

Chapter – 16

Light

Reflection and Laws of Reflection

Reflection: When the light falls on an object, it bounces back. This process of sending back the light ray is called the reflection of light.

Luminous objects: The objects which emit their own light are called luminous objects. E.g. Sun, electric bulb, torch.

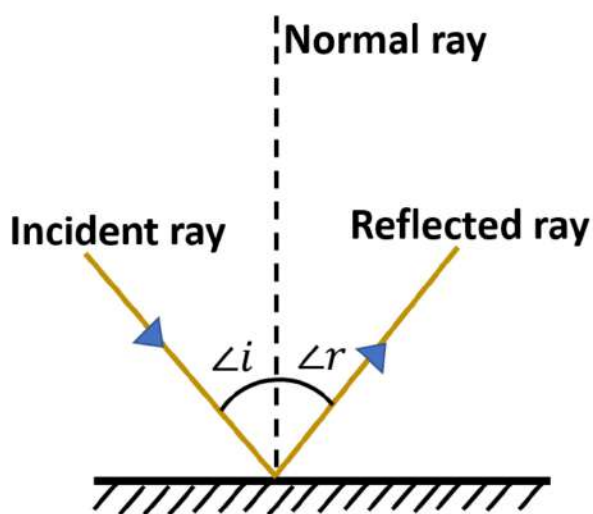
Non-luminous objects: The objects which do not emit their own light are called non-luminous objects. E.g. moon, mirror, diamond.

Non-luminous objects are visible to us because they reflect the light falling on them from any luminous object into our eyes.

Laws of Reflection:

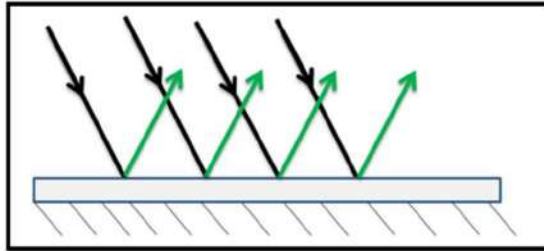
1. The incident ray, the normal at the point of incidence and the reflected ray all lie in the same plane.
2. The angle of incidence is always equal to the angle of reflection.

$$\angle i = \angle r$$



Regular and Diffused Reflection

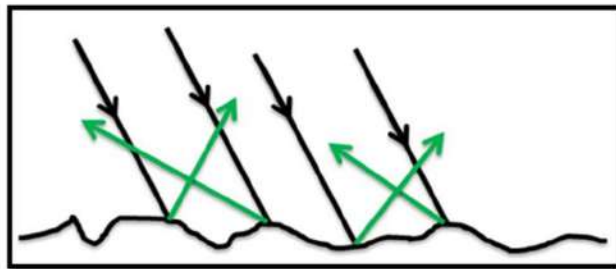
Regular reflection: When a light ray is reflected from the smooth surface, the reflection is called regular reflection. In regular reflection, a parallel beam of incident light is reflected as a parallel beam in one direction. Example: Reflection of light from the mirror.



Diffused reflection: When all the parallel rays reflected from a plane surface are not parallel to each other, the reflection is known as diffused or irregular reflection.

Irregularities in the reflecting surface cause irregular reflection or diffused reflection.

Example: When light rays fall on the room wall there is a diffused reflection and the light spread in all directions that helps us to see it.



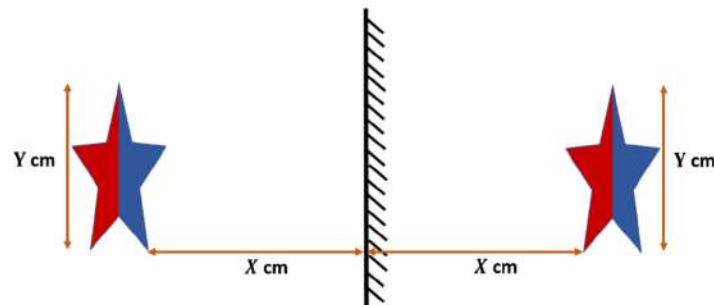
Tip: Remember both regular and diffused reflection obey laws of reflection.

Reflected Light Can be Reflected Again

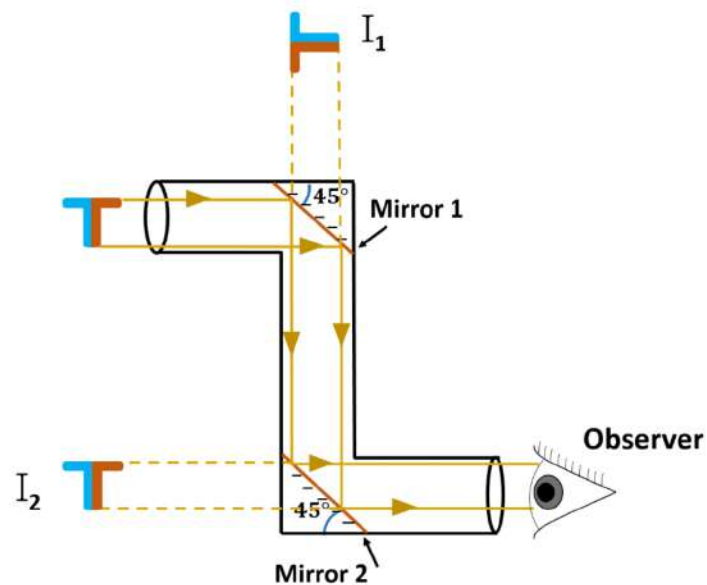
Characteristics of an image formed by a plane mirror:

- The image formed by a plane mirror is virtual and erect.
- The distance of an image formed in a plane mirror is the same distance as the object is in front of it.
- The size of an image is the same as the size of the object.

- The image formed in a plane mirror is laterally inverted.

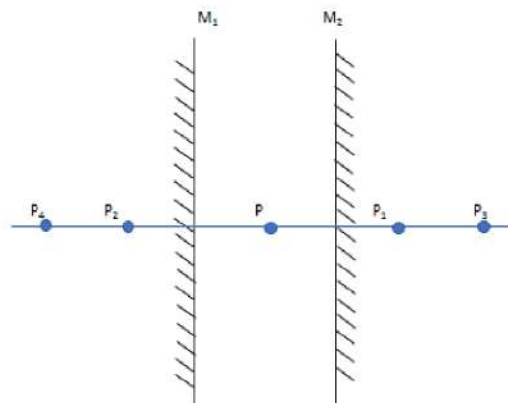


Periscope: Periscope is a device that is used to see objects that are out of the direct line of sight. It is based on the fact that the reflected light is reflected again.



Multiple Images

Multiple images: There are multiple images of an object formed when two plane mirrors are kept inclined at an angle.



Multiple images of object P are formed at P_1 , P_2 , P_3 and P_4 .

Tip: Infinite number of images of an object formed when the object is placed between two plane mirrors parallel to each other.

Kaleidoscope: The kaleidoscope is an instrument containing inclined plane mirrors which produce multiple images. When small pieces of coloured glass are kept in it, beautiful patterns are formed.

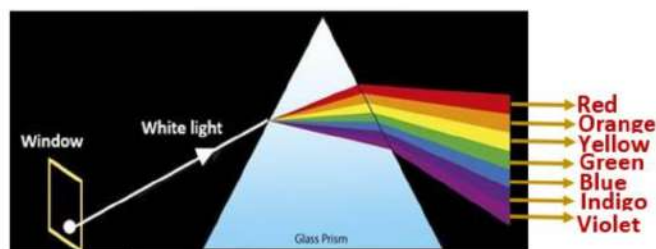
Designers of wallpapers and fabrics use kaleidoscopes to get ideas for patterns.

Sunlight — White or Coloured

Sunlight (white light): Sunlight is the white light as it consists of seven colours that are VIBGYOR.

Dispersion: The splitting of light into its colours is known as dispersion of light.

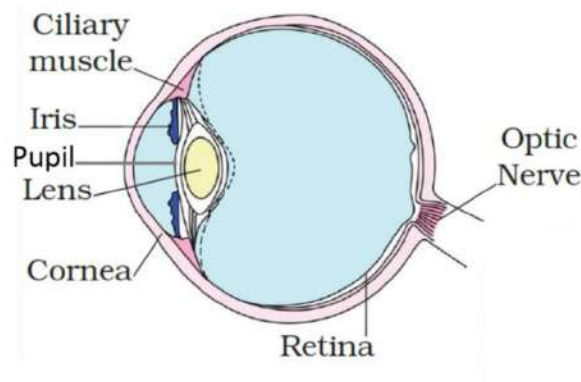
The white light (Sunlight) when passing through the prism splits into seven colours is an example of dispersion of light.



What is inside Our Eyes?

Human eye:

- **Cornea:** It is a transparent part of the eye from where light enters the eye.
- **Iris:** Behind the cornea dark muscular structure is called Iris. Iris is responsible for the distinctive colour of the eye.
- **Pupil:** In the iris, there is a small opening called the pupil. The pupil controls the amount of light entering in the eye. The size of the pupil is regulated by the iris.
- **Retina:** The retina is a screen on which the image is formed by the lens.
- **Cone cell:** They are the nerve cell on the retina in the shape of cones which is sensitive to bright light.
- **Rod cell:** They are the nerve cell on the retina in the shape of rods which is sensitive to dim light.
- **Blind spot:** The spot at the retina where no nerve cell is present. A person does not see anything when an image is formed at a blind spot.



Persistence of vision: The image of an object persists on the retina of an eye for about $\frac{1}{16}$ seconds even after the object has disappeared. This property of the human eye is called the persistence of vision.

Range of human eye: The human eye can see an object clearly without any strain when the object is minimum at a distance of 25 cm.

Defects of vision:

- **Cataract:** A cataract is a clouding of the lens in the eye which leads to a decrease in vision.

- **Night blindness:** Night blindness is the inability to see well at night or in poor light. It causes due to a deficiency of vitamin A and lack of rod cells.
- **Colour blindness:** Colour blindness is the inability to sense colours. It causes due to the lack of cone cells.
- **Myopia:** A person suffering from this defect can see nearby objects clearly but the distant objects appear blurred. With suitable corrective lenses, these defects of the eye can be corrected.
- **Hypermetropia:** A person suffering from this defect can see distant objects clearly but nearby objects appear blurred. With suitable corrective lenses, these defects of the eye can be corrected.

Example: Why an owl can see very well at the night but not during the day?

Solution: This is because the Owl has a large cornea and a large pupil to allow more light in its eye. Also, it has on its retina a large number of rod cells that are sensitive to dim light and only a few cone cells which are sensitive to bright light.

Care of the Eyes

The precautions to protect our eyes are the following:

- 1) If advised, use suitable spectacles.
- 2) Wash your eyes frequently with clean water.
- 3) Never rub your eyes. If particles of dust go into your eyes, wash your eyes with clean water. If there is no improvement go to the doctor.
- 4) Do not look directly into the sun.
- 5) Do not work or read in dim light or very bright light.
- 6) Always read at the normal distance (25 cm) for vision. Do not read by bringing your book too close to your eyes or keeping it too far.
- 7) In case of infections in the eyes consult a doctor as early as possible.
- 8) Avoid watching TV or working on a computer for long sessions.
- 9) Eat a balanced diet rich in Vitamin A. Vitamin A is present in food like raw carrots, broccoli, green vegetables, cod liver oil, eggs, milk, curd and in fruits

like papaya and mango. Apart from this Vitamin C and E are also beneficial for the eyes.

Visually Impaired Persons Can Read and Write

Resources can enable handicapped persons to develop their capabilities.

These resources can be of two types: **Non-optical aids and optical aids.**

Optical Aids:

Optical aids include bifocal lenses, contact lenses, tinted lenses, magnifiers and telescopic aids. While the lens combinations are used to rectify visual limitations, telescopic aids are available to view chalkboard and class demonstrations.

Non-optical aids:

Non-optical aids include visual aids, tactual aids, auditory aids and electronic aids, tape recorder.

Braille system:

Visually challenged persons can read and write using the Braille system.

Louis braille was visually challenged and created a braille system for visually challenged persons which help them to read and write and publish it in 1821.

Visually challenged people to learn the Braille system by beginning with letters, then special characters and letter combinations. Methods depend upon recognition by touch. Each character has to be memorised. Braille texts can be produced by hand or by machine. Typewriter like devices and printing machines have now been developed.