

NAME \_\_\_\_\_

Module 5    Decimal Operations, Exponents, and Powers  
Lesson 7    Scientific Notation

### Lesson Objectives

- Demonstrate an understanding of place values using powers of 10 and write numbers greater than one in scientific notation with and without appropriate technology.
- Convert between scientific notation and standard notation using numbers greater than one.
- Convert between scientific notation and standard notation using numbers from zero to one.

### Subtopic 1    Powers of Ten with Integer Exponents

- Powers of 10 with integer exponents are **place values**.
- To write a power of 10 greater than or equal to 1, count the number of **zeros** in the number. Use that number as the **exponent**.
- To write a power of 10 that is less than 1, count the number of **places** after the **decimal point**. Use the **opposite** of that number as the exponent.
- To evaluate  $10^n$  for  $n$  **greater than** or **equal** to 0, write 1 followed by  $n$  zeros.
- To evaluate  $10^n$  for  $n$  **less than** 0, write 1 in the  $n$ th decimal place, preceded by as many zeros as necessary.

Write as a Power of 10.

1    1,000,000  
 $10^6$

2    0.00001  
 $10^{-5}$

Evaluate.

3     $10^7$   
10,000,000

4     $10^{-7}$   
0.0000001

### Subtopic 2    Multiply by a Power of Ten with an Integer Exponent

- To multiply by a power of 10 with a nonnegative integer exponent, move the decimal point one place to the **right** for every power of 10.
- To multiply by a power of 10 with a negative integer exponent, move the decimal point one place to the **left** for every negative power of 10.
- A number is written in **expanded form** when it is expressed as a sum of products of each digit and its place value.

**Multiply.**

**5**  $14.25 \times 10^3$   
 $\underline{14.250.}$   
 $\underline{14,250}$

**6**  $0.35 \times 10^{-1}$   
 $\underline{.035}$   
 $\underline{0.035}$

**7** Write 4.075 in expanded form.

ones	.	tenths	hundredths	thousandths
$10^0$	.	$10^{-1}$	$10^{-2}$	$10^{-3}$
4	.	0	7	5

$$4.075 = (4 \times 10^0) + (0 \times 10^{-1}) + (7 \times 10^{-2}) + (5 \times 10^{-3})$$
$$4.075 = 4 + 0.07 + 0.005$$

### Subtopic 3 Scientific Notation

- Scientific notation presents a way to write numbers that are very **large** or very **small**.
- A number written in scientific notation is the **product** of a number that is at least **1** but less than **10** and a power of **10** in exponential form.

**Tell whether the number is written in scientific notation.**

**8**  $5.6 \times 10^7$   
**Yes**

**9**  $0.4 \times 10^{-5}$   
**No**

**10**  $8 \times 10^{87}$   
**Yes**

**Subtopic 4    Converting Between Standard and Scientific Notation**
**Writing a number greater than one in scientific notation**

- Move the decimal point so only one **nonzero number** is before the decimal point.
- Count the **number of places** moved from the original decimal point.
- The number of places counted is the **exponent of 10**.
- If the count is to the **right** of the 1st nonzero digit, the exponent is positive.

**Writing a number less than one in scientific notation**

- Move the decimal point so only one nonzero number is before the decimal point.
- Count the number of places moved from the **original decimal point**.
- The number of places counted is the **exponent of 10**.
- If the count is to the left of the 1st nonzero digit, the exponent is **negative**.


**11**

Write 876,000 in scientific notation.

$$\begin{array}{ccccccc} 8 & 7 & 6 & 0 & 0 & 0 & . \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \\ 1 & 2 & 3 & 4 & 5 & & \end{array}$$

$$8.76 \times 10^5$$


**12**
Write  $6.12 \times 10^{-4}$  in standard notation.

$$\begin{array}{ccccccc} 0 & . & 0 & 0 & 0 & 6 & 12 \\ \downarrow & & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ -4 & & -3 & -2 & -1 & & \end{array}$$

$$0.000612$$


**13**

Write 0.00000024 in scientific notation.

$$\begin{array}{ccccccccccc} 0 & . & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 4 \\ \downarrow & & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ -7 & & -6 & -5 & -4 & -3 & -2 & -1 & & \end{array}$$

$$2.4 \times 10^{-7}$$


**14**
Write  $4.5 \times 10^{-2}$  in standard notation.

$$\begin{array}{ccc} . & 4 & 5 \\ \downarrow & \downarrow & \\ -2 & -1 & \end{array}$$

$$0.045$$

