Significant Figures Guidelines

Introduction

The significant figures convention follows the assumption that there is unit uncertainty in the last digit of a measurement. The purpose of keeping track of significant figures is to avoid artificially overstating the precision of a result. The precision of an experiment can not be increased by mathematical manipulation!

The Cardinal Rule for Significant Figures in Ch1a

Make sure to follow the guidelines given on the first homework set. These rules will hold for all homework sets in this course and may differ from those you find in other sources.

Additional Guidance

- There is a brief chapter on significant figures in OGN (Appendix 3).
- It is usually a good practice to apply the significant figure guidelines at the end of a calculation, when you are reporting your final result.
- **Sums and Differences**: The number of decimal places in the number with the *smallest* number of decimal places is the number of decimal places appearing in the result of the operation.

  Examples: $1+0.1+0.01+0.001=1$

  $$2+.0078+.1-(1\times10^{1})=-8$$

- **Products and Quotients**: A rule of thumb is to round the result of these operations to contain the same number of significant digits as the original number with the smallest number of significant digits. *This rule of thumb will apply in Ch 1a*. However, consider that this procedure can lead to incorrect rounding.

  Example: $\frac{24\times4.52}{100.0}=1.08$ and $\frac{24\times4.02}{100.0}=0.965$

If these two results were rounded according to our rule of thumb, the results would be stated as 1.1 and 0.96. If we consider that there is an implied uncertainty of ±1 in the last digit of each of the numbers in the operation, the relative uncertainties associated with each number in the first operation are 1/24, 1/452, and 1/1000. Since the relative uncertainty is by far the greatest in the first number, the relative uncertainty in the result should be 1/24. The absolute uncertainty is then $1.08 \times 1/24 = .045 = 0.04$. The absolute uncertainty in the second answer is $0.965 \times 1/24 = 0.040 = 0.04$.

Therefore the first result should really be rounded to three significant figures, or 1.08, but the second should only be rounded to two, 0.96.

- **Logarithms and Antilogarithms**: In a log of a number, keep as many digits to the right of the decimal point as there are significant figures in the original number. In an antilogarithm, keep as many digits as there were to the right of the decimal point in the original number.

  Example: $\log(3.000 \times 10^{-4}) = -3.5229$

  antilog (-8.1) = $10^{-8.1} = 8 \times 10^{-9}$

- **Rounding Data**: When a number to be rounded ends in 5, as in averaging 1.11 and 2.22 to get 1.665, should the result be reported as 1.67 or 1.66? It is generally a good policy to eliminate bias in rounding. One way to do this is to always round in the direction that gives an even digit in the last reported decimal place. In this case the result would be 1.66. This practice removes bias because there is an equal likelihood that the nearest even number will be the higher or the lower in any given case.