GENERATIONGENIUS
ALWAYS QUESTION. ALWAYS WONDER.

LESSON PLAN

OUR SOLAR SYSTEM
GRADES 6-8

SUMMARY

Students apply mathematical concepts and processes to explain how the scale of the solar system determines the amount of time it would take to travel to other planets using a spacecraft similar to the one used in the Mars 2020 Mission.

NEXT GENERATION SCIENCE STANDARDS CORRELATION

MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

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

Science & Engineering Practices	Connections to Classroom Activity
Asking Questions	• Students ask questions after watching the video clip of the rocket launch for the Mars 2020 Mission.
Using Mathematics and Computational Thinking	• Students calculate the time it would take to travel to each planet using the speed of travel from the Mars 2020 Mission.
Obtaining, Evaluating, and Communicating Information	• Students use the NASA websites to determine the central ideas related to the exploration of each planet.
Developing and Using Models	• Students create a timeline model to describe the phases of and ideas related to the Mars 2020 Mission.

Disciplinary Core Ideas	Connections to Classroom Activity
ESS1.A The Universe and Its Stars Earth and its solar system are a part of the Milky Way galaxy, which is one of many galaxies in the universe. **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.	• Students watch the video that provides information about the Milky Way galaxy and its place in the universe. • Students watch the video that provides information about the collection of objects in our solar system and calculate the time it would take to travel to several of the planets. Students also use NASA websites to learn more about the planets and efforts related to planetary exploration.
Cross Cutting Concepts	**Connections to Classroom Activity**
Scale	• Students watch the video where a scale model of the solar system is built in the desert. • Students use the proportional relationship of speed as the ration of distance traveled to time taken in order to calculate and understand the magnitude of time it would take to travel to other planets using a similar spacecraft to the one used in the Mars 2020 Mission.

DURATION

90 min.

MATERIALS

- Poster paper
- Markers and/or colored pencils
- Student notebooks
- Calculator
- Sticky notes

ENGAGE

Students watch two clips from the NASA coverage of the *Perseverance* rover launch on July 30, 2020 (Watch NASA's Perseverance Rover Launch to Mars!) Play the first 2 mins of the video and then skip to 47:40 mins to watch the final countdown of the launch. Continue to watch until the 50:00-minute mark.

Ask students to individually write down as many questions as they can think of in their notebooks about the phenomenon they just witnessed. After providing time for students to think of questions in their alone zone, ask each student to share one question they have about the launch and write or display it on the board or screen. Ask each student to share one question without repeating a question asked by another student.

EXPLORE

Tell students that the launch date of the Mars 2020 Mission was July 30, 2020. The travel time for the space craft carrying the *Perseverance* rover from Earth to the surface of Mars is 203 days. (If all goes according to plan, *Perseverance* will arrive on Mars February 18, 2021).

Provide students with the following dataset by writing the data table on a poster paper in front of the class or projecting it on a screen. Ask students to copy the data table into their notebooks. Ask students to work in small groups of 2 to 4 to figure out how many days it would take to get to the other planets if a similar spacecraft traveling at the same speed launched from Earth using the data provided. Tell students they may estimate the time by rounding the days to the nearest day and years to the nearest tenths place.

Insert Distance and Travel Time to Planets Within Our Solar System

Departing From	Traveling To	Distance (miles)	Length of Time in Days to Reach Planet	Length of Time in Years to Reach Planet
Earth	Mars	48, 678,219	203	
Earth	Jupiter	390,674,710		
Earth	Saturn	792,248,270		
Earth	Uranus	1,692,662,530		
Earth	Neptune	2,703,959,960		

While students are working to figure out the calculations, guiding questions can be used to help facilitate the process such as:

- How would you be able to figure out how many miles the spacecraft is traveling each day? The answer would be to divide the number of miles by the number of days. The algebraic expression would be:

  48,678,219 miles / 203 days = 239,794 miles/day

- How would you be able to figure out how many days it would take to travel at that speed to reach the planet? How might the units help you figure this out? The answer would be to divide the number of miles needed to travel to the planet by the number of miles traveled each day. The algebraic expressions are provided below.

  390,674,710 miles x 1 day / 239,794 miles = 1,629 days to Jupiter
  792,248,270 miles x 1 day / 239,794 miles = 3,304 days to Saturn
  1,692,662,530 miles x 1 day / 239,794 miles = 7,059 days to Uranus
  2,703,959,960 miles x 1 day / 239,794 miles = 11,276 days to Neptune

- How would you be able to figure out how many years that equals? How might the units help you figure this out? The answer would be to divide the number of days by the number of days in a year (365).

  203 days x 1 year/365 days = 0.6 years to Mars
  1,629 days x 1 year/365 days = 4.5 years to Jupiter
  3,304 days x 1 year/365 days = 9 years to Saturn
  7,059 days x 1 year/365 days = 19.3 years to Uranus
  11,276 days x 1 year/365 days = 30.9 years to Neptune

Once students have been provided time to figure out the mathematical calculations, ask each group to share out one answer and write it in the data table displayed in front of the class. Ask the other groups if they agree on this number. If there is a disagreement, have students explain their process for figuring out the calculation until consensus is reached on the results and the data table is complete.

Facilitate a class discussion about the results. Guiding questions to help facilitate the class discussion might be:

- Why do you think there is such a difference in time it takes to reach each planet?
- Do you think that NASA has sent spacecraft to every planet? Why or why not?
- How might the scale of the solar system help to explain the results?

End of Day 1

EXPLAIN

WATCH THE GENERATION GENIUS SOLAR SYSTEM VIDEO AS A GROUP

After watching the video, bring student attention back to the data table completed the day before. Ask students to return to their small groups and use any new knowledge they learned from the video to discuss the questions:

- How does scale help to explain the amount of time it takes to travel to each planet?
- How might this knowledge about the scale of our solar system and the characteristics of each planet help NASA develop spacecraft to explore such faraway places?

ELABORATE

Provide students with the link to the NASA Solar System Exploration website.

Ask students to spend time exploring the information about the planets and take notes regarding information related to space travel to and exploration of each planet by NASA.

Gathering information on the exploration of each planet can be done in the following ways:

- Assign each group a different planet and share out findings using a jigsaw method.
- The teacher projects the website to gather information as a whole class.

Facilitate a class discussion regarding the similarities and differences in the methods of exploring each planet.

Guiding questions to help facilitate this discussion might be:

- Why do you think Mars is the most explored planet in our solar system?
- What seems to be the difference between the most current mission to Mars and the missions to other planets?
- What are the similarities in the spacecraft orbiting planets?
- What types of information do you think orbit spacecraft collect?
- What problems did NASA need to solve in order to send the spacecraft and rover used in the Mars 2020 mission?
- What problems might NASA need to solve in order to send a similar spacecraft and rover used in the Mars 2020 mission to planets other than Mars?

EVALUATE

There are multiple ways to assess your students' understanding of this topic. The exit ticket is an opportunity for students to use the science ideas they built in the lesson in a new context. Alternatively, you can use the Kahoot! quiz (which provides downloadable scores at the end of the game) and/or the paper quiz. All these resources are located right below the video in the assessment section.

EXTENSION

Provide students with poster paper and markers or colored pencils to draw a timeline model explaining each stage of the Mars 2020 mission using the mission timeline summary and other information found on the NASA website.

Ask students to work in small groups of 2 to 4. Hang the posters around the room and ask students to participate in a gallery walk. Provide each group with a set of sticky notes and ask them to write down one compliment and one question for each group.

Bring the attention of the class back to the initial questions that were documented during the explore activity. Go through each question to see how many they are now able answer after participating in this lesson.