5.5 – Scientific Notation

Powers of 10 are used in science to represent very large and very small values.

Power of 10	Value
10^3	1000
10^2	100
10^1	10
10^0	1
10^{-1}	$\frac{1}{10} = 0.1$
10^{-2}	$\frac{1}{100} = 0.01$
10^{-3}	$\frac{1}{1000} = 0.001$

Number	Value
10^3	Thousand
10^6	Million
10^9	Billion
10^{12}	Trillion
10^{-1}	Tenth
10^{-2}	Hundredth
10^{-3}	Thousandth
10^{-6}	Millionth

This is called scientific notation.

SCIENTIFIC NOTATION

A real number a is in **scientific notation** when a is written in the form $b \times 10^n$, where $1 \leq |b| < 10$ and n is an integer.

Converting between standard and scientific notations – always remember that **small numbers** (decimals less than one) in standard notation **have negative exponents** in scientific notation, while **large numbers have positive exponents**. When the number is in scientific notation, the exponent tells you how far to move the decimal point.

a)   0.0008034

b) 3.5196×10^7

c) 9.27×10^{-2}

d)   4.006

Recognizing common numbers in scientific notation. For each number below, rewrite it using either scientific notation or "newspaper notation" (*e.g.* 140 million, 2.3 trillion, etc.).

a) 3.18×10^9

b) 75.3 million

c) 2.43 thousandths

d) 8.44×10^6

Multiplying numbers in scientific notation – multiply the number parts, add the powers of 10, **and** increase or decrease the powers of 10 to move the decimal into the correct position.

a) $(3.17 \times 10^5)(2.8 \times 10^4)$

b) $(5.36 \times 10^{11})(1.631 \times 10^{-8})$

c) $(7.302 \times 10^{12})(4.0 \times 10^5)$

d) $(2.23 \times 10^{-22})(8.614 \times 10^{-19})$

Dividing numbers in scientific notation – divide the number parts, subtract the powers of 10, **and** increase or decrease the powers of 10 to move the decimal into the correct position.

a) $\dfrac{9.41 \times 10^8}{5.33 \times 10^4}$

b) $\dfrac{4.126 \times 10^{-23}}{1.835 \times 10^{14}}$

c) $\dfrac{6.0 \times 10^5}{7.88 \times 10^3}$

d) $\dfrac{3.18 \times 10^{-78}}{9.4 \times 10^{-13}}$

(1) The speed of light is 3×10^8 meters/second. If the sun is 1.5×10^{11} meters from earth, how many seconds does it take light to reach the earth. Express your answer in scientific notation

(2) *Average Family Net Worth*   A family refers to a group of two or more people related by birth, marriage, or adoption who reside together. In 2000, the average family net worth was $280,000, and there were about 7.2×10^7 families. Calculate the total family net worth in the United States in 2000.   (*Source:* U.S. Census Bureau.)