**Name:**

# Skill Builder                    Scientific Notation $\boxed{S_B}$

Writing numbers like 1,000,000,000,000 and 0.000001 can be challenging. It is difficult to work with and use these numbers because of all the zeros. Scientific notation helps simplify these numbers into a form that is easily recognized. Using this method, numbers are written as a value between 1 and 10, and then multiplied times a power of 10. In this skill sheet you will learn how to write numbers using scientific notation and how to perform calculations using scientific notation.

## 1. Writing numbers using scientific notation

Here's a step-by-step example of how to write numbers in scientific notation.

**Table 1: Using scientific notation**

| Step 1 | Move the decimal until you get a value that is between 1 and 10. Count the number of times you move the decimal. |
|---|---|
| Step 2 | Write down the new number without all of the zeros. |
| Step 3 | Write $\times$ 10 after the number. |
| Step 4 | Write the number of times you moved the decimal as the power of 10 (the exponent). If you moved the decimal to the left, the exponent will be positive. If you moved the decimal to the right, the exponent will be negative. |

Using these steps, fill in the table by converting the numbers in the left column into scientific notation. The first two examples are done for you.

| Number | Scientific Notation |
|---|---|
| 1,000,000,000,000 | $1 \times 10^{12}$ |
| 0.000001 | $1 \times 10^{-6}$ |
| 5,000 | |
| 0.000098 | |
| 100 | |
| 6,500,000 | |
| 0.1 | |
| 0.000000000021 | |
| $10 \times 10 \times 10 \times 10$ | |

## 2. Writing out scientific notation

The following problems give you the scientific notation for a number. Write out each number as it would appear without using scientific notation.

1.  The closest star to our sun, Alpha Centauri, is $4.1 \times 10^{13}$ kilometers away. Write out this number.

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2.  Earth is approximately $1.5 \times 10^{8}$ kilometers from the sun. Write out this number.

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3.  The wavelength of red light is $7 \times 10^{-7}$ meters long. Write out this number.

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## 3. Solving problems using scientific notation

Using scientific notation simplifies multiplying and dividing big and small numbers. If you are multiplying, you *add* the exponents. If you are dividing, you *subtract* the exponents. Use the examples below to help you solve the problems on the next page.

Sample Problem 1: Multiplying with exponents:

$$\left(2.0\times10^{3}\right)\times\left(6.5\times10^{6}\right)=?$$

**Step one - divide the numbers:**

$$2.0\times6.5=13.0$$

**Step two - add the exponents:**

$$10^{(3+6)}=10^{9}$$

**Step three - move the decimal and adjust the exponent:**

$$13.0\times10^{9}=1.3\times10^{10}$$

Sample Problem 2: Dividing with exponents:

$$\left(1.2\times10^{10}\right)\div\left(6.0\times10^{-5}\right)=?$$

**Step one - divide the numbers:**

$$1.2\div6.0=0.2$$

**Step two - subtract the exponents:**

$$10^{\left[10-(-5)\right]}=10^{15}$$

**Step three - move the decimal and adjust the exponent:**

$$0.2\times10^{15}=2.0\times10^{14}$$

1. $(1.5 \times 10^7) \times (4.5 \times 10^3) =$

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2. $(2 \times 10^3) \div (3 \times 10^2) =$

_____

3. $(3.6 \times 10^2) \times (2 \times 10^4) \times (1 \times 10^{-3}) =$

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4. $(4 \times 10^5) \div (4 \times 10^6) =$

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5. Multiply 46,000 by 100,000.
   a  Setup this problem using scientific notation.

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   b  Write your answer in scientific notation.

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6. Divide 0.1 by 200.
   a  Setup this problem using scientific notation.

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   b  Write your answer in scientific notation.

_____

7. Divide 0.03 by 0.09.
   a  Setup up this problem using scientific notation.

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   b  Place your answer in scientific notation.

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8. Divide 6 million by 100. Write out this problem and its answer using scientific notation.

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9. The speed of light travels at 186,000 miles per second. You want to find out how far light will travel in a million seconds and you don't have a calculator. Can you solve this problem anyway? How? What is the answer?

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