Introduction to Chemistry

Two Types of Data Analysis

Quantitative Measurements

Measurements where data is collected using a measuring tool to compare to other measurements of the same type

Qualitative Measurements

Measurements where no data is collected but comparisons are made using the main human senses (*sight, smell, touch, sound, taste*)

Examples

Weight (*mass*)
Size (*volume*)
Temperature (*heat*)
Length

Comparing reaction speed or color made
Smell, texture (*touch*), Sound

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Introduction to Chemistry

Taking Good Measurements

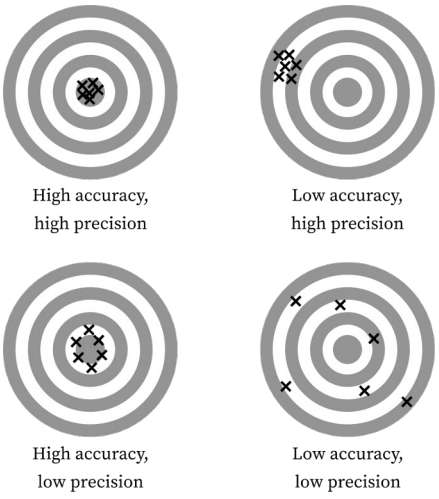
Accuracy

How close a measurement is taken relative to the correct true value

Precision

How close a series of measurements taken together are to each other

Measurement sets can be accurate and/or precise. A and P are not linked to each other directly, but independent terms



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Introduction to Chemistry

Determining Accuracy and Precision

Known Correct (*accurate*) Measurement: 12.0 ± 0.5g $CO_2(g)$

Precise Measurement defined as $\pm$ 0.3g or better

Good Accuracy Good Precision	Good Accuracy Poor Precision	Poor Accuracy Good Precision	Poor Accuracy Poor Precision
12.0g	11.7g	16.4g	5.6g
12.1g	12.4g	16.5g	18.4g
12.0g	11.5g	16.3g	8.4g
12.1g	11.8g	16.4g	12.9g
11.9g	12.5g	16.5g	10.4g
±0.1g, 11.9 – 12.1	±0.5g, 11.5 – 12.5	±0.1g, 16.3 – 16.5	±12.8g, 5.6 – 18.4

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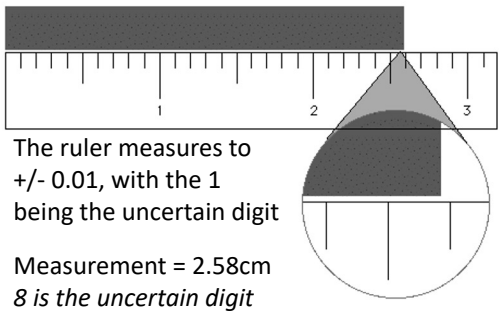
Introduction to Chemistry

Accuracy in Written Measurements

Any measurement can have any number of true (*known*) and one estimated (unknown) digits in its quantity.

In any measurement one uncertain digit always exists*

The uncertain digit is always one digit smaller than the *resolution*, the smallest marking on the scale or measuring device



The ruler measures to +/- 0.01, with the 1 being the uncertain digit

Measurement = 2.58cm
8 is the uncertain digit

* Numbers know exactly (*counts / conversion factors*) have no uncertain digits

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Introduction to Chemistry

Writing Accuracy in Measurements

Any measurement can have any number of true (*known*) and one estimated (unknown) digits in its quantity.

Ex: 345.20g NaCl

Known digits	Unknown digit
345.2 (4)	0 (1)
System of Measure	Label
mass (*g*)	NaCl

Ex: 0.928L Water

Known digits	Unknown digit
0.928 (3)*	8 (1)
System of Measure	Label
volume (L)	Water

* Leading zeros are called *placeholders* and are not digits at all, they just locate the decimal point in the measurement

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