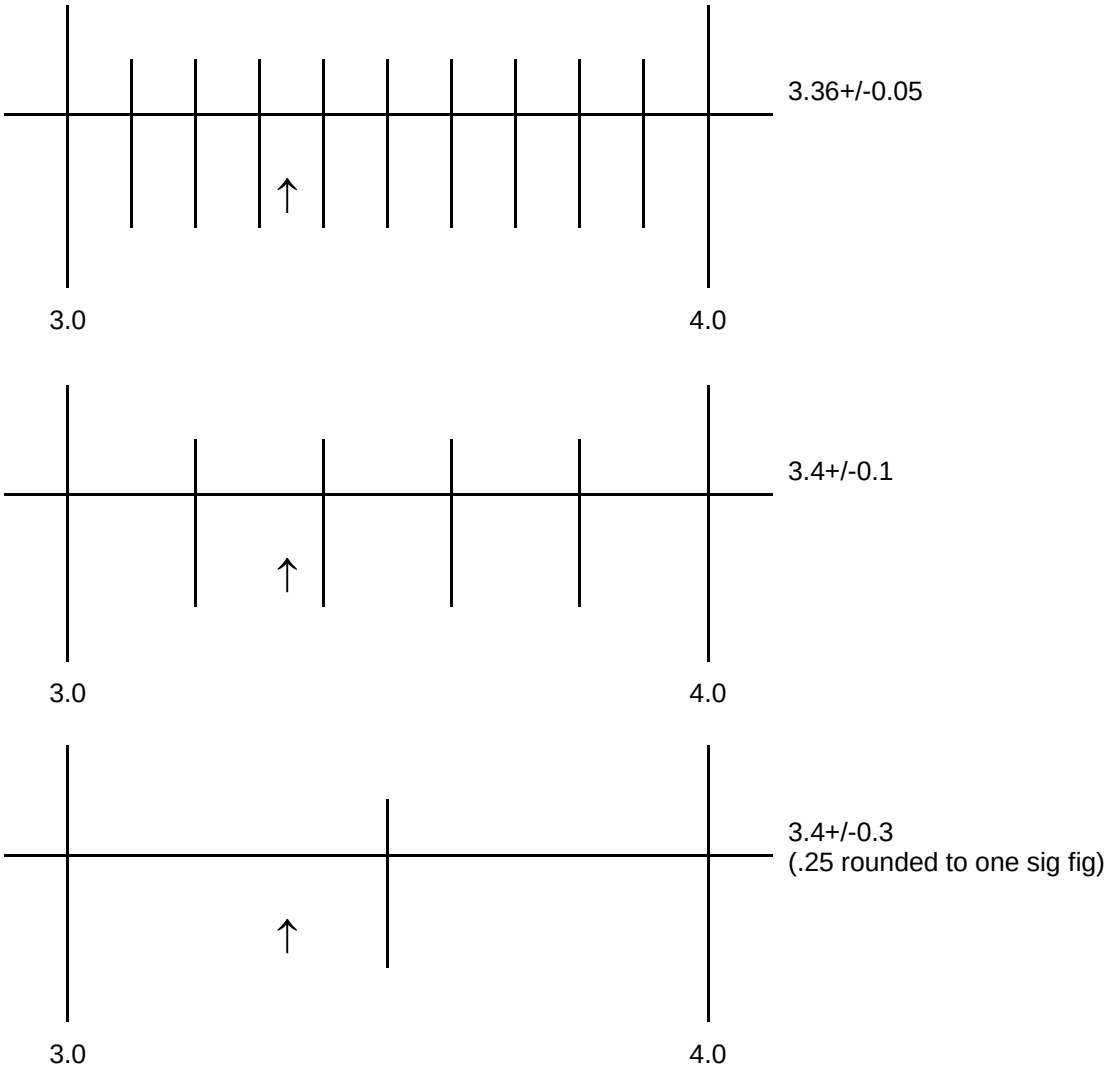
Dealing with Measurement Uncertainty

In general when doing calculations we will be following the rules for significant figures. When we are working with measured numbers there is a more accurate way of dealing with the uncertainty of those numbers in the calculations.

When a measurement is taken, it should always be recorded as the value +/- an uncertainty.

For measurements taken on analog equipment the uncertainty will be taken as ½ of the least exact count on the measuring device rounded to one significant figure. The least exact count of a device is the smallest marked division on the device. Look at the examples drawn below for additional clarification.



On a digital device, the uncertainty will be taken as 5 times the smallest decimal the device measures. If a device reads 2.341 g, that will be taken as 2.341 +/- .005 g. The exception to this rule shall be CBL's which read to the third decimal, but are reliable only to the 2nd. Therefore the uncertainty on a CBL reading shall be +/- .05 of whatever unit is being measured.

When doing calculations with measured data the following rules will be applied.

When adding or subtracting data the uncertainty of the answer is the SUM of the uncertainties in the measurements rounded to one sig fig.

ex: 22.3 +/- 0.2 cm - 11.7 +/- 0.5 cm = 10.6 +/- 0.7 cm

When uncertainties begin to add up to larger and larger amounts you may need to adjust the rounding on your answer.

ex: 22.3 +/- 0.2 + 11.7 +/- 0.5 + 3.8 +/- 0.5 = 37.8 +/- 1.2

BUT errors must be 1 sig fig so the correct answer is 38 +/- 1

When multiplying or dividing data the uncertainty of the answer is the math answer * the SUM of the PERCENTAGES of the uncertainties.

ex: 22.3 +/- 0.2 cm * 11.7 +/- 0.5 cm = 260 +/- 10

Uncertainty = 260.91 (the calculator answer) * [(.2/22.3) + (.5/11.7)] = 13, rounded to 1 sig fig is 10

Thus, the answer would be 260 +/- 10 cm

On graphs, error bars should be used to indicate the uncertainty in all numbers.