

Unit 0. Units and Basic Maths

Y12

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1 Standard Units and Basic Maths

1.1 Review of symbols

Symbol	Meaning
\approx	Approximately equal
\neq	Not equal, different
\sum	Sum of a series of numbers
\prod	Product of a series of numbers
\int	Integral operation
Δ	Augment, difference in an interval
\propto	Proportional
d or ∂	Derivative
∞	Infinity
$ x $	Modulus of x
\vec{x}	Vector x

1.2 Base units

How many units do you think you really need in Physics? 10? 20? 100?... [Guess](#)

Base units: decided by scientific community, they are the minimum quantity needed to describe all other magnitudes.

SI units: the internationally decided units for each base unit, revised periodically to increase precision, ease of use, etc:

BASIC QUANTITY	UNIT NAME	UNIT SYMBOL
mass	kilogram	kg
time	second	s
length	metre	m
electric current	ampere	A
temperature	kelvin	K
amount of substance	mole	mol
light intensity	candela	cd

Figure 1: Basic units

- kg (prototype)
- s ($9 \cdot 10^9 \Delta C_{groundlevel}$)
- m (distance light in $\frac{1}{3} \cdot 10^8 s$)
- A (current for $2 \cdot 10^{-7} \frac{N}{m}$ 1m apart)
- K ($273.16^{-1} waters^{s-l-g}$)
- mol (atoms 0.012kg, ^{12}C)
- cd ($10^{-3} \frac{W}{rad^2}$, intensity of a $5 \cdot 10^{14} Hz$ light).

Derived units: the rest, p.e.:

- $\frac{m}{s}$ or $m \cdot s^{-1}$
- N , Newton
- J , Jules
- W , Watts
- Hz , Hertz
- C , Coulombs
- V , Volts
- Ω , Ohms
- ...

DERIVED QUANTITY	UNIT NAME	UNIT SYMBOL	BASE UNITS EQUIVALENT
force	newton	N	$kg \cdot m \cdot s^{-2}$
energy (work)	joule	J	$kg \cdot m^2 \cdot s^{-2}$
power	watt	W	$kg \cdot m^2 \cdot s^{-3}$
frequency	hertz	Hz	s^{-1}
charge	coulomb	C	$A \cdot s$
voltage	volt	V	$kg \cdot m^2 \cdot s^{-3} \cdot A^{-1}$
resistance	ohm	Ω	$kg \cdot m^2 \cdot s^{-3} \cdot A^{-2}$

Figure 2: Derived units

Units can be added *power prefixes*. You must know nano up to giga.

Careful with time above seconds! (not x10)

FACTOR	NAME	SYMBOL	FACTOR	NAME	SYMBOL
10^1	deca-	da	10^{-1}	deci-	d
10^2	hecto-	h	10^{-2}	centi-	c
10^3	kilo-	k	10^{-3}	milli-	m
10^6	mega-	M	10^{-6}	micro-	μ
10^9	giga-	G	10^{-9}	nano-	n
10^{12}	tera-	T	10^{-12}	pico-	p
10^{15}	peta-	P	10^{-15}	femto-	f
10^{18}	exa-	E	10^{-18}	atto-	a
10^{21}	zetta-	Z	10^{-21}	zepto-	z
10^{24}	yotta-	Y	10^{-24}	yocto-	y

Figure 3: Decimal system

1.3 Maths Revision

You should know already...

- $360^\circ = 2\pi \text{ rad} \rightarrow 30^\circ = 2\pi \cdot \frac{30}{360} \text{ rad}$
- **Vectors:** (2, 3) means 2 in the x direction, 3 in the y direction.
- **Trigonometry:** *SOH CAH TOA*

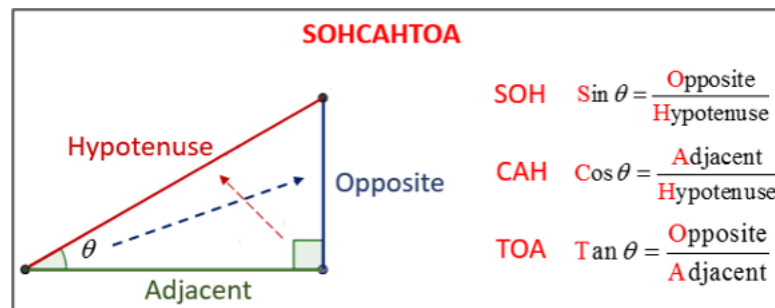


Figure 4: SOH CAH TOA

- **Graphs:**
 - Gradient: slope of a graph $m = \frac{\Delta y}{\Delta x}$
 - Line equation: $y = ax + b$, where b is the gradient or slope.
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