FORMULA SHEET XI PHYSICS

Formula	Description	Unit
CHAPTER # 2		
Magnitude of Position Vector $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ $\lvert r\rvert = \sqrt{x^2 + y^2 + z^2}$ **Magnitude of Rectangular Components** $A_x = A\,Cos\theta$ $A_y = A\,Sin$ **Magnitude and Direction of Resultant** $A = \sqrt{A_x^2 + A_y^2}$ $\theta = Tan^{-1}\left(\frac{A_y}{A_x}\right)$	A_x = Horizontal Component A_y = Vertical Component A = Resultantant Vector	
Addition by Rectangular Components $F = \sqrt{F_1^2 + F_2^2 + 2F_1F_2\,COS\,\theta}$		
Dot Product $\vec{A}.\vec{B} = \lvert A\rvert \lvert B\rvert \, Cos\,\theta$ **Projection** $\vec{A}.\vec{B} = AB_A$ **3D unit vectors** $\hat{i}.\hat{i} = \hat{j}.\hat{j} = \hat{k}.\hat{k} = 1$ $\hat{i}.\hat{j} = \hat{j}.\hat{k} = \hat{k}.\hat{i} = 0$ **General form** If $\vec{A} = Ax\hat{i} + Ay\hat{j} + Az\hat{k}$ $\vec{B} = Bx\hat{i} + By\hat{j} + Bz\hat{k}$ $\vec{A}.\vec{B} = Ax\,Bx + Ay\,By + Az\,Bz$ If vectors are perpendicular the $\vec{A}.\vec{B} = 0$	B_A = Projection of B onto A	
Cross Product $\vec{C} = (\vec{A} \times \vec{B}) = A\,B\,Sin\theta$ **For 3 D unit Vector** $\hat{i} \times \hat{i} = \hat{j} \times \hat{j} = \hat{k} \times \hat{k} = 0$ $\hat{i} \times \hat{j} = \hat{k}, \quad \hat{j} \times \hat{k} = \hat{i}$	C is perpendicular to both A and B	

General Form $\vec{A}X\vec{B} = (A_x\hat{i} + A_y\hat{j} + A_z\hat{k}) \times (B_x\hat{i} + B_y\hat{j} + B_z\hat{k})$ $A \times B = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ A_x & A_y & A_z \\ B_x & B_y & B_z \end{vmatrix}$ Area of Parallelogram = $\lvert \vec{A} \times \vec{B} \rvert$ Area of Triangle $= \frac{1}{2} \times \lvert \vec{A} \times \vec{B} \rvert$		
CHAPTER # 3		
Equation of Motion $vf = vi + at$ $S = vi\,t + \frac{1}{2}a\,t2$ $2aS = vf2 - vi2$ $S = vt$	v_i = Initial Velocity v_f = Final Velocity a =Acceleration S= Distance t =Time	m/s m/s m/s^2 m sec
Tension (Two bodies move vertically) $a = \frac{(m_1 - m_2)}{(m_1 + m_2)} g$ $T = \frac{2m_1 m_2}{(m_1 + m_2)} g$	m_1 = Mass of body moving downward m_2 = Mass of body moving upward g = Gravitational acceleration a = acceleration of bodies T = Tension in String	Kg Kg m/s^2 m/s^2 N
Tension (One bodies vertically other Horizontally) $a = \frac{m_1 g}{(m_1 + m_2)}$ $T = \frac{m_1 m_2 g}{(m_1 + m_2)}$	m_1 = Mass of body moving Vertically m_2 = Mass of body moving Horizontally g = Gravitational acceleration a = acceleration of bodies T = Tension in String	Kg Kg m/s^2 m/s^2 N
Inclined Plane $a = g\,Sin\,\theta$ $a = g\,Sin\,\theta - \frac{f}{m}$	a = acceleration of bodies g = Gravitational acceleration m = Mass of body Force of Friction = f Angle of Inclined Plane = θ	m/s^2 m/s^2 Kg N
Momentum and Force $F = \frac{mV_f - mV_i}{t}$ **Law of Conservation of Momentum** $m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$	m = Mass of body v_i = Initial Velocity v_f = Final Velocity t =Time u = velocity v = velocity	Kg m/s m/s s m/s m/s

Final velocities after Elastic Collision $v_1 = \frac{(m_1 - m_2)}{(m_1 + m_2)} u_1 + \frac{2 m_2}{(m_1 + m_2)} u_2$ $v_2 = \frac{2 m_1}{(m_1 + m_2)} u_1 + \frac{(m_2 - m_1)}{(m_1 + m_2)} u_2$		
CHAPTER # 4		
Projectile Motion **Total Time of Flight** $T = 2\frac{V_o \sin\theta}{g}$ **Maximum Height** $Y = \frac{Vo^2 Sin^2\theta}{2g}$ **Horizontal Range** $R = \frac{V_o^2}{g} \sin 2\theta$ **Maximum horizontal range** $R_{max} = \frac{V_o^2}{g}$	V_o = Initial Velocity g = Gravitational acceleration	
Centripetal Acceleration $a_c = \frac{v^2}{r}$ $a_c = \frac{4r\pi^2}{T^2}$ $ac = 4\pi^2 r f^2$	r = radius oof circular path f = frequency T = Time period	m Hz s
Centripetal Force $F_c = m a_c$ $F_c = \frac{m v^2}{r}$	F_c = Centripetal Force a_c = Centripetal Acceleration	N $m.s^2$
CHAPTER # 5		
Torque or Moment of Force $\vec{\tau} = \vec{r} x \vec{F}$ **Angular Momentum** $\vec{L} = \vec{r} x \vec{P}$ $L = m v r$	r = Radius τ = Torque P = Linear momentum v = velocity m = Mass of body	m N.m N.s m/s Kg

CHAPTER # 6		
Law of Gravitation $F = G\frac{m_1 m_2}{r^2}$ $g = \frac{GM_E}{R_E^2}$ **Variation of 'g' with Depth** $g' = \left(1 - \frac{x}{R_E}\right) g$ **Variation of "g" With Altitude** $g' = \frac{GM_E}{(R_E + h)^2}$	M_E = Mass of Earth R_E = Radius of Earth G = Gravitational Constant h = Height from surface of Earth x = Depth from surface of Earth	
Elevator **Elevator is at Rest** $F_w = m\,g$ **Elevator is Ascending** $F_w = m\,g + m\,a$ **Elevator is Descending** $F_w = m\,g - m\,a$	F_w = Apparent weight	N
Artificial Gravity $f = \frac{1}{2\pi}\sqrt{\frac{g}{r}}$	f = frequency r = radius	Hz m
CHAPTER # 7		
Work $W = \vec{F}.\vec{d}$ **Potential Energy** $P.E = mgh$ **Kinetic Energy** $K.E. = \frac{1}{2}mv2$ **Power** $P = \frac{W}{t}$ $P = \vec{F}.\vec{v}$ **Work Energy Equation** $\frac{1}{2}mv2 = mgh - f.h$	W = work P = Power P.E K.E f = Force of Friction Same as Previous Descriptions	J Watt J J N
CHAPTER # 8		
Frequency and Time Period $f = \frac{1}{T}$	f = frequency T = Time Period	Hz S

Acceleration of SHM $$a = -\frac{k}{m}x$$ **Time Period of Spring** $$T = 2\pi\sqrt{\frac{m}{K}}$$ **Time Period of Simple Pendulum** $$T = 2\pi\sqrt{\frac{l}{g}}$$ **Potential Energy** $$P.E = \frac{1}{2}Kx^2$$ **Kinetic Energy** $$K.E = \frac{1}{2}mv^2$$ **Total Energy** $$E = K.E + P.E$$ $$E = \frac{1}{2}Kx_o^2$$	K = Spring constant l = Length of pendulum x = displacement x_o = Amplitude v = velocity	N/m m m m m/s
Stationary Waves **Velocity of Transverse Wave in String** $$v = \sqrt{\frac{Mg}{\mu}} = \sqrt{\frac{Mgl}{m}}$$ $$\upsilon\lambda = v$$ $$\upsilon_1 = \frac{v}{2L}$$ $$\upsilon_n = n\upsilon_1$$ $$\lambda_n = \frac{2L}{n}$$	υ = frequency λ = Wavelength μ = Linear Density L = Length of String υ_1 = Fundamental frequency (One loop) υ_n = n loop frequency n = number of loops	
Doppler's Effect **Listener is moving towards the Source** $$\upsilon' = \left(\frac{v + v_L}{v}\right)\upsilon$$ **Listener is moving away** $$\upsilon'' = \left(\frac{v - v_L}{v}\right)\upsilon$$ **Source is moving towards** $$\upsilon' = \left(\frac{v}{\upsilon - v_S}\right)v$$ **Source is moving away** $$\upsilon' = \left(\frac{v}{\upsilon + v_S}\right)v$$	υ = Original Frequency υ' = Apparent Frequency v_S = Velocity of Source v_L = Velocity of Listener v = Velocity of Sound	

Both moving towards each other $$\upsilon' = \left(\frac{v + v_L}{\upsilon - v_s}\right) v$$ **Both moving away from other** $$\upsilon' = \left(\frac{v - v_L}{\upsilon + v_s}\right) v$$		
Newton's formula for speed of sound $$v = \sqrt{\frac{\gamma P}{\rho}}$$ $$v = \sqrt{\frac{\gamma RT}{M}}$$ **Temperature and Speed of Sound** $$v_t = v_o \sqrt{\frac{T}{T_o}}$$	v = Velocity of Sound P = Pressure γ = Ratio of specific heat ρ = Density R = Universal gas constant (8.314 J/mole/K) T = Temperature M = Molecular Mass v_o = Velocity of sound at 0°C (332 m/s) v_t = Velocity of sound at t° C T_o = 0° C = 273 K	m/s N/m^2 No unit Kg/m^3 K
Beats $$f_b = \mid f_1 - f_2 \mid$$	f_b = Beat frequency f_1 = First frequency f_2 = Second frequency	Hz
CHAPTER # 9		
Young's Double Slit **Fringe Spacing** $$\Delta x = \frac{L\lambda}{d}$$ **Position of Bright Fringes** $$y_m = \frac{nL\lambda}{d}$$ **Dark Fringes** $$y_d = \left(m + \frac{1}{2}\right)\frac{L\lambda}{d}$$	λ = Wavelength L = distance between slit and screen d = distance between slits Δx = Fringe Spacing y = Position of Fringe	m m m m m
Michelson Interferometer $$d = \frac{n\lambda}{2}$$	λ = Wavelength n = Number of fringes d = Distance of moveable mirror	m m
Diffraction Grating **Grating Element** $$d = \frac{\text{Length of grating in meters}}{\text{No. of lines}} = \frac{l}{N}$$	d = grating element	m m

Grating Equation $n\lambda = d\,Sin\,\theta$	λ = Wavelength n = order of maxima θ = Angle of deviation	
Diffraction of X-Rays (Bragg's Equation) $m\lambda = 2\,d\,Sin\,\theta$	m = order of maxima d = distance between cleavage plane θ = Glancing Angle	m
Newton's Rings **Radius of Bright Ring** $r_N = \sqrt{\left(N - \frac{1}{2}\right)\lambda R}$ **Radius of Dark Ring** $r_N = \sqrt{N\lambda R}$	Λ = Wavelength r_N = Radius of nth ring N = number of rings R = Radius of curvature of planoconvex lens	m m m
CHAPTER # 10		
Thin Lens Formula $\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$ **Linear Magnification** $M = \frac{q}{p}$ **Magnifying Glass** $1 + \frac{d}{f} = M$	f = Focal length p = Object distance q = Image distance M = Linear Magnification d = Least Distance of Distant Vision (25 cm = 250 mm)	Same Units Cm or mm
Compound Microscope **Magnifying Power** $M = Mo \times Me$ $M = \frac{q_o}{p_o}\left(1 + \frac{d}{f_e}\right)$ **Length of Microscope** $L = q_o + f_e$	d = Least Distance of Distant Vision = d fo = Focal length of Objective fe = Focal length of Eye Piece M = Magnifying Power L = Length of microscope po = Object distance from objective qo = Image distance from Objective p_e = Object distance from Eye piece q_e = Image distance from Eye piece	Same Units Cm or mm
Astronomical Telescope **Magnification** $M = \frac{f_o}{f_e}$ **Length of Telescope** $L = f_o + f_e$	fo = Focal length of Objective fe = Focal length of Eye Piece L = Length of Telescope	Same Units Cm or mm
Combination of Lens $\frac{1}{f_c} = \frac{1}{f_1} + \frac{1}{f_2}$	fc = Combined Focal length f_1 = Focal length of first lens f_2 = Focal length of Objective	Same Units Cm or mm