Uncertainty and Error

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Absolute - the uncertainty in the measurement given as a fixed quantity - eg 2.4cm ± 0.1cm
Fractional - given as a fraction on the measurement 2..3 cm ± 2/25
Percentage - given as a percentage. Usually you have to convert from one of the others

Use Larger Readings...

Suppose you have meter and can measure to ± 0.1 V

What is the % error on readings of 3V and 12V?

$$3V: \% \text{ is } \frac{0.1}{3} \times 100 = 3\% \text{ so} \Rightarrow 3V \pm 3.3\%$$

$$12V: \% \text{ is } \frac{0.1}{12} \times 100 = 0.8\% \text{ so} \Rightarrow 12V \pm 0.8\%$$

Key here is that errors decrease on larger readings.

Errors on Means

Here are 5 repeated readings in Amps: 0.5, 0.3, 0.3, 0.3, 0.4

The range is largest - smallest = 0.5 - 0.3 = 0.2
The error is half the range - in this case 0.1 so the mean is:
0.36 ± 0.1V which should be expressed as 0.4 ± 0.1

Combining Uncertainties

Often when putting numbers in to formulae you have errors on different quantities - so you have to follow these rules to combine the uncertainties.

Adding or Subtracting:

Add the **absolute** uncertainties

Multiplying or Dividing:

Add the **percentage** uncertainties

Raising to a power:

Multiply the **percentage** uncertainty by the power