

Chapter 7: Reflection of Light

Reflection of Light

Definition: The return of light into the same medium after striking a surface.

Types of Reflection

1. **Regular Reflection:** Occurs on smooth, polished surfaces like mirrors.
 2. **Irregular (Diffuse) Reflection:** Occurs on rough surfaces like walls or books; allows us to see most objects.
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Important Terms

- **Incident Ray:** Ray striking the surface.
 - **Reflected Ray:** Ray bouncing off the surface.
 - **Point of Incidence:** Where the incident ray hits the surface.
 - **Normal:** Perpendicular to the surface at the point of incidence.
 - **Angle of Incidence (i):** Angle between incident ray and normal.
 - **Angle of Reflection (r):** Angle between reflected ray and normal.
 - **Plane of Incidence:** Contains incident ray and normal.
 - **Plane of Reflection:** Contains reflected ray and normal.
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Laws of Reflection

1. $\angle i = \angle r$
 2. Incident ray, reflected ray, and normal lie in the same plane.
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Image Formation by Reflection

- Light rays from an object reflect to form images.
- **Types of Images:**
 - **Real:** Formed by actual intersection of reflected rays; inverted; seen on screen.

- **Virtual:** Formed by apparent intersection when rays are extended backward; erect; not seen on screen.
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Plane Mirror

- **Lateral Inversion:** Left-right reversal of image.
 - **Image Characteristics:**
 - Virtual
 - Erect
 - Same size as object
 - Laterally inverted
 - Same distance behind the mirror as the object in front
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Multiple Images

- **Two Inclined Mirrors:** Multiple images lie in a circular pattern.
 - **Parallel Mirrors:** Infinite images formed.
 - **Perpendicular Mirrors:** Three images formed.
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Uses of Plane Mirrors

- Looking glass
 - Optician's room
 - Barber's shop (paired mirrors)
 - Periscope (2 mirrors at 45°)
 - Kaleidoscope (3 mirrors at 60°)
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Spherical Mirrors

Curved mirrors forming part of a sphere:

1. **Concave Mirror:** Silvered outer surface, reflection from inner surface.
2. **Convex Mirror:** Silvered inner surface, reflection from outer surface.

Key Terms:

- **Centre of Curvature (C):** Centre of sphere of which mirror is a part.
- **Radius of Curvature (R):** Radius of that sphere.
- **Pole (P):** Centre of mirror surface.
- **Aperture:** Effective area of the mirror.
- **Principal Axis:** Line joining pole and centre of curvature.
- **Focus (F):**
 - **Concave:** Rays parallel to axis converge at F after reflection.
 - **Convex:** Rays appear to diverge from F after reflection.
- **Focal Length (f):** Distance between pole and focus.

Ray Diagrams for Concave Mirror

Object Position	Image Position	Nature of Image
At infinity	At focus (F)	Real, inverted, point-sized
Far away	Near focus	Real, inverted, highly diminished
Beyond C	Between F and C	Real, inverted, diminished
At C	At C	Real, inverted, same size
Between C and F	Beyond C	Real, inverted, magnified
At F	At infinity	Real, inverted, highly magnified
Between F and P	Behind mirror	Virtual, erect, magnified

Convenient Rays for Ray Diagrams

1. Through centre of curvature – reflected back on same path.
2. Parallel to principal axis – passes through (concave) or appears from (convex) focus.
3. Through focus – becomes parallel after reflection.
4. Incident at pole – reflects symmetrically ($\angle i = \angle r$).

Uses of Spherical Mirrors

Concave Mirror:

- Shaving mirror
- Doctor's head mirror
- Reflectors in torches, headlights

Convex Mirror:

- Streetlight reflectors

- Rear-view mirrors in vehicles (wide field of view, always shows erect and diminished images)
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