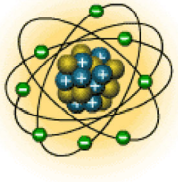
PRINCIPLES - LESSON 10E
SCIENTIFIC NOTATION

Sometimes, especially when working in Science, very large or very small numbers are necessary.

Consider the distance from the Sun to the planet Saturn:

1,400,000,000 kilometers

Or the size of an oxygen atom:



0.00000000014 meters

Scientific Notation is just a way of writing really BIG or small numbers.

SCIENTIFIC NOTATION

Scientific Notation uses the idea that multiplying by powers of 10 simply move the decimal place.

Scientific Notation **ONLY** deals with powers of 10.

Let's look at the number below and rewrite it in a much shorter way.

32,100,000

WHICH OF THESE NUMBERS IS IN SCIENTIFIC NOTATION?

Only one of these numbers is written in Scientific Notation.

But which ones equal 32,100,000 ?

Check each number with your calculator.

1. $32{,}100{,}000 \times 10^{0}$
2. $3{,}210{,}000 \times 10^{1}$
3. $321{,}000 \times 10^{2}$
4. $32{,}100 \times 10^{3}$
5. 3210×10^{4}
6. 321×10^{5}
7. 32.1×10^{6}
8. 3.21×10^{7}

Every one of these is equal to 32,100,000.

SCIENTIFIC NOTATION

Although all of the numbers written on the last page were different ways to write 32,100,000, only the one below is written in Scientific Notation.

$$32{,}100{,}000 = 3.21 \times 10^{7}$$

In Scientific Notation:

Only one digit can be to the left of the decimal.

That digit CANNOT be a zero.

SCIENTIFIC NOTATION

Write the following number in Scientific Notation.

ex1) **7,200,000,000,000**

1 2 3 4 5 6 7 8 9 10 11 12

7.200,000,000,000.

We will move the decimal to here. (after the first nonzero digit)

Draw a line from the new decimal location to the old location. Count every number that you have now underlined. This is the exponent digit on the 10. (could be positive or negative)

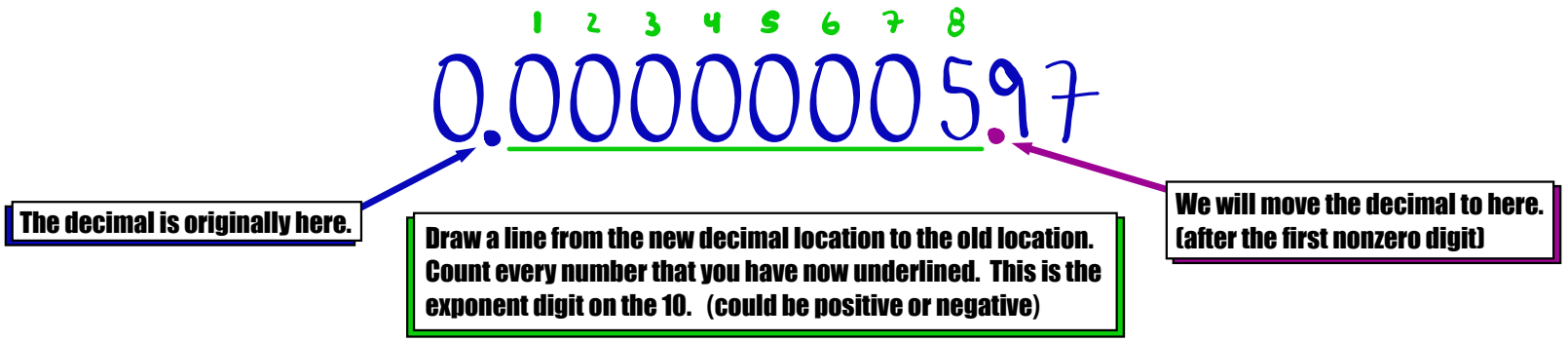
The decimal is originally here.

$= 7.2 \times 10^{12}$

SCIENTIFIC NOTATION

Write the following number in Scientific Notation.

ex2) **0.0000000597**



$= 5.97 \times 10^{-8}$

POSITIVE OR NEGATIVE EXPONENT?

There is a very simple way to remember if the exponent should be positive or negative when working with Scientific Notation:

BIG NUMBERS (numbers greater than 1) ⇨ **POSITIVE EXPONENT**

$$2.15 \times 10^{8} = 215{,}000{,}000$$

small numbers (numbers between 0 and 1) ⇨ **Negative Exponent**

$$2.15 \times 10^{-8} = 0.0000000215$$

SCIENTIFIC NOTATION

Write the following number in Scientific Notation.

ex3) **0.000632**

1 2 3 4

0.000632

The decimal is originally here.

Draw a line from the new decimal location to the old location. Count every number that you have now underlined. This is the exponent digit on the 10. (This exponent is negative because this is a small number.)

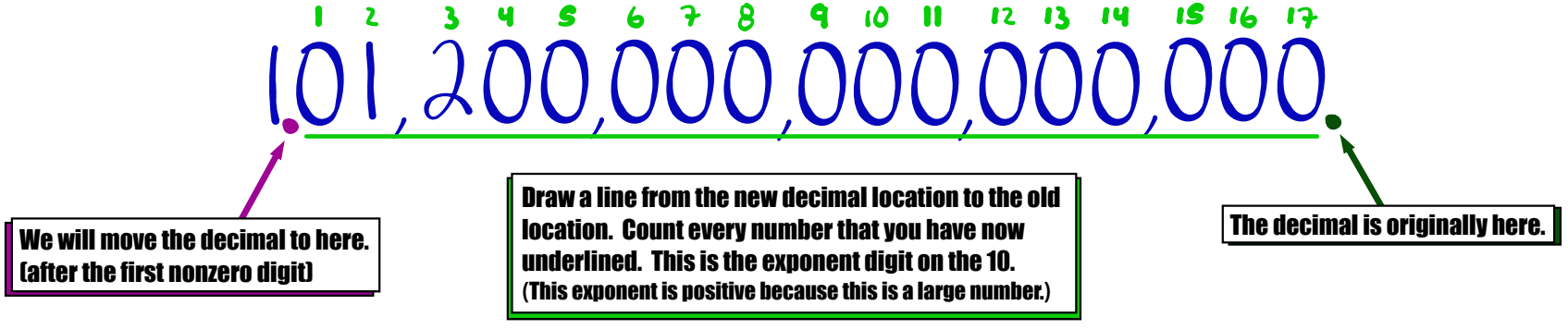
We will move the decimal to here. (after the first nonzero digit)

$= 6.32 \times 10^{-4}$

SCIENTIFIC NOTATION

Write the following number in Scientific Notation.

ex4) **101,200,000,000,000,000**

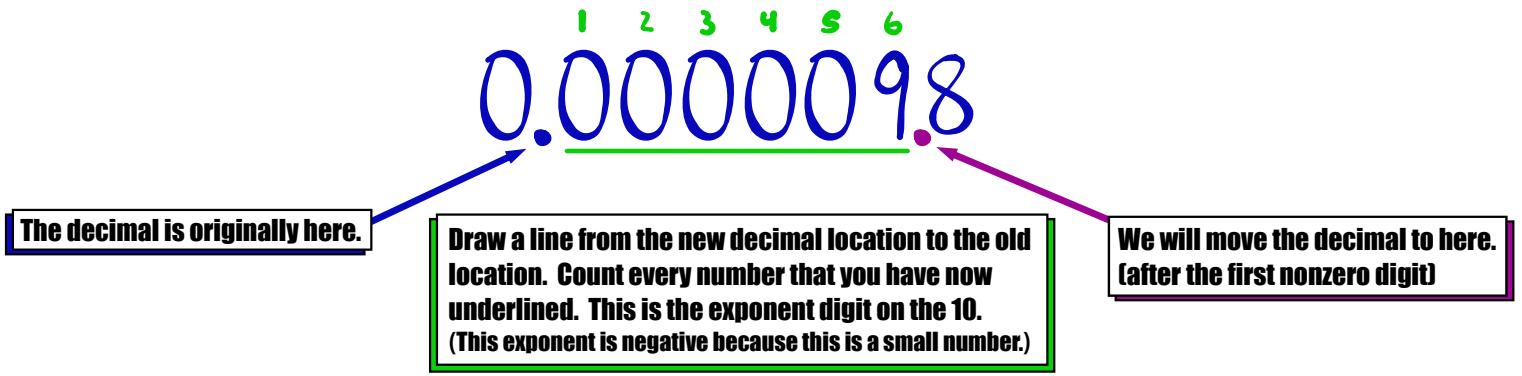


$= 1.012 \times 10^{17}$

SCIENTIFIC NOTATION

Write the following number in Scientific Notation.

ex5) **0.0000098**



$= 9.8 \times 10^{-6}$

SCIENTIFIC NOTATION

Write the following number in Standard Decimal Notation.

ex6) 8.23×10^{7} ← Positive exponent = BIG number (decimal must move RIGHT 7)

$= 82,300,000$

SCIENTIFIC NOTATION

Write the following number in Standard Decimal Notation.

ex7) 7.642×10^{-9} ← Negative exponent = SMALL number (decimal must move LEFT 9)

= 0.000000007642