Notation for NASA, Part 2

Operations with Scientific Notation

Corrie Matchell, Michell Eike, Amber Smith
Published by *K20 Center*

Grade Level	7th – 9th Grade	**Time Frame**	110–120 minutes
Subject	Mathematics, Science	**Duration**	3 class periods
Course	Earth Science, Physical Science, Pre-Algebra		

Essential Question

How can we use very large or small numbers?

Summary

In this lesson, students will look for patterns then formalize rules for multiplying and dividing numbers written in scientific notation and use this to analyze and interpret information about the solar system. Being able to express and interpret numbers in scientific notation is prerequisite knowledge to this lesson. This is the second lesson in the "Notation for NASA" lesson duo.

Snapshot

Engage

Students recall what they know to identify the fictional statement hidden among the given scientific facts.

Explore

Students analyze math problems to find patterns and generalize the rules for multiplying and dividing numbers in scientific notation.

Explain

Students formalize their understanding of multiplying and dividing numbers in scientific notation.

Extend

Students apply what they have learned by planning their mission to space.

Evaluate

Students reflect on how they feel and what they think about their learning.

Standards

ACT College and Career Readiness Standards - Mathematics (6-12)

A511: Work with scientific notation

ACT College and Career Readiness Standards - Science (6-12)

IOD301: Select two or more pieces of data from a simple data presentation
IOD302: Understand basic scientific terminology

Oklahoma Academic Standards (8th Grade)

8.ESS1.2 : Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
8.ESS1.3 : Analyze and interpret data to determine scale properties of objects in the solar system.*

Oklahoma Academic Standards Mathematics (8th Grade)

PA.N.1.3: Multiply and divide numbers expressed in scientific notation and express the answer in scientific notation.

Attachments

- Constellation Stations—Notation for NASA, Part 2.docx
- Constellation Stations—Notation for NASA, Part 2.pdf
- Fiction in the Facts—Notation for NASA, Part 2 - Spanish.docx
- Fiction in the Facts—Notation for NASA, Part 2 - Spanish.pdf
- Fiction in the Facts—Notation for NASA, Part 2.docx
- Fiction in the Facts—Notation for NASA, Part 2.pdf
- Guided Notes (Model Notes)—Notation for NASA, Part 2.docx
- Guided Notes (Model Notes)—Notation for NASA, Part 2.pdf
- Guided Notes—Notation for NASA, Part 2 - Spanish.docx
- Guided Notes—Notation for NASA, Part 2 - Spanish.pdf
- Guided Notes—Notation for NASA, Part 2.docx
- Guided Notes—Notation for NASA, Part 2.pdf
- Lesson Slides—Notation for NASA, Part 2.pptx
- Mission Analysis—Notation for NASA, Part 2 - Spanish.docx
- Mission Analysis—Notation for NASA, Part 2 - Spanish.pdf
- Mission Analysis—Notation for NASA, Part 2.docx
- Mission Analysis—Notation for NASA, Part 2.pdf
- Model Sketch—Notation for NASA, Part 2 - Spanish.docx
- Model Sketch—Notation for NASA, Part 2 - Spanish.pdf
- Model Sketch—Notation for NASA, Part 2.docx
- Model Sketch—Notation for NASA, Part 2.pdf
- Note Catcher—Notation for NASA, Part 2 - Spanish.docx
- Note Catcher—Notation for NASA, Part 2 - Spanish.pdf
- Note Catcher—Notation for NASA, Part 2.docx
- Note Catcher—Notation for NASA, Part 2.pdf

Materials

- Lesson Slides (attached)
- Fiction in the Facts posters (attached; one set per class; print one-sided)
- Constellation Stations signs (attached; multiple sets per class; print one-sided)
- Note Catcher handout (attached; one per student; print two-sided)
- Guided Notes handout (attached; one per student; print two-sided)
- Guided Notes (Model Notes) document (attached)

- Mission Analysis handout (attached; one per student; print two-sided)
- Model Sketch handout (optional; attached; one per student; print one-sided)
- Scientific calculators (one per student)
- Pencils
- Paper
- Sticky notes or index cards (optional; one per student)
- Student devices with internet access (optional)

25 minutes

Engage

Teacher's Note: Activity Preparation

Hang the five **Fiction in the Facts** posters.

After introducing the lesson title on **slide 2**, transition through **slides 3–4** to introduce the essential question and lesson objectives.

Show **slide 5** and introduce the Fiction in the Facts strategy. Let students know that they will all begin at one poster, dividing the class into relatively even groups, and then stay with their group as they visit all five posters. At each poster, they should:

- Read the three statements that all relate to space.
- Discuss which one they think is fiction.
- Individually record their own answer and reasoning in 1–2 sentences.

Move to **slide 6** and have students get out a piece of paper. Have students create a table so they can record the number of the poster, the number of the corresponding false statement, and their reasoning.

Display **slide 7** and have students find a poster. Tell students that their challenge is to use what they know about space and their reasoning skills to figure out which statement at each station does not belong. Let students know that the discussion is meant to help them think more deeply, but they may disagree and record different decisions. Each student is responsible for their own response.

Have students write the number of the poster on their paper. Tell students they have approximately two minutes at each poster, and then have them begin.

After all groups have visited each station, have students return to their seats. Bring the class together for a whole-group discussion. Show **slide 8**, displaying the three statements from Poster 1 and ask the class which statement they thought was fiction. Ask for volunteers to share their reasoning. Then, transition to **slide 9** to reveal the false statement.

Repeat this for each poster using **slides 10–17**. Use this time to spotlight strong reasoning, clarify any misconceptions, and build energy for what is coming next in the lesson.

Teacher's Note: Guiding the Activity

- **Set 1:** Statement 3 is false. The Sun is not cold at all! It is actually extremely hot and not even close to being the coldest star.
- **Set 2:** Statement 2 is false. You can not float on Jupiter. It is a gas giant with no solid surface.
- **Set 3:** Statement 2 is false. There is no secret Moon base—sorry. The “dark side” refers to the side we do not see; it is not a secret.
- **Set 4:** Statement 3 is false. As of 2025, humans have not landed on Mars, but NASA is working on it!
- **Set 5:** Statement 2 is false. The sky is blue because of the way sunlight scatters in our atmosphere —not because of ocean reflection.

20 minutes

Explore

Teacher's Note: Activity Preparation

Hang or place the prepared **Constellation Station** signs in their dedicated locations.

Display **slide 18** and introduce the students to the Painting a Picture strategy. Give each student a copy of the attached **Note Catcher** handout. Tell students that there are two different constellation-themed stations: *Libra* for multiplication and *Aries* for division. Explain that they are expected to take their handout to the Libra and Aries stations and record the examples before independently reflecting on what they notice and attempting to write a rule for the operation at their station.

Move to **slide 19** and have students find a station. Give students approximately 5 minutes, then have them move to a station with a different name/operation. If students have not answered all of the reflection questions during this time, still have students move to the next station. They can still participate in the later discussion even if they do not currently have each reflection question answered.

After another 5 minutes, transition to **slide 20** and have students return to their seats. Have students share and compare with a neighboring partner what they noticed and what "picture" they painted on how to multiply and divide numbers in scientific notation. Give pairs approximately 5 minutes to discuss, and then ask for volunteers to share their findings with the class. Create a list of observations (students' responses) for the class to see. Ask students if they observed any similarities or differences between multiplying and dividing numbers in scientific notations. If any observations are inaccurate, record them as well.

Teacher's Note: Guiding the Lesson

Class may end between the Explore and Explain phases of this lesson, so this list may be created on the first day of the lesson but discussed on the second day of the lesson. For this reason, consider creating this list in a place that can be easily referenced later. This could be written with marker on chart paper, typed in a document, etc.

After students have shared all observations, ask if there is anything on the list that they disagree with or would like explained further. Ideally, this list should form the basis of the rules for multiplying and dividing numbers in scientific notation. If there are still misconceptions, they can be addressed during the Explain phase.

25 minutes

Explain

Display **slide 21** and give each student a copy of the attached **Guided Notes** handout. Resume the discussion from the Explore phase of the lesson, specifically focusing on the patterns and rules students had around multiplying numbers in scientific notation. Use the slide and their list of observations to discuss how to multiply numbers in scientific notation. Ask students to fill in the spaces in their Guided Notes as you progress. Use the attached **Guided Notes (Model Notes)** document as needed.

Give each student a calculator. Express to them that this is a great time for them to use this tool as a time-saver since you know that they know how to multiply. The focus of the lesson today is to understand how to quickly multiply and divide numbers written in scientific notation, so using this tool will allow them to focus their attention on learning these new skills.

Show **slide 22** and follow the steps to go through the example: $(2.5 \times 10^2) \cdot (8.1 \times 10^5)$. After multiplying the coefficients and adding the exponents, you have 20.25×10^7. Ask students if this is written in scientific notation and how they know. If needed, ask guiding questions to help students realize that it is not because there is more than one nonzero digit in front of the decimal point.

Transition through **slides 23–24** to explain how to correctly rewrite a number in scientific notation. Display **slide 25** and then lead the class through completing the previous example by rewriting the previous result in scientific notation.

Direct students' attention to the back of their handout and move to **slide 26**. Have students practice multiplying numbers in scientific notation. The notes are structured so that examples (a) and (c) can be used as whole-class practice and examples (b) and (d) can be used for students to work individually and informally assess their progress. However, all examples can be done together either as a whole class or individually, depending on the needs of the students.

Transition through **slides 27–30** to reveal each final product. Give students time to check and correct their work as needed. Use this time to answer any questions they may have.

Show **slide 31** and discuss how to divide numbers in scientific notation. Display **slide 32** and have students practice dividing numbers in scientific notation. Transition through **slides 33–36** in the same way as you did the previous examples with slides 27–30.

30 minutes

Extend

Optional Career-Focused Activity

If your class has not completed the Notation for NASA, Part 1 lesson, unhide **slides 37–39** for students to watch a career-focused video and complete the following activity.

Show **slide 37** and introduce the I Notice, I Wonder strategy. Let students know that as they watch the upcoming video, they should be thinking about what they notice, any details, facts, or ideas that stand out and what they wonder, questions or curiosities sparked by what they see and hear.

Display **slide 38** and play the *Aeronautical Engineering for NASA* video, featuring Donna Shirley, a former NASA engineer. Encourage students to stay engaged and thoughtful throughout the video in preparation for the group reflection.

After the video ends, display **slide 39**. Facilitate a whole class discussion about what students noticed and wonder. Invite students to share what stood out to them and what questions they have. Use their responses to deepen understanding and encourage curiosity.

Then, share your wonder (asking the reflection question): "Donna Shirley helped send rovers to Mars, which is really far from Earth. Think of a situation where she might have needed to multiply or divide numbers in scientific notation."

Use this prompt to guide a brief discussion connecting the video to the concept of scientific notation, helping students see its real-world relevance.

Teacher's Note: Activity Preparation

During the previous lesson, students selected a planet or moon and found its key properties with their device. For the following activity, students need either their Mission Report handout from the previous lesson—that contains that information—or a device to use to look up that information.

If you did not complete the previous lesson, have students select a planet (other than Earth) or moon in our solar system. Reassure students that even if they did not complete the activity from the Notation for NASA, Part 1 lesson that it will be okay; they can still jump into this activity. They will use scientific notation and their problem-solving skills to take the next step in this space mission.

Display **slide 40** and give each student a copy of the attached **Mission Analysis** handout. Have students get out their Mission Report handout from the previous lesson or a device. Explain to students that because of their excellent work on their Mission Reports, their missions have been approved! Inform students that their next task is to plan for their mission: calculating distances, modeling how gravity affects motion, and solving real-world problems NASA teams face when planning space travel.

Show **slide 41** and have students work in pairs to complete the activity. Encourage students to imagine themselves as real NASA mission planners as they apply their scientific knowledge and mathematical reasoning to help plan the mission.

Meeting the Science Standard

If you teach science, have students create a model of their mission. Give each student a copy of the attached **Model Sketch** handout and have students:

- Draw and label the Sun, Earth, and their selected planet/moon.
- Label the distances from the Earth to the Sun and to their selected planet/moon.
- Find the volume of the Earth and of their selected planet/moon, and then calculate the ratio of the volumes.
- Draw arrows and label the gravitational pull and orbital direction.

See the hidden **slides 42–43** for sample responses for this optional activity.

Once students complete their mission planning, move to **slide 44**. Have students take out a piece of notebook paper and answer the reflection questions on the slide:

- How did using scientific notation help you understand the scale of space?
- What surprised you the most about the distances, sizes, or gravity that you calculated?

As time allows, ask for volunteers to share their responses with the class.

Sample Student Responses:

- Using scientific notation helped me see how huge the numbers are in space. Instead of writing a ton of zeros, I could look at the exponents and compare distances or sizes more easily.
- I was surprised by how far away my planet is from Earth. I didn't know it would take so many kilometers to get there. I was also surprised by how different the gravity was. Some planets have way more or way less gravity than Earth!

10 minutes

Evaluate

Have students use the How Am I Feeling? What Am I Thinking? strategy to reflect on both their emotional and cognitive responses to the lesson.

Provide each student with a sticky note, index card, or piece of paper and display **slide 45**. Instruct them to draw a line that divides it into two sections. On one side of their paper, have them draw a picture, symbol, or emoji that represents how they feel about the content they explored, whether that is confidence, curiosity, confusion, excitement, or another emotion.

On the other side of their paper, have students write a sentence expressing what they are thinking about regarding the lesson. This could include something they now understand better, a question they still have, a surprising discovery, or a personal insight.

Once they finish their reflection, have students place their notes on a designated board, wall, or collection area. Collect and review their responses to better understand their learning and emotional state. Use this insight to inform your next steps in instruction and support.

Resources

- Lora. (2022, August 9). Aries. [Illustration]. Noun Project. https://thenounproject.com/icon/aries-5126164/
- Lora. (2022, August 9). Libra. [Illustration]. Noun Project. https://thenounproject.com/icon/libra-5126161/
- K20 Center. (n.d.). Fiction in the facts. Strategies. https://learn.k20center.ou.edu/strategy/60
- K20 Center. (n.d.). How am I feeling? What am I thinking? Strategies. https://learn.k20center.ou.edu/strategy/187
- K20 Center. (n.d.). I notice, I wonder. Strategies. https://learn.k20center.ou.edu/strategy/180
- K20 Center. (n.d.). Painting a picture. Strategies. https://learn.k20center.ou.edu/strategy/1331
- K20 Center. (2025, May 29). *Aeronautical Engineering for NASA*. [Video]. YouTube. https://www.youtube.com/watch?v=rYT3JoJDh9E