Agenda:

1) Bell Ringer: page 68

2) Lesson 6: Numbers in Scientific Notation

EQ: What is scientific notation? Why is it used? How do you convert numbers into scientific notation?

3) Practice pages 75-76

4) Homework: page 80

4) Exit Ticket (p.77 #1-5)

Sep 10-9:19 AM

Warm-Up Activity

Name _____ **Date** _____

Concept: Understanding Components of Scientific Notation

Directions: The following activity is designed to review writing very large or very small numbers in a more precise form known as **scientific notation.** For starters, a review of powers of 10 is necessary. Work with a partner to investigate positive and negative integer exponents. Then, relocate the decimal point in preparation for writing in scientific notation.

1. Powers of 10 Use a calculator and write each power as a rational number.

10^1	10^2	10^3	10^4	10^5	10^6
10	100	1000	10000	100,000	1,000,000

10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}	10^{-6}
$\frac{1}{10} = .1$	$\frac{1}{100} = .01$	$\frac{1}{1000} = .001$	$\frac{1}{10000} = .0001$	$\frac{1}{100,000} = .00001$	$\frac{1}{1000000} = .000001$

$10^3 = 1000$

$10^2 = 100$

$10^1 = 10.$

$10^0 = 1.$

$10^{-1} = .1$

$10^{-2} = .01$

$10^{-3} = .001$

Oct 1-12:26 PM

What does it mean to have a positive exponent? Large #

How are negative exponents used? small #, decimals fractions

2. Relocation of the Decimal Point Relocate the decimal point so that the new number lies between 1 and 10.

1) 34.63	2) 0.00257	3) 0.000056	4) 656,000,000,000
3.463	2.57	5.6	6.56

X. Scientific Notation Use the answers to Part 2 and write each number in scientific notation.

1) 34.63	2) 0.00257	3) 0.000056	4) 656,000,000,000

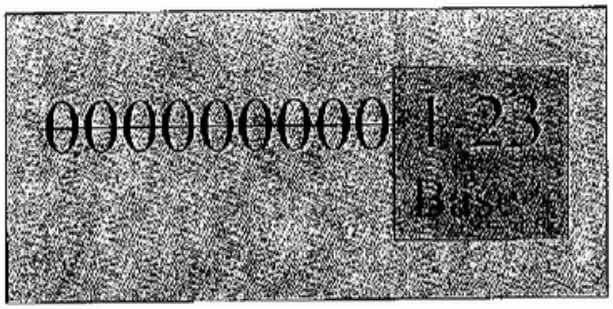
HOW TO WRITE SMALL NUMBERS IN SCIENTIFIC NOTATION

To write the number .000000000123 in *scientific notation*:

To determine the base, put the decimal after the first non-zero digit and drop the zeros.

Base $\times 10^{n}$

1.23×10^{-10}



In the number .000000000123, the base number will be 1.23.

Oct 1-11:55 AM

To find the exponent count the number of places from the decimal in the base number to the decimal in the original number.

In .000000000123, there are 10 places counted to the left of the decimal in the base number. Therefore, we write .000000000123 in scientific notation as

1.23×10^{-10}

2.)

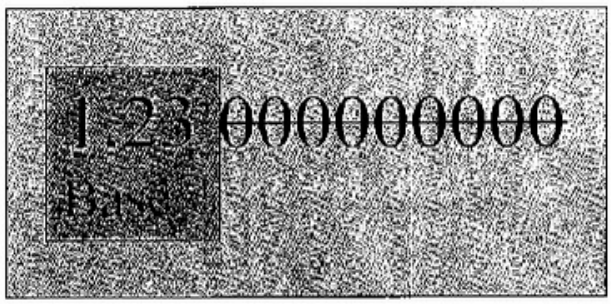
HOW TO WRITE LARGE NUMBERS IN SCIENTIFIC NOTATION

To write the number 123,000,000,000 in *scientific notation*:

To determine the base, put the decimal after the first non-zero digit and drop the zeros.

Base

1.23×10^{11}



In the number 123,000,000,000 the base number will be 1.23.

To find the exponent count the number of places from the decimal in the base number to the end of the original number.

In 123,000,000,000, there are 11 places counted to the right of the decimal in the base number. Therefore, we write 123,000,000,000 in scientific notation as

1.23×10^{11}

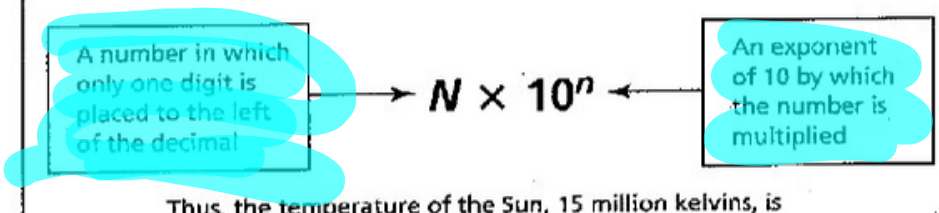
(3)

Oct 1-10:47 AM

Scientific Notation

Scientific Notation

Scientists need to express small measurements, such as the mass of the proton at the center of a hydrogen atom (0.000 000 000 000 000 000 000 001 673 kg), and large measurements, such as the temperature at the center of the Sun (15 000 000 K). To do this conveniently, they express the numerical values of small and large measurements in scientific notation, which has two parts.



Thus, the temperature of the Sun, 15 million kelvins, is written as 1.5×10^7 K in scientific notation.

Oct 1-11:54 AM

Positive Exponents Express 1234.56 in scientific notation.

1234.56

Each time the decimal place is moved one place to the left,

$1234.56 \times 10^0 = 123.456 \times 10^1$

$123.456 \times 10^1 = 12.3456 \times 10^2$

$12.3456 \times 10^2 = 1.234\,56 \times 10^3$

$1.234\,56 \times 10^3$

the exponent is increased by one.

Oct 1-11:54 AM

Negative Exponents Express 0.006 57 in scientific notation.

$0.006\ 57$

$0.006\ 57 \times 10^{0} = 0.0657 \times 10^{-1}$

$0.0657 \times 10^{-1} = 0.657 \times 10^{-2}$

$0.657 \times 10^{-2} = 6.57 \times 10^{-3}$

6.57×10^{-3}

Each time the decimal place is moved one place to the right, the exponent is decreased by one.

Oct 1-11:54 AM

MATH HANDBOOK TRANSPARENCY WORKSHEET 1

Scientific Notation

Use with Appendix B, Scientific Notation

1. Express each of the following numbers in scientific notation.

a. 230 2.3×10^{2}

b. 5601 5.601×10^{3}

c. 14,100,000 1.41×10^{7}

d. 56 million 56,000,000 5.6×10^{7}

e. 2/10 .2 2×10^{-1}

f. 0.450 13 4.5013×10^{-1}

g. 0.089 8.9×10^{-2}

Oct 1-10:47 AM

h. 0.000 26 2.6×10^{-4}

i. 0.000 000 698 6.98×10^{-7}

j. 12 thousandth $.0012$ 1.2×10^{-3}

2. Express each of the following measurements in scientific notation.

a. speed of light in a vacuum, 299 792 458 m/s 2.99792458×10^{8}

b. number of seconds in a day, 86 400 s 8.64×10^{4}

c. mean radius of Earth, 6378 km 6.378×10^{3}

d. density of oxygen gas at 0°C and pressure of 101 kPa, 0.001 42 g/mL 1.42×10^{-3}

e. radius of an argon atom, 0.000 000 000 098 m 9.8×10^{-11}

SCIENTIFIC NOTATION

Name _____

Scientists very often deal with very small and very large numbers, which can lead to a lot of confusion when counting zeros! We have learned to express these numbers as powers of 10.

Scientific notation takes the form of $M \times 10^n$ where $1 \leq M < 10$ and "n" represents the number of decimal places to be moved. Positive n indicates the standard form is a large number. Negative n indicates a number between zero and one.

Example 1: Convert 1,500,000 to scientific notation.

We move the decimal point so that there is only one digit to its left, a total of 6 places.

$1{,}500{,}000 = 1.5 \times 10^6$

Example 2: Convert 0.000025 to scientific notation.

For this, we move the decimal point 5 places to the right.

$0.000025 = 2.5 \times 10^{-5}$

(Note that when a number starts out less than one, the exponent is always negative.)

Convert the following to scientific notation.

Oct 1-11:53 AM

Convert the following to scientific notation.

1. 0.005 = 5×10^{-3}
2. 5,050 = 5.05×10^{3}
3. 0.0008 = 8×10^{-4}
4. 1,000 = 1×10^{3}
5. 1,000,000 = 1×10^{6}
6. 0.25 = 2.5×10^{-1}
7. 0.025 = 2.5×10^{-2}
8. 0.0025 = 2.5×10^{-3}
9. 500 = 5×10^{2}
10. 5,000 = 5×10^{3}

Convert the following to standard notation.

1. 1.5×10^{3} = 1500
2. 1.5×10^{-3} = .0015
3. 3.75×10^{-2} = .0375
4. 3.75×10^{2} = 375
5. 2.2×10^{5} = 220,000
6. $.335 \times 10^{-1}$ = .335
7. 1.2×10^{-4} = .00012
8. 1×10^{4} = 10,000
9. 1×10^{-1} = .1
10. 4×10^{0} = 4

① 1.500 ② .0015 ③ .0375 ④ 375 ⑤ 2.20000 ⑥ 10000 ⑦ .00012

Before you begin this lesson on scientific not the correct answer for each problem.

1. What is 2.8×10^4 written in standard notation?

   A 28,000
   B 2,800
   C 0.00028
   D 0.000028

2. What is 3.4×10^{-3} written in standard notation?

   A 0.0000034
   B 0.000034
   C 0.00034
   D 0.0034

Oct 1-10:48 AM

3. What is 594,000,000 written in scientific notation?

A 5.94×10^9

B 5.94×10^8

C 5.94×10^7

D 5.94×10^6

Oct 1-10:48 AM

4. Which is equal to $(2.4 \times 10^3) \times (1.2 \times 10^6)$?

   A 2.88×10^6
   B 3.6×10^6
   C 2.88×10^9
   D 3.6×10^9

5. Which is equal to $\frac{4.4 \times 10^8}{1.1 \times 10^2}$?

   A 3.3×10^4
   B 4.0×10^4
   C 3.3×10^6
   D 4.0×10^6

6. The speed of light is 1.86×10^5 miles per second. Using a year of 365 days, how far does light travel in a year?

   A 6.79×10^7
   B 5.26×10^{10}
   C 5.87×10^{12}
   D 6.87×10^{12}

p. 7

Oct 1-10:48 AM

Name _____ Date _____

Write each number in standard format.

3.443×10^{-7} = .0000003443

7.75763×10^{-7} = .000000775763

5.8×10^{-7} = .00000058

1.525×10^{6} = 1525000.

6.58157×10^{7} = 65,815,700

Oct 1-10:51 AM

$5.1821 \times 10^{-4} =$ .00051821

$1.21 \times 10^{-7} =$ .000000121

$5.2314 \times 10^{-7} =$ .0000005 2314

$7.141 \times 10^{-5} =$ .00007141

$5.256 \times 10^{6} =$ 5,256,000

(8)

Oct 1-10:51 AM

p. 9

Write each number in scientific notation.

0.07882 = 7.882×10^{-2}

0.00000272338 = 2.72338×10^{-6}

118000 = 1.18×10^{5}

87200 = 8.72×10^{4}

0.00002786 = 2.786×10^{-5}

0.000000664 = 6.64×10^{-7}

Oct 1-10:48 AM

450 = 4.5×10^{2}

74171.7 = 7.41717×10^{4}

770 = 7.7×10^{2}

0.0000085 = 8.5×10^{-6}

Oct 1-10:48 AM

Practice

Circle the letter of the best answer.

1. Mars is about 141,600,000 mi from the Sun. What is this number of miles written in scientific notation?

   A 1.416×10^5 C 1.416×10^7

   B 1.416×10^6 D 1.416×10^8

2. A foot is equal to 1.5×10^{-2} chains. In decimal form, how many chains are equal to one foot?

   F 0.0015 H 0.15

   G 0.015 J 150

3. The 2005–2006 Broadway season brought an all-time high attendance of 1.2×10^7 people. What was the attendance, in standard form, for the 2005–2006 Broadway season?

   A 120,000 C 12,000,000

   B 1,200,000 D 120,000,000

6. Which of these numbers has the greatest value?

   F 4.21×10^{-3} H 5.08×10^{-4}

   G 3.16×10^{-3} J 2.36×10^{-3}

7. An angstrom is a measure of length equal to 4×10^{-9} in. In inches, what is the measure of an angstrom in standard form?

   A 0.0000000004 C 0.0000004

   B 0.000000004 D 0.000004

8. Which of these countries has the least population?

   F Bangladesh, 1.474×10^8

   G China, 1.313×10^9

   H India, 1.112×10^9

   J United States, 2.98×10^8

4. What is 0.002702 written in scientific notation?

F 2.702×10^{-6} H 2.702×10^{-4}

G 2.702×10^{-5} J 2.702×10^{-3}

5. New Croton Dam has a capacity of 71,900,000 m^3. What is this number of cubic meters written in scientific notation?

A 7.19×10^{7} C 7.19×10^{9}

B 7.19×10^{8} D 7.19×10^{10}

9. The ladybug has a length of between 0.038 in. and 0.41 in. What are these values in scientific notation?

A 3.8×10^{-3} and 4.1×10^{-2}

B 3.8×10^{-2} and 4.1×10^{-1}

C 3.8×10^{-2} and 4.1×10^{-2}

D 3.8×10^{-3} and 4.1×10^{-1}

(10)

PS #4

1-5 Prob + 1

Ex $-2 + 4 = 2$

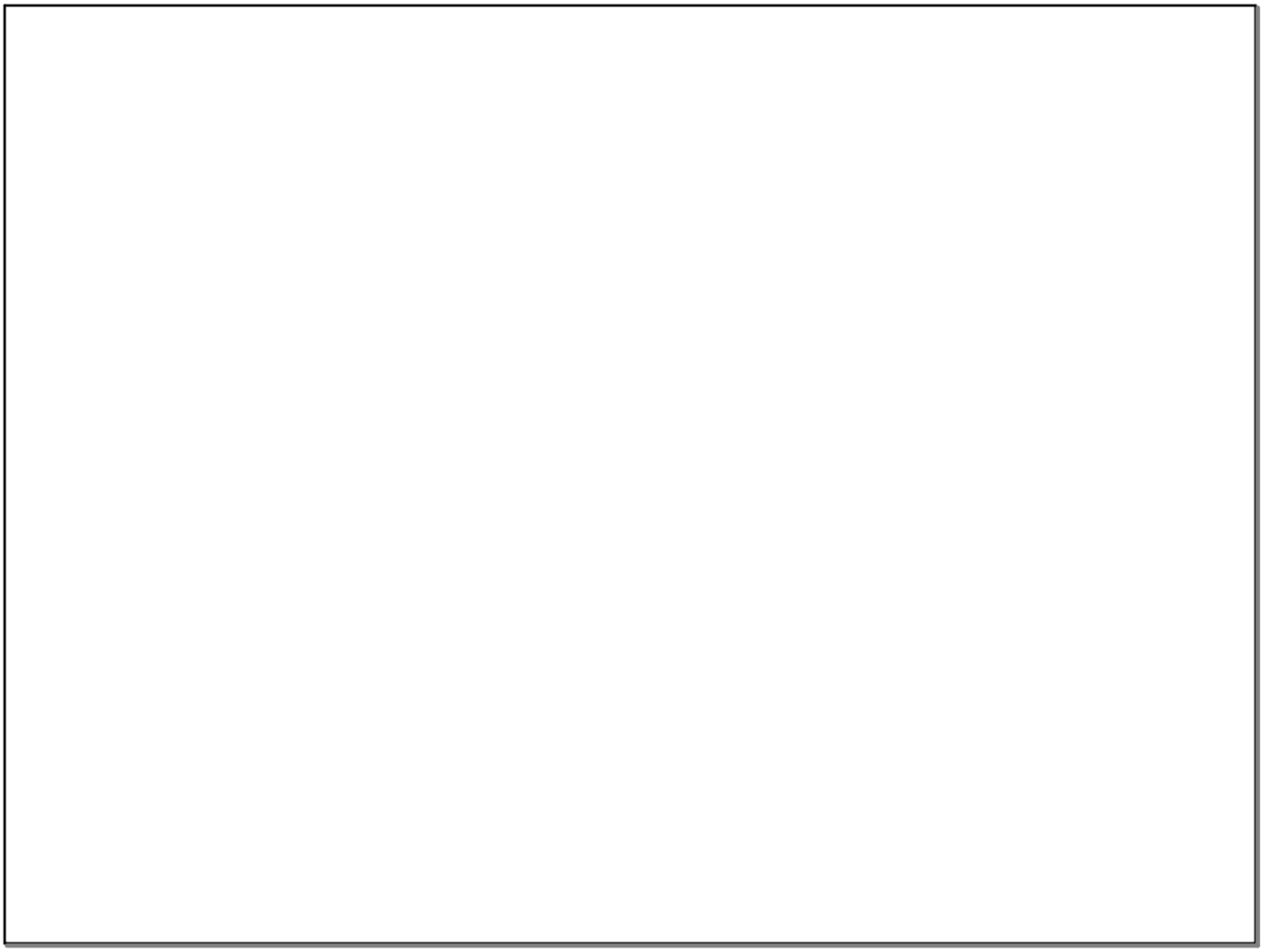
− − + + + +

6-10

Ex multiply $(2x^2)(-3x)$

$(2)\, x \cdot x\, (-3) \cdot x$

$-6x^3$



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