

Scientific Notation

Monday, September $(2^2 \times 3)^1$, 2016

AIMS:

- ✓ SWBAT write, add, and subtract numbers in scientific notation and understand what is meant by the term leading digit

AGENDA:

- I. Do Now (2 min)
- II. Open/Do Now Review (3 min)
- III. Class Notes: Scientific Notation
- IV. Guided Practice
- V. Independent Practice
- VI. Class Notes: Adding and Subtracting in Scientific Notation
- VII. Guided Practice
- VIII. Independent Practice
- IX. Practicing our AIMS:
 - ✓ Homework: ExPWN it! 10
- X. Close (2 min)

Will your choices help us STRIVE?

“There is
NO SUBSTITUTE
for HARD WORK.”

—THOMAS EDISON

8th Grade
Math
Scientific
Notation

Name: Key #:

Date: _____

Homeroom:  Cleveland State University



EXPWN It! 10

AIM(S):

- ✓ SWBAT write, add, and subtract numbers in scientific notation and understand what is meant by the term leading digit

DO NOW

Directions: Complete the following questions.

Write the following in **standard form**:

1) $10^0 = 1$

2) $10^9 = 1,000,000,000$

3) $10^{-2} = 0.01$

4) $10^1 = 10$

5) $2 \times 10^0 = 2 \times 1 = 2$

6) $2 \times 10^9 = 2,000,000,000$

7) $2 \times 10^{-2} = 0.02$

8) $2 \times 10^1 = 20$

9) What does an integer base with a negative exponent (ex: 4^{-3}) mean? Select all that apply:

- The expression always simplifies to a negative number
- The expression always simplifies to a number between 0 and 1
- The negative exponent means to repeatedly divide by the base
- The negative exponent means to repeatedly subtract the base from itself

Lesson Opener

Our knowledge of the integer powers of 10 enable us to understand the next concept,

Scientific Notation

We will estimate numbers such as:

6,187 as 6×10^3

0.000 033 4 as 3×10^{-5}

Why use scientific notation? Let's take a look...

It is estimated that there are 60,000,000,000,000,000,000 stars in the Universe. We don't have to write this number this way! We can use scientific notation by writing this as 6×10^{21} . This is much easier to write and less likely that you would leave a zero out or make a mistake.

Take a minute...

1. What do you notice about the exponent and the number of zeros?

They are the same amount

Scientific Notation is used to shorten and simplify numbers with very large order of magnitude by multiplying by a positive power of 10 (ex: 10^{21}) and very small orders of magnitude by multiplying by a negative power of 10 to show it is a number between 0 & 1 (ex: 10^{-6})

Class Notes: Scientific Notation

Directions: Board Equals Paper!

VOCAB

Power(s) of ten: numbers with a base of 10 & an integer exponent

EX: 10^{-14} , 10^3 , 10^{30} , 10^{-6} , 10^0

Order of Magnitude: how large or small a number is compared to 0

Scientific Notation: a number n ($0 < n \leq 10$) multiplied by an integer power of 10, to simplify very large/small numbers

Leading digit: the n ($0 < n \leq 10$) multiplied by a power of 10.

Is it in scientific notation?

A number which is ≥ 0 and ≤ 10 , (has 1 digit before the decimal). Called the leading digit

A multiplication symbol

$$3.55 \times 10^{-43}$$

An integer exponent, which shows the order of Magnitude (size) of the number

A base of 10, so we can easily determine the order of magnitude by moving the decimal

A positive, finite decimal s is said to be written in scientific notation if it is expressed as a product $d \times 10^n$, where d is a finite decimal so that $1 \leq d < 10$, and n is an integer.

The integer n is called the order of magnitude of the decimal $d \times 10^n$.

Example 1: Six students were told to write equivalent expressions to 234.567. Which are equal? Which are in scientific notation?

$$2.34567 \times 10^2$$

$$0.234567 \times 10^3$$

$$23.4567 \times 10$$

$$234.567 \times 10^0$$

$$234567 \times 10^{-3}$$

$$234567000 \times 10^{-6}$$

All of these are equal to 234.567, but only the 1st one is in scientific notation.

Guided Practice

Directions: Board=Paper!

Are the following numbers written in scientific notation? Circle YES or NO. If not, state the reason.

1) 1.908×10^{17} YES or NO

If not, why? _____

2) 18.432×5^{88} YES or NO

If not, why? 2 digits before decimal, not a power of 10

3) Write the numbers in **standard form**.

a.) 3.5×10^3

3,500

b.) 2.48×10^6

2,480,000

c.) 3.5×10^{-3}

0.0035

d.) 2.48×10^{-6}

0.00000248

You Try

Are the following numbers written in scientific notation? Circle YES or NO. If not, state the reason.

1) $4.0701 + 10^7$ YES or **NO**

If not, why? needs to be a product

2) 0.325×10^{-2} YES or **NO**

If not, why? needs to have a leading digit between 1 & 9

3) 7.99×10^{32} **YES** or NO

If not, why? _____

4) 8×10^{-17} **YES** or NO

If not, why? _____

5) Write the numbers in **standard form**

a.) 5.1×10^4

51,000

b.) 9.16×10^2

916

c.) 5.1×10^{-4}

0.00051

d.) 9.16×10^{-2}

0.0916

Guided Practice: Finding Sums and Differences with Scientific Notation

NOTES:

- 1) Write the numbers you are adding/subtracting in scientific notation
- 2) Make them have the same power of 10. This may require splitting a power of ten up!

EX: Add 3.6×10^{93} and 7.2×10^{95}

$$3.6 \times 10^{93} + (7.2 \times 10^2) \times 10^{93} \leftarrow 93+2=95!$$
$$3.6 \times 10^{93} + 720 \times 10^{93}$$

- 3) Use the distributive property to add the leading digits, and keep your powers of 10 the same!

$$(3.6 + 720) \times 10^{93}$$
$$723.6 \times 10^{93}$$

- 4) If the result you received when adding the leading digits is no longer between 1 & 10, correct your result so it is still in scientific notation

$$723.6 \times 10^{93}$$

↳ 2 places!

$$7.236 \times 10^{95}$$

Guided Practice: Finding Sums and Differences with Scientific Notation

- 1) In 2012, Texas had a population of about 26 million people, and North Dakota had a population of about 6.9×10^4 . Determine the difference in the populations of Texas and North Dakota.

Texas Population: $26000000 = 2.6 \times 10^7$

North Dakota Population: 6.9×10^4

Finding the difference:

$$\begin{aligned}
 (2.6 \times 10^7) - (6.9 \times 10^4) &= (2.6 \times 10^3) \times 10^4 - (6.9 \times 10^4) \\
 &= 2600 \times 10^4 - 6.9 \times 10^4 \\
 &= (2600 - 6.9) \times 10^4 \\
 &= 2593.1 \times 10^4 = 2.5931 \times 10^7 \text{ people difference.}
 \end{aligned}$$

Handwritten calculation on the left:

$$\begin{array}{r}
 2600.0 \\
 - 6.9 \\
 \hline
 2593.1
 \end{array}$$

- 2) Water, also known as H_2O , has mass! One hydrogen atom is approximately $0.000\,000\,000\,000\,000\,000\,000\,000\,001\,7$ kilograms. One oxygen atom is approximately $0.000\,000\,000\,000\,000\,000\,000\,000\,000\,000\,000\,027$ kilograms. Determine the combined mass of water (two hydrogens and one oxygen atom).

1 Hydrogen atom: 1.7×10^{-27}

1 Oxygen atom: 2.7×10^{-26}

2 Hydrogen atoms: $1.7 \times 10^{-27} \times 2 = 3.4 \times 10^{-27}$

2 Hydrogen atoms + 1 Oxygen atom:

$$\begin{aligned}
 &(3.4 \times 10^{-27}) + (2.7 \times 10^{-26}) \\
 &\quad \downarrow \\
 &(3.4 \times 10^{-1} \times 10^{-26}) + (2.7 \times 10^{-26}) \\
 &0.34 \times 10^{-26} + 2.7 \times 10^{-26} \\
 &(0.34 + 2.7) \times 10^{-26} = 3.04 \times 10^{-26} \text{ kg.}
 \end{aligned}$$

A water atom weighs approximately 3.04×10^{-26} kg.

Independent Practice

Directions: Complete every question below! Do your best! When done, you may work on the ADVANCED WORK ONLY (not homework ☺)

Directions: Use the table below to complete questions 1 – 6 for Your Turn and Independent Practice.

The table below shows the debt of the three most populous states and the three least populous states.

State	Debt (in dollars)	Population (2012)
California	407,000,000,000	38,000,000
New York	337,000,000,000	19,000,000
Texas	276,000,000,000	26,000,000
North Dakota	4,000,000,000	690,000
Vermont	4,000,000,000	626,000
Wyoming	2,000,000,000	576,000

1. What is the sum of the debts for the three most populous states?
Express your answer in scientific notation.

$$\begin{aligned}4.07 \times 10^{11} + 3.37 \times 10^{11} + 2.76 \times 10^{11} &= (4.07 + 3.37 + 2.76) \times 10^{11} \\ &= 10.2 \times 10^{11} \\ &= (1.02 \times 10) \times 10^{11} \\ &= 1.02 \times 10^{12} \text{ people.}\end{aligned}$$

2. What is the sum of the debt for the three least populous states?
Express your answer in scientific notation.

$$\begin{aligned}4 \times 10^9 + 4 \times 10^9 + 2 \times 10^9 &= (4 + 4 + 2) \times 10^9 \\ &= 10 \times 10^9 \\ &= 1 \times 10^{10}\end{aligned}$$

3. How much larger is the combined debt of the three most populous states than that of the three least populous states? Express your answer in scientific notation.

$$\begin{aligned}
 (1.02 \times 10^{12}) - (1 \times 10^{10}) &= (1.02 \times 10^2 \times 10^{10}) - (1 \times 10^{10}) \\
 &= 102 \times 10^{10} - 1 \times 10^{10} \\
 &= (102 - 1) \times 10^{10} \\
 &= 101 \times 10^{10} \\
 &= (1.02 \times 10^2) \times 10^{10} \\
 &= \boxed{1.02 \times 10^{12}}
 \end{aligned}$$

4. What is the sum of the population of the three most populous states? Express your answer in scientific notation.

$$\begin{aligned}
 (3.8 \times 10^7) + (1.9 \times 10^7) + (2.6 \times 10^7) &= (3.8 + 1.9 + 2.6) \times 10^7 \\
 &= \boxed{8.3 \times 10^7}
 \end{aligned}$$

5. What is the sum of the population of the three least populous states? Express your answer in scientific notation.

$$\begin{aligned}
 (6.9 \times 10^5) + (6.26 \times 10^5) + (5.76 \times 10^5) &= (6.9 + 6.26 + 5.76) \times 10^5 \\
 &= 18.92 \times 10^5 \\
 &= (1.892 \times 10^1) \times 10^5 \\
 &= \boxed{1.892 \times 10^6}
 \end{aligned}$$

6. Approximately how many times greater is the total population of California, New York, and Texas compared to the total population of North Dakota, Vermont, and Wyoming?

$$\frac{8.3 \times 10^7}{1.892 \times 10^6} = \frac{8.3}{1.892} \times \frac{10^7}{10^6} \approx 4.39 \times 10 = 43.9$$

The combined population of Cal, NY, & Texas is about 43.9 times greater than that of ND, Ver. & Wyoming.

8th Grade Math Advanced Work (Due 9/13/16)

Directions: Complete this for dollars! Turn in advanced work with your homework.

Name: _____ #: _____ HR: _____

- 1) There are about 9 billion devices connected to the Internet. A wireless router can support 300 devices.

Part A. Express 9,000,000,000 (9 billion) as a single-digit integer times a power of 10.

Part B. Express 300 as single-digit integer times a power of 10

Part C. About how many wireless routers are necessary to connect all 9 billion devices wirelessly? Show all of your work.

- 2) How many times greater is 6×10^7 than 3×10^5 ?

- a. 2 times greater
- b. 20 times greater
- c. 200 times greater
- d. 2,000 times greater



Name and Number:

Is this a re-submit? _____

Ms. Huber
614-859-0019
Mshubersmath.weebly.com



HOMework

8th Grade Math

ExpWN it! 10
Scientific Notation

Date: _____

Class: _____

_____/ 5 = _____ % DNG
A B C D F

STRIVE Due Date:
9/13/16

Accepted
Until:
9/20/16

Directions: Complete all of the below problems (FRONT AND BACK). If you have questions, first check the examples in your packet. Then, check the class website or ask a classmate or guardian for help. Then, you can call your teacher if you still have questions.

1) Write the number 68,127,000,000,000 in scientific notation. Which of the two representations of this number do you prefer? Explain.

Write the following numbers in **scientific notation**.

1) 396,000,000

2) 11,020

3) 0.000316

4) 6,310,000

5) 0.114

6) 0.00876

7) Is 107×10^4 written in scientific notation? Explain your answer.

LIP OVER!

8) The approximate total surface area of Earth is $5.1 \times 10^8 \text{ km}^2$. All the salt water on Earth has an approximate surface area of $352,000,000 \text{ km}^2$, and all the freshwater on Earth has an approximate surface area of $9 \times 10^6 \text{ km}^2$.

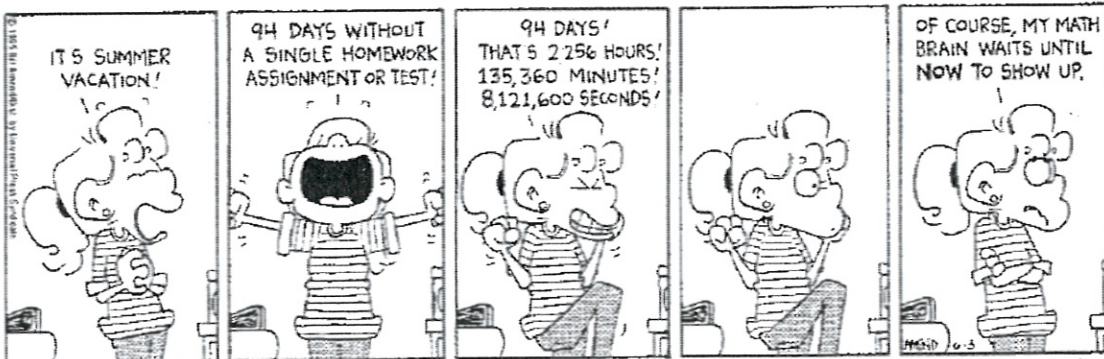
a) How much of Earth's surface is covered by water, including both salt and fresh water? Write your answer in scientific notation.

b) How much of Earth's surface is covered by land? Write your answer in scientific notation.

9) Use the cartoon below to answer the following questions. (NOT OPTIONAL!)

FoxTrot

by Bill Amend



a.) Write the number of hours in scientific notation.

b.) Write the number of minutes in scientific notation.

c.) Write the number of seconds in scientific notation.