Warm-Up Activity #4

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^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}	10^{-6}
_____	_____	_____	_____	_____	_____

What does it mean to have a positive exponent?

How are negative exponents used?

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. 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
_____	_____	_____	_____

Warm-Up Activity #4

Name **ANSWER KEY**

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 in ***decimal*** form.

10^1	10^2	10^3	10^4	10^5	10^6
10	100	1000	10000	100000	1000000

10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}	10^{-6}
0.1	0.01	0.001	0.0001	0.00001	0.000001

What does it mean to have a positive exponent?

Positive exponents tell how many times to use a number as a factor. These numbers are very large. When working with powers of 10, they represent a movement of the decimal point to the right.

How are negative exponents used?

Negative exponents are used to represent very small numbers. When working with powers of 10, they represent a movement of the decimal point to the left.

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

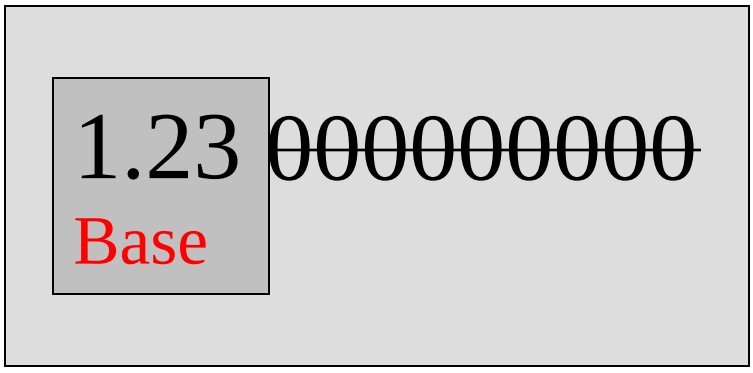
3. Scientific Notation Use the answers to Part 2 and write each number in scientific notation.

1) 34.63	2) 0.00257	3) 0.000056	4) 656,000,000,000
3.463×10	2.57×10^{-3}	5.6×10^{-5}	6.56×10^{1}

HOW TO WRITE LARGE NUMBERS IN SCIENTIFIC NOTATION

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

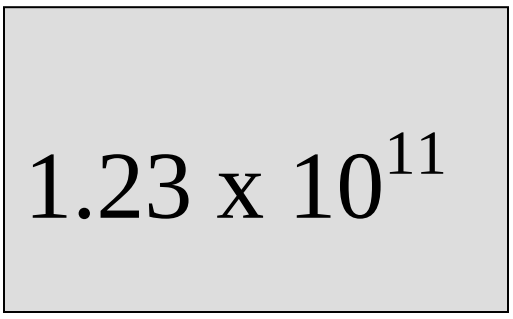
To determine the base, put the decimal after the first non-zero digit and drop the zeros.



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.

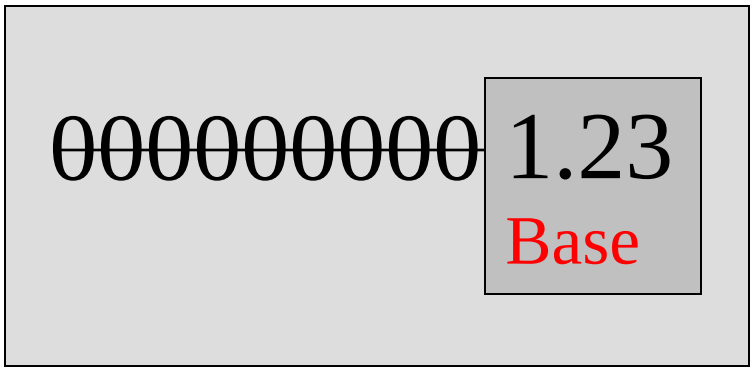
In 123,000,000,000, there are 11 places counted to the right of the decimal in the base number. Therefore, we write 123,000,000,000 in scientific notation as



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.



In the number .000000000123, 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 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

$$1.23 \times 10^{-10}$$

Scientific Notation in the Real World

Name _____ **Date** _____

Directions: Many numbers in real life are very large or very small. Indicated below are several examples of instances where extremely large or small numbers occur. Work with a partner and write the missing equivalent forms using your knowledge of rational numbers and scientific notation.

Real-Life Examples	Word Notation	Integer	Scientific Notation
Population of the world	6 billion, 174 million, 798 thousand, 604		
Speed of light		300,000,000 m/sec	
Distance from Earth to Sun			9.3×10^{7}
Distance from Earth to Moon		240,000 miles	
Raindrops in a thundercloud	6 trillions		
Cells in the human body			1.0×10^{14}
Density of oxygen	1332 millionths g per cc		
Miles in a light-year*		5,880,000,000,000	
Stars in Milky Way from Earth*	80 thousand light-years		
Water on Earth's surface			1.40×10^{8} sq mi
Mass of a dust particle	753 trillionths of a kg		
Diameter of a grain of sand		.0024 in	

*Extension: How many miles from the Earth are the stars in the Milky Way?

Who would ever need such big numbers in the workplace?

Scientific Notation in the Real World

Name **ANSWER KEY**

Directions: Many numbers in real life are very large or very small. Indicated below are several examples of instances where extremely large or small numbers occur. Work with a partner and write the missing equivalent forms using your knowledge of integers and scientific notation.

Real-Life Examples	Word Notation	Integer	Scientific Notation
Population of the world	6 billion, 174 million, 798 thousand, 604	6,174,798,604	6.174798604×10^9 or $\approx 6.17 \times 10^9$
Speed of light	300 million meters/sec	300,000,000 m/sec	3.00×10^8
Distance from Earth to Sun	93 million miles	93,000,000 miles	9.3×10^7
Distance from Earth to Moon	240 thousand miles	240,000 miles	2.4×10^5 miles
Raindrops in a thundercloud	6 trillions	6,000,000,000,000	6.0×10^{12}
Cells in the human body	100 trillion	100,000,000,000,000	1.0×10^{14}
Density of oxygen	1332 millionths g per cc	.001332 g per cc	1.332×10^{-3} g per cc
Miles in a light-year*	5 trillion, 880 billion	5,880,000,000,000	5.88×10^{12}
Stars in Milky Way from Earth*	80 thousand light-years	80,000 light-years	8×10^4 light-years
Water on Earth's surface	140 million square miles	140,000,000 sq miles	1.40×10^8 sq mi
Mass of a dust particle	753 trillionths of a kg	.000000000753 kg	7.53×10^{-10} kg
Diameter of a grain of sand	24 ten-thousandths in.	.0024 in.	2.4×10^{-3}

*Extension: How many miles from the Earth are the stars in the Milky Way?

$8 \times 10^4 \times 5.88 \times 10^{12} = (8 \times 5.88) \times (10^4 \times 10^{12}) = 47.04 \times 10^{(12+4)} = 47.04 \times 10^{16} = 4.74 \times 10^{17}$

470,400,000,000,000,000 miles

470 quadrillion 400 trillion

Who would ever need such big numbers in the workplace?

Astronauts, astronomers, scientists

All for a WALK on the MOON

"When Are We Ever Going To *USE* This MATH?"

Name _____ Date _____

Directions: What better place is there to explore the use of scientific notation than to take a look at the events around a walk on the moon! The Apollo program became the backbone of the American space program. Read each problem carefully and be sure to answer in the form that the question asks! Use the Scientific Notation in the Real World activity sheet as needed.

1. At its peak, more than 4.0×10^5 people worked on Apollo exploration programs. The effort was the largest enterprise ever undertaken. How many people worked on Apollo at its peak? Express this number as an integer.

2. When Apollo began, neither the United States nor the Soviet Union possessed a rocket powerful enough to send humans to the Moon and back. The United States developed the super-booster Moon Rocket. The thrust at lift off is reported to be 1.6×10^6 pounds. Express this number as an integer.

3. Each Apollo spacecraft left the ground on a Saturn V rocket. All stages of each mission combined were carrying 5,625,000 pounds of fuel. How many pounds of fuel did the eleven Apollo missions carry? Express the weight as pounds in scientific notation.

4. The Apollo spacecraft set a new speed record en route from the Earth to the Moon. The Voyager spacecraft are the fastest vehicles in existence. The Apollo's speed reached 20,000 mph. The Voyager's speed reached 39,000 mph. This represented an increase of 1.9×10^4 mph. Express the increase in speed as an integer.

5. You have already determined the Moon is 240,000 miles from the Earth. However, when Apollo 11 landed on the Moon in 1969 that only represented the trip to the Moon. Let's don't forget the trip back home. Express the round trip to and from the Moon in words, integer notation, and scientific notation.

6. There were a total of eleven manned Apollo missions. Only eight successfully orbited or landed on the moon. What is the total round trip mileage (not including orbits) of the eight missions to the Moon and safely back to Earth? Express the mileage in words, integer notation, and scientific notation.

7. The *Lunar Rover* was first used with Apollo 15. The astronauts traveled over 17 miles of the moon's surface. How many miles could have been covered if all eleven Apollo missions had the *Lunar Rover*? (Consider all eleven missions successfully landed on the moon.) Show set-up for calculation and express the answer in scientific notation.

8. Astronauts collected moon dust samples. A lunar dust particle has a mass of .000000000753 kg. A sample of lunar dust contains 100 dust particles. Find its mass. Express the mass in scientific notation.

9. The distance around Earth is about 24,887 miles. An orbit around Earth takes place several thousand miles in space. Therefore, an orbit would be much greater than the distance around Earth. Apollo 7 and Apollo 9 together made 314 orbits of Earth. Their total miles orbited around Earth is 7.814518×10^6 miles. Express this number as an integer and in words.

10. The cost of each new Apollo spacecraft was $170 million. Find the cost of eleven missions if each mission required a new spacecraft. Express the amount in integer notation, words, and scientific notation.

All for a WALK on the MOON

"When Are We Ever Going To *USE* This MATH?"

Name ANSWER KEY

Special Note: Because the problems require reading extremely large or small numbers in scientific notation, the readability level of this document is on an 8.6 reading level.

1. At its peak, more than 4.0×10^5 people worked on Apollo exploration programs. The effort was the largest enterprise ever undertaken. How many people worked on Apollo at its peak? Express this number as an integer. More than 400,000

2. When Apollo began, neither the United States nor the Soviet Union possessed a rocket powerful enough to send humans to the Moon and back. The United States developed the super-booster Moon Rocket. The thrust at lift off is reported to be 1.6×10^6 pounds. Express this number as an integer. 1,600,000 pounds

3. Each Apollo spacecraft left the ground on a Saturn V rocket. All stages of each mission combined were carrying 5,625,000 pounds of fuel. How many pounds of fuel did the eleven Apollo missions carry? Express the weight as pounds in scientific notation.

   5,625,000 pounds x 11 = 61,875,000
   Scientific notation: 6.1875×10^7 pounds

4. The Apollo spacecraft set a new speed record en route from the Earth to the Moon. The Voyager spacecraft are the fastest vehicles in existence. The Apollo's speed reached 20,000 mph. The Voyager's speed reached 39,000 mph. This represented an increase of 1.9×10^4 mph. Express the increase in speed as an integer.

   Scientific notation of 1.9×10^4 mph = 19,000 mph

5. The Moon is 240,000 miles from the Earth. However, when Apollo 11 landed on the Moon in 1969 that only represented the trip to the Moon. Let's don't forget the trip back home. Express the round trip to and from the Moon in words, integer notation, and scientific notation.

   Word notation: 480 thousand miles
   Integer notation: 480,000 miles
   Scientific notation: 4.8×10^5

6. There were a total of 11 manned Apollo missions. Only eight successfully orbited or landed on the moon. What is the total round trip mileage (not including orbits) of the eight missions to the Moon and safely back to Earth? Express the mileage in words, integer notation, and scientific notation.

   8 round trips = 16 trips 240,000 x 16 = 3,840,000

   Word notation: 3 million 840 thousand miles
   Integer notation: 3,840,000 miles
   Scientific notation: 3.84×10^{6} miles

7. The *Lunar Rover* was first used with Apollo 15. The astronauts traveled over 17 miles of the moon's surface. How many miles could have been covered if all eleven Apollo missions had the *Lunar Rover*? (Consider all eleven missions successfully landed on the moon.) Show set-up for calculation and express the answer in scientific notation.

   17 miles per mission x 11 missions = 187 miles or 1.87×10^{2}

8. Astronauts collected moon dust samples. A lunar dust particle has a mass of .000000000753 kg. A sample of lunar dust contains 100 dust particles. Find its mass. Express the mass in scientific notation.

   $0.000000000753 \times 100 = 0.0000000753 = 7.53 \times 10^{-8}$ kg

9. The distance around Earth is about 24,887 miles. An orbit around Earth takes place several thousand miles in space. Therefore, an orbit would be considerably greater than the distance around Earth. Apollo 7 and Apollo 9 together made 314 orbits of Earth. Their total miles orbited around Earth is 7.814518×10^{6} miles. Express the number of miles orbited as an integer and in words.

   7,814,518 miles which is 7 million 814 thousand 518 miles

10. The cost of each new Apollo spacecraft was $170 million. Find the cost the 11 missions if each mission required a new spacecraft. Express the amount in integer notation, words, and scientific notation.

    $170 million x 11 = $1,870,000,000

    Word notation: $1 billion, 870 million
    Integer notation: 1,870,000,000 miles
    Scientific notation: 1.87×10^{9}

GUIDELINES FOR ORIGINAL MATH PROBLEM

1. Information is presented in logical sequence which reader can easily follow.
2. Symbolic representation must demonstrate understanding of content as related to the real world.
3. No numerical errors occur in the problem set-up.
4. Understanding and reasoning within real-world content is of high standard.
5. Equivalency is demonstrated with correct examples.
6. No arithmetic errors occur in problem solution key and the correct answer is obtained.
7. Writing contains no editing* errors.

***Editing includes the following:**

- Correct spelling
- Correct punctuation – including commas, colons, and common uses of semicolons
- Correct capitalization
- Correct sentence formation
- Correct instances of possession

OCCUPATION: CONTRACTOR

Mr. Jones is contracted to build a 2000 sq ft house for Mr. Smith. New houses now cost 43 dollars ($43.00) per square foot of heated and cooled space. This does not include a carport or garage. Mr. Jones is offering a discount of 10% off the price per square foot this month. How much does Mr. Jones charge Mr. Smith to build his house?

Solution Key:

Regular price:	$43.00 per sq ft
Discount price:	$43.00 x 10% = 43 x .10 = $4.30 off
	$43.00 – 4.30 = $38.70 per sq ft
Cost of house:	2000 x 38.70 = $77,400

1. Is the information in logical sequence & easy to follow?
2. Does symbolic representation (sq ft and %) relate to the real world content demonstrated?
3. Are there any numerical errors in the problem set-up?
4. Does the problem make sense? Is information missing?
5. Does evidence of numbers written in equivalent forms occur?
6. Are there any arithmetic errors in the solution key? Is the answer correct?
7. Does the writing contain any editing errors?