

UNCERTAINTIES (P73 + Revision Guide)

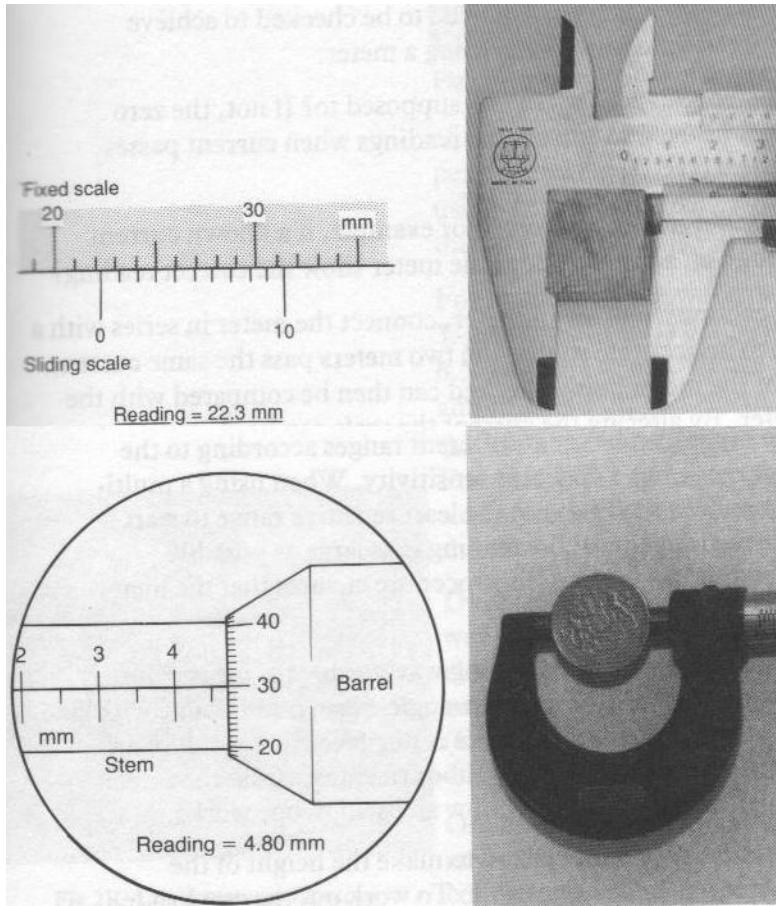
Single measurement smallest division 19 ± 1 mm meter rule 18.8 ± 0.1 mm
 vernier

% uncertainty $\frac{1}{19} \times 100\% = 5.3\%$, $\frac{0.1}{18.8} \times 100\% = 0.53\%$

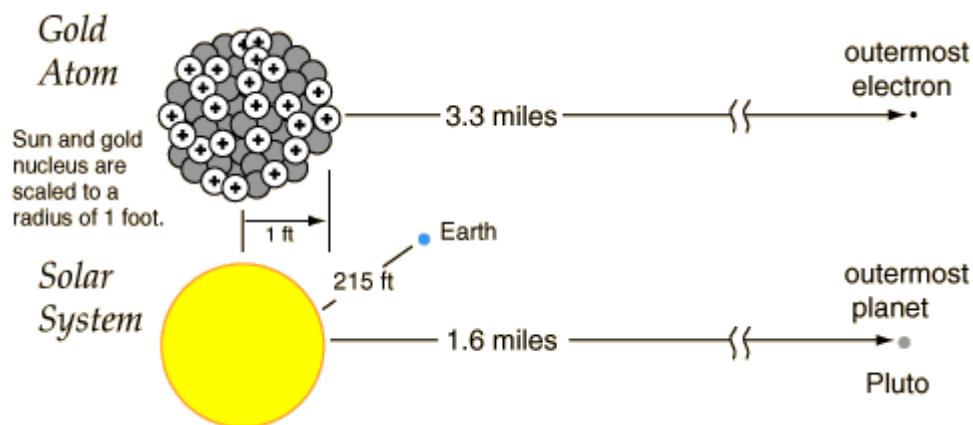
set of readings average value $\pm \frac{1}{2}$ total spread

own errors \rightarrow take several measurements and use range (as above)

Add + subtract readings \rightarrow add uncertainties
 multiply or divide readings \rightarrow add percentage uncertainties
 (powers \rightarrow multiply % uncertainty by the power \rightarrow as above)
 To calculate % difference between two values use \rightarrow $\frac{100 \times \text{difference}}{\text{average value}}$



Prefix	Symbol	Multiplier
giga	G	10^9
mega	M	10^6
kilo	k	10^3
milli	m	10^{-3}
micro	μ	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}
femto	f	10^{-15}



Basic Mechanical Units

	SI Units (MKS)	(CGS)	U.S. Common
Length (L)	meter (m)	centimeter (cm)	foot (ft)
Time (T)	second (s)	second (s)	second (s)
Mass (M)	kilogram (kg)	gram (gm)	slug
Velocity (L/T)	m/s	cm/s	ft/s
Acceleration (L/T²)	m/s ²	cm/s ²	ft/s ²
Force (ML/T²)	kg m/s ² = Newton(N)	gm cm/s ² = dyne	slug ft/s ² = pound(lb)
Work (ML²/T²)	N m = joule (j)	dyne cm = erg	lb ft = ft lb
Energy (ML²/T²)	joule	erg	ft lb
Power (ML²/T³)	j/s = watt (W)	erg/s	ft lb/s

Accuracy:

the number of significant digits a number has.

Precision:

the decimal position of the last significant digit.

When **adding or subtracting approximate** numbers, keep as many decimal places in your answer as contained in the number having the **fewest decimal places**.

When **multiplying** 2 or more approximate numbers, round the result to as many digits as are in the factor having the **fewest significant digits**.

THIS IS FOR APPROXIMATE NUMBERS.

Eg

2041.2 has 5 significant figures and 1 decimal place

0.006 has 1 significant figure and 3 decimal places

So to add them

2041.2 + 0.006 = 2041.206 BUT the fewest decimal places is 1 (2041.2) so our answer is quoted to 1 decimal place =

2041.2

Multiply them

2041.2 * 0.006 = 12.2472 BUT 0.006 has only 1 significant digit so the answer is = **10**

