



Practical

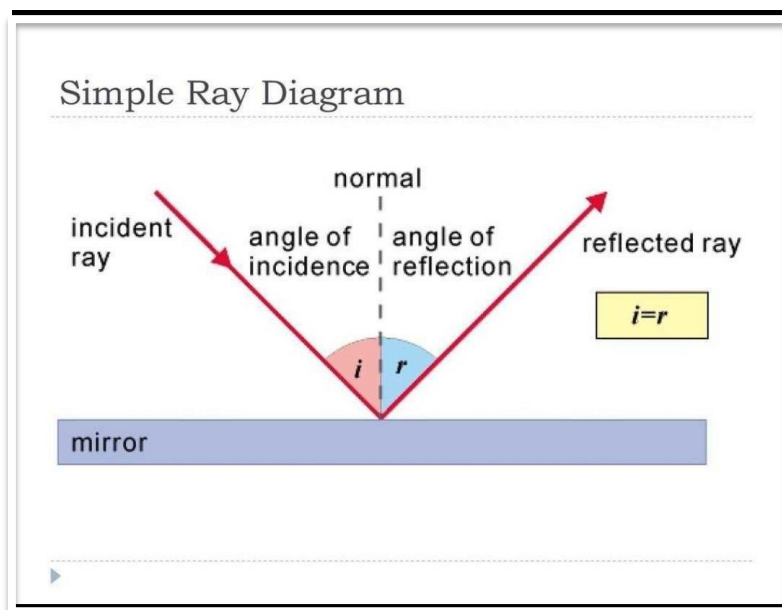
Light Reflection, Absorption, and Refraction Experiment

Lecture 2

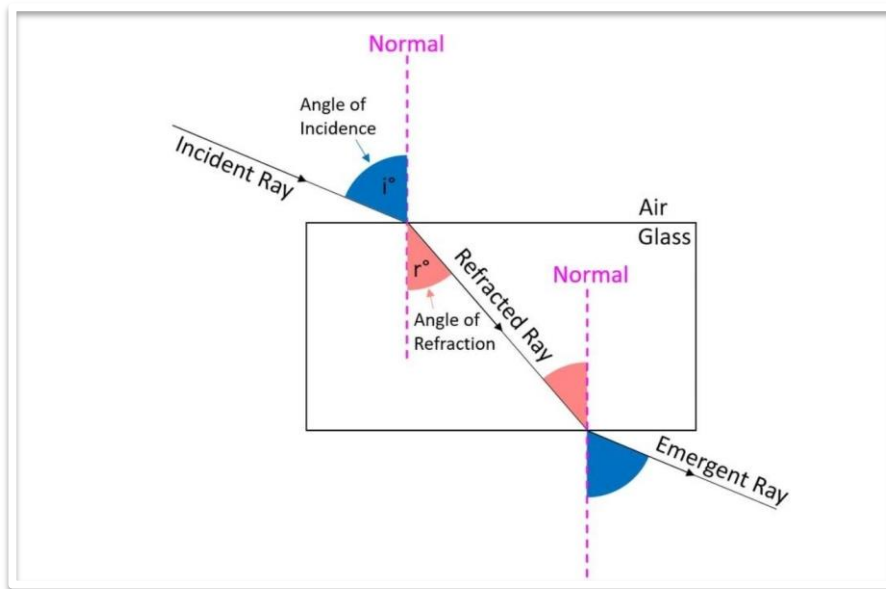
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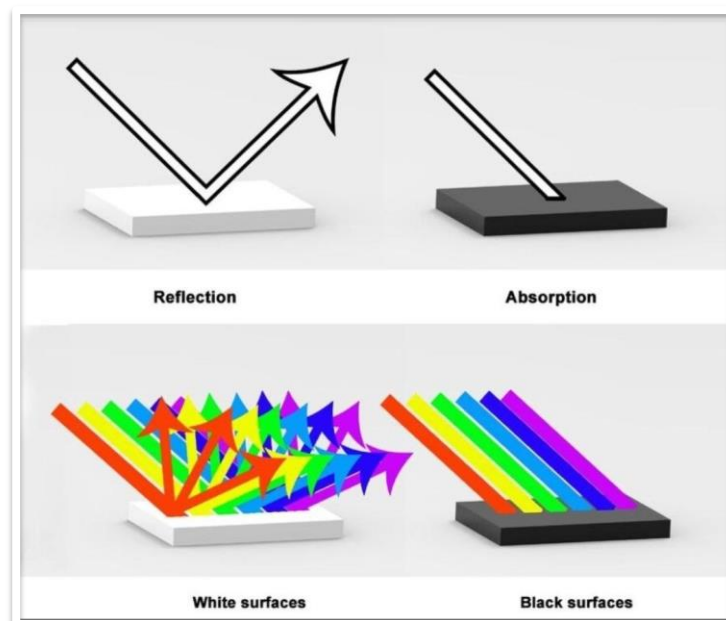
Reflection :is the bouncing back of light into the same medium when it strikes a surface.



Refraction :is the change in the direction of light as it passes from one medium to another due to a change in its speed.



Absorption :is the process by which a material takes in light energy and converts it into other forms of energy.



1. Experiment Objective

- To study and understand the fundamental optical phenomena: reflection, refraction, and absorption when exposing material media to light.
- To experimentally verify the Law of Reflection (angle of incidence equals angle of reflection).
- To verify Snell's Law and determine the refractive index of a transparent medium (such as glass).
- To study the physical attenuation of light and calculate the absorption coefficient using the Beer-Lambert Law.

2. Apparatus Required

- Laser Diode / Light Source.
- Optical Goniometer / Disc (graduated in degrees).
- Plane Mirror.
- Glass Block / Prism (rectangular or semicircular transparent glass. block)
- Power Meter / Light Sensor.
- Light-absorbing sheets or media with variable thickness.

3. Part One: Light Reflection

When a light beam falls on a reflective boundary surface, the light bounces back into the same medium. The Law of Reflection states that the angle of incidence equals the angle of reflection, and all rays as well as the normal line lie in the same plane.

Mathematical Law of Reflection: $\theta_i = \theta_r$ Where: θ_i : Angle of Incidence, θ_r : Angle of Reflection (both measured relative to the normal line).

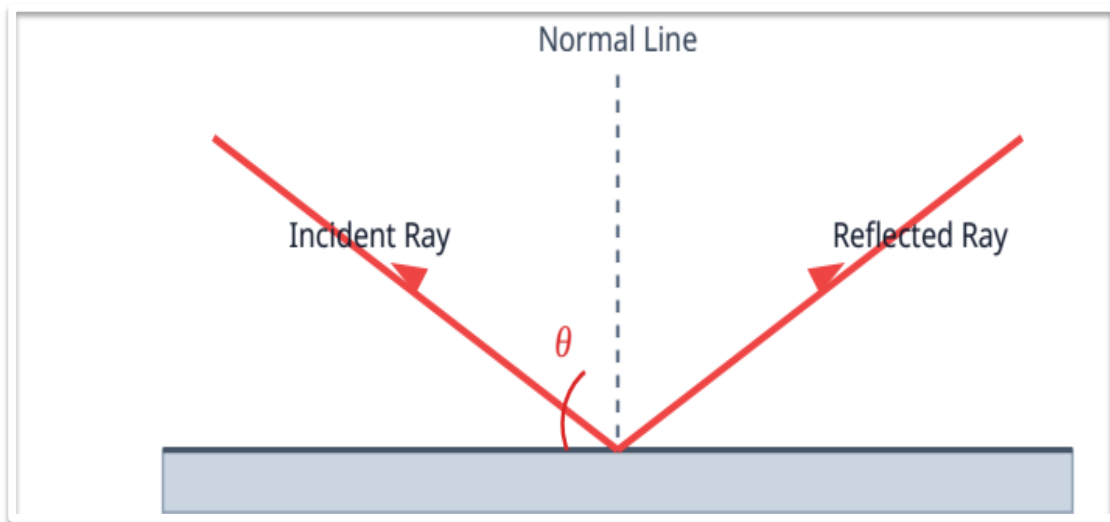


Figure Schematic diagram illustrating the Law of Reflection on a plane mirror ($\theta_i = \theta_r$).

Procedure:

- Mount the plane mirror in the center of the optical disc such that it aligns with the zero line.
- Direct the laser beam toward the point of incidence at an angle of incidence $\theta_i = 30^\circ$.
- Record the corresponding angle of reflection θ_r on the graduated disc.
- Repeat the reading for different incidence angles (40° , 50° , 60°) and record the results.

4. Part Two: Light Refraction

When light travels between two transparent media with different optical densities (such as air and glass), its path and speed change as a result of the change in refractive index.

Snell's Law: $n_1 \sin(\theta_1) = n_2 \sin(\theta_2)$ Where: n_1 , n_2 are the refractive indices of the two media, and θ_1 , θ_2 are the angles of incidence and refraction.

Procedure:

- Place the semicircular glass block in the center of the optical bench.
- Direct the laser beam from air ($n_1 \approx 1.00$) into glass at an angle of incidence $\theta_1 = 30^\circ$.
- Determine the angle of refraction θ_2 inside the glass block.
- Calculate the refractive index of glass using the formula: $n_2 = \sin(\theta_1) / \sin(\theta_2)$

5. Part Three: Light Absorption

When light passes through a material medium, the medium absorbs a portion of the light energy, and the transmitted intensity gradually decreases with increasing medium thickness according to the Beer-Lambert Law.

Beer-Lambert Law: $I = I_0 e^{-\alpha x}$ Where: I_0 : Incident light intensity, I : Transmitted light intensity, α : Absorption coefficient of the medium, x : Thickness of the absorbing medium.

Procedure:

- Measure the direct intensity of the incident light I_0 without any obstacle using the light sensor.
- Place an absorbing sheet of known thickness x and measure the transmitted intensity I .
- Repeat the reading by increasing the number of sheets (increasing thickness x).
- Calculate the absorption coefficient α by plotting the relationship between $\ln(I_0 / I)$ and x .