Important Wave Optics Formulas PDF

Formulas
Examples
with Units

List of 27
Important Wave Optics Formulas

1) Intensity and Interference of Light Waves Formulas

1.1) Angular Width of Central Maxima Formula

Evaluate Formula

Formula

$$d_{angular} = \frac{2 \cdot \lambda}{a}$$

Example with Units

$$6.0099° = \frac{2 \cdot 26.8\,cm}{5.11}$$

1.2) Intensity of Constructive Interference Formula

Evaluate Formula

Formula

$$I_C = \left(\sqrt{I_1} + \sqrt{I_2}\right)^2$$

Example with Units

$$52.4558\,cd = \left(\sqrt{9\,cd} + \sqrt{18\,cd}\right)^2$$

1.3) Intensity of Destructive Interference Formula

Evaluate Formula

Formula

$$I_D = \left(\sqrt{I_1} - \sqrt{I_2}\right)^2$$

Example with Units

$$1.5442\,cd = \left(\sqrt{9\,cd} - \sqrt{18\,cd}\right)^2$$

1.4) Interference of Waves of Two Intensities Formula

Evaluate Formula

Formula

$$I = I_1 + I_2 + 2 \cdot \sqrt{I_1 \cdot I_2} \cdot \cos(\Phi)$$

Example with Units

$$46.922\,cd = 9\,cd + 18\,cd + 2 \cdot \sqrt{9\,cd \cdot 18\,cd} \cdot \cos(38.5°)$$

1.5) Malus Law Formula

Evaluate Formula

Formula

$$I_T = I_1 \cdot (\cos(\theta))^2$$

Example with Units

$$8.341\,cd = 9\,cd \cdot (\cos(15.7°))^2$$

1.6) Path Difference of Two Progressive Wave Formula

Evaluate Formula

Formula

$$\Delta x = \frac{\lambda \cdot \Phi}{2 \cdot \pi}$$

Example with Units

$$2.8661\,\text{cm} = \frac{26.8\,\text{cm} \cdot 38.5°}{2 \cdot 3.1416}$$

1.7) Phase Difference Formula

Evaluate Formula

Formula

$$\Phi = \frac{2 \cdot \pi \cdot \Delta x}{\lambda}$$

Example with Units

$$38.4999° = \frac{2 \cdot 3.1416 \cdot 2.8661\,\text{cm}}{26.8\,\text{cm}}$$

1.8) Phase Difference of Constructive Interference Formula

Evaluate Formula

Formula

$$\Phi_{ci} = 2 \cdot \pi \cdot n$$

Example with Units

$$1800° = 2 \cdot 3.1416 \cdot 5$$

1.9) Phase Difference of Destructive Interference Formula

Evaluate Formula

Formula

$$\Phi_{di} = (2 \cdot n + 1) \cdot \pi$$

Example with Units

$$1980° = (2 \cdot 5 + 1) \cdot 3.1416$$

1.10) Resultant Intensity of Incoherent Sources Formula

Evaluate Formula

Formula

$$I_{IS} = I_1 + I_2$$

Example with Units

$$27\,\text{cd} = 9\,\text{cd} + 18\,\text{cd}$$

1.11) Resultant Intensity On-Screen of Young's Double-Slit Experiment Formula

Evaluate Formula

Formula

$$I = 4 \cdot \left(I_{S1}\right) \cdot \cos\left(\frac{\Phi}{2}\right)^2$$

Example with Units

$$46.9254\,\text{cd} = 4 \cdot \left(13.162\,\text{cd}\right) \cdot \cos\left(\frac{38.5°}{2}\right)^2$$

2) Thin Film Interference and Optical Path Difference Formulas

2.1) Optical Activity Formula

Evaluate Formula

Formula

$$\alpha = \frac{\theta}{L \cdot C_x}$$

Example with Units

$$1.9573 = \frac{15.7°}{35\,\text{cm} \cdot 0.4}$$

2.2) Optical Path Difference Formula

Evaluate Formula

Formula

$$\Delta = (RI - 1) \cdot \frac{D}{d}$$

Example with Units

$$0.6346 = (1.333 - 1) \cdot \frac{20.2\,\text{cm}}{10.6\,\text{cm}}$$

2.3) Optical Path Difference given Fringe Width Formula

Evaluate Formula

Formula

$$\Delta = (RI - 1) \cdot t \cdot \frac{\beta}{\lambda}$$

Example with Units

$$0.6346 = (1.333 - 1) \cdot 100\,\text{cm} \cdot \frac{51.07\,\text{cm}}{26.8\,\text{cm}}$$

2.4) Thin-Film Constructive Interference in Reflected Light Formula

Evaluate Formula

Formula

$$I_c = \left(n + \frac{1}{2}\right) \cdot \lambda$$

Example with Units

$$1.474 = \left(5 + \frac{1}{2}\right) \cdot 26.8\,\text{cm}$$

2.5) Thin-Film Constructive Interference in Transmitted Light Formula

Evaluate Formula

Formula

$$I_c = n \cdot \lambda$$

Example with Units

$$1.34 = 5 \cdot 26.8\,\text{cm}$$

2.6) Thin-Film Destructive Interference in Reflected Light Formula

Evaluate Formula

Formula

$$I_d = n \cdot \lambda$$

Example with Units

$$1.34 = 5 \cdot 26.8\,\text{cm}$$

2.7) Thin-Film Destructive Interference in Transmitted Light Formula

Evaluate Formula

Formula

$$I_d = \left(n + \frac{1}{2}\right) \cdot \lambda$$

Example with Units

$$1.474 = \left(5 + \frac{1}{2}\right) \cdot 26.8\,\text{cm}$$

3) Young's Double Slit Experiment (YDSE) Formulas

3.1) Distance from Center to Light Source for Constructive Interference in YDSE Formula

Evaluate Formula

Formula

$$y_{CI} = \left(n + \left(\frac{1}{2}\right)\right) \cdot \frac{\lambda \cdot D}{d}$$

Example with Units

$$280.8943\,\text{cm} = \left(5 + \left(\frac{1}{2}\right)\right) \cdot \frac{26.8\,\text{cm} \cdot 20.2\,\text{cm}}{10.6\,\text{cm}}$$

3.2) Distance from Center to Light Source for Destructive Interference in YDSE Formula

Evaluate Formula

Formula

$$y_{DI} = (2 \cdot n - 1) \cdot \frac{\lambda \cdot D}{2 \cdot d}$$

Example with Units

$$229.8226\,\text{cm} = (2 \cdot 5 - 1) \cdot \frac{26.8\,\text{cm} \cdot 20.2\,\text{cm}}{2 \cdot 10.6\,\text{cm}}$$

3.3) Fringe Width Formula

Evaluate Formula

Formula

$$\beta = \frac{\lambda \cdot D}{d}$$

Example with Units

$$51.0717\,\text{cm} = \frac{26.8\,\text{cm} \cdot 20.2\,\text{cm}}{10.6\,\text{cm}}$$

3.4) Path Difference for Constructive Interference in YDSE Formula

Evaluate Formula

Formula

$$\Delta x_{CI} = \frac{y_{CI} \cdot d}{D}$$

Example with Units

$$147.3505\,\text{cm} = \frac{280.8\,\text{cm} \cdot 10.6\,\text{cm}}{20.2\,\text{cm}}$$

3.5) Path Difference for Destructive Interference in YDSE Formula

Evaluate Formula

Formula

$$\Delta x_{DI} = (2 \cdot n - 1) \cdot \left(\frac{\lambda}{2}\right)$$

Example with Units

$$120.6\,\text{cm} = (2 \cdot 5 - 1) \cdot \left(\frac{26.8\,\text{cm}}{2}\right)$$

3.6) Path Difference for Maxima in YDSE Formula

Evaluate Formula

Formula

$$\Delta x_{max} = n \cdot \lambda$$

Example with Units

$$134\,\text{cm} = 5 \cdot 26.8\,\text{cm}$$

3.7) Path Difference for Minima in YDSE Formula

Evaluate Formula

Formula

$$\Delta x_{min} = (2 \cdot n + 1) \cdot \frac{\lambda}{2}$$

Example with Units

$$147.4\,\text{cm} = (2 \cdot 5 + 1) \cdot \frac{26.8\,\text{cm}}{2}$$

3.8) Path Difference in YDSE given Distance between Coherent Sources Formula

Evaluate Formula

Formula

$$\Delta x = d \cdot \sin(\theta)$$

Example with Units

$$2.8684\,\text{cm} = 10.6\,\text{cm} \cdot \sin(15.7°)$$

3.9) Path Difference in Young's Double-Slit Experiment Formula

Evaluate Formula

Formula

$$\Delta x = \sqrt{\left(y + \frac{d}{2}\right)^2 + D^2} - \sqrt{\left(y - \frac{d}{2}\right)^2 + D^2}$$

Example with Units

$$2.8664\,\text{cm} = \sqrt{\left(5.852\,\text{cm} + \frac{10.6\,\text{cm}}{2}\right)^2 + 20.2\,\text{cm}^2} - \sqrt{\left(5.852\,\text{cm} - \frac{10.6\,\text{cm}}{2}\right)^2 + 20.2\,\text{cm}^2}$$

Variables used in list of Wave Optics Formulas above

- **a** Aperture of Objective
- C_x Concentration at x Distance
- **d** Distance between Two Coherent Sources *(Centimeter)*
- **D** Distance between Slits and Screen *(Centimeter)*
- $d_{angular}$ Angular Width *(Degree)*
- **I** Resultant Intensity *(Candela)*
- I_1 Intensity 1 *(Candela)*
- I_2 Intensity 2 *(Candela)*
- I_c Constructive Interference
- I_C Resultant Intensity of Constructive *(Candela)*
- I_d Destructive Interference
- I_D Resultant Intensity of Destructive *(Candela)*
- I_{IS} Resultant Intensity of Incoherent Sources *(Candela)*
- I_{S1} Intensity from Slit 1 *(Candela)*
- I_T Transmitted Intensity *(Candela)*
- **L** Length *(Centimeter)*
- **n** Integer
- **RI** Refractive Index
- **t** Thickness *(Centimeter)*
- **y** Distance from Center to Light Source *(Centimeter)*
- y_{CI} Distance from Center to Light Source for C I *(Centimeter)*
- y_{DI} Distance from Center to Light Source for D I *(Centimeter)*
- **α** Optical Activity
- **β** Fringe Width *(Centimeter)*
- **Δ** Optical Path Difference
- **Δx** Path Difference *(Centimeter)*
- Δx_{CI} Path Difference for Constructive Interference *(Centimeter)*

Constants, Functions, Measurements used in list of Wave Optics Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Functions: **cos**, cos(Angle) *Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.*
- Functions: **sin**, sin(Angle) *Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.*
- Functions: **sqrt**, sqrt(Number) *A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.*
- Measurement: **Length** in Centimeter (cm) *Length Unit Conversion*
- Measurement: **Luminous Intensity** in Candela (cd) *Luminous Intensity Unit Conversion*
- Measurement: **Angle** in Degree (°) *Angle Unit Conversion*

- Δx_{DI} Path Difference for Destructive Interference *(Centimeter)*
- Δx_{max} Path Difference for Maxima *(Centimeter)*
- Δx_{min} Path Difference for Minima *(Centimeter)*
- θ Angle from Slit Center to Light Source *(Degree)*
- λ Wavelength *(Centimeter)*
- Φ Phase Difference *(Degree)*
- Φ_{ci} Phase Difference of Constructive Interference *(Degree)*
- Φ_{di} Phase Difference of Destructive Interference *(Degree)*

Download other Important Optics PDFs

- Important Wave Optics Formulas

Try our Unique Visual Calculators

- Winning percentage
- LCM of two numbers
- Mixed fraction

Please SHARE this PDF with someone who needs it!

This PDF can be downloaded in these languages

English Spanish French German Russian Italian Portuguese Polish Dutch

9/18/2024 | 9:53:54 AM UTC