- ★ **4B/M13** The number of hours of daylight and the intensity of the sunlight both vary in a predictable pattern that depends on how far north or south of the equator the place is. This variation explains why temperatures vary over the course of the year and at different locations.

Teaching Roundtable Discussions with *Seasons on Mars*

Activate and Build Background Knowledge

1. On the board, write the following guiding question: "**How can scientists learn about Mars if no astronauts have landed on Mars?**"
2. Pose the guiding question and invite students to turn to a neighbor to talk about their ideas.
3. Explain that rovers are one way scientists collect data about other planets that are too far away for humans to investigate firsthand. Share that scientists sometimes discuss their interpretations and share ideas in a structured format such as a Roundtable Discussion.
4. Project the Roundtable Discussion copymaster. Read the first statement aloud and discuss students' reasoning about their ideas. At this point, do not tell students whether their ideas are accurate. Instead, set a purpose for reading to learn more about these statements.
5. Follow the same procedure for the next three statements on the copymaster.

Set Purpose for Reading

1. Introduce *Seasons on Mars*, telling students it addresses complex ideas about the reason for seasons and the differences between seasons on Earth and seasons on Mars. Let students know they will read to gather evidence about the four statements.
2. Next, invite students to form groups of four. Direct each student in the group to select one statement to focus on as they read *Seasons on Mars*.
3. Distribute copies of the article and encourage students to highlight, underline, or annotate places in the text that relate to their selected statement. Remind students to use the illustrations and data table as sources of information.
4. Distribute copies of the Roundtable Discussion copymaster and invite students to record evidence related to their selected statement in the space provided on the copymaster. Model this if you feel your students need more support gathering evidence.

Teaching Roundtable Discussions with *Seasons on Mars* (continued)

Integrate Text and Experience

1. After students have finished reading and gathering information, regain their attention and instruct groups to follow the procedures for a Roundtable Discussion.
 - ★ The person who is the leader for the first statement reads the statement aloud.
 - ★ The leader asks the group to share ideas. Everyone listens and takes notes.
 - ★ The leader encourages everyone to contribute and cite textual evidence.
 - ★ Repeat this procedure for the next three statements.
2. Debrief students' overall findings before introducing another source of information. Project and view the video "The Reason for the Seasons" found at http://blogs.nasa.gov/cm/blog/NES_Teachers_Corner/posts/post_1300460795779.html. As students watch, invite them to record more notes about seasons on Earth.
3. Discuss ways in which the video reinforced or contradicted information found in the article. Identify the statements for which the video offers the most information.

Apply New Ideas

1. Return to the guiding question **How can scientists learn about Mars if no astronauts have landed on Mars?** and invite students to share questions they have about Mars exploration and discoveries.
2. See below for additional or updated NASA resources.

Additional Support for Students with Dyslexia

- ★ **Modify reading materials.**
The student articles and copymasters are available in the Dyslexie font, a typeface developed to help individuals with dyslexia read more fluently. For more information, see <http://www.studiostudio.nl/>.
- ★ **Provide explicit instruction.**
Work directly with students to interpret the information in the data table and visual comparison of the orbits of Earth and Mars.
- ★ **Make concrete connections.**
Review the causes of Earth's seasons, using one of the other videos found here: http://blogs.nasa.gov/cm/blog/NES_Teachers_Corner/posts/post_1300460795779.html.
- ★ **Enhance information processing.**
Allow students to preread the article with a partner and practice finding information for the statement that is most interesting to the student.
- ★ **Engage another learning modality.**
Listen to a podcast of the Mars Exploration Rovers found here: http://www.nasa.gov/mp3/429613main_jpl-mer20100224.mp3.
- ★ **Encourage independent exploration.**
Allow students to navigate a Mars rover, using this online activity: <http://www.nasa.gov/externalflash/m2k4/driverover/frameset.html>.

NASA Resources

Information About Seasons on Other Planets: http://www.nasa.gov/audience/foreducators/postsecondary/features/F_Planet_Seasons.html

Mars Rover Updates: http://www.nasa.gov/mission_pages/msl/index.html

Rover Podcast: http://www.nasa.gov/mp3/143672main_MRO-podcast.mp3

Space Weather Math Educator Guide: http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Space_Weather_Math.html

Mars Rover Landing Site Math Activity: http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Image_Scale_Math.html

Mars on a Map: <http://www.google.com/mars/>

Name _____ Date _____

Roundtable Discussion

Title of article: _____

Circle the number that you were assigned. You will be the discussion leader for the statement next to that number.

1. Earth's seasons are caused by the changing distance between Earth and the Sun at different times of the year.

Notes/Evidence:

2. Earth's seasons are caused by the tilt of Earth on its axis.

Notes/Evidence:

3. Mars has the same number of seasons as Earth.

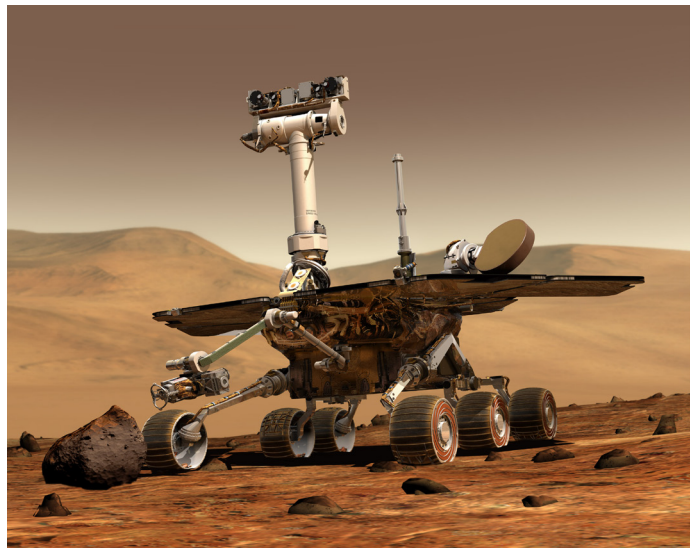
Notes/Evidence:

4. Seasons on Mars are shorter than seasons on Earth.

Notes/Evidence:

Seasons on Mars

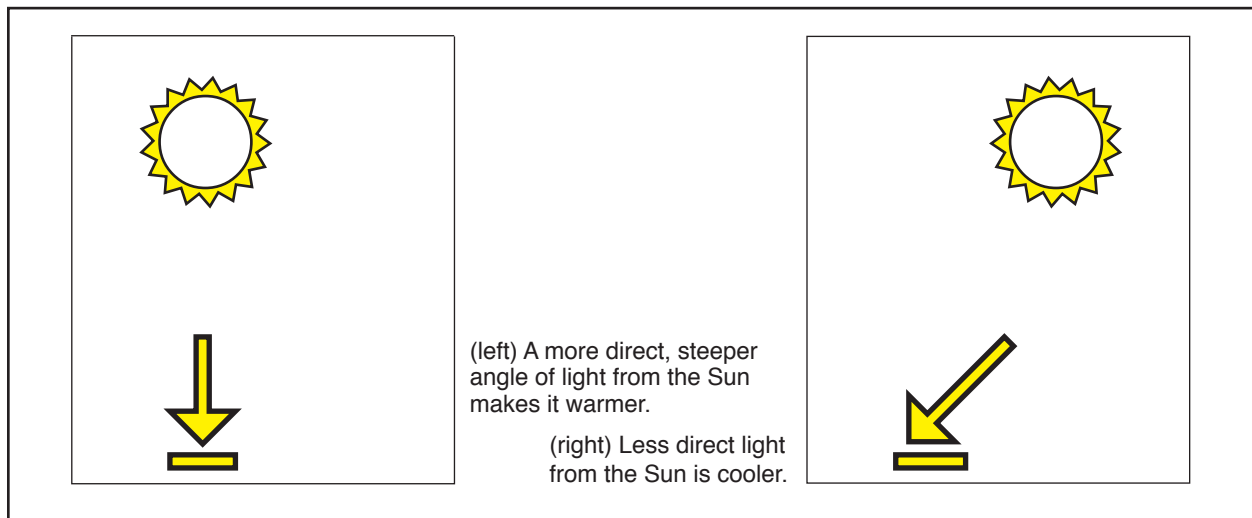
People have a lot of questions about the planet Mars. No astronauts have gone there yet, but one day we hope they will. Several NASA missions have explored Mars, including the Mars Exploration Rovers. In August 2012, *Curiosity* landed and is sending images and information back to Earth. Two rovers, *Spirit* and *Opportunity*, landed on Mars in January 2004 and successfully explored the Red Planet for multiple Martian years. Since Mars travels around the Sun more slowly than Earth does, and its orbit is much bigger, a Mars year is about twice as long as an Earth year. During their time on Mars, rovers have gathered amazing new evidence about the Red Planet, including what it is like there in different seasons.



Rovers are exploring Mars and sending information back to scientists on Earth.

What Causes Seasons on Mars?

One of the reasons for seasons on Mars is the same as on Earth—the tilt of the planet’s axis. Mars’ tilt is slightly more than Earth’s. As on Earth, this makes parts of Mars face the Sun more directly at times. When the Sun’s light hits those parts at a steeper angle, the light intensity is greater, and so it is warmer. The planet’s tilt also causes those places to have longer daylight.

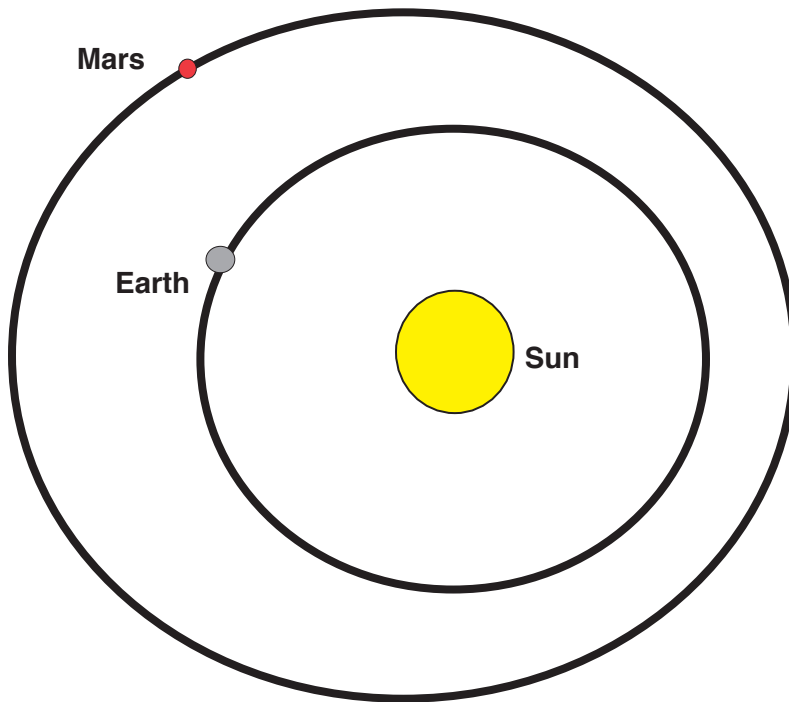


Seasons on Mars have another cause that we don’t have on Earth. Earth’s orbit around the Sun is almost a circle, so the difference in our distance to the Sun at different times is very small compared

to the total distance from Earth to the Sun. However, the orbit of Mars is not a circle. It is much more stretched out. The distance between Mars and the Sun varies by almost 42 million kilometers. That distance makes a difference in temperatures and length of seasons.

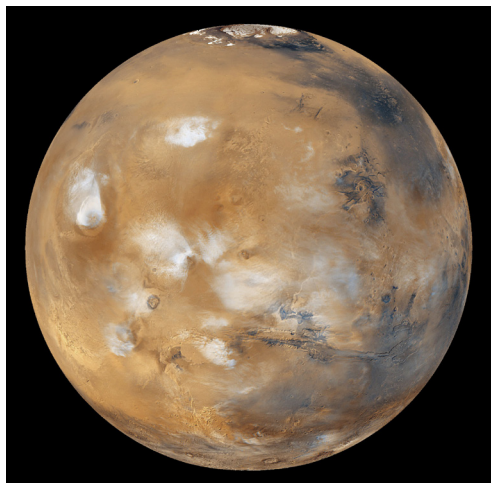
Comparing the Orbits of Earth and Mars

Mars moves faster in its orbit when it is closer to the Sun and slower when it is farther from the Sun, which means the seasons have different lengths on Mars. On Earth, the seasons are about equal.



Mars' orbit is the shape of a stretched-out circle, causing temperatures and seasons to vary greatly.

Earth's orbit is a more even circle, giving Earth seasons that are more equal in length.



This photograph of Mars shows clouds and ice at its north pole.

| Spring | 93 | 199 |
|--------|----|-----|
| Summer | 93 | 183 |
| Fall | 90 | 146 |
| Winter | 89 | 158 |

The Mars data is for Martian year 31, September 13, 2011–July 30, 2013. Year 1 began in 1955.