Study Notes: Reflection and Refraction of Light

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Reflection of Light

Definition

Laws of Reflection

1. The incident ray, the reflected ray, and the normal to the surface at the point of incidence all lie in the same plane.
2. The angle of incidence is equal to the angle of reflection.

Examples

- A light ray hitting a mirror reflects back.
- Light bouncing off water surfaces.

Applications

- Formation of images in mirrors.
- Use in optical devices like periscopes.

Mirror Formula

Definition

Formula

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

Where: - f: Focal length of the mirror - v: Image distance - u: Object distance

Sign Conventions

- Object distance u: Negative for real objects
- Image distance v: Positive for real images, negative for virtual images
- Focal length f: Positive for concave mirrors, negative for convex mirrors

Refraction of Light

Definition

Laws of Refraction

1. The incident ray, the refracted ray, and the normal to the interface all lie in the same plane.
2. **Snell's Law**: The ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant for a given pair of media.

$$\frac{\sin i}{\sin r} = \frac{n_2}{n_1}$$

Where:

3. i: Angle of incidence
4. r: Angle of refraction
5. n_1, n_2: Refractive indices of the two media

Key Concepts

- **Refractive Index**: The ratio of the speed of light in vacuum to the speed of light in a medium.

$$n = \frac{c}{v}$$

- **Optical Density**: The ability of a medium to slow down light.

Examples

- Light passing through a glass slab.
- Formation of a rainbow.

Applications

- Lenses in cameras and microscopes.
- Fiber optics.

Summary

Reflection of Light

- Light rays bounce back when they hit a reflective surface.
- Follows the laws of reflection.

Mirror Formula

- Mathematical relation: $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$
- Used to determine image and object distances.

Refraction of Light

- Bending of light due to change in speed across media.
- Governed by Snell's Law and refractive index.

Images

Figure 1: Reflection of Light

Light rays bouncing back from a reflective surface.

Figure 2: Refraction of Light

Light bending as it passes from one medium to another.

Formulas and Equations

Formula	Description
$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$	Mirror formula
$\frac{\sin i}{\sin r} = \frac{n_2}{n_1}$	Snell's Law
$n = \frac{c}{v}$	Refractive index

Comparison Table: Reflection vs. Refraction

Feature	Reflection	Refraction
Definition	Bouncing back of light	Bending of light
Medium	Same medium	Different media
Speed of Light	Remains unchanged	Changes
Direction	Reversed	Changes direction
Examples	Mirrors, water surfaces	Lenses, prisms

Key Terms

- **Incident Ray**: Light ray approaching a surface.
- **Reflected Ray**: Light ray bouncing back from a surface.
- **Refracted Ray**: Light ray bending as it enters a new medium.
- **Normal**: Perpendicular line to the surface at the point of incidence.
- **Focal Length**: Distance from the mirror's pole to the focal point.
- **Refractive Index**: Measure of how much a medium slows down light.

Conclusion

This lecture has covered the fundamental concepts of **reflection and refraction** of light, including their definitions, laws, formulas, and applications. Understanding these phenomena is essential for comprehending how light interacts with different materials and is used in various technologies.