Scientific Notation

UNIVERSITY OF MINNESOTA

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

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

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

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

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

Addition

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

Addition

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

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

$$1.74 \times 10^9$$

Addition

$$1.74 \quad \times \quad 10^9$$
$$+ \quad 2.49 \quad \times \quad 10^8$$

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

$$1.99 \times 10^9$$

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.