Scientific Notation

Strand: Number and Number Sense

Topic: Ordering numbers written in scientific notation

Primary SOL: 7.1 The student will
b) compare and order numbers greater than zero written in scientific notation.

Related SOL: 7.1a

Materials

- Scissors
- Graphic Organizer (attached)
- Graphic Organizer (Fillable) (attached)
- Standard Form Cards activity sheet (attached)
- Scientific Notation Card Sheet (attached)
- Scientific Notation with the Solar System activity sheet (attached)
- Glue

Vocabulary

ascending, descending, exponent, factor, product, standard form (earlier grades)
scientific notation (7.1)

Student/Teacher Actions: What should students be doing? What should teachers be doing?

1. Display several large numbers in standard form. Give these numbers some context, such as population, gallons of water in a river, or the amount of money a celebrity paid for a house. Lead a discussion about why it could be difficult to rewrite these numbers correctly. Then, write the numbers in scientific notation, and use this to introduce scientific notation. Ask students to brainstorm what steps are taken to change a number from standard form to scientific notation.
2. Demonstrate how to write a number using scientific notation. The Graphic Organizer can be used to assist the demonstration. Explain that scientific notation is the product of two factors. One factor is a decimal greater than or equal to 1 but less than 10. The other factor is a power of ten. Give students some examples and ask them to identify examples and non-examples. Ask students to explain why the non-examples are incorrect. Give students some numbers, and ask them to write each number using scientific notation.
3. Give each student a Standard Form Cards activity sheet. Ask students to cut apart the cards and arrange them by the standard form, in ascending order. Have students convert and record, at the bottom of each card, the number in scientific notation.
4. Once the cards are arranged in correct order, ask students what patterns they see in the arrangement of the scientific notation. The discussion should focus on the fact that the numbers with the smallest exponential value are also smallest in value. If the exponential value is repeated, then the numbers are arranged by the decimal.

5. Give each student a Scientific Notation Card Sheet. Have students cut apart Set A and arrange them by the scientific notation, in descending order. The discussion should focus on the value of the exponents, which are all positive, and then the fact that they are arranged by the decimal. After the discussion, have students paste the cards onto lined paper using the greater than symbol (>) to show the order.
6. Have students cut apart Set B and arrange them by the scientific notation, in ascending order. The discussion should focus on the value of the exponents, which are all negative, and then the arrangement by decimal. After the discussion, have students paste the cards to lined paper using the less than symbol (<) to show the order.
7. Have students cut apart Set C and arrange them by the scientific notation, in descending order. The discussion should focus on the value of the exponents, which are negative and positive, and then the arrangement by decimal.
8. Distribute the Scientific Notation with the Solar System activity sheet, and have students complete it.

Assessment

- **Questions**
  - Why would you want to write a number in scientific notation?
  - When numbers are written in scientific notation, why is the exponent important?
- **Journal/writing prompts**
  - Write the steps for converting a number in standard form to a number in scientific notation.
  - Explain how to order numbers written in scientific notation with negative exponents.
- **Other Assessments**
  - Use the second graphic organizer (i.e., with the empty descriptors). Have students use the vocabulary to create their own problem.

Extensions and Connections (for all students)

- Have students design a scientific notation poster. The poster should include an explanation on how to convert a whole number and a decimal from standard form to scientific notation. It should also include an explanation about ordering numbers written in scientific notation with at least two examples.
- Write the mass of the planets using scientific notation.
- Use the Standard Form Cards as a partner activity. One partner completes the left column, and the other partner completes the right. Partners then check each other's work and discuss.
- In Science, students will be working with metric unit conversions. Students can bring the conversions to class and make a connection with scientific notation.

Strategies for Differentiation

- When identifying examples and non-examples, give students cards on their desk to sort.

- Some students will need extra reinforcement with the greater-than and less- than symbols.
- With the Scientific Notation with the Solar System activity sheet, if students have their own devices, remove the distances and have students find the distances for each planet from the sun. Students must use reasoning and logic to estimate/round the values appropriately in order that they can be written in scientific notation.
- Preteach vocabulary to students who many need additional exposure prior to the lesson.
- Provide worked examples for some students in the solar system chart of the first two or three planets.

Note: The following pages are intended for classroom use for students as a visual aid to learning.

Graphic Organizer

Numbers can be written in standard form and in scientific notation.

Standard Form: 5,200,000,000,000 **Scientific Notation:** 5.2×10^{12}

Numbers written in scientific notation are made up of three parts: the coefficient, the base, and the exponent.

$$5.2 \times 10^{12}$$

Coefficient must be greater than or equal to 1 and less than 10.

Base is always 10.

Exponent shows the number of decimal places that the decimal needs to be moved to change the number to standard notation.

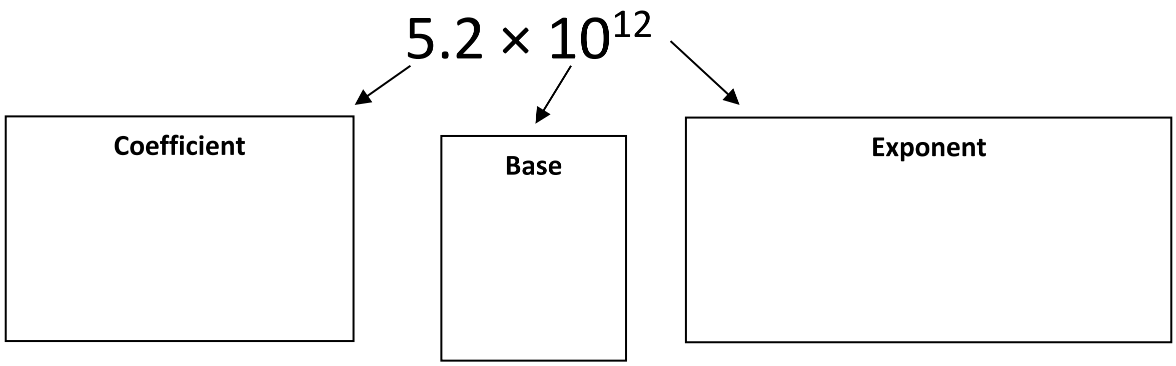
(A **negative exponent** indicates that the decimal is moved to the left when changing to standard notation.)

Graphic Organizer (Fillable)

Numbers can be written in standard form and in scientific notation.

Standard Form: 5,200,000,000,000 **Scientific Notation:** 5.2×10^{12}

Numbers written in scientific notation are made up of three parts: the coefficient, the base, and the exponent.



Standard Form Cards

1,200,000,000	11,900,000
9,800,000	203,000,000,000
80,000,000	60,510,000
27,000,000,000	1,050,000,000
0.000003	0.00000612
0.000054	0.00000036
0.0000409	0.00006296
0.0000000367	0.00000067

Scientific Notation Card Sheet

Set A

2.75×10^{3}	1.05×10^{6}
8.1×10^{3}	5×10^{8}

Set B

2.15×10^{-3}	4×10^{-2}
3.1×10^{-6}	1.11×10^{-4}

Set C

7.3×10^{3}	7.3×10^{-3}
7.03×10^{3}	7.003×10^{-1}

Scientific Notation with the Solar System

Name ________________________________ **Date** ______________________

Complete the chart.

Planet	Approximate Distance from the Sun	Distance Written in Scientific Notation
Earth	93,000,000	
Jupiter	484,000,000	
Mars	142,000,000	
Mercury	36,300,000	
Neptune	2,800,000,000	
Saturn	888,000,000	
Uranus	1,780,000,000	
Venus	67,200,000	

List the planets in order from **greatest to least**, using scientific notation.

Planet	Distance from the Sun Written in Scientific Notation