Notation for NASA, Part 1

Introduction to Scientific Notation

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Grade Level	7th – 9th Grade	**Time Frame**	90–120 minutes
Subject	Mathematics, Science	**Duration**	2–3 class periods
Course	Earth Science, Physical Science, Pre-Algebra		

Essential Question

How can we represent very large or very small numbers?

Summary

In this lesson, students will compare very large and very small measurements and see the need for scientific notation. Students will learn how to convert between scientific notation and standard notation and connect their learning to the real world through a video of a former aeronautical engineer. This is the first lesson in the "Notation for NASA" lesson duo.

Snapshot

Engage

Students consider the scale of the solar system and just how big it is.

Explore

Students discuss how to measure very large or very small things, then match objects with their approximate size in standard form.

Explain

Students learn how to translate between standard and scientific notation.

Extend

Students watch a video of a former aeronautical engineer and complete a task related to the field.

Evaluate

Students reflect on their learning by using the Muddiest Point strategy.

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

Oklahoma Academic Standards Mathematics (8th Grade)

PA.N.1.2: Express and compare approximations of very large and very small numbers using scientific notation.

Attachments

- Choice Board—Notation for NASA, Part 1.docx
- Choice Board—Notation for NASA, Part 1.pdf
- Guided Notes (Model Notes)—Notation for NASA, Part 1.docx
- Guided Notes (Model Notes)—Notation for NASA, Part 1.pdf
- Guided Notes—Notation for NASA, Part 1.docx
- Guided Notes—Notation for NASA, Part 1.pdf
- Items and Measurements—Notation for NASA, Part 1.docx
- Items and Measurements—Notation for NASA, Part 1.pdf
- Lesson Slides—Notation for NASA, Part 1.pptx
- Mission Report—Notation for NASA, Part 1.docx
- Mission Report—Notation for NASA, Part 1.pdf

Materials

- Lesson Slides (attached)
- Choice Board handout (attached; one per student; print one-sided)
- Items and Measurements cards (attached; one set per group; print one-sided)
- Guided Notes handout (attached; one per student; print one-sided)
- Guided Notes (Model Notes) document (attached)
- Mission Report handout (attached; one per student; print two-sided)
- Pencils
- Paper
- Student devices with internet access

Preparation

Before you begin, print the attached **Items and Measurements** cards. Students will be working in groups of 2–3 to match the cards, so print enough copies for each group to have one set of cards. Consider printing on cardstock paper, especially if you plan to reuse these cards.

Once printed, cut out the cards. All of these cards are the same size for easy cutting.

During the Explain phase of the lesson, students are going to learn how to convert between *standard* and *scientific notation* and be introduced to the concept of *significant figures*. Understanding and using significant figures is not an important part of this lesson for a typical Pre-Algebra or eighth-grade science class. The idea of significant figures is included in this lesson to familiarize students with the vocabulary that they will see in higher-level science classes throughout high school. Consider teaming up with your students' math or science teacher to team teach the lesson or determine which details are important in the other subject matter. Unhide **slides 18–19** and share those slides, as needed.

15 minutes

Engage

After introducing the lesson title on **slide 2**, have students get out a piece of notebook paper. Explain that they are about to watch a video about the solar system. Ask students to watch carefully and jot down any questions that come to mind as they view the video. Transition to **slide 3** and play the *To Scale: The Solar System* video.

Embedded video
https://youtube.com/watch?v=zR3Igc3Rhfg

Next, display **slide 4** and introduce the Choice Boards strategy. Give each student a copy of the attached **Choice Board** handout, which contains a set of questions related to the video. Instruct students to thoughtfully select and respond to two questions of their choice. Direct students to label and write their answers on the back of their handout.

Once students have completed their responses, move to **slide 5** and invite a few volunteers to share the questions they selected and their answers. Encourage the rest of the class to listen actively and engage in the discussion that follows.

Avoid going into too much detail when addressing any misconceptions; allow space for curiosity and exploration as students dive deeper into the topic later in the lesson.

25 minutes

Explore

Display **slide 6** and divide the students into groups of 2–3. Give each group a set of the **Items and Measurements** cards. Introduce the Card Matching strategy and inform students that they are to work together to match each item with its appropriate measurement. Explain to the class that they are not expected to know these facts but can use context clues, including units of measurement and the size of the numbers, to match the cards.

Give groups approximately 15 minutes to work together on this activity. As you walk around the room monitoring their progress, take note of the conversations that arise. If students are frustrated, ask leading questions that can help them categorize the objects (big/small, units of measurement, etc.).

After 15 minutes of students working on their Card Matching activity, bring the class back together as a whole. If some groups have not finished, tell them that it is all right.

Teacher's Note: Guiding the Activity

The purpose of this activity is not for everyone to get all of the cards matched correctly; it is for students to gain experience looking at very large and very small numbers, recognizing how difficult it can be to read and work with numbers like these.

Some students may ask if they can search for the answers on their devices. This is discouraged, because immediate access to the answers removes the opportunity for productive struggle and building problem-solving skills.

If a group believes that they have finished before 15 minutes have passed, you may check their answers and inform them if any are incorrect. It is up to you to decide how much detail you want to give them about the incorrect answers. Use the hidden **slides 7–8** for reference.

If your students are interested and time allows, consider unhiding slides 7–8 and going through the correct matches with them.

Display **slide 9** and lead the class in a discussion using the below questions:

- What similarities and differences did you notice about the objects on the cards?
- How did it feel trying to compare or organize these very large and very small numbers?
- Was it easy or difficult to read them? Why?
- What were some clues you used to sort or match the cards?

Show **slide 10** and summarize the previous discussion by explaining that numbers can be difficult to read and work with when they are very big or very small. To overcome this challenge, scientists use a special form to write these kinds of numbers that makes them easier to read and use in calculations. Introduce the vocabulary term: *scientific notation*.

Transition through **slides 11–12** to introduce the essential question and lesson objectives.

25 minutes

Explain

Teacher's Note: Cross-Curricular Learning

During this phase of the lesson, students are going to learn how to convert between *standard* and *scientific notation* and are introduced to the concept of *significant figures*. The idea of significant figures is included in this lesson to familiarize students with the vocabulary that they will see in future science classes. Feel free to go through as much or as few of **slides 16–19** as you feel is appropriate for your students, unhiding the corresponding slides as needed.

Display **slide 13** and give each student a copy of the **Guided Notes** handout. Tell the class that they are going to learn how to convert between the two notations: *standard notation* and *scientific notation*.

Transition through **slides 14–15** and explain to students how to convert numbers in standard notation to scientific notation. Direct students to complete their Guided Notes as you progress through the slides.

Direct students' attention to the instructions at the bottom of their handout for the first example. Point out the words "significant figures." This is likely new vocabulary for students. Direct their attention to the "Significant Figures" portion of their handout (above the first example's directions). Use **slides 16–17** to introduce the concept of *significant figures* (*sig figs*) and their significance. Have students write any notes about significant figures on their Guided Notes.

Use the hidden slides **18–19** as needed.

Explain to students that, while significant figures are important, all of the numbers they work with today will only have two significant figures, so they do not need to worry about this while doing the examples or assignment. Let students know that this vocabulary is being introduced today to support their learning in other classes.

Move to **slide 20** and have students practice using the rules for converting standard notation to 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. All examples can be done together as a whole class or individually, depending on the needs of the students.

Transition to **slide 21** and give students time to check and correct their work as needed. Use this time to answer any questions they may have.

Show **slide 22** and explain to students how to convert numbers from scientific notation to standard notation. Remind students to complete their Guided Notes. As you describe the direction to move the decimal point, ask students how they think one determines how many places to move the decimal point. Help students see that the exponent determines the number of places to move the decimal. Transition through **slides 23–24** in the same way as you did the examples with slides 20–21.

Assist the students in completing the last section of their Guided Notes by showing **slide 25**. Here students compare numbers written in scientific notation. Have students talk with a partner about which inequality symbol would be correct for the first example.

After a minute or two, transition to **slide 26** and reveal that the greater than symbol is correct since the larger number is the one with the larger exponent. Repeat this process with the remaining examples using **slides 27–29**.

30 minutes

Extend

Display **slide 30** and share 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 31** and play the *Aeronautical Engineering for NASA* career-focused video, featuring Donna Shirley, a former NASA engineer. Encourage students to stay engaged and thoughtful throughout the video in preparation for the group reflection.

Embedded video
https://youtube.com/watch?v=rYT3JoJDh9E

When the video ends, move to **slide 32**. Facilitate a whole class discussion about what students noticed and wonder. Ask for volunteers to share what stood out to them and what questions they have.

Then, share your own "wonder" by asking the below reflection question:

- "Donna Shirley helped send rovers to Mars, which is really far from Earth—about 225,000,000 kilometers! Why would using scientific notation be helpful for working with numbers this big?"

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

Show **slide 33** and give each student a copy of the **Mission Report** handout. Explain to the students that they will now take on the role of a planetary scientist at NASA. Their mission is to select a planet (other than Earth) or moon in our solar system to explore. To do this, they must analyze and interpret key scale properties such as distance, size, and surface gravity using scientific notation. Remind students to use appropriate units: use kilometers (km) for diameter and distance, and use meters per second squared (m/s^2) for surface gravity.

Guide students to use their device to find properties of their selected planet/moon: diameter, distance from Earth, and surface gravity. Encourage students to also use their device to look up how two of the properties of their planet/moon compares with those of Earth. Have students independently analyze their gathered data to write their reasoning behind recommendation of the chosen destination.

Alternative Pacing

This Mission Report can be completed in class or assigned as homework for students to turn in the next day. If time is a concern, consider the latter option.

5 minutes

Evaluate

Show **slide 34**. Have students reflect on the lesson and their overall understanding of the content using the Muddiest Point strategy. Have students answer the following questions:

- Crystal Clear: What do you think is the easiest part of scientific notation?
- Muddiest Point: What do you think is the most confusing part of scientific notation?

You can collect responses in a variety of ways, depending on your class. Sticky notes, pieces of paper, and digital posts are a few examples.

Read through the responses and make note of which concepts students are comfortable and which they are struggling with. Use this information to guide any review or refreshing that needs to be done before moving on to the next lesson: Notation for NASA, Part 2.

Resources

- K20 Center. (n.d.). Card matching. Strategies. https://learn.k20center.ou.edu/strategy/1837
- K20 Center. (n.d.). Choice boards. Strategies. https://learn.k20center.ou.edu/strategy/73
- K20 Center. (n.d.). I notice, I wonder. Strategies. https://learn.k20center.ou.edu/strategy/180
- K20 Center. (n.d.). Muddiest point. Strategies. https://learn.k20center.ou.edu/strategy/109
- K20 Center. (2025, May 29). *Aeronautical engineering for NASA* [Video]. YouTube. https://www.youtube.com/watch?v=rYT3JoJDh9E
- To Scale. (2015, September 16). *The solar system* [Video]. YouTube. https://www.youtube.com/watch?v=zR3Igc3Rhfg