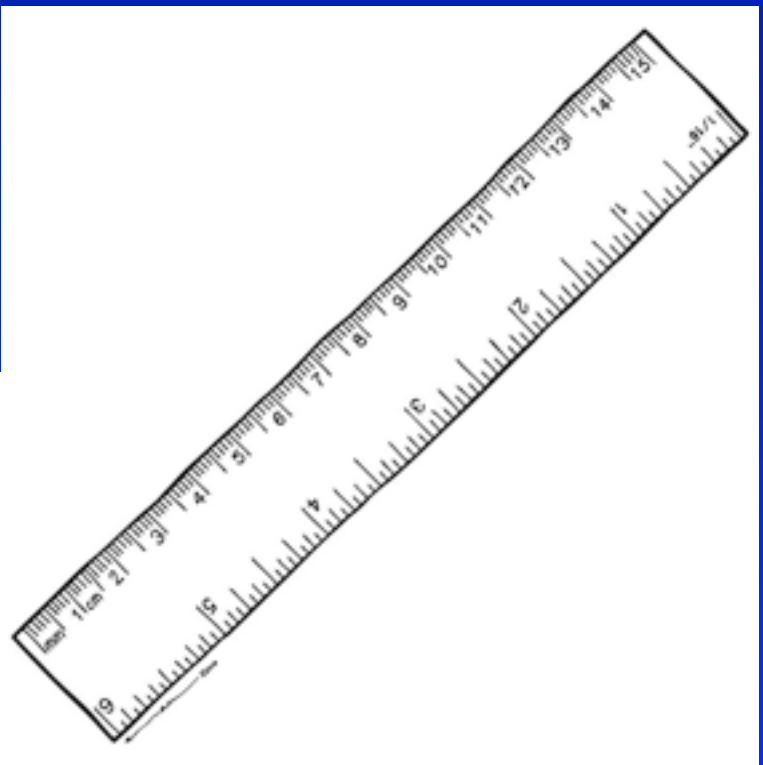
International System of Units

Or...what do Libya, Myanmar and USA have in common?

These countries DO NOT use the same units as the rest of the world!

Think about it: How many times a day do you measure something?



The International System of Units

Scientist wish to make the study of science something that is practiced around the world, and not confined to certain countries.

In an effort to make science into an international study, scientists have developed an international system of units to describe certain values.

There are many different units, used around the world to describe the same things.

Example: length can be described by both inches and centimetres.

Scientists can still use these different units, they are still valid. It's just that, for the most part, they try to stick to these standard units.

Standard International (S.I.) Units

Quantity	Unit	Symbol	Quantity	Unit	Symbol
Length	metre	m	Resistance	Ohm	Ω
Mass	gram	g	Charge	Coulomb	C
Volume	metre cubed	m^3	Power	Watt	W
Time	second	s	Force	Newton	N
Energy	joule	J	Pressure	Pascal	Pa
Temperature	kelvin	K	Amount of substance	mole	Mol
Current	ampere	A	Frequency	Hertz	Hz
Potential Difference	Volt	V	Luminous intensity	candela	cd

S.I. Base Units

Of all these units there are seven "base units":

metre for length
kilogram for mass
second for time
ampere for electric current
kelvin for temperature
candela for luminous intensity
mole for the amount of substance

All other S.I. units can be expressed using these base units...For example, Newtons can be expressed can be expressed using kilograms, metres and seconds.

$$1\ \mathrm{N} = 1\ \mathrm{kgm/s^2}$$

Metric Prefixes

Sometimes the S.I. units are too small or too large to describe a certain quantity.

For example a metre would be too big to describe the size of an atom; an atom is a very small thing.

In this case scientists use scientific notation or metric prefixes to increase or decrease a unit by factors of ten.

Prefix	Symbol	Meaning of prefix	Relationship to unit
		How many times larger compared to unit?	*Given that unit = 1, what equates to it?*
Mega	M	10^6 = 1 000 000	0.000001 megaunit
		10^5 = 100 000	
		10^4 = 10 000	
Kilo	**k**	10^3 = 1000	0.001 kilo unit
Hecta	h	10^2 = 100	0.01 hectaunit
Deca	da	10^1 = 10	0.1 decaunit
Unit		10^0 = 1	1 unit
Deci	d	10^{-1} = 0.1	10 deciunit
Centi	**c**	10^{-2} = 0.01	100 centiunit
Milli	**m**	10^{-3} = 0.001	1 000 milliunit
		10^{-4} = 0.000 1	
		10^{-5} = 0.000 01	
Micro	**µ**	10^{-6} = 0.000 001	1 000 000 microunit
		10^{-7} = 0.000 000 1	
		10^{-8} = 0.000 000 01	
Nano	**n**	10^{-9} = 0.000 000 001	1 000 000 000 nanounit

Just how **small**
is a nanometre?

Converting Metric Prefixes

- We must use the factors of ten that the prefix represents.
- To convert from one metric prefix to another we can first convert to base unit, then convert to the new prefix.

Example

Convert 8.2×10^4 cm to hm.

$8.2 \times 10^4 \times 10^{-2}$ m

$= 8.2 \times 10^{4-2}$ m

$= 8.2 \times 10^2$ m

Since a hecta-metre is larger than a metre we can divide by 10^2.

$= 8.2 \times 10^2 \div 10^2$ hm

$= 8.2 \times 10^{2-2}$ hm

$= 8.2 \times 10^0$ hm

$= 8.2 \times 1$ hm

$= 8.2$ hm

Scientific Notation

Scientific notation is the way that scientists easily handle very large numbers or very small numbers.

For example, instead of writing 0.0000000056, we write 5.6×10^{-9}. So, how does this work?

A **positive** exponent shows that the decimal point is shifted that number of places to the right.

$24327 = 2.4327 \times 10^{4}$

A **negative** exponent shows that the decimal point is shifted that number of places to the left.

$0.0078 = 7.8 \times 10^{-3}$