

**PHYSICS 2APHY and 2BPHY**  
**Formulae and constants sheet**

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## Forces and motion

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Mean velocity	$v_{av} = \frac{s}{t} = \frac{v+u}{2}$
Equations of motion	$a = \frac{\Delta v}{\Delta t}$ ; $s = ut + \frac{1}{2}at^2$ ; $v^2 = u^2 + 2as$ ; $v = u + at$
Force	$F = ma$
Weight force	$F = mg$
Momentum	$p = mv$
Change in momentum (impulse)	$F\Delta t = mv - mu$
Kinetic energy	$E_k = \frac{1}{2}mv^2$
Gravitational potential energy	$E_p = mgh$
Work done	$W = Fs = \Delta E$
Power	$P = \frac{W}{t} = \frac{\Delta E}{t} = Fv_{av}$

## Particles

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Energy of photon	$E = hf$
Activity	$A = \frac{\Delta N}{\Delta t}$
Half-life	$A = A_0 \left(\frac{1}{2}\right)^n$
Absorbed radiation dose	absorbed dose $= \frac{E}{m}$
Dose equivalent	dose equivalent = absorbed dose x quality factor
Mass-energy relationship	$E = mc^2$
Change of temperature	$Q = mc\Delta T$
Change of state	$Q = mL$
Absolute zero of temperature	0 K = - 273 °C

## Electricity and magnetism

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Electric current	$I = \frac{q}{t}$
Electric field	$E = \frac{F}{q} = \frac{V}{d}$
Work and energy	$W = qV = VIt$
Ohm's law	$V = IR$
Resistances in series	$R_T = R_1 + R_2 + \dots$
Resistances in parallel	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$
Power	$P = VI = I^2 R = \frac{V^2}{R}$

## Physical constants

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Speed of light in vacuum or air.....	c	= $3.00 \times 10^8 \text{ m s}^{-1}$
Electron charge.....	e	= $-1.60 \times 10^{-19} \text{ C}$
Electron volt.....	1 eV	= $1.60 \times 10^{-19} \text{ J}$
Unified atomic mass unit.....	1 u	= $1.66 \times 10^{-27} \text{ kg}$
Mass of electron.....	$m_e$	= $9.11 \times 10^{-31} \text{ kg}$
Mass of proton.....	$m_p$	= $1.67 \times 10^{-27} \text{ kg}$
Mass of neutron.....	$m_n$	= $1.68 \times 10^{-27} \text{ kg}$
Mass of alpha.....	$m_\alpha$	= $6.65 \times 10^{-27} \text{ kg}$
Mass–energy equivalent.....	1 u	= 931 MeV
Tonne.....	1 tonne	= $10^3 \text{ kg} = 10^6 \text{ g}$

## Physical data

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Mean acceleration due to gravity on Earth.....	g	= $9.80 \text{ m s}^{-2}$
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## Quality factors

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Approximate quality factor for alpha radiation.....	$QF_\alpha$	= 20
Approximate quality factor for beta radiation.....	$QF_\beta$	= 1
Approximate quality factor for gamma radiation.....	$QF_\gamma$	= 1
Approximate quality factor for slow neutrons.....	$QF_{sn}$	= 3
Approximate quality factor for fast neutrons.....	$QF_{fn}$	= 10

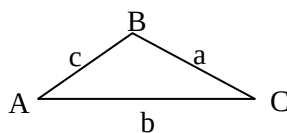
## Prefixes of the metric system

Factor	Prefix	Symbol	Factor	Prefix	Symbol
$10^{12}$	tera	T	$10^{-3}$	milli	m
$10^9$	giga	G	$10^{-6}$	micro	$\mu$
$10^6$	mega	M	$10^{-9}$	nano	n
$10^3$	kilo	k	$10^{-12}$	pico	p

## Mathematical expressions

Given  $ax^2 + bx + c = 0$ ,  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

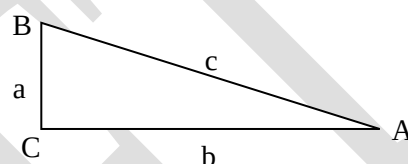
The following expressions apply to the triangle ABC as shown:



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$b = \sqrt{a^2 + c^2 - 2ac \cos B}$$

The following expressions apply to the right-angled triangle ABC as shown:

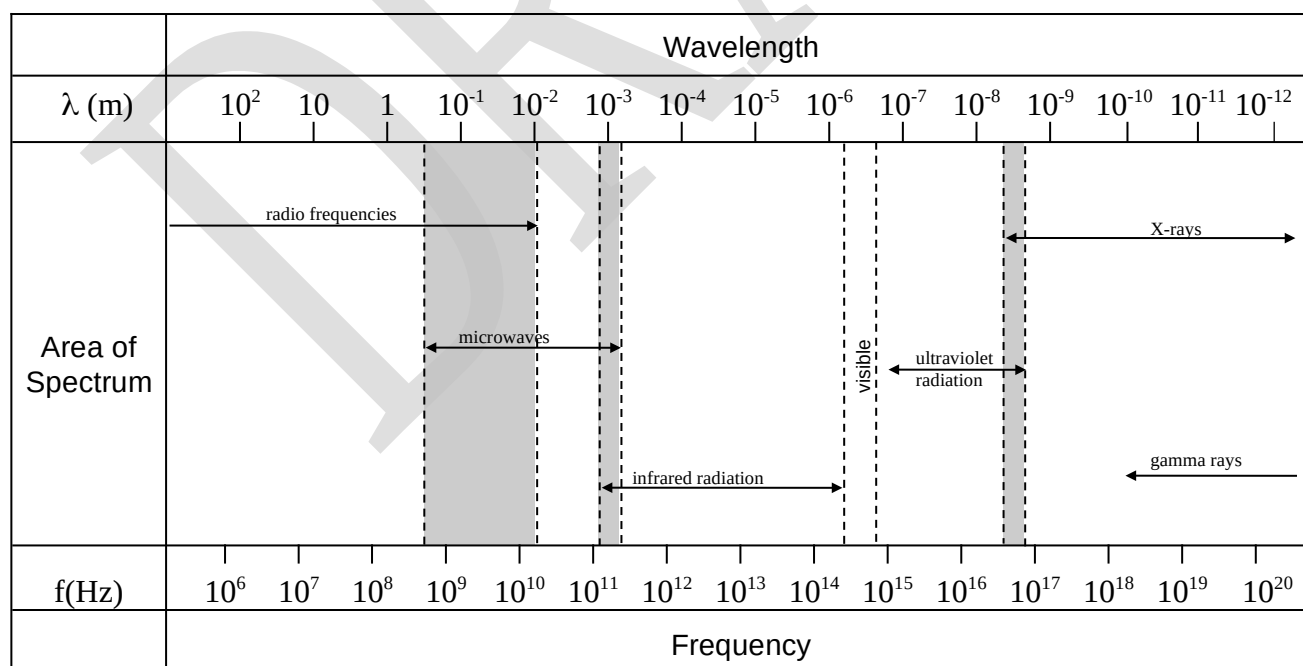


$$\sin A = \frac{a}{c}$$

$$\cos A = \frac{b}{c}$$

$$\tan A = \frac{a}{b}$$

## Electromagnetic spectrum



- Note: 1. Shaded areas represent regions of overlap.  
2. Gamma rays and X-rays occupy a common region.