An easy way to Physics: 00 How to write very big and very small numbers

Big numbers
In physics and chemistry we often find very big numbers and very small numbers. In 18 grams of water we find more than 602 200 000 000 000 000 000 000 small water particles, the so called „water molecules“. It is very difficult to read numbers with so many zeroes, and it is very easy to miss one of these many zeroes.

We use, therefore, an easier way to write those big numbers:
602 200 000 000 000 000 000 000 = 6,022 · 100 000 000 000 000 000 000 000 = 6,022 · 10^{23}.
The small number in a high position says, how many zeroes follow the 1. This small number is called the exponent. 10 = 10, 100 = 10^2, 100 = 10^3, 1 000 000 = 10^6.

Rules for calculating big numbers
$10^2 \cdot 10^3 = 100 \cdot 1000 = 100\,000 = 10^5$. If you multiply two numbers with each other, you get the exponent of the result, if you add the exponents of both numbers.

$10^5 : 10^3 = 100\,000 : 1000 = 100 = 10^2$. If you divide a number by another number, you get the exponent of the result, if you subtract the exponent of the second number from the exponent of the first number.

Small numbers
$10^3 : 10^3 = 1000 : 1000 = 1 = 10^0$.

0,001 = 1 : 1000 = 10^{-3}. Numbers between 0 and 1 are written with negative exponents. A water molecule, therefore, weighs less than 18 g : (6,022 · 10^{23}) = 2,989 · 10^{-23} g.

The value 6,022 · 10^{23} is taken from: AIP 50th Anniversary Physics Vade Mecum (Ed. Anderson, H.J.) (New York 1981)