

## A small problem

The number ZERO has several uses. It may be a measured number, but it may also be a mere "placeholder" that wasn't measured at all!

So how do we tell a measured zero from a placeholder? There are a few ways:

1: BEGINNING ZEROS: Beginning zeros are NEVER considered significant.

$0.15 \text{ g}$  ( $.15 \text{ g}$  ... another way of writing)  
 $0.15 \text{ g}$   
 This zero merely indicates that there is a decimal point coming up!

$0.015 \text{ m}$  ( $1.5 \text{ cm}$ )  
 These zeros are placeholders. They'll disappear if you change the UNITS of this number!

$0,00063 \text{ mm}$   
 None of these zeros are considered significant

2: END ZEROS are sometimes considered significant. They are significant if

- there is a WRITTEN decimal point in the number
- there is another written indicator that the zero is significant. Usually this is a line drawn over or under the last zero that is significant!

$1.50 \text{ km} \pm 0.01 \text{ km}$

This zero IS considered significant. There's a written decimal.

$1500 \text{ m} \pm 100 \text{ m}$

These zeros ARE NOT considered significant (no written decimal, and no other indication that the zeros are significant)

$143\overline{0}000 \text{ g} \pm 100 \text{ g}$

These zeros are not significant.

This zero IS significant. It's marked.

How many significant figures are there in each of these measurements?

$$\frac{76.070}{5} \text{ g} \pm 0.001 \text{ g}$$

$$\frac{85000.}{5} \text{ mm} \pm 1 \text{ mm}$$

↑  
decimal point

$$\frac{0.001030}{4} \text{ kg} \pm 0.000001 \text{ kg}$$

$$\frac{156.0002}{7} \text{ g} \pm 0.0001 \text{ g}$$

$$\frac{0.10}{2} \text{ s} \pm 0.01 \text{ s}$$

$$\frac{17000000}{2} \text{ mg} \pm 1000000 \text{ mg}$$

$$\frac{120000}{4} \text{ km} \pm 100 \text{ km}$$

$$\frac{1350}{3} \text{ ms} \pm 10 \text{ ms}$$

(Number of significant figures is indicated in RED below each measurement. Significant digits are UNDERLINED.)

(Approximate uncertainty in each of these measurements is indicated in GREEN after each one.)