Scientific Notation

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9:58 AM

Mathematics 9
Exponents
Scientific Notation

A. Definitions

Scientific Notation: a mathematical/scientific way of writing very large or very small numbers.

Standard Form: the common (normal) way that numbers are written.

B. Working with Scientific Notation

Scientists estimate that there are 120,000,000,000 stars in the Milky Way galaxy. In this example only the first two numbers are significant, the rest of the zeros are place holders to show the original position of the decimal point.

The mass of a hydrogen atom is 0.000000000000000000000000167 grams. In this example the last three numbers are significant, the rest of the zeros are place holders to show the original position of the decimal point.

Very large numbers and very small numbers are often awkward to write and even more difficult to read. As a means of simplifying the question mathematicians and scientists often use Scientific Notation to represent these types of numbers.

Scientific Notation is grounded in the fact that our number system is based on multiples of 10 (think of the place value that you learned in elementary school). Because of this we are able to write a more condensed version of the number by eliminating all of the repetitive zeros and writing it as a multiple of 10.

Example #1

Stars in the Milky Way Galaxy

120,000,000,000

1.2×10^{11}

Example #2

Mass of a Hydrogen Atom

0.000000000000000000000000167

1.67×10^{-24}

To Solve

a) Find the significant numbers.
b) Put the decimal after the first significant number.
c) Multiply by 10
d) Count the places needed to move the decimal after the first number. This becomes the exponent on base 10.

* Large numbers have positive exponents. Small numbers have negative exponents.

C. Practice

Change the following into Scientific Notation.

1) 13,500,000,000,000,000

1.35×10^{16}

2) 0.000000002843

2.843×10^{-9}

Change the following to Standard Form.

1) 6.4×10^{-4}

.0006,4

.00064

2) 1.5896×10^{10}

1.5896,000,000,000

15,896,000,000

Write the following in Scientific Notation.

1) 245×10^{3} +2

2.45×10^{5}

2) 0.045×10^{-6} −2

4.5×10^{-8}

3) 51.7×10^{-5} +1

5.17×10^{-4}

4) 2986×10^{-7} +3

2.986×10^{-4}

For each of the following, determine the value of n.

1) $127000 = 1.27 \times 10^{n}$

$n = 5$

2) $0.00000000007 = 7 \times 10^{n}$

$n = -11$

Assignment: Scientific Notation Assignment

Name:_____

Scientific Notation Assignment

1. Write each of the following in scientific notation.

a) The human eye blinks an average of $4{,}200{,}000$ times a year. _____

b) A computer processes a certain command in 15 nanoseconds. A nanosecond is one billionth of a second. In decimal form, this number is $0.\ 000\ 000\ 015$. _____

c) There are $97{,}000$ km in blood vessels in the human body. _____

d) The highest temperature ever produced in a laboratory was $920{,}000{,}000$ degrees Fahrenheit at the Tokamak Fusion Test Reactor in Princeton, New Jersey USA. _____

e) Scientists have calculated the mass of a single proton is $0.000\ 000\ 000\ 000\ 000\ 000\ 001\ 673$ grams. _____

f) Astronomers believe the mass of the sun is approximately $1{,}989{,}000{,}000{,}000{,}000{,}000{,}000{,}000{,}000{,}000{,}000$ grams. _____

g) Astronomers believe there are approximately $50{,}000{,}000{,}000$ galaxies in the universe. _____

h) A plant cell is approximately 0.00001276 meters wide. _____

i) The world's population is approximately seven billion. _____

2. Write each of the following in standard form.

a) 5.2×10^{-5}

b) 6.22×10^{4}

c) 3.7×10^{-2}

d) 7.15×10^{2}

e) 1.3×10^{6}

f) 2.75×10^{-1}

3. Write each of the following in scientific notation.

a) 18×10^{-4}

b) 0.022×10^{-5}

c) 425×10^{2}

d) 3800×10^{-5}

e) 0.025×10^{-1}

f) 94000×10^{-2}

Answers

1. a) 4.2×10^{6} b) 1.5×10^{-8}

   c) 9.7×10^{4} d) 9.2×10^{8}

   e) 1.673×10^{-24} f) 1.989×10^{33}

   g) 5×10^{10} h) 1.276×10^{-5}

   i) 7×10^{9}

2. a) 0.000052 b) 62,200

   c) 0.037 d) 715

   e) 1,300,000 f) 0.275

3. a) 1.8×10^{-3} b) 2.2×10^{-7}

   c) 4.25×10^{4} d) 3.8×10^{-2}

   e) 2.5×10^{-3} f) 9.4×10^{2}