

## 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  $\approx 39.37$

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

Maximum wavelength of visible light  
 $\approx 0.000074$  millimeters

## Powers of 10

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

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

## 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

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

## Addition

$$\begin{array}{r} 1.74 \times 10^9 \\ + 2.49 \times 10^5 \\ \hline 1,740,000,000 \\ + \quad \quad 249,000 \\ \hline 1,740,249,000 \end{array}$$

$$1.74 \times 10^9$$

## Addition

$$\begin{array}{r} 1.74 \times 10^9 \\ + 2.49 \times 10^8 \\ \hline 1,740,000,000 \\ + \quad 249,000,000 \\ \hline 1,989,000,000 \end{array}$$

$$1.99 \times 10^9$$

## 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.