

Scientific Notation



Preliminaries and Objectives

Preliminaries

- Exponential Notation
- Laws of Exponents

Objectives

- Define Scientific Notation
- Work with Significant Digits

Magnitude of Large Numbers

Number of inches in a meter ≈ 39.37

Number of molecules in a mole (Avogadro's number)
 $\approx 602,214,076,000,000,000,000,000$

Maximum wavelength of visible light
 ≈ 0.000074 millimeters

Powers of 10

602,214,076,000,000,000,000,000.

$$6.022 \times 10^{23}$$

Scientific Notation

Scientific Notation

Every real number can be expressed as

$$n \times 10^p$$

where $1 \leq n < 10$ and p is an integer.

The exponent on 10 is called the **magnitude** of the number.

Examples

$$\text{Avogadro's Number} = 6.022 \times 10^{23}$$

$$0.000074 \text{ millimeters} = 7.4 \times 10^{-5} \text{ mm}$$

$$26,500,000,000 = 2.65 \times 10^{10}$$

$$0.0000000174 = 1.74 \times 10^{-8}$$

Addition

$$\begin{array}{r} 1.74 \times 10^9 \\ + 2.49 \times 10^9 \\ \hline 4.23 \times 10^9 \end{array}$$

Addition

$$\begin{array}{r} 1.74 \times 10^9 \\ + 2.49 \times 10^5 \\ \hline \end{array}$$

$$\begin{array}{r} 1,740,000,000 \\ + 249,000 \\ \hline 1,740,249,000 \end{array}$$

$$1.74 \times 10^9$$

Addition

$$\begin{array}{r} 1.74 \times 10^9 \\ + 2.49 \times 10^8 \\ \hline \end{array}$$

$$\begin{array}{r} 1,740,000,000 \\ + 249,000,000 \\ \hline 1,989,000,000 \end{array}$$

$$1.99 \times 10^9$$

Multiplication

$$(3.71 \times 10^5)(6.4 \times 10^{-3})$$

$$23.744 \times 10^2$$

$$2.3744 \times 10^3$$

$$2.4 \times 10^3$$

Recap

Scientific Notation

Every real number can be expressed as

$$n \times 10^p$$

where $1 \leq n < 10$ and p is an integer.

- When adding, exclude any digits which are of a place value further to the right than the rightmost significant digit in any of the numbers being added.
- When multiplying, the number of significant digits in the product is the smallest number of significant digits in any factor.