SPH 3U - Gr.11U Physics

Reference

Physical Constants

Quantity	Symbol	Approximate value
speed of light in a vacuum	c	3.00×10^8 m/s
gravitational constant	G	6.67×10^{-11} N·m^2/kg^2
Coulomb's constant	k	9.00×10^9 N·m^2/C^2
charge on electron	$-e$	-1.60×10^{-19} C
charge on proton	e	1.60×10^{-19} C
electron mass	m_e	9.11×10^{-31} kg
proton mass	m_p	1.673×10^{-27} kg
neutron mass	m_n	1.675×10^{-27} kg
atomic mass unit	u	1.660×10^{-27} kg
Planck's constant	h	6.63×10^{-34} J·s

Terrestrial and Lunar Data

Quantity	Approximate value
mass of Earth	5.98×10^{24} kg
radius of Earth at equator (mean)	6.38×10^6 m
radius of Earth's orbit (mean)	1.50×10^{11} m
acceleration due to gravity (g)	
on Earth at equator (sea level)	9.7804 m/s^2
on Earth at poles (sea level)	9.8322 m/s^2
on the Moon	1.62 m/s^2
Earth-Moon distance (mean)	3.84×10^8 m
mass of Moon	7.35×10^{22} kg
radius of the Moon (mean)	1.74×10^6 m
radius of the Moon's orbit (mean)	3.84×10^8 m
Earth-Sun distance (mean)	1.50×10^{11} m
standard atmospheric pressure	1 atm or 1.013×10^5 Pa
length of Earth year	3.16×10^7 s

Unit 1 – Kinematics

$\Delta\vec{d} = \vec{v}\Delta t$	$a_{av} = \dfrac{v_2 - v_1}{\Delta t}$	$\vec{v}_2 = \vec{v}_1 + \vec{a}\Delta t$	$\Delta\vec{d} = \dfrac{(\vec{v}_1 + \vec{v}_2)}{2}\Delta t$
$\vec{v}_2^{\,2} = \vec{v}_1^{\,2} + 2\vec{a}\Delta\vec{d}$	$\Delta\vec{d} = \vec{v}_1\Delta t + \dfrac{1}{2}\vec{a}\Delta t^2$	$\Delta\vec{d} = \vec{v}_2\Delta t - \dfrac{1}{2}\vec{a}\Delta t^2$	$\Delta t = \sqrt{\dfrac{2\Delta d}{g}}$

Unit 2 – Forces and Motion

$\vec{F} = m\vec{a}$	$\vec{F}_g = mg$	$\left\vert\vec{F}_f\right\vert = \mu_k\left\vert\vec{F}_N\right\vert$	$F_g = \dfrac{Gm_1m_2}{r^2}$

Unit 3 – Energy and Momentum

$W = F\Delta d$	$W = \Delta E$	$E_k = \dfrac{1}{2}mv^2$	$E_g = mg\Delta h$
$\Delta Q = mc\Delta T$	$Q_{lost} = Q_{gained}$ $m_1c_1\Delta T = -m_2c_2\Delta T$	$P = \dfrac{W}{\Delta T}$	$P = \dfrac{\Delta E}{\Delta T}$

Unit 4 – Vibrations, Waves, and Sound

$f = \frac{1}{T}$	$T = \frac{1}{f}$	$v = f\lambda$	$v_{sound} = 332 + 0.59T$
$f_{beat} = \lvert f_2 - f_1 \rvert$	$f_{obs} = \left(\frac{v}{v \pm v_s} \right) f_s$	Closed air column: $L = \frac{(2n-1)}{4}\lambda,\ n = 1,2,3\ldots$	
Open air column: $L = \frac{n}{2}\lambda,\ n = 1,2,3\ldots$			

Unit 5 – Electricity and Magnetism

$F = \frac{kq_1q_2}{r^2}$	$I = \frac{Q}{\Delta t}$	$\Delta V = IR$	$P = VI$
$R_{total} = R_1 + R_2 + \cdots$	$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots$	$B = \frac{\mu NI}{L}, \quad \mu = 4\pi \times 10^{-7}$	