An easy way to Physics: 02 Formulas

Formulas

Often measurements are made in order to see, how one quantity influences another one. We look at a very simple example: A spiral spring is suspended at its upper end, and at its lower end hang different masses m. For each mass m we measure, how much the spring is made longer by the distance x. We write the results of our measurement into a table:

m	0.0 kg	1.0 kg	2.0 kg	3.0 kg	5.0 kg	10.0 kg
x	0.0 cm	2,.1 cm	4.2 cm	6.3 cm	10.5 cm	23.0 cm

If we want to know x, when m = 1.5 kg, we can measure it. There is another way: In the table we can see, that for masses m up to 5 kg x doubles, when m doubles, x triples,when m triples ...
We can simply write: $x = m \cdot 2.1$ cm/kg.
This simple formula saves a lot of writing, and it allows to calculate x for other values of the mass m, e.g. 1.25 kg, 0.247 kg, 4.95 kg. This formula is valid for masses between 0 kg and 5 kg.

With this formula we can predict the results for masses outside of this domain of validity. This is a process called <u>extrapolation</u>. For m = 10.0 kg the formula predicts x = 21.0 cm and that is not far from the measured value of 23.0 cm. For a mass of m = 5000 kg, the formula predicts   x = 10500 cm, which is evidently absurd. Extrapolation gives good ideas, but it must be checked, whether it gives correct results.