7.5 BREWSTER'S LAW

According to this law, the refractive index of the refractive medium (n) is numerically equal to the tangent of the angle of polarization $\left(I_B\right)$. i.e. $n = \tan I_B$

Illustration 22: What is the polarizing angle of a medium of refractive index 1.732? **(JEE MAIN)**

Sol: As per Brewster's law, $n = \tan i_B$ or $i_B = \tan^{-1} n = \tan^{-1} 1.732 = 60°$

PROBLEM-SOLVING TACTICS

1. Most of the questions in JEE are related to Young's Double slit experiment with minor variations. For any such problem, drawing a rough figure and writing down the given parameters is a good idea before solving the question.
2. Wave optics has a lot of derivations. It is advisable to remember the end results for faster problem solving.
3. Use the concept of optical path carefully and check for phase relations.
4. Only direct formulae related questions are asked from sections of diffraction, polarizations and scattering so these formulae must be learnt.

FORMULAE SHEET

S. No.	Term	Description	
1	Wave front	It is the locus of points in the medium which at any instant are vibrating in the same phase.	
2	Huygens' Principle	1	Each point on the given primary wave front acts as a source of secondary wavelets spreading out disturbance in all direction.
		2	The tangential plane to these secondary wavelets constitutes the new wave front.
3	Interference	It is the phenomenon of non-uniform distribution of energy in the medium due to superposition of two light waves.	
4	Condition of maximum intensity	$\phi = 2n\pi$ or $x = n\lambda$, where n=0,1,2,3,....	
6	Condition of minimum intensity	$\phi = (2n+1)\pi$ or $x = (2n+1)y/2$ where n=0,1,2,3...	
7	Ratio of maximum and minimum intensity	$\frac{I_{max}}{I_{min}} = \frac{(a_1 + a_2)^2}{(a_1 - a_2)^2}$	
8	Distance of nth bright fringe from centre of the screen	$y_n = \frac{nD\lambda}{d}$, where d is the separation distance between two coherent sources of light, D is the distance between screen and slit, λ is the wavelength used.	

S. No.	Term	Description
9	Angular position of nth bright fringe	$\theta_n = \frac{y_n}{D} = \frac{n\lambda}{d}$
10	Distance of nth dark fringes from centre of the screen	$y'_n = \frac{(2n+1)D\lambda}{2d}$
11	Angular position of nth dark fringe	$\theta'_n = \frac{y'_n}{D} = \frac{(2n+1)\lambda}{2d}$
12	Fringe width	$\beta = \frac{D\lambda}{d}$

Diffraction and polarization of light

S. No.	Term	Description
1	Diffraction	It is the phenomenon of bending of light waves round the sharp corners and spreading into the regions of the geometrical shadow of the object.
2	Single slit diffraction	Condition for dark fringes is $\sin\theta = \frac{n\lambda}{a}$ where $n = \pm1, \pm2, \pm3, \pm4.....$, a is the width of the slit and θ is the angle of diffraction. Condition for bright fringes is $\sin\theta = \frac{(2n+1)\lambda}{2a}$
3	Width of central maximum is	$\theta_0 = \frac{2\lambda D}{a}$, where D is the distance between the slit and the screen.
4	Diffraction grating	The arrangement of large number of narrow rectangular slits of equal width placed side by side parallel to each other. The condition for maxima in the interference pattern at the angle θ is $d\sin\theta = n\lambda$ where n=0, 1, 2, 3, 4.....
6	Resolving power of the grating	For nearly two equal wavelengths λ_1 and λ_2 between which a diffraction grating can just barely distinguish, resolving power is $R = \frac{\lambda}{\lambda_1 - \lambda_2} = \frac{\lambda}{\Delta\lambda}$ where $\lambda = (\lambda_1 + \lambda_2)/2$
7	Diffraction of X-Rays by crystals	The condition for constructive interference is $2d\sin\theta = n\lambda$
8	Polarisation	It is the phenomenon due to which vibrations of light are restricted in a particular plane.
9	Brewster's law	$\mu = \tan p$ where μ is refractive index of medium and p is the angle of polarisation.
10	Law of Malus	$I = I_0 \cos^2\theta$ where I is the intensity of emergent light from analyser, I_0 is the intensity of incident plane polarised light and θ is the angle between planes of transmission of the analyser and the polarizer.