

## Pre-Algebra

Essential Question: How can we use scientific notation to represent very large and very small numbers?

Do Now: Find the product.

a)  $3.5 \times 10$

35

b)  $3.5 \times 100$

350

c)  $3.5 \times 1,000$

3,500

d)  $3.5 \times 0.1$

0.35

e)  $3.5 \times 0.01$

0.035

f)  $3.5 \times 0.001$

0.0035



Take a closer look at the Do Now. Are the products below (g - l) equivalent to a - f?

g)  $3.5 \times 10^1$

h)  $3.5 \times 10^2$

i)  $3.5 \times 10^3$

j)  $3.5 \times 10^{-1}$

k)  $3.5 \times 10^{-2}$

l)  $3.5 \times 10^{-3}$

A number is written in scientific notation when it is represented as a product of a number and a power of 10. The number part must be greater than or equal to 1 and less than 10.

### SCIENTIFIC NOTATION

$$c \times 10^n$$

where  $c$  is a value  $\geq 1$  and  $< 10$  and  $n$  is an integer.

### Powers of 10

$$10^4 = 10 \times 10 \times 10 \times 10 = 10,000$$

$$10^3 = 10 \times 10 \times 10 = 1,000$$

$$10^2 = 10 \times 10 = 100$$

$$10^1 = 10$$

$$10^0 = 1$$

$$10^{-1} = \frac{1}{10} = 0.1$$

$$10^{-2} = \frac{1}{10^2} = \frac{1}{100} = 0.01$$

$$10^{-3} = \frac{1}{10^3} = \frac{1}{1,000} = 0.001$$

$$10^{-4} = \frac{1}{10^4} = \frac{1}{10,000} = 0.0001$$

coefficient  
\*  $c \geq 1$  and  $c < 10$

$$1.3 \times 10^4$$

exponent  
\* must be an integer

base  
\* must be 10

State whether each number is written in scientific notation.

1)  $4.5 \times 10^2$

yes

2)  $34.5 \times 10^3$

no  $34.5 > 10$

3)  $12.1 \times 10^{-1}$

no  $12.1 > 10$

4)  $9.6 \times 10^3$

no the base must be 10

How do we write numbers in standard form if they are written in scientific notation?

Example:  $4.9 \times 10^4 =$  49,000

4.9000

Example:  $4.9 \times 10^{-4} =$  0.00049

0.00049

Scientific Notation  $\rightarrow$  Standard Form

$2.756 \times 10^5$

$= 2.75600$

$= 275\,600 \checkmark$

Because the exponent is **Positive** 5, move the decimal point 5 places to the right.

Add in Zeroes to fill the empty gaps.

$3.76 \times 10^{-3}$

$= 0.00376$

$= 0.00376 \checkmark$

Because the exponent is a **Negative** 3, move the decimal point 3 places to the left.

Add in Zeroes to fill the empty gaps.

Write each number in standard form.

5)  $3.2 \times 10^7$

3.20000000

32,000,000

6)  $8.69 \times 10^5$

8.69000

869,000

7)  $1.75 \times 10^{-3}$

0.00175

0.00175

8)  $2.05 \times 10^{-2}$

0.0205

0.0205

How do we write numbers in scientific notation if they are written in standard form?

Example:  $670,000 =$   $6.7 \times 10^5$

670000.

Example:  $0.00983 =$   $9.83 \times 10^{-3}$

0.00983

Standard Form  $\rightarrow$  Scientific Notation

- Place the decimal point to the right of the first non-zero digit.
- Count the number of decimal places the decimal has "moved" from the original number. This will be the exponent of the 10.

- If the original number was less than 1, the exponent is negative;
- If the original number was greater than 1, the exponent is positive.

Write each number in scientific notation.

9) 1,250

1.250

$1.25 \times 10^3$

10) 304,050,000

304050000.

$3.0405 \times 10^8$

11) 0.0016

0.0016

$1.6 \times 10^{-3}$

12) 0.000409

0.000409

$4.09 \times 10^{-4}$

## It's time to Partner Up!

13) Write each number in standard form.

a)  $9.02 \times 10^6$   
 $9,020,000$

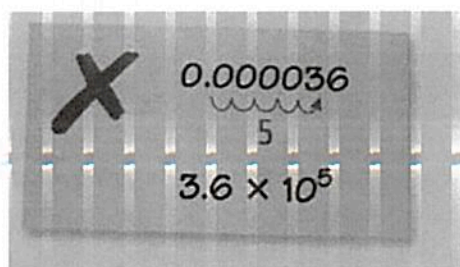
b)  $6.79 \times 10^{-6}$   
 $0.00000679$

14) Write each number in scientific notation.

a) 250,000,000  
 $2.5 \times 10^8$

b) 0.00001408  
 $1.408 \times 10^{-5}$

15) Describe and correct the error.



The exponent should be negative, not positive, because the original number is less than 1.  
 $3.6 \times 10^{-5}$

16) The current population in the world is about 7.5 billion. Write this number in scientific notation.

$7,500,000,000$   
 $7.5 \times 10^9$

17) Polly's parents' car weighs about 3500 pounds. Samantha, Esther and Polly each wrote the weight of the car in scientific notation. Polly wrote  $35.0 \times 10^2$ , Samantha wrote  $0.35 \times 10^4$ , and Esther wrote  $3.5 \times 10^4$ . Which of these girls, if any, is correct? Explain the mistakes of those who were incorrect.

Polly	Samantha	Esther
$35.0 \times 10^2$ No because $35.0 > 10.$	$0.35 \times 10^4$ No because $0.35 < 1$	$3.5 \times 10^4$ 35000 No the exponent should be 3.

The **TAKEAWAY**

Scientific Notation can be used to express very large and very small numbers. For a number to be written in proper scientific notation form, it must be written as a product of a number greater than or equal to 1 and less than 10, and a power of 10.