

# Bellringer

Write the following in standard notation:

- $7.8 \times 10^9$
- $9.23 \times 10^3$
- $1 \times 10^7$

Write the following in scientific notation:

- 623,000
- 250
- 120,000,000

## **2.3 Scientific Notation with Negative Powers of 10**

8.EE.3

Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other

Recall:

## Scientific Notation with Positive Powers of 10

- If we have a number in scientific notation being multiplied by a positive power of 10, move right

$$\text{ex: } 1.23 \times 10^4 = \underline{12300} = 12,300$$

- If we have a number in standard notation, we move to the left until we reach a number greater than/equal to 1 and less than 10

$$\text{ex: } \underline{1233000} = 1.233 \times 10^6$$

## EXPLORE ACTIVITY



COMMON CORE 8.EE.3

## Negative Powers of 10

You can use what you know about writing very large numbers in scientific notation to write very small numbers in scientific notation.

$$a^{-n} = \frac{1}{a^n}$$

**A typical human hair has a diameter of 0.000025 meter. Write this number in scientific notation.**

- A** Notice how the decimal point moves in the list below. Complete the list.

$2.345 \times 10^0$	$= 2.345$	<i>It moves one place to the right with each increasing power of 10.</i>	$2.345 \times 10^0$	$= 2.345$	<i>It moves one place to the left with each decreasing power of 10.</i>
$2.345 \times 10^1$	$= 23.45$		$2.345 \times 10^{-1}$	$= 0.2345$	
$2.345 \times 10^2$	$= 234.5$		$2.345 \times 10^{-2}$	$= 0.02345$	

$2.345 \times 10^{\boxed{3}}$	$= 2345$	$2.345 \times 10^{\boxed{-3}}$	$= 0.002345$
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- B** Move the decimal point in 0.000025 to the right as many places as necessary to find a number that is greater than or equal to 1 and

less than 10. What number did you find? 2.5

- C** Divide 0.000025 by your answer to **B**. .00001

Write your answer as a power of 10.  $10^{-5}$

- D** Combine your answers to **B** and **C** to represent 0.000025 in

scientific notation.  $2.5 \times 10^{-5}$

0.000025

## Writing a Number in Scientific Notation

- To write a number less than 1 in scientific notation, move decimal point to the right and use a negative exponent

ex:  $.000235$

$$2.35 \times 10^{-4}$$

**EXAMPLE 1**COMMON  
CORE

8.EE.3

The average size of an atom is about 0.00000003 centimeter across.  
Write the average size of an atom in scientific notation.

**STEP 1**

Move the decimal point as many places as necessary to find a number greater than/equal to 1 and less than 10

$$\underline{0.00000003} = 3.$$

**STEP 2**

Count how many places you moved 8 places

**STEP 3**

write in scientific notation

$$3 \times 10^{-8}$$

## ADDITIONAL EXAMPLE 1

The weight of one of the smaller species of butterflies was measured at 0.0007 ounces. Write the weight of this butterfly in scientific notation.



$$7 \times 10^{-4}$$

**YOUR TURN** 

Write each number in scientific notation.

4. 0.0000829

8.29 × 10<sup>-5</sup>

5. 0.000000302

3.02 × 10<sup>-7</sup>

6. A typical red blood cell in human blood has a diameter of approximately 0.000007 meter. Write this diameter

in scientific notation. 7 × 10<sup>-6</sup> m



## Writing a Number in Standard Notation

- To translate between Scientific notation & Standard notation with very small numbers, you move the decimal point the number of places indicated by the exponent power of 10. When the exponent is negative, move the decimal to the left

**EXAMPLE 2**COMMON  
CORE

8.EE.3

Platelets are one component of human blood. A typical platelet has a diameter of approximately  $2.33 \times 10^{-6}$  meter. Write  $2.33 \times 10^{-6}$  in standard notation.

**STEP 1**

Look to the exponent to see how many places to move decimal  $\leftarrow$  6 places

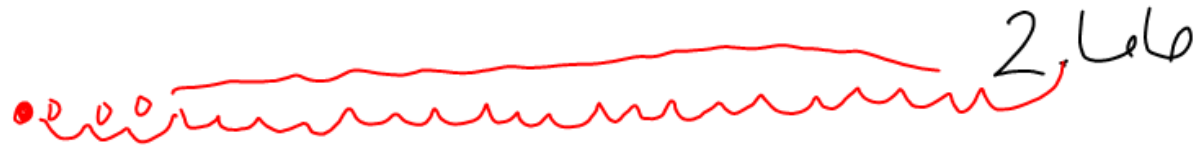
**STEP 2**

Begin moving decimal the necessary direction however many places indicated. Fill in placeholder zeros

$$\underbrace{000000}_{\text{placeholder zeros}} 2.33 = .00000233$$

## ADDITIONAL EXAMPLE 2

A single atom of oxygen has a mass of  $2.66 \times 10^{-23}$  grams. Write  $2.66 \times 10^{-23}$  in standard notation.

A handwritten red scribble consisting of a wavy line that starts with three small circles on the left and ends with the number 2.66 on the right.

A handwritten red scribble consisting of a long string of zeros followed by the number 2.66.

**YOUR TURN**

Write each number in standard notation.

9.  $1.045 \times 10^{-6}$

.000001045

10.  $9.9 \times 10^{-5}$

.000099

11. Jeremy measured the length of an ant as  $1 \times 10^{-2}$  meter.  
Write this length in standard notation.

.01 m

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## Guided Practice

Write each number in scientific notation. (Explore Activity and Example 1)

1. 0.000487

Hint: Move the decimal right 4 places.

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3. 0.000059

$$5.9 \times 10^{-5}$$

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5. Picoplankton can be as small as 0.00002 centimeter.

$$2 \times 10^{-5} \text{ cm}$$

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2. 0.000028

Hint: Move the decimal right 5 places.

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4. 0.0417

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6. The average mass of a grain of sand on a beach is about 0.000015 gram.

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**Write each number in standard notation. (Example 2)**

**7.**  $2 \times 10^{-5}$

Hint: Move the decimal left **5** places.

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**9.**  $8.3 \times 10^{-4}$

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**11.**  $9.06 \times 10^{-5}$

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*.0000906*

**8.**  $3.582 \times 10^{-6}$

Hint: Move the decimal left **6** places.

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**10.**  $2.97 \times 10^{-2}$

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**12.**  $4 \times 10^{-5}$

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- 13.** The average length of a dust mite is approximately 0.0001 meter.  
Write this number in scientific notation. (Example 1)

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- 14.** The mass of a proton is about  $1.7 \times 10^{-24}$  gram. Write this number in standard notation. (Example 2)

HW

GP p48. 1-15

IP p49 16-34