PHYSICS 3APHY and 3BPHY

Formulae and constants sheet

Physics 3A/3B: Formulae and constants sheet

Forces and motion

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	$P = \frac{W}{t} = \frac{\Delta E}{t} = Fv_{av}$
Centripetal acceleration	$a_c = \frac{v^2}{r}$
Centripetal force	$F_c = ma_c = \frac{mv^2}{r}$
Newton's Law of Universal Gravitation	$F = G\frac{m_1 m_2}{r^2}$
Gravitational field strength	$g = G\frac{M}{r^2}$
Moment of a force	$\tau = rF$

Electricity and magnetism

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	$R_T = R_1 + R_2 + ...$
Resistances in parallel	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + ...$
Power	$P = VI = I^2R = \frac{V^2}{R}$
Magnetic flux	$\Phi = BA$
Electromagnetic induction	$emf = -N\frac{\Delta\Phi}{\Delta t}$, $emf = \ell v B$
Magnetic force	$F = I\ell B$, $F = qvB$
Ideal transformer turns ratio	$\frac{V_s}{V_p} = \frac{N_s}{N_p}$

Particles and waves

Energy of photon	$E = hf$
Energy transitions	$E_2 - E_1 = hf$
Wave period	$T = \frac{1}{f}$
Wave equation	$v_{wave} = f\lambda$
Internodal distance	$d = \frac{1}{2}\lambda$
Absolute refractive index	$n_x = \frac{c}{c_x}$
Snell's law	$n_1 \sin\theta_1 = n_2 \sin\theta_2$

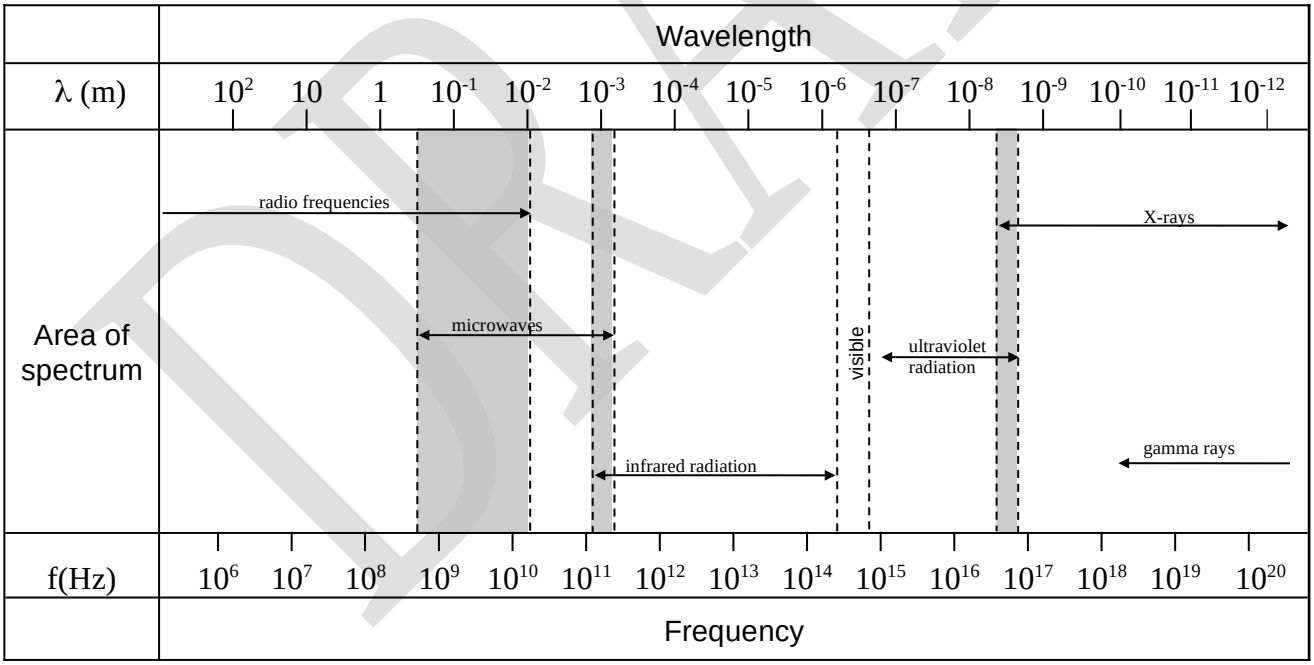
Physical constants

Speed of light in vacuum or air	c	$= 3.00 \times 10^{8}$ m s^{-1}
Electron charge	e	$= -1.60 \times 10^{-19}$ C
Mass of electron	m_e	$= 9.11 \times 10^{-31}$ kg
Planck's constant	h	$= 6.63 \times 10^{-34}$ J s
Universal gravitational constant	G	$= 6.67 \times 10^{-11}$ N m^2 kg^{-2}
Electron volt	1 eV	$= 1.60 \times 10^{-19}$ J
Mass of proton	m_p	$= 1.67 \times 10^{-27}$ kg
Mass of alpha	m_α	$= 6.65 \times 10^{-27}$ kg

Physical data

Mean acceleration due to gravity on Earth	g	$= 9.80$ m s^{-2}
Mean acceleration due to gravity on the Moon	g_M	$= 1.62$ m s^{-2}
Mean radius of the Earth	R_E	$= 6.37 \times 10^{6}$ m
Mass of the Earth	M_E	$= 5.98 \times 10^{24}$ kg
Mean radius of the Sun	R_S	$= 6.96 \times 10^{8}$ m
Mass of the Sun	M_S	$= 1.99 \times 10^{30}$ kg
Mean radius of the Moon	R_M	$= 1.74 \times 10^{6}$ m
Mass of the Moon	M_M	$= 7.35 \times 10^{22}$ kg
Mean Earth-Moon distance		3.84×10^{8} m
Mean Earth-Sun distance		1.50×10^{11} m
Tonne	1 tonne	$= 10^{3}$ kg $= 10^{6}$ g

Electromagnetic spectrum



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

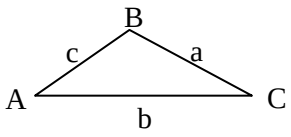
Prefixes of the metric system

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

Mathematical expressions

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

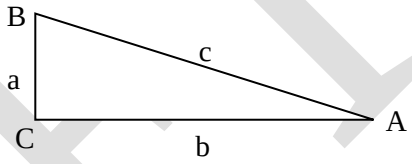
The following expressions apply to the triangle ABC as shown:



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

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

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



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

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

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