Rules for Significant Digits

The number of significant digits in a measured value is an indication of the precision of the measurement. For example, a mass of 12.324 g (5 sig digs) is much more precise than a measurement of 12 g (2 sig digs).

Rules for Determining the Number of Significant Digits in Measured Values

1. All digits from 1 – 9 are significant, no matter where they are in a number.
2. Zeroes between the digits 1 – 9 are significant.
   eg. 3009 has 4 sig digs   140012 has 6 sig digs
3. "Leading zeroes" (zeroes in front of a number) are not significant. They are "place holders".
   eg. 0.00231 has 3 sig digs   0.1003 has 4 sig digs
4. If there is **NO** decimal point in the number, then trailing zeroes (zeroes at the end of a number) are not significant.
   eg. 100 has only 1 sig dig   45300 has 3 sig digs
5. If there **IS** a decimal point in the number, then trailing zeroes (zeroes at the end of a number) are significant.
   eg. 103.00 has 5 sigs digs   0.02480 has 4 sig digs   250. has 3 sig digs
6. Counted values and conversion factors are considered to be exact; that is, they have an unlimited number of significant digits. Counted values and conversion factors do not limit the number of sig digs that can be reported.
   eg. 24 sheep is exactly 24 sheep (it means 24.0000000000000000000000000…)
   100 cm in a metre is exactly 100 (it means 100.0000000000000000000000…)
7. For logarithmic values such as pH, the number of decimal points indicates the number of sig digs.
   eg. a pH of 3.244 has 3 sig digs (3 decimal places) which is equivalent to [H+] = 0.000570 mol/L (3 sd)
   [H+] = 0.000056 mol/L (2 sig digs) is equivalent to a pH of 4.25 (2 decimal places)

Rules for Calculations with Significant Digits

When measured values are used in calculations, the final calculated value can not be more precise than the least precise measured value.

For example, if density is calculated from a mass of 12.324 g and a volume of 12 mL, the density can have only 2 sig digs because the least precise measurement (volume) has only 2 sig digs.

D = m/V
 = 12.324 g)12 mL
 = 1.027 g/mL
 = 1.0 g/mL (2 sig digs)

1. In general, for calculations involving measured values, look at the data and determine which measured value has the fewest sig digs. Round the final answer to this number of sig digs.
2. For calculations that involve more than one step, carry at least two more sig dig than you will report in your final answer. Round only the **final answer** to the correct number of sig digs.
3. If necessary, convert the final answer to scientific notation to correctly report the number of sig digs. All digits in scientific notation are significant.
4. Round the final answer only once.
   eg. 4.5578 rounded to three sig digs is 4.56
   539.45 rounded to two sig digs is 540 or 5.4×10^2
   1049.882 rounded to two sig digs is 1.0×10^3