

There are few simple mathematical operations that you need to understand before you can do any chemical problems. These are Multiplication, Division, Addition and Subtraction, and Power and Roots. Let us discuss these operations.

Multiplication

When two numbers in scientific notations are multiplied, the prefixes are multiplied and the exponents are added.

$$(a \times 10^n) \times (b \times 10^m) = (a \times b) \times 10^{n+m}$$

$$(2 \times 10^4) \times (3 \times 10^5) = (2 \times 3) \times 10^{4+5} = 6 \times 10^9$$

Division

When two scientific numbers are divided, the numerator prefix is divided by the denominator prefix and the denominator exponent is subtracted from the numerator exponent.

$$(a \times 10^n) / (b \times 10^m) = (a/b) \times 10^{n-m}$$

$$(8 \times 10^7) / (2 \times 10^3) = (8 / 2) \times 10^{7-3} = 4 \times 10^4$$

Addition and Subtraction

Addition and subtraction follow the same rule with one requirement- the exponents in both numbers should be the same. However, if the exponents are not the same, they first have to be converted to the same exponent and then addition or subtraction is carried out.

Same exponents:

$$(a \times 10^n) \pm (b \times 10^n) = (a \pm b) \times 10^n$$

$$(4.6 \times 10^2) \pm (2.5 \times 10^2) = (4.6 \pm 2.5) \times 10^2 \quad \begin{array}{l} = 7.1 \times 10^2 \quad \text{for addition} \\ = 2.1 \times 10^2 \quad \text{for subtraction} \end{array}$$

Different exponents:

Consider the addition of 5.0×10^4 and 2.8×10^6 . These numbers have different exponents, and hence cannot be added in their original form. They have to be brought to the same exponent either changing the first number or the second number or both numbers. Let us change the second number from 2.8×10^6 to 0.028×10^4 by shifting the decimal place and add them up:

$$(5.0 \times 10^4) + (2.8 \times 10^6) = (5.0 \times 10^4) + (0.028 \times 10^4) = 5.028 \times 10^4$$

Powers and Roots

To raise the scientific number to a power, raise the prefix to the power and multiply the exponent by the power.

$$(a \times 10^n)^m = a^m \times 10^{n \times m}$$

$$(7.5 \times 10^3)^4 = 7.5^4 \times 10^{3 \times 4} = 3164.0625 \times 10^{12} = (3.164 \times 10^3) \times 10^{12} \\ = 3.164 \times 10^3 \times 10^{12} = 3.164 \times 10^{15}$$

To take the mth root of a scientific number, take the mth root of the prefix and divide the exponent by the root.

$$(a \times 10^n)^{1/m} = a^{1/m} \times 10^{n/m}$$

$$(9 \times 10^{12})^{1/3} = 9^{1/3} \times 10^{12/3} = 3 \times 10^4$$

For more and other mathematical operations you may consult the following book

“Mathematical Methods for Chemistry Beginners,” by M. Kumbar,
iUniverse.com