Significant Figures

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In Physics we predominantly dealing with real life measurements and within any measurement you make in the real world there is an uncertainty or an error percentage associated with the measurement.

Question: How long is your Desk? How could you make an accurate measurement?

blank meter stick

Length = 1.6m ± 0.1
1.5m
1.5m
1.55m
1.6
1.55m
1.55m ± 0.05

Regular meter stick

Length = 1.5150 m
1.5750 m
1.57 m

When we give a measurement in a problem we signify how accurate the measurement is by the number of digits given in the question.

Example: Four students jumps off a 8.3m cliff with a horizontal velocity of 23.3m/s. He lands on the ground five seconds later.

Question: What is the most accurate and least accurate measurements?

most accurate is the Velocity (3 digit)
Least accurate is the time (1 digit)

★ Counting numbers are infinitely accurate
i.e. The Helium nucleus has 2 protons and 2 neutrons
Don't take them into account

Multiplying measurments:

3 sig figs 2 sig figs
3.24kg x 4.3m/s
= 13.932 ← round to the lower Sig fig
= 14kg m/s

★ only round your final Answer

Our accuracy is only as good as our least number of sig. figs. (ie. 4.3 had two sig figs so our answer should be in 2 sig figs.)

Adding Measurements:

5m + 0.0198m = 5.0198m
1 sig fig 3 sig fig
= 5 m

Our accuracy is only as good as our largest unit. (Ie. 5m is our largest accurate measure so our final answer is only accurate to the meters place value)

Scientific Notations

Question: How accurate is the measurement 200m?

I have to write these last two zero's

$200m = 2.0 \times 10^2 m$
2 sig figs

$200m = 2 \times 10^2 m$
1 Sig fig

$200m = 2.0000 \times 10^2 m$
5 Sig figs

i.e. How many Sig figs are in 0.0310 sec

Tips for getting the most accurate answer.

1. Use all the digits provided in a question.
2. Avoid doing any rounding until the final answer. This is best done by not putting in numbers till your final step.
3. If you need to do multiple calculations in a problem keep at least 2 extra significant digits until the final answer.

Example: Mr. Roome and Mr. Horncastle often bike to school together. They bike at the same constant speed for the entire trip however Mr. Horncastle must bike 1hr where as Mr. Roome only bikes for 45min. Mr. Horncastle bikes 12.3km farther than Mr. Roome. How far do they both bike when they go to school? **(Remember: d=vt)**

$$v = \frac{d}{t}$$

$V_H = V_R$

$d_H = d_R + 12.3$

$t_H = 60\text{min}$

$t_R = 45\text{min}$

$$V_H = \frac{d_H}{t_H} \qquad V_R = \frac{d_R}{t_R}$$

$$\frac{d_H}{t_H} = \frac{d_R}{t_R}$$

$$\frac{d_R + 12.3}{60} = \frac{d_R}{45}$$

$$45\left(d_R + 12.3\right) = \left(\frac{60 d_R}{45}\right)(45)$$

$$45 d_R + (45)(12.3) = 60 d_r$$

$$-45 d_R \qquad -45 d_R$$

$$\frac{(45)(12.3)}{15} = \frac{15 d_R}{15}$$

$$\boxed{\begin{array}{l} 36.9\text{km} = d_R \\ 49.2\text{km} = d_H \end{array}}$$