Scientific notation

Original lesson by Heather Sparks

Big Idea

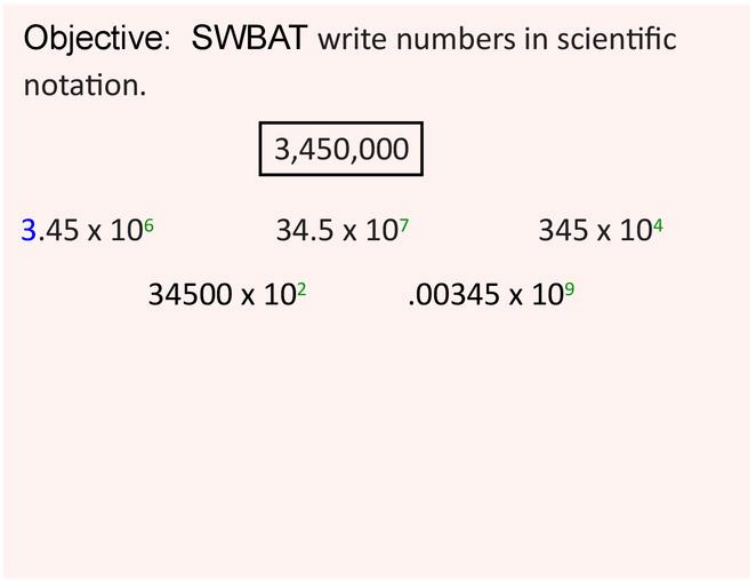
In this lesson, students will discover and practice procedures for writing numbers in scientific notation.

The Effects of Powers of 10

5 MINUTES

After warm up, I introduce today's Learning Objective. I then point out the number 3,450,000 and five different representations of that number. I ask students what they notice about the numbers. Right away, students respond that all the numbers have the same digits, so I ask how the numbers are related to each other. I call on a student who responds, "They are all equal." I ask him to explain or demonstrate how he knows this, so he comes to the board and says, "If I move the decimal for each exponent, they all come out the same." I ask for student understanding by displaying a 'thumbs-up' (understand), 'thumbs-down' (don't understand) or 'thumbs-sideways' (not sure). I see several 'thumbs sideways' and two 'thumbs down', so I ask students to conduct a 30-second 'table talk' where the students at the table who understand the concept explain it to the students who do not. Many groups demonstrate the concept for their tablemates to build understanding.

At the end of 30 seconds, I explain that although each of these representations is equivalent to the original number, only the first one is written in correct scientific notation. I then ask students to describe the attributes of the first representation. They soon realize the only difference is the number of digits before the decimal. I congratulate them on their deduction skills and reiterate that proper scientific notation is written as a number between 1 and 9 multiplied by 10 raised to a power.



Trash Can Sort

5 MINUTES

To solidify student understanding of proper scientific notation, I move to the next slide, where I have created a sorting activity, Trash Can Sort, in which students drag and drop numbers into one of two columns: 'numbers written in proper scientific notation' and 'NOT written correctly in scientific notation'. I call students at random (using name sticks drawn from a cup) to come to the board to sort. This activity prompts some important points to be made like why 0.23 x 10^4 is not proper scientific notation.

Sort the given values.

2.35×10^{5}

5×10^{-9}

45.9×10^{-6}

0.23×10

3.214×10^{1}

12×10^{0}

2.1203×10^{-16}

6.09×10^{7}

-78.3×10^{23}

1.9×10^{-22}

-4.89×10^{8}

Written in proper scientific notation

NOT written in proper scientific notation

Recognizing Significant Digits

4 MINUTES

Once we have sorted all the numbers and gained an understanding that proper scientific notation is expressed as a number between 1 and 9 multiplied by 10 raised to a power, I introduce the definition of 'Significat Digits'. Then, by pulling sticks, I randomly select students to come to the board to circle significant digits in each example number. I explain that recognizing the significant digits is half the work of writing a number in scientific notation.

Numbers written in scientific notation are expressed as the significant digits, with a decimal point after the first digit, multiplied by a power of ten.

$92{,}300{,}000 \longrightarrow 9.23 \times 10^{?}$

How many times will you multiply 9.23 times 10 to get 92,300,000?

Next, I display the definition of scientific notation (How Many x 10). I show the significant digits multiplied by 10 and ask, "How Many times will you multiply 9.23 times 10 to get 92,300,000? I call on a student to give the answer and then demonstrate her thinking. I restate her explanation while demonstrating with a new number: "So what I heard you say was I need to multiply the coefficient by 10 seven times in order to get 73,200,000. Is that right? So what would my exponent of 10 be?" My goal is for students to see the connection between the number of times they multiply by ten and the number they use as the exponent in scientific notation. This understanding will go far to fix the common misunderstanding some students have of counting zeroes to determine the exponent.

Let's Practice!

Write each number in proper scientific notation.

A. 24,000,000

B. 0.0000573

C. 192,400,000

D. 0.00028

Let's Practice!

12 MINUTES

At this point, the students are ready to Practice, so I provide nine numbers to convert to scientific notation. I only reveal 3 problems at a time to limit the student's focus. We go through the first two problems together as I guide their thinking first to significant digits, then proper decimal placement, then determining the exponent. After the students complete the third problem without my guidance, I reveal the next three numbers. I circulate through the classroom providing assistance when needed. Once the majority of students have finished, I ask for volunteers to share their responses and ask the class to agree or disagree with 'thumbs-up' or 'thumbs-down'. Finally, I reveal the last 3 problems and ask students to compare answers at their tables as they finish. As I move about the room, I am on the look out for

common misconceptions, the most common of which is that the exponent used is the number of zeroes in the given number.

Let's Practice!

Write each number in proper scientific notation.

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B. 0.0000573

C. 192,400,000

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Ticket Out the Door

7 MINUTES

To gather data on levels of student understanding, I close class with an Exit Ticket. Today's Ticket Out the Door includes three sections: circling significant digits in given numbers, writing number in scientific notation, and evaluating the work of another student. Student responses often reveal misconceptions and common errors that can be used as teaching points the following day.

Exit Ticket
Scientific Notation

Name: _____

1. Circle the significant digits in each number:

.0000042 35,700,000 .000803 2,400,000

2. Write each number in scientific notation:

a. 57,800,000 _____

b. 0.000092 _____

3. Marlo wrote 54,200,000 in scientific notation as 54.2×10^6. Was she correct? Why or why not?

_____
_____
_____
_____
_____

Exit Ticket
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Out the Door

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Acknowledgement

https://teaching.betterlesson.com/lesson/527135/introduction-to-scientific-notation