

## Significant Figures

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Scientific notation can tell you how many significant figures there are in a measurement, but not always. This practice cannot be assumed.

A distance is given to be 10,000 m, but how good was the measurement? It could be a rough measurement like 13,000, which rounds to 10,000 [13 rounds down to 10], or it could be very precise, like 9,999, which rounds up. One is a very precise measurement and the other is not, but both round to 10,000.

If the number is written in scientific notation, we know for sure.

$1 \times 10^4$  1 Sig Fig. Not precise: roughly 10,000.  
 $1.00 \times 10^4$  3 Sig Figs. More precise: could be off by 100s  
 $1.0000 \times 10^4$  5 Sig Figs; Very precise: exactly 10,000!

### How Many Sig Figs?

1) All numbers between 1 and 9 are always significant. 2) Any zero that is written just to make the number big or little is not significant.

1,200,000 — only 2 sig. figs. The zeros are just there to make it a big number.

You could write it as  $1.2 \times 10^6$

203 — 3 sig. figs. The zero has to be there. You can't write 203 without it.

0.0035 — 2 sig figs. The zeros are just to make it a small number:  $3.5 \times 10^{-3}$

0.00350 — 3 sig figs. The last zero doesn't need to be there, so it must be significant. This means that you didn't get 0.00349, but exactly 0.00350. In scientific notation:  $3.50 \times 10^{-3}$

### Math and Sig Figs

**Addition and Subtraction**—Use the least number of decimals.

**Multiplication and Division**—Use the least number of sig figs.

Ex.1:  $12.1 + 2.002 = 12.102$  (calculator answer)  
With sig figs = 12.1 (to the 10<sup>th</sup> place)

Ex.3:  $31 \times 2 = 62$  (calculator answer)  
With sig figs = 60 (1 sig fig)

Ex.2  $3500 + 225 = 3725$  (calculator answer)  
With sig figs = 3700 (to the hundred place)

Ex.4  $4.22 \div 2 = 2.11$  (calculator answer)  
With sig figs = 2 (1 sig fig)

### Units and Sig Figs

When adding or subtracting with sig figs the units must match.

Ex.  $1.21 \text{ m} + 3.5 \text{ cm} =$  (first change both to meters or cm)  
 $1.21 \text{ m} + 0.037 \text{ m} = 1.247$  (with sig figs use the least number of  
1.247 rounds to 1.25 m decimals, which is the hundredth  
place, so you'll have to round.)