

Expressing Rates and Numbers in Scientific Notation

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When you conduct a study that uses samples and chemicals, your methods section usually reports such measurements. Sometimes, when numbers, ratios, or rates that are very large or very small, it becomes important to display them in different formats to avoid cumbersome repetition of zeros.

Ratios vs Rates

Both terms express a comparison between two numbers. There is a slight difference based on what's being compared.

A **ratio** expresses a relationship between two numbers regardless of the units. For example, you have five cats and seven pounds of cat food and you want to find out how much food there is per cat. Notice the word per, which usually means divided by. You can express the ratio of food to cats as follows:

7 (pounds of food) divided by 5 (cats) or $7/5$. This can be expressed as 7:5 (note the colon) or as the decimal 1.4. Notice that the "units" are not expressed.

We change the whole number into a decimal and use the power of 10 to denote the magnitude expressed as:

$$1.0 \text{ AMU} = 1.66 \times 10^{-27} \text{ Kg.}$$

The basics of scientific notation are as follows:

- $0 = 1.0 \times 10^0$
- $0 = 1.0 \times 10^2$
- $0 = 1.0 \times 10^3$
- $1 = 1.0 \times 10^{-1}$
- $01 = 1.0 \times 10^{-2}$
- $001 = 1.0 \times 10^{-3}$

Note the placement of the decimal points. If the last example above were 0.00156 (1.56×10^{-3}), the exponent would be the same. The position of the decimal dictates the exponent.

Significant Figures

Can you imagine what would happen if our measurements weren't accurate? Would our efforts to explore outer space have ever happened? What would happen in a laboratory if we were off by only one decimal point when measuring rare compounds?

Still, we can only be as precise as our instruments and tools. We measure as precisely as possible and "round off" to the nearest whole number. For example, we might round the number 152 down to 150. We might round 158 up to 160. The general rule is that if number following the ones to be kept is less than 5, round down; if greater than 5, round up.

[Significant figures](#) refer to the remaining numbers (i.e., two for 150 and 160). If we had decimal points (e.g., 150.0), we would have four significant figures. This is important because a decimal point indicates more precision.

In performing calculations, the numeral with the least number of digits determines the number of significant figures. You would then round up or down before adding or subtracting but after multiplying or dividing. This can be confusing, but there are several online sources to help with these details.

The use of rates, ratios, scientific notation, and significant figures is very important in scientific writing. Be sure familiarize yourself with these terms and how to use them. Did you enjoy reading this post? Please share your thoughts by commenting in the section below.

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