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**Absolute  
and Rela...**

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# Absolute and Relative Error

Any measurement made with a measuring device is approximate.  
If you measure the same object ~~two~~ different times, the two measurements may not be exactly the same. The difference between the two measurements is called an error (or uncertainty) in the measurements. This "error" is not the same as a "mistake".

There are two main types of measurement errors:  
absolute error and relative error

Absolute error - the difference between a measurement and its true value.

In many cases the absolute error is given.

Example 1: The Dasani water company might give an absolute error of  $\frac{1}{2}$  ounce when filling 20 ounce bottles. This would mean that acceptable amounts of water in the bottle would range from:  $19\frac{1}{2}$  oz to  $20\frac{1}{2}$  oz

$$20 - \frac{1}{2} = 19\frac{1}{2}$$

$$20 + \frac{1}{2} = 20\frac{1}{2}$$

Example 2: If 2 inch nails are guaranteed to be within  $\pm \frac{1}{10}$  inch:

What is the length of the shortest nail? 1.9 in

$$2 - \frac{1}{10} \text{ or } 2 - 0.1$$

What is the length of the longest nail? 2.1 in

$$2 + \frac{1}{10} \text{ or } 2 + 0.1$$

## Relative Error

- the ratio of the absolute error of the measurement to the accepted measurement or measured value.

$$\text{Relative Error} = \frac{\text{Absolute Error}}{\text{Actual Measurement}}$$

$$R = \frac{A}{m}$$

Example 3: Find the relative error if a measured item is 76.4 cm long and has an absolute error of  $\pm 0.1$  cm. <sup>78]</sup>

$$RE = \frac{AE}{\text{meas}}$$

$$RE = \frac{0.1 \text{ cm}}{76.4 \text{ cm}} = 0.00130\dots$$

$\times 100$  to change to %

$$\boxed{0.13\%}$$

Your Turn: A certain bolt is 12.8 cm long. It is made with an absolute error of 0.04 cm. What is the relative error of the length of the bolt?

$$RE = \frac{0.04 \text{ cm}}{12.8 \text{ cm}} = 0.00312\dots$$

$\times 100$

$$\boxed{0.31\%}$$