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Physics 2 CRAMSheet

PHYSICS 2

WAVES AND SOUND

MOTION OF WAVES

Equations you will need

Description	Equation	Description	Equation
Displacement of a transverse wave traveling to the right	$y(x,t) = f(x+vt)$	Displacement of a transverse wave traveling to the left	$y(x,t) = f(x-vt)$
Equation of a sinusoidal wave traveling to the right	$y = A\sin[\frac{2\pi}{\lambda}(x-vt)]$	Equation of a sinusoidal wave traveling to the left	$y = A\sin[\frac{2\pi}{\lambda}(x+vt)]$
Wave number	$k = \frac{2\pi}{\lambda}$	Angular frequency	$\omega = 2\pi f = \frac{2\pi}{T}$
Compact form of a sinusoidal wave	$y = A\sin(kx-\omega t)$	Speed of the wave	$v = \lambda f$
The maximum values of the transverse speed and transverse acceleration	$v_{y,\max} = \omega A$ $a_{y,\max} = \omega^2 A$	Speed of a wave on a string	$v = \sqrt{\frac{T}{\mu}}$
Rate of energy transfer in any sinusoidal wave	$P = \frac{1}{2}\mu\omega^2 A^2 v$	Linear wave equation	$\frac{\partial^2 y}{\partial x^2} = \frac{1}{v^2}\frac{\partial^2 y}{\partial t^2}$

SPEED OF SOUND WAVES AND DOPPLER EFFECT

Equations you will need

Description	Equation
Speed of longitudinal sound waves in a solid	$v = \sqrt{\frac{Y}{\rho}}$
Speed of longitudinal sound waves in liquid and gases	$v = \sqrt{\frac{B}{\rho}}$
Periodic variation of pressure	$\Delta P = (\rho v \omega d_{\max})\sin(kx-\omega t)$
Speed of sound waves as a function of temperature	$v = (331\text{m/s})\sqrt{1+\frac{T_C}{273^0 C}}$
Rate of energy transfer	$P = \frac{1}{2}\rho A v(\omega d_{\max})^2$
Intensity of a wave *The intensity of a wave is the rate at which energy is transported by the wave per unit area perpendicular to the direction of propagation.	$I = \frac{1}{2}\rho v(\omega d_{\max})^2$
*Intensity of a spherical wave	$I = \frac{P_{av}}{4\pi r^2}$
*Sound level in decibels $I_0 = 1.0 \times 10^{-12}\ W/m^2$	$\beta = 10\log(\frac{I}{I_0})$

Description	Equation
Doppler effect :- Doppler effect is a phenomenon that occurs due to the relative motion of the source of sound and the observer.	
Apparent frequency :- *When the source is moving towards the observer	$f^| = (\frac{v}{v-v_S})f$
*When the source is moving away from the observer	$f^| = (\frac{v}{v+v_S})f$
*When the observer is moving towards the source	$f^| = (\frac{v+v_0}{v})f$
*When the observer is moving away from the source	$f^| = (\frac{v-v_0}{v})f$
*When the source and observer are moving towards each other	$f^| = (\frac{v+v_0}{v-v_S})f$
*When the source and observer are moving away from each other	$f^| = (\frac{v-v_0}{v+v_S})f$
*Mach angle	$\sin\theta = \frac{v}{v_S}$

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THE PRINCIPLE OF LINEAR SUPERPOSITION AND INTERFERENCE PHENOMENA

INTERFERENCE OF WAVES

Equations you will need

Description	Equation	Description	Equation
Resultant displacement for superposition of 2 sinusoidal waves	$y = 2A\cos(\frac{\phi}{2})\sin(kx - \omega t + \frac{\phi}{2})$	Condition for (a) Constructive interference (b) Destructive interference	$\delta = n\lambda$ $\delta = (n + \frac{1}{2})\lambda$
Expression for a standing wave :- Distance between 2 nodes and 2 antinodes Distance between a node and an antinode	$y = 2A\sin(kx)\cos(\omega t)$ λ/2 λ/4	Frequency of vibration of a stretched string n=1; Fundamental n=2; 2nd Harmonic n=3; 3rd Harmonic	$f_n = \frac{n}{2L}\sqrt{\frac{T}{\mu}}$
Frequency of standing waves in an open organ pipe	$f_n = n(\frac{v}{2L})$	Frequency of standing waves in a closed organ pipe	$f_n = (2n+1)(\frac{v}{4L})$
Resultant amplitude of two waves of different frequencies but same amplitude the resultant wave	$A_{RES} = 2A\cos 2\pi(\frac{f_1 - f_2}{2})t$	Beat frequency	$f_{BEAT} = \lvert f_1 - f_2 \rvert$
Expression for superposition of 2 waves having nearly equal frequency		$y = [2AC\text{os}\, 2\pi(\frac{f_1 - f_2}{2})t]S\text{in}\, 2\pi(\frac{f_1 + f_2}{2})t$	
Fourier's theorem		$y(t) = \sum_n (A_n \sin 2\pi f_n t + B_n \cos 2\pi f_n t)$	

ELECTRIC FORCES AND ELECTRIC FIELDS

ELECTRIC FORCES

Good to know

1. Like charges repel, opposite charges attract.
2. A body can be charged by:-
   (a). Conduction
   (b). Induction

Equations you will need

Description	Equation
COULOMB'S LAW:- where k_e = 8.9875 x 10^9 N.m^2/ C^2 where ε_0 = 8.8542 x 10^{-12} N.m^2/ C^2 and is called the permittivity of free space	$\vec{F} = \frac{k_e \lvert q_1 \rvert\lvert q_2 \rvert}{r^2}\hat{r}$ $k_e = \frac{1}{4\pi\varepsilon_0}$
Acceleration of a charged particle q in an electric field E is	$\vec{a} = \frac{q\vec{E}}{m}$

GAUSS'S LAW AND ELECTRIC FLUX

Good to know

Properties of a conductor in equilibrium:
(a). $\vec{E}$ is zero everywhere inside the conductor.
(b). Charges reside on the surface of the conductor.
(c). The magnitude of the electric field outside the conductor is σ / ε_0 and is perpendicular to the surface.
(d). Smaller the radius of curvature on an irregularly shaped conductor, larger is the surface charge density.

Equations you will need

Description	Equation
GAUSS'S LAW:- The electric flux is independent of the size and shape of the surface enclosing the charge.	$\Phi = \oint \vec{E}.d\vec{A} = \frac{Q_{enc}}{\varepsilon_0}$
Electric flux is given as	$\Phi = EA\cos\theta$

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ELECTRIC FORCES AND ELECTRIC FIELDS

ELECTRIC FORCES

Equations you will need

Description	Equation
Electric field $\vec{E}$ where q_T is the Test charge	$\vec{E} = \frac{\vec{F}}{q_T}$
Charge distribution	
Point charge	$\vec{E} = \frac{k_e q}{r^2}\hat{r}$
Line charge	$\vec{E} = k_e \int \frac{\lambda dl}{r^2}\hat{r}$
Surface charge	$\vec{E} = k_e \int \frac{\sigma dA}{r^2}\hat{r}$
Volume charge	$\vec{E} = k_e \int \frac{\rho dV}{r^2}\hat{r}$

Tips to remember

While drawing electric field lines:

A). Electric field lines start on a positive charge and terminate on a negative charge.

B). Two field lines can never cross each other.

C). The number of field lines drawn leaving or entering a charge is proportional to the magnitude of the charge.

GAUSS'S LAW AND ELECTRIC FLUX

Equations you will need

Description	Equation
Electric field and electric potential	
A). Insulating sphere of radius R, uniform charge density, and total charge Q	E=$\frac{k_eQ}{r^2}$ V=$\frac{k_eQ}{r}$ When r > R E=$\frac{k_eQ}{R^2}$ V=$\frac{k_eQ}{R}$ When r = R E=$\frac{k_eQr}{R^3}$ V=$\frac{k_eQ}{2r}(3-\frac{r^2}{R^2})$ When r < R
B). Thin spherical shell of radius R and total charge Q	E=$\frac{k_eQ}{r^2}$ V=$\frac{k_eQ}{r}$ When r > R E=$\frac{k_eQ}{R^2}$ V=$\frac{k_eQ}{R}$ When r = R E=zero V=$\frac{k_eQ}{R}$ When r < R

ELECTRIC POTENTIAL ENERGY AND ELETRIC POTENTIAL

ELECTRIC POTENTIAL

Equations you will need

Description	Equation
Electric potential is given as	$V = -\int_{\infty}^{r} \vec{E}.d\vec{l}$
Electric potential difference between points A and B	$\Delta V = -\int_{A}^{B} \vec{E}.d\vec{l}$
Electric potential energy	$\Delta U = Q\Delta V$
Relationship between V and $\vec{E}$:	$\vec{E} = \vec{\nabla}V$ $\Delta V = E.d$
For a uniformly charged disc of radius R on the axis	E= $2\pi k_e \sigma(1-\frac{x}{(x^2+r^2)^{1/2}})$
For a uniformly charged disc of radius R on the axis	V= $2\pi k_e \sigma((x^2+r^2)^{1/2}-x)$

Description	Equation
Electric field and potential due to various charge distributions:	
A). due to a point charge at a distance r from the charge distance x from one	E= $\frac{k_eQ}{r^2}$ V= $\frac{k_eQ}{r}$
B). due to a uniform line charge of length l along the axis at a distance x from the center	E= $\frac{k_eQ}{x(x+l)}$
C). due to a uniformly charged disc of radius r along the axis at a distance x from the center	V= $\frac{k_eQ}{l}\ln(1+\frac{l}{x})$

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ELECTRIC CIRCUITS

CAPACITANCE AND DIELECTRICS

Equations you will need

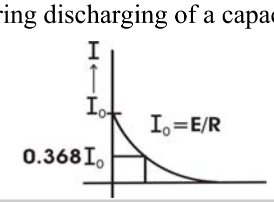
Description	Equation	Description	Equation
Capacitance of a capacitor is	$C = \frac{Q}{\Delta V}$	Capacitance of an isolated charged sphere	$C = 4\pi\varepsilon_0 R$
Capacitance of a parallel plate capacitor	$C = \frac{\varepsilon_0 A}{d}$	Equivalent capacitance A). Capacitors in parallel:	$C_{eq} = C_1 + C_2 + C_3 + \ldots\ldots$
Energy stored in a capacitor is	$U = \frac{1}{2}C\Delta V^2 = \frac{Q\Delta V}{2} = \frac{1}{2}\frac{Q^2}{C}$	B). Capacitors in series:	$1/C_{eq} = 1/C_1 + 1/C_2 + 1/C_3 + \ldots\ldots$
Energy density in an electric field	$u_E = \frac{1}{2}\varepsilon_0 E^2$	Capacitance of a capacitor filled with a dielectric	$C = \frac{\kappa\varepsilon_0 A}{d}$
Electric dipole moment	p=2aq	Potential energy of a dipole in an external electric field	$U = -\vec{p}.\vec{E}$
Torque on a dipole in an external electric field	$\vec{\tau} = \vec{p} \times \vec{E}$	Induced charge density in a dielectric	$\sigma_{ind} = \sigma(\frac{\kappa - 1}{\kappa})$

DC – CIRCUITS

Equations you will need

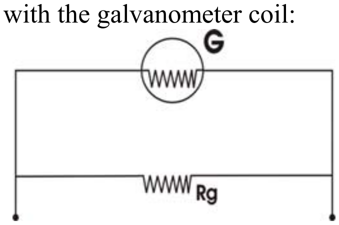
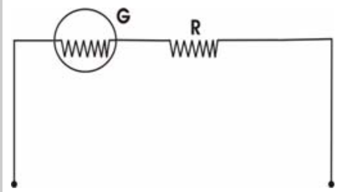
Description	Equation	Description	Equation
Instantaneous current	$I = \frac{dQ}{dt}$	Resistance of a conductor	$R = \frac{\Delta V}{I}$
The relationship between current I and drift velocity v_d :	$I = nev_d A$	Relationship between current density $\vec{J}$, conductivity σ , electric field	$\vec{J} = \sigma\vec{E}$
Variation of resistivity with temperature	$\rho = \rho_0(1 + \alpha\Delta T)$	Relationship between v_d and $\vec{E}$: τ being the time between collisions	$v_d = \frac{q\vec{E}\tau}{m_e}$
Power delivered to a resistor	$P = I\Delta V = I^2 R = \frac{\Delta V^2}{R}$		

DIRECT CURRENT CIRCUITS AND METERS

Description	Equation	Description	Equation
Terminal voltage of the battery	$\Delta V = \varepsilon - IR$	KIRCHOFF'S RULES: A). The algebraic sum of currents at a junction in a circuit must be zero	$\sum I_{IN} - \sum I_{OUT} = 0$
Equivalent resistance A). Resistors in series B). Resistors in parallel	$R_{eq} = R_1 + R_2 + R_3 + \ldots\ldots$ $1/R_{eq} = 1/R_1 + 1/R_2 + 1/R_3 + \ldots\ldots$	B). The algebraic sum of the potential drops in a closed loop of a circuit must be zero.	$\sum_{closed\ loop} \Delta V = 0$
Instantaneous charge and current during charging of a capacitor	$q(t) = C\varepsilon(1 - e^{-t/RC})$ $I(t) = \frac{\varepsilon}{R}(e^{-t/RC})$	Instantaneous charge and current during discharging of a capacitor 	$q(t) = Qe^{-t/RC}$ $I(t) = -\frac{Q}{RC}e^{-t/RC}$

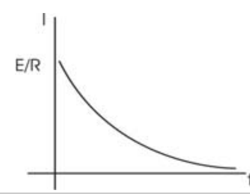
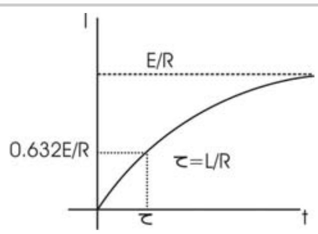
DIRECT CURRENT CIRCUITS AND METERS

Equations you will need

Description	Equation	Description	Equation
Conversion of a galvanometer to an ammeter connect a low resistance shunt in parallel with the galvanometer coil: 	$S = \frac{i_g R_g}{(i - i_g)}$	Conversion of a galvanometer to a voltmeter connect a high resistance in series with the galvanometer coil: 	$R = \frac{V}{i_g} - R_g$

RESISTORS, CAPACITORS AND INDUCTORS IN A DC CIRCUIT

Equations you will need

Description	Equation	Description	Equation
Growth of current in an RL circuit	$I = \frac{\varepsilon}{R}\left(1 - e^{-t/\tau}\right)$	Decay of current in an RL circuit	$I = I_o e^{-t/\tau}$ 
Where $I = I_o\left(1 - e^{-t/\tau}\right)$ τ= time constant		Total energy stored in an LC circuit	$u = u_C + u_L$ $= \frac{Q^2_{max}}{2C} Cos^2 wt + \frac{LI^2_{max}}{2} Sin^2 wt$
Frequency of oscillation in an LC circuit	$f = \frac{1}{2\pi\sqrt{LC}}$	At Q = 0, purely inductive circuit	$u = \frac{LI^2_{max}}{2}$
At I = 0, purely capacitive ckt	$u = \frac{Q^2_{max}}{2C}$	Damped angular frequency of an LCR circuit	$w_d = \left[\frac{1}{LC} - \left(\frac{R}{2L}\right)^2\right]^{\frac{1}{2}}$
Decay of charge in an LCR circuit	$Q = Q_{max} e^{-Rt/2L} Cos\omega_d t$		

MAGENETIC FORCES AND MAGENETIC FIELDS

MAGENETIC FORCES

Equations you will need

Description	Equation	Description	Equation
Magnetic force on a charge q moving with a velocity $\vec{v}$ in a magnetic field $\vec{B}$	$\vec{F}_B = q(\vec{v} \times \vec{B})$	Magnetic force on a conductor of length L carrying a current I in a magnetic field $\vec{B}$	$\vec{F}_B = I(\vec{L} \times \vec{B})$
Magnetic dipole moment where A is the area of the loop	$\mu = IA$	Torque on a loop carrying a current in a magnetic field	$\vec{\tau} = \vec{\mu} \times \vec{B}$
Potential energy of a dipole placed in a magnetic field	$U = -\vec{\mu}.\vec{B}$	Radius of the circular path for a charged particle in a magnetic field	$R = \frac{mv}{qB}$

MAGENETIC FORCES

Equations you will need

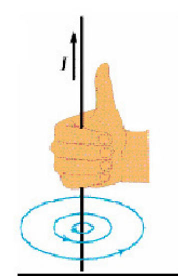
Description	Equation
Period of revolution in a magnetic field	$T = \dfrac{2\pi m}{qB}$
Lorentz force	$\vec{F} = q[\vec{E} + (\vec{v} \times \vec{B})]$
Hall co-efficient is given as	$R_H = 1/nq$

Description	Equation
Kinetic energy gained in a cyclotron	$KE = \dfrac{(qBR)^2}{2m}$
Hall voltage across a conductor of width d	$\Delta V_H = \dfrac{IBd}{nqA}$

MAGNETIC FIELD DUE TO CURRENT

Equations you will need

Description	Equation
BIOT SAVART LAW Where $\mu_0 = 4\pi \times 10^{-7}$ Tm /A and is called the permeability of free space	$\vec{dB} = \dfrac{\mu_0}{4\pi} \dfrac{i\vec{ds} \times \vec{r}}{r^3}$
Magnetic field due to an infinite wire carrying a current	$B = \dfrac{\mu_0 I}{2\pi r}$
Magnetic field due to a circular coil carrying current	$B = \dfrac{\mu_0 I}{2r}.N$
AMPERE'S LAW	$\oint \vec{B}.\vec{ds} = \mu_0 i_{enc}$
Magnetic field inside a solenoid. where n=number of turns/unit length	$B = \mu_0 in$
Displacement current where ϕE is changing electric flux.	$id = \varepsilon o \dfrac{d\phi E}{dt}$
AMPERE-MAXWELL LAW	$\phi \vec{B}.\vec{ds} = \mu_0 \varepsilon_0 \dfrac{d\phi\varepsilon}{dt} + M_0 i_{enc}$
Magnetization	$M = \dfrac{measured\ magnetic\ moment}{volume}$
μ_m = magnetic permeability	$B = \mu_m H$
Relationship between magnetization, applied magnetic field and temperature for a paramagnetic substance CURIE'S LAW C being the curie's constant	$M = \dfrac{CB_{ext}}{T}$
Magnetic field due to a finite segment of wire carrying a current	$B = \dfrac{\mu_0 I}{4\pi r} \int_{\theta_1}^{\theta_2} \sin\theta d\theta$ $B = \dfrac{\mu_0 I}{4\pi r}(\cos\theta_1 - \cos\theta_2)$

Description	Equation
RIGHT- HAND RULE :- Magnetic field around straight wire : Straight current = thumb Curled B – field = fingers	
Force between 2 wires :- Wires carrying current in the same direction attract and repel if the currents are in opposite direction	$F = \dfrac{\mu_0 L I_1 I_2}{2\pi d}$
Magnetic flux inside a loop	$\phi B = \int \vec{B}.d\vec{A}.$ or $= BA\ \vec{B} \perp^{r}\ area\vec{A}$
Magnetic moment of the electron where L= orbital angular moment	$\mu = \left(\dfrac{e}{2me}\right)L$
Bohr magneton = 9.27×10^{-24} J/T	$\mu_B = \dfrac{eh}{4\pi m} = 9.27 \times 10^{-24}\ J/T$
Magnetic field strength where n = number of turns/units length.	H = n I
Susceptibility where M=magnetization, H= auxiliary magnitude.	$X_m = \dfrac{M}{H}$
Relationship between permeability and susceptibility	$\mu_m = \mu_0(1 + X_m)$

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THE REFLECTION OF LIGHT: MIRRORS

MIRRORS

Good to know

Properties of image in Flat Mirrors

1). Image is far behind as object is in front of it.
2). Image is virtual, upright and unmagnified.
3). Image is laterally inverted.

Sign convention in mirrors

Quantity	Positive when	Negative when
Object location (p)	Object front of mirror	Object is behind the mirror
Image location (q)	Image is in front of mirror	Image is behind mirror
Image height (h_i)	Image is upright	Image is inverted
Focal length (f) and radius (R)	Mirror is concave	Mirror is convex
Magnification	Image is upright	Image is inverted

Equations you will need

Description	Equation
Energy of a photon	$E = h\nu$
The index of refraction of a material	$n = c/V = \lambda_0/\lambda$ λ_0 = wavelength in vacuum. λ = wavelength in medium
Critical angle θ_c .	$Sin\theta_c = \frac{n_2}{n_1}$ where $n_1 > n_2$
Images formed by refraction Relation between object distance and image distance for a spherical refracting surface.	$\frac{h_1}{p} + \frac{n_2}{q} = \frac{h_2 - n_1}{R}$ for an object in medium n_1
Flat refracting surface H	$q = \frac{n_2}{n_1} p$
Laws of reflection of light	$\lfloor i = \lfloor r$, $\theta = \theta'$
Laws of refraction Snell's law For a prism having apex angle A and angle of deviation D. Total internal reflection occurs when only light travel from denser to rarer medium.	$n_1 Sin\theta_1 = n_2 Sin\theta_2$ $n = \frac{Sin(A+D/2)}{Sin A/2}$
Linear magnification	$M = h_i/h_o = -q/p$
Mirror equation	$1/p + 1/q = 1/f$
Lenses Len's makers equation focal length of a thin lens	$\frac{1}{f} = (n-1)\left(1/R_1 - 1/R_2\right)$

THE REFRACTION OF LIGHT: LENSES AND OPTICAL INSTRUMENTS

Good to know

Sign convection for thin lenses

Quantity	Positive When	Negative When
Object location (p)	Object in front of lens	Object is in back of lens
Image location (q)	Image is in back of lens	Image is in front of lens
Image height (h')	Image height is upright	Image is in front lens
R_1 and R_2	Centre of curvature is in back of lens	Centre of curvature is in front of lens
Focal length (f)	Converging lens	Diverging lens

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THE REFRACTION OF LIGHT: LENSES AND OPTICAL INSTRUMENTS

LENSES

Equations you will need

Len's makers equation focal length of a thin lens	$\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$	Magnification	$M = \frac{h_i}{h_o} = \frac{-q}{p}$
Thin lens equation	$\frac{1}{p} + \frac{1}{q} = \frac{1}{f}$	Combination of thin lenses :- Focal length of combination of two thin lens	$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$

OPTICAL INSTRUMENTS

Equations you will need

Camera f – number	$f_{number} = \frac{f}{D}$ Where D = diameter of lens.	Intensity of light incident on film.	$I \alpha \frac{1}{(f/D)^2} \alpha \frac{1}{(f_{number})^2}$
Magnifying glass. Eye focused at ∞	$M = \frac{N}{f}$ Where N =25cm for normal eye	Eye focused at near point.	$M = \frac{N}{f} + 1$
Telescope angular magnification	$m = \frac{-f_o}{f_e}$	Compound microscope. Total magnification	$M = m_o M_e = \frac{-L}{f_o}\left(\frac{25cm}{f_e}\right)$ where l = distance between the lenses.

INTERFERENCE AND WAVE NATURE OF LIGHT

Good to know

Condition for interference

1). Sources must be coherent - that is they must maintain a constant phase with respect to each other.
2). The sources must be monochromatic – that is of a single wavelength.

YOUNG'S DOUBLE SLIT EXPERIMENT

Equations you will need

Path difference	$\delta = dSin\theta$	Conditions for 1). Constructive interference	$d\ Sin\theta_{bright} = m\lambda$
Position of bright fringe measured from centre.	$Y_{bright} = \frac{\lambda L}{d} m\,(m = 0, \pm1, \pm2 ---)$	2). Destructive interference	$d\ Sin\theta_{dark} = (m + 1/2)\lambda$
Position of dark fringe measured from centre.	$Y_{dark} = \frac{\lambda L}{d}(m+1/2)(m=0,\pm1,\pm2---)$	Thin films: Condition for constructive interference in a film of thickness 't' and index of refraction 'n' surrounded by air.	$2nt = (m+1/2)\lambda(m=0,1,2,........)$
Intensity at a point	$I = I_{\max} Cos^2\left(\frac{\pi d\ Sin\theta}{\lambda}\right)$	For destructive interference	$2nt = m\lambda$

DIFFRACTION

Equations you will need

Single slit condition for 1). Destructive Interference 2). Constructive interference	$Sin\theta_{dark} = \frac{m\lambda}{a}$ $Sin\theta_{bright} = (m + 1/2)\frac{\lambda}{a}(m = \pm1, \pm2, ...)$

DIFFRACTION BY DOUBLE SLIT

Equations you will need

Intensity	$I(\theta) = I_m \left(Cos^2\beta\right)\left(\frac{Sin\alpha}{\alpha}\right)^2$ where $\beta = \frac{\pi d\ Sin\theta}{\lambda}$ and $\alpha = \frac{\pi a\ Sin\theta}{\lambda}$ d= distance between centers of slit. a = slit width

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YOUNG'S DOUBLE SLIT EXPERIMENT

DIFFRACTION

Equations you will need

The intensity I	$I - I_{\max} = \left[\dfrac{Sin(\beta/2)}{\beta/2}\right]^2$ where I_{max} = intensity at $\theta = 0$ and $\beta = (2\pi/\lambda)aSin\theta$
Rayleigh's criterion when the central maximum of one image falls on the first minimum of another image, the images are said to be just resolved. The limiting condition of resolution is known as Rayleigh's criterion.	
Limiting angle of resolution for a circular aperture.	$\theta_{\min} = \dfrac{1.22\lambda}{D}$ D = Distance of aperture
For circular aperture first minimum	Sin θ = 1.22 λ/d θ = angular separation of slit.

DIFFRACTION BY DOUBLE SLIT

Equations you will need

Diffraction grating dispersion of a grating – measures of how well lines are separated.	$D = \Delta\theta/\Delta\lambda$ where $\Delta\theta$ = angular separation $\Delta\lambda$ = wavelength difference $D = \dfrac{m}{dCos\theta}$ m = order of diffraction d = distance between slits D = grating spacing
Resolving power R	$R = \lambda_{av}/\Delta\lambda = Nm$ N= number of rulings in the grating
Condition for interference maxima for a grating	$dSin\theta_{bright} = m\lambda$ for $m = 0, \pm1, \pm2.....$
X-Ray diffraction BRAGG'S LAW Criterion for intensity maxima	$2dSin\theta = m\lambda$ for m = 1, 2, 3 ……...