

EQUATION SHEET

The following tables show the symbols of common quantities and the magnitude of physical constants used in the equations. Other symbols used are shown next to the equations. Vectors are indicated by arrows. If only the magnitude of a vector quantity is used, the arrow is not used.

Symbols of Common Quantities

acceleration	\vec{a}	wavelength	λ	momentum	\vec{p}
time	t	force	\vec{F}	electric field	\vec{E}
displacement	\vec{s}	charge	q	kinetic energy	K
velocity	\vec{v}	mass	m	magnetic field	\vec{B}
period	T	potential difference	ΔV	electric current	I
frequency	f	work done	W		

Magnitude of Physical Constants

Acceleration due to gravity at the Earth's surface	$g = 9.8 \text{ m s}^{-2}$	Charge of the electron	$e = 1.60 \times 10^{-19} \text{ C}$
Constant of universal gravitation	$G = 6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$	Mass of the electron	$m_e = 9.11 \times 10^{-31} \text{ kg}$
Speed of light in a vacuum	$c = 3.00 \times 10^8 \text{ m s}^{-1}$	Mass of the proton	$m_p = 1.673 \times 10^{-27} \text{ kg}$
Coulomb's law constant	$\frac{1}{4\pi\epsilon_0} = 9.00 \times 10^9 \text{ N m}^2 \text{ C}^{-2}$	Mass of the neutron	$m_n = 1.675 \times 10^{-27} \text{ kg}$
Planck's constant	$h = 6.63 \times 10^{-34} \text{ J s}$	Mass of the α particle	$m_\alpha = 6.645 \times 10^{-27} \text{ kg}$

Section 1: Motion in Two Dimensions

$\vec{v} = \vec{v}_0 + \vec{a}t$	\vec{v} = velocity at time t \vec{v}_0 = velocity at time $t = 0$	$\tan \theta = \frac{v^2}{rg}$	θ = banking angle
$v^2 = v_0^2 + 2as$		$F = G \frac{m_1 m_2}{r^2}$	r = distance between masses m_1 and m_2
$\vec{s} = \vec{v}_0 t + \frac{1}{2} \vec{a} t^2$		$v = \sqrt{\frac{GM}{r}}$	M = mass of object orbited by satellite r = radius of orbit
$v_H = v \cos \theta$	θ = angle to horizontal	$\vec{F} = m\vec{a}$	
$v_v = v \sin \theta$		$\vec{p} = m\vec{v}$	
$v = \frac{2\pi r}{T}$	r = radius of circle	$\vec{F} = \frac{\Delta \vec{p}}{\Delta t}$	
$\Delta \vec{v} = \vec{v}_f - \vec{v}_i$	\vec{v}_f = final velocity \vec{v}_i = initial velocity	$K = \frac{1}{2} mv^2$	
$\vec{a}_{ave} = \frac{\Delta \vec{v}}{\Delta t}$	\vec{a}_{ave} = average acceleration	$W = Fs \cos \theta$	θ = angle between force \vec{F} and displacement \vec{s}
$a = \frac{v^2}{r}$			

PLEASE TURN OVER

Section 2: Electricity and Magnetism

$$F = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r^2} \quad r = \text{distance between charges } q_1 \text{ and } q_2$$

$$F = I\Delta l B \sin \theta \quad \theta = \text{angle between field } \vec{B} \text{ and current element } I\Delta \vec{l}$$

$$\vec{E} = \frac{\vec{F}}{q}$$

$$F = qvB \sin \theta \quad \theta = \text{angle between field } \vec{B} \text{ and velocity } \vec{v}$$

$$E = \frac{1}{4\pi\epsilon_0} \frac{q}{r^2}$$

$$r = \frac{mv}{qB} \quad r = \text{radius of circle}$$

$$W = q\Delta V$$

$$T = \frac{2\pi m}{qB}$$

$$E = \frac{\Delta V}{d} \quad d = \text{distance between parallel plates}$$

$$K = \frac{q^2 B^2 r^2}{2m}$$

Section 3: Light and Matter

$$v = f\lambda \quad v = \text{speed of light}$$

$$E = hf \quad E = \text{energy of photon}$$

$$d \sin \theta = m\lambda \quad d = \text{distance between slits}$$

$\theta = \text{angular position of } m\text{th maximum}$

$m = \text{integer } (0, 1, 2, \dots)$

$$p = \frac{h}{\lambda}$$

$$K_{\max} = hf - W \quad W = \text{work function of the metal}$$

$$\Delta y = \frac{\lambda L}{d} \quad \Delta y = \text{distance between adjacent minima or maxima}$$

$L = \text{slit-to-screen distance}$

$$W = hf_0 \quad f_0 = \text{threshold frequency}$$

$$f_{\max} = \frac{e\Delta V}{h} \quad \Delta V = \text{potential difference across the tube}$$

$$d = \frac{1}{N} \quad N = \text{number of slits per metre of grating}$$

Section 4: Atoms and Nuclei

$$E_n - E_m = hf \quad E_n - E_m = \text{energy difference}$$

$$E = mc^2 \quad E = \text{energy}$$

$$A = Z + N \quad A = \text{mass number}$$

$$Z = \text{atomic number}$$

$$N = \text{number of neutrons}$$

TABLE OF PREFIXES

Refer to the following table when answering questions that involve the conversion of units:

Prefix	Symbol	Value
tera	T	10^{12}
giga	G	10^9
mega	M	10^6
kilo	k	10^3
centi	c	10^{-2}
milli	m	10^{-3}
micro	μ	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}