Powers of Ten

In computers and electronics, deal with very large numbers (10000000000000 bits of data) or with very small numbers (0.000000001 amps of current leakage in a circuit)

Instead of writing numbers in such a fashion, it is best to convert them to short hand notation...power of 10

$$10^{n}$$

For powers of 10, 10 is considered the base and n is the exponent part

The exponent, n refers to the multiples of 10

If n < 0, then the number is less than 1
If n = 0, then the number is equal to 1
If n > 0, then the number is greater than 1

Powers of Ten

1000000 = 10*10*10*10*10*10	10^{6}
100000 = 10*10*10*10*10	10^{5}
10000 = 10*10*10*10	10^{4}
1000 = 10*10*10	10^{3}
100 = 10*10	10^{2}
10 = 10	10^{1}
1 = 10/10	10^{0}
0.1 = 1/10	$1/10^{1} = 10^{-1}$
0.01 = 1/100 = 1/(10*10)	$1/10^{2} = 10^{-2}$
0.001 = 1/1000 = 1/(10*10*10)	$1/10^{3} = 10^{-3}$
0.0001 = 1/10000 = 1/(10*10*10*10)	$1/10^{4} = 10^{-4}$
0.00001 = 1/100000 = 1/(10*10*10*10*10)	$1/10^{5} = 10^{-5}$
0.000001 = 1/1000000 = 1/(10*10*10*10*10*10)	$1/10^{6} = 10^{-6}$

Converting from Decimal Fractions to Power of 10 Form and Vice Versa

In converting from a fraction, count the number of multiples of 10 that are being used to represent the initial number. Replace the multiples of 10 with an exponent equivalent.

$$\frac{1}{10000}=\frac{1}{10\times10\times10\times10}=\frac{1}{10^4}=\frac{10^{-4}}{1}$$

In converting from a decimal, determine the value of the denominator. Place the 1 in that position. Follow the steps from above to convert to power of 10.

$$0.001=\frac{1}{1000}=\frac{1}{10\times10\times10}=\frac{1}{10^3}=\frac{10^{-3}}{1}$$

In converting from power of 10, use reciprocal principle to convert to positive fraction power and then to multiples of 10

$$\frac{10^{-5}}{1}=\frac{1}{10^5}=\frac{1}{10\times10\times10\times10\times10}=\frac{1}{100000}=0.00001$$

Multiplication and Division in Power of 10

In multiplication, add the exponents $10^m \times 10^n = 10^{m+n}$

$10^6 \times 10^{-2}$

$10^{-1} \times 10^{-6}$

In division, subtract the exponents $\frac{10^m}{10^n} = 10^{m-n}$

$\frac{10^{-6}}{10^3}$

$\frac{10^{-7}}{10^{-4}}$

Combined Multiplication and Division in Power of 10

Whenever a power of 10 is in the denominator, it can be moved to the numerator with a change of sign or vice versa...reciprocal principle

$$\frac{10^{-7}\times10^{13}\times10^{5}}{10^{-4}\times10^{-8}}$$

$$\frac{10^{-2}\times10^{-11}}{10^{3}\times10^{-9}\times10^{10}}$$