

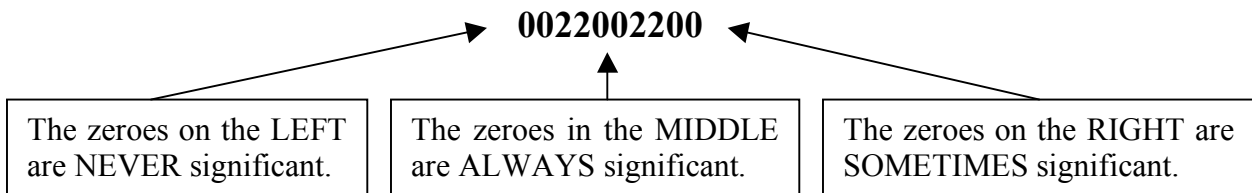
Significant Figures

In the sciences we will want to be able to make judgments about the accuracies of different measurements. One way to do this is to use significant figures, but this can be confusing at first. This sheet is designed to help you determine what numbers are significant in a measurement and use significant figures correctly to make accurate and reliable calculations.

Determining Significance:

Non-zero numbers are always significant. For example all the numbers in 2.455953 are significant.

Zeros are sometimes significant. In the number 0.00034076, the first four zeroes are not significant but the last one is significant. In determining the significance of zeroes their placement is important. There are really only three placements for zeroes, before a nonzero number, between nonzero numbers, or after a nonzero number.



Zeros following the last nonzero number ARE SIGNIFICANT if they are to the RIGHT of the DEICMAL POINT.

Zeros following the last nonzero number ARE NOT SIGNIFICANT if they are to the LEFT of the DEICMAL POINT.

.22000 **22000**
Significant **Not Significant**

One easy way to clear up confusion is to write all your numbers in scientific notation. Only significant figures are included in the number part of scientific notation, while the non-significant zeroes are “hidden away” in the powers of ten.

0.0000031459
There are five significant figures in this number.
 3.1459×10^{-6}
This is easily in the scientific notation form of the same number.

Using significant figures:

Once you have determined the number of significant figures, you will undoubtedly want to make some calculations. This too can be confusing but listed below are the simple rules for each mathematical operation you will probably perform.

Addition:

When adding two numbers, round the sum to the same decimal place as the addend with the largest decimal place (tenths are larger than hundredths).

$$\begin{array}{l} \mathbf{3.45 + 2.004 = 5.45} \qquad \mathbf{NOT\ 5.454} \\ \mathbf{5.97 + 0.00005 = 5.97} \qquad \mathbf{NOT\ 5.97005} \end{array}$$

Subtraction:

The same rules apply as with addition.

$$\begin{array}{l} \mathbf{3.45 - 2.004 = 1.45} \qquad \mathbf{NOT\ 1.446} \\ \mathbf{5.97 - 0.00005 = 5.97} \qquad \mathbf{NOT\ 5.96995} \end{array}$$

Multiplication/Division:

When multiplying or dividing numbers, the product or quotient should have the same number of significant figures as the factor or dividend/divisor with the least number of significant figures.

$$\begin{array}{l} \mathbf{3.45 \times 2.004 = 6.91} \qquad \mathbf{NOT\ 6.9138} \\ \mathbf{3.45 \div 2.004 = 1.72} \qquad \mathbf{NOT\ 1.72155688...} \end{array}$$

Most of the operations you will carry out can be broken down into these four basic operations. For example, an average is just a series of addition and division operations and should be treated as such in your final answer. However to prevent serious rounding errors you should keep extra digits around during the calculations and round your final answer to the appropriate number of significant figures. Should you encounter an operation that you are unsure about the significant figures feel free to ask!