

## 1. Geometric Optics

**Law of Reflection:**

$$\theta_i = \theta_r$$

**Snell's Law of Refraction:**

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

where  $n = c/v$  is the refractive index.

**Spherical Mirrors Lenses:**

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

$$\text{Magnification } m = -\frac{d_i}{d_o} = \frac{h_i}{h_o}$$

**Lensmaker's Equation:**

$$\frac{1}{f} = (n - 1) \left( \frac{1}{R_1} - \frac{1}{R_2} \right)$$

## 2. Wave Optics

**Young's Double Slit Experiment:** Path difference  
 $\delta = d \sin \theta \approx d \tan \theta = \frac{dy}{D}$ .

**\* Constructive Interference (Maxima):**

$$d \sin \theta = m\lambda, \quad m = 0, \pm 1, \pm 2, \dots$$

**\* Destructive Interference (Minima):**

$$d \sin \theta = \left( m + \frac{1}{2} \right) \lambda$$

**Thin Film Interference:** \* Constructive (with phase change on one surface):

$$2nt = \left( m + \frac{1}{2} \right) \lambda$$

\* Destructive:

$$2nt = m\lambda$$

## 3. Diffraction Polarization

**Single-Slit Diffraction:** Minima occur at:

$$a \sin \theta = m\lambda, \quad m = \pm 1, \pm 2, \dots$$

**Diffraction Grating:**

$$d \sin \theta = m\lambda$$

**Resolving Power (Rayleigh Criterion):**

$$\theta_R \approx 1.22 \frac{\lambda}{D}$$

(Circular aperture)

**Polarization (Brewster's Law):**

$$\tan \theta_p = \frac{n_2}{n_1}$$

**Malus's Law:**

$$I = I_0 \cos^2 \theta$$