

DRAFT

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

$$a = \frac{\Delta v}{\Delta t}; \quad s = ut + \frac{1}{2}at^2; \quad v^2 = u^2 + 2as; \quad v = u + at$$

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

$$R_T = R_1 + R_2 + \dots$$

Resistances in parallel

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$$

Power

$$P = VI = I^2 R = \frac{V^2}{R}$$

Magnetic flux

$$\Phi = BA$$

Electromagnetic induction

$$\text{emf} = -N \frac{\Delta \Phi}{\Delta t}, \text{emf} = \ell v B$$

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

$$v_{\text{wave}} = f\lambda$$

Internodal distance

$$d = \frac{1}{2}\lambda$$

Absolute refractive index

$$n_x = \frac{c}{c_x}$$

Snell's Law

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

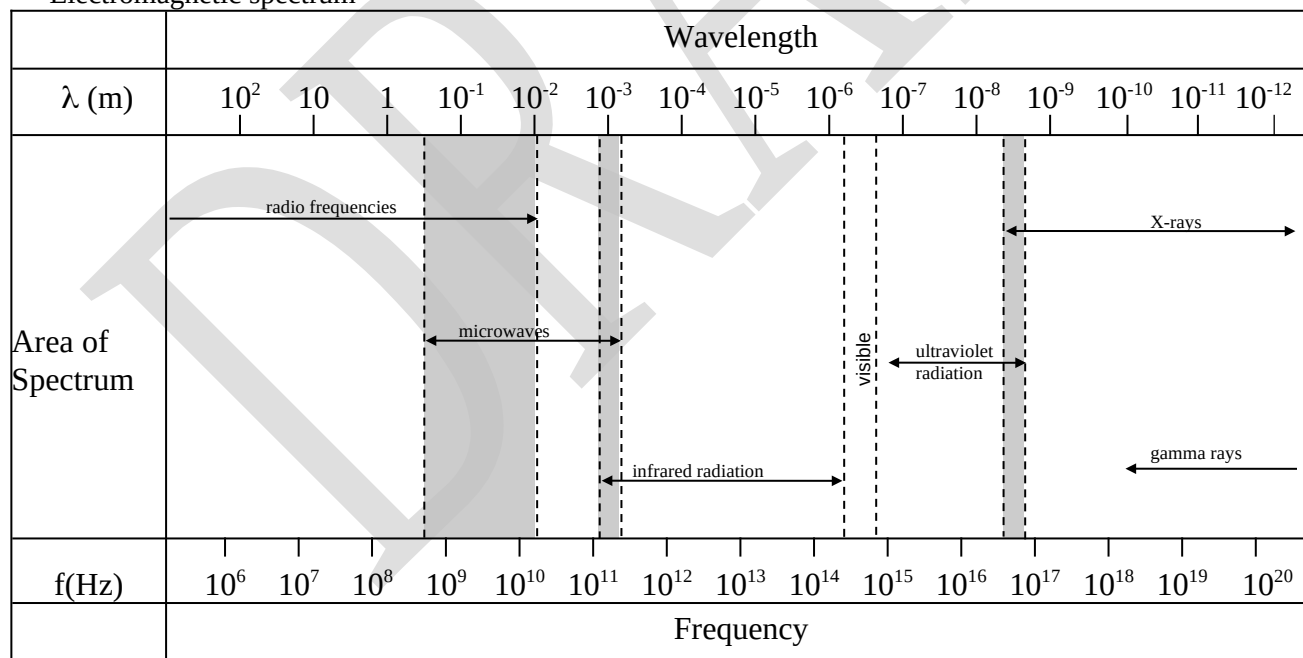
Physical Constants

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

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	= $6.37 \times 10^6 \text{ m}$
Mass of the Earth..... M_E	= $5.98 \times 10^{24} \text{ kg}$
Mean radius of the Sun..... R_S	= $6.96 \times 10^8 \text{ m}$
Mass of the Sun..... M_S	= $1.99 \times 10^{30} \text{ kg}$
Mean radius of the Moon..... R_M	= $1.74 \times 10^6 \text{ m}$
Mass of the Moon..... M_M	= $7.35 \times 10^{22} \text{ kg}$
Mean Earth-Moon distance.....	$3.84 \times 10^8 \text{ m}$
Mean Earth-Sun distance.....	$1.50 \times 10^{11} \text{ m}$
Tonne.....1 tonne	= $10^3 \text{ kg} = 10^6 \text{ g}$

Electromagnetic spectrum



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

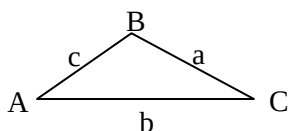
Prefixes of the Metric System

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

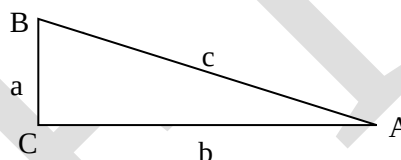
The following expressions apply to the triangle ABC as shown:



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

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

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



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

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

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