M@thεm@ti¢§ 9

Real numbers

Part 4 (Scientific notation)

Introduction

In sciences, there is need to use numbers extremely large or small.

For example:

The mass of an earth is 5900000000000000000000000 kg

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Introduction

In sciences, there is need to use numbers extremely large or small.

For example:

The mass of a grain of sand is 0.00000001562 kg

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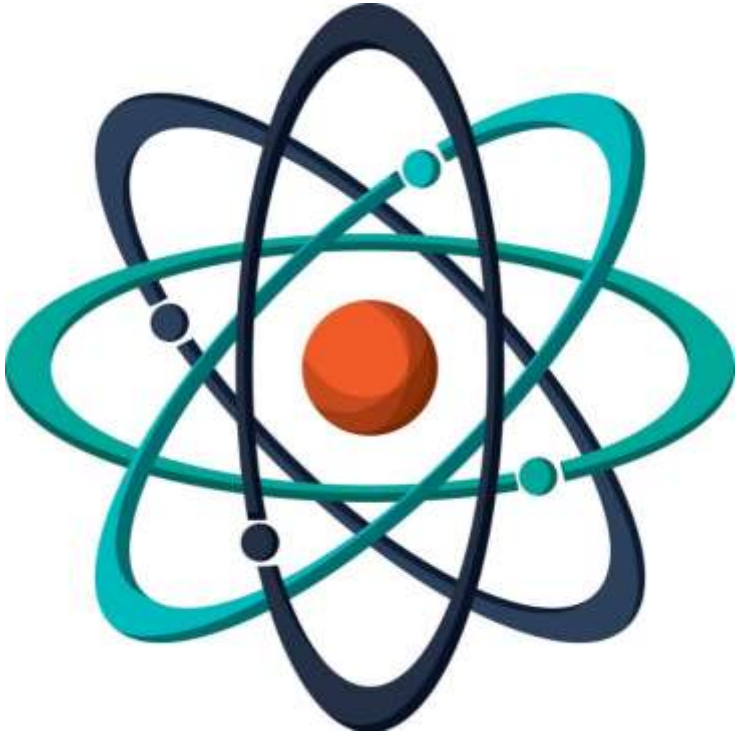
Introduction

In sciences, there is need to use numbers extremely large or small.

For example:

A carbon atom weighs less than 0.000000000000000000000002 kg



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Introduction

590000000000000000000000 kg
0.00000001562 kg
0.000000000000000000000002 kg

As a result it is hard to read and perform calculation on such long numbers. In addition most of calculator can’t accept numbers extremely large or small because of the limited space in its show window.

Introduction

To remedy this, it is necessary to express these numbers in a notation that is simple to read, write and perform calculations.
This notation is called:

Scientific Notation

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Definition

Scientific notation is a short hand method to represent a number that is extremely large or small.

General Form: $a \times 10^{n}$ → **n is an integer**

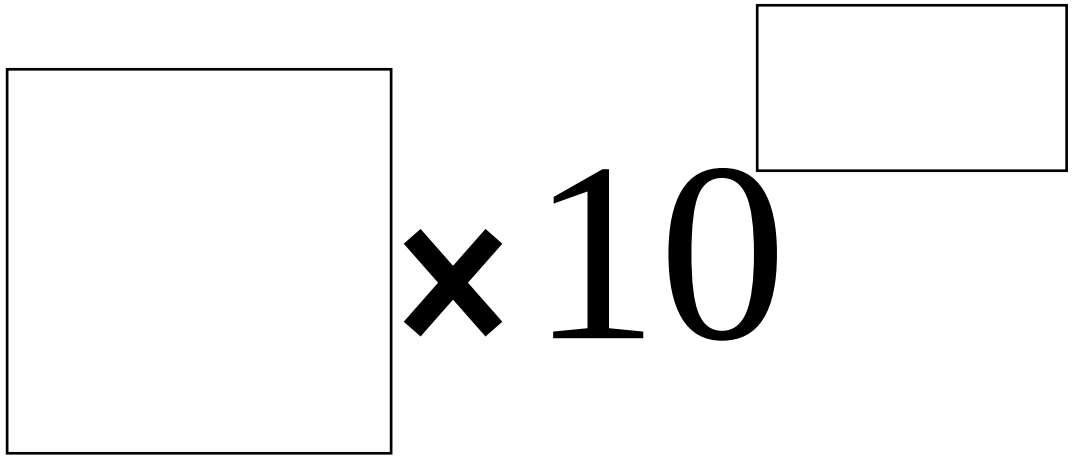
$$1 \leq a < 10$$

How to transform a number into scientific notation?

Converting to scientific notation

Example 1:

2 2 0 0 0 0 0 0 0



This number is large, we need to reduce it.
In order to perform this, we need to follow the following steps:

Converting to scientific notation

Example 1:

2.2.0.0.0.0.0.0.0. $\square \times 10^{\square}$

Step1:

Move the decimal point to the left to obtain an integer part strictly between 0 and 10. (0 and 10 are not allowed)

The obtained number is 2.2000000

Converting to scientific notation

Example 1:

2.2 0 0 0 0 0 0 0

$2.2 \times 10^{\square}$

Step 2:

Remove the useless zeroes: 2.2~~0000000~~

The obtained number is 2.2

Converting to scientific notation

Example 1:

2.2 0 0 0 0 0 0 0

$2.2 \times 10^{+7}$

Step 3:

The exponent of 10 will be the number of times the point is moved.
So it is 7.
The number becomes smaller by moving the point to the left. In order to remedy the change, the exponent will be positive: +7.

Converting to scientific notation

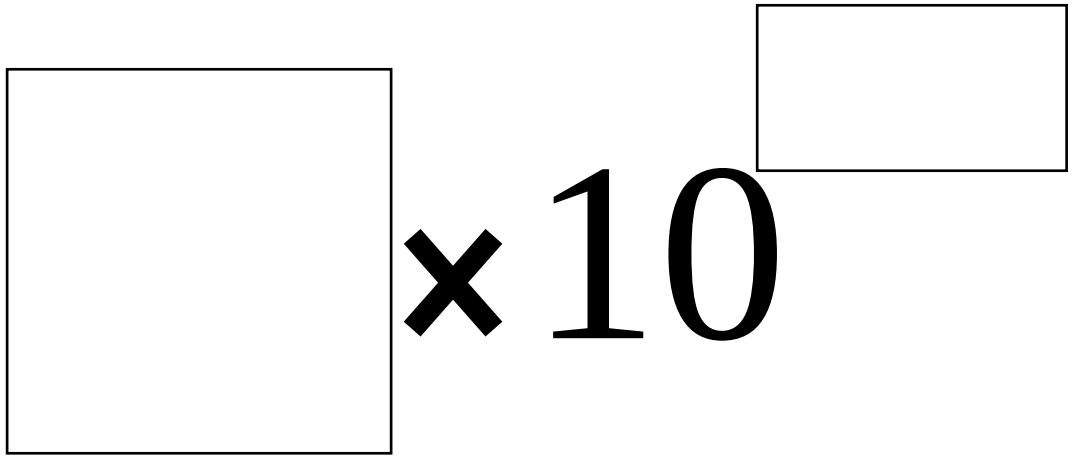
Example 2:

0.000025 $\square \times 10^{\square}$

This number is small, we need to enlarge it.
In order to perform this, we need to follow the following steps:

Converting to scientific notation

Example 2:

0 . 0.0.0.0.0.2.5  ×10

Step1:

Move the decimal point to the right to obtain an integer part strictly between 0 and 10.(0 and 10 are not allowed)

The obtained number is 000002.5

Converting to scientific notation

Example 2:

0 0 0 0 0 2.5

$2.5 \times 10^{\square}$

Step 2: remove the useless zeroes: ~~00000~~2.5

the number becomes 2.5

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Converting to scientific notation

Example 2:

0 0 0 0 0 2.5

2.5×10^{-5}

Step 3:

The exponent of 10 will be the number of times the point is moved. So the exponent is 5.

The number becomes greater by moving the point to the left.

In order to remedy the change, the exponent will be negative: -5.

Converting to scientific notation

Example 3:

$7.00025 = \square \times 10^{\square}$

The integer part of this number is 7.
7 is strictly between 0 and 10.
So, this number is in scientific notation and no need to change it.

Converting to scientific notation

Example 4:

$7\,0\,0.5 \times 10^{5}$ $\square \times 10^{\square}$

The integer part of this number is 700.
So, this number is not in scientific notation.
Applying the same steps as in the first example.

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Converting to scientific notation

Example 4:

$7.0.0.5 \times 10^{5}$ 7.005×10^{7}

Step 1:

Move the point to the left two times. The number becomes 7.005

Step 2:

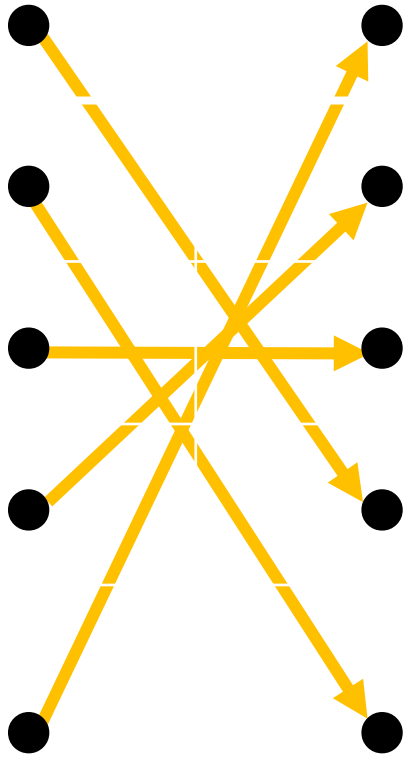
There is no useless zeroes to remove.

Step 3:

Since the decimal point is moved two times to the left, the exponent of 10 will become 5+2=7

Match each number to its corresponding scientific notation.

$25\,000$	5.23×10^{-32}
1.36	-5×10^{-5}
-63×10^{5}	-6.3×10^{6}
-0.00005	2.5×10^{4}
0.523×10^{-31}	1.36×10^{0}



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