

Science Olympiad Policy for Measuring and Recording Significant Figures

Significant Figures in measurement include all the digits of a number that can be read directly from the markings or graduations of the instrument or measuring device plus the digit that is estimated. The last digit (and **only** the last one) of a measurement should be an estimate, which is counted as a significant figure. All Science Olympiad events follow this basic measurement rule. Division B students are not expected to apply the significant figure rules below for B events (e.g., Metric Mastery) unless otherwise stated in the Event Rule. By convention, if a number is less than one, a zero should always be written to the left of the decimal point, but this zero is **not** significant (e.g., **0.2**).

Rules on determining how many significant figures are in a number:

- All non-zero digits **are** always significant.
- All zeros between two significant figures **are** significant.
- All leading zeros are **not** significant.
- Trailing zeros in a number containing a decimal point **are** significant.
- Trailing zeros in a whole number **may or may not** be significant, but **are** significant if they were a known measured or counted value. *[Note: whole numbers rarely occur with Science Olympiad measurements because you generally record the last digit as an estimate (e.g., if you measured exactly 100mm on a ruler marked in mm, you must estimate the last digit even if it is closest to a zero and record it as 100.0mm, so in this case all four digits are significant). However, if you read 100g on an electronic balance, you cannot estimate the last digit and would record it as 100g (by convention, you should either place a bar under (or over) the last significant figure or express the number in scientific notation with the appropriate exponent (e.g., 100g or 1.00×10^2 so in this case all three digits are significant)]*

Rounding off rules. Examine the digit to the right of the one that is to be the last significant figure:

- If the digit is below 5, drop it and all digits to the right of it.
- If the digit is more than 5, increase by 1 the significant figure to the left.
- If the digit is 5, round the significant figure to the left so that it is an **even** digit (exception: for the Fermi event, always round up if the digit is 5).

Calculations and significant figures:

- **Addition and subtraction:** the result should have as many decimal places as the measured number with the **smallest number of decimal places**.
- **Multiplication and division:** the result should have as many significant figures as the measured number with the **smallest number of significant figures**.
- **When performing intermediate** calculations, keep as many digits as is practical until the end of calculation to avoid rounding errors.

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Recommended Resources:

http://en.wikipedia.org/wiki/Significant_figures
<http://www.hccfl.edu/media/181113/sigfigs.pdf>