Waters
Lab Highlights
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A THREE PART SERIES

INTRODUCTION TO STATISTICS: I. ACCURACY II. PRECISION III. SIGNIFICANT FIGURES AND CORRECT VALUES

PART I: ACCURACY

The term accuracy tells how close a single experimental result or a mean (average) of a group of results (replicates) is to the "correct" value. An accepted, true, or correct value must be available before accuracy can be discussed. Accuracy is usually expressed in terms of error:

Absolute error = experimental value - correct value

$$\text{Relative error} = \frac{\text{absolute error}}{\text{correct value}} \times 100 \text{ or } 1000$$

When the last equation uses 100, the relative error is in percent. When it uses 1000, error is in parts per thousand (ppt).

Example Calculation:

Correct answer = 12.30 mg

Experimental values = 12.00, 12.10, 12.50 mg

Mean of experimental values:

$$\begin{array}{r} 12.00 \\ 12.10 \\ \underline{12.50} \\ \text{Sum} = \quad 36.60 \div 3 = 12.20 \text{ (mean)} \end{array}$$

Absolute error = 12.20 - 12.30 = -0.10 mg

The - sign indicates a negative error; i.e., the experimental value is lower than it should be. A + error would be higher than it should be.

$$\text{Relative error} = \frac{0.10}{12} \times 100 = 0.83\% \text{ or } 8.3 \text{ ppt}$$

The idea of "relative" error is that you are expressing the result in terms of the size of the thing you are measuring. The 0.10 mg absolute error above is analytically much less serious when the value measured is 12 mg than if the same absolute error was made in measuring 1.2 mg. The relative error would then be calculated as:

$$\frac{0.10}{1.2} \times 100 = 8.3\%$$

Although the absolute errors are the same, the second relative error is ten times as large as the first.

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