

8.5 Scientific Notation

We use scientific notation to express very large and very small numbers in compact form.

Scientific notation is written as the product of two numbers: one of which is a number between 1 and 10 (not including 10), and the other is a power of 10.

Powers of 10.

Complete the table

Value	1000	100	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
Power	10^3	10^2	10^1	10^0	10^{-1}	10^{-2}	10^{-3}

Let's try a few in scientific notation

$$1200 = 1.2 \times 1000 = 1.2 \times 10^3$$

$$120 = 1.2 \times 100 = 1.2 \times 10^2$$

$$1.2 = 1.2 \times 1 = 1.2 \times 10^0$$

$$.12 = 1.2 \times \frac{1}{10} = 1.2 \times 10^{-1}$$

$$.012 = 1.2 \times \frac{1}{100} = 1.2 \times 10^{-2}$$

$$.0012 = 1.2 \times \frac{1}{1000} = 1.2 \times 10^{-3}$$

Try these: $875,000 = 8.75 \times 100,000 = 8.75 \times 10^5$

$$3,700,000,000 = 3.7 \times 1,000,000,000 = 3.7 \times 10^9$$

$$,000,000,000,125 = 1.25 \times \frac{1}{1,000,000,000} = 1.25 \times 10^{-10}$$

Products and Quotients

$$\begin{aligned}
 1. \quad & (3 \times 10^3)(4 \times 10^{-5}) \\
 & \quad \quad \quad \uparrow \quad \quad \uparrow \quad \quad \uparrow \\
 & (3 \times 4) \times (10^3 \times 10^{-5}) \\
 & 12 \times 10^{-2} \\
 & (1.2 \times 10^1)(10^{-2}) \\
 & 1.2 \times (10^1 \times 10^{-2}) \\
 & 1.2 \times 10^{-1}
 \end{aligned}$$

$$\begin{aligned}
 2. \quad & (2 \times 10^{-2})(7 \times 10^8) \\
 & (2 \times 7) \times (10^{-2} \times 10^8) \\
 & 14 \times 10^6 \\
 & (1.4 \times 10^1)(10^6) \\
 & 1.4 \times 10^7
 \end{aligned}$$

$$\begin{aligned}
 & \frac{2.5 \times 10^4}{5 \times 10^2} \\
 & \frac{2.5}{5} \times \frac{10^4}{10^2} \\
 & .5 \times 10^4 \\
 & (5 \times 10^{-1})(10^4) \\
 & 5 \times 10^3
 \end{aligned}$$