

LIGHT

Light is a form of energy which excites our sense of sight.

Sources of light

- The primary source of light is the Sun.
- Secondary source is the brightness of the sky.
- Other common sources are flames, electric bulbs, tube lights (fluorescent tubes), compact fluorescent lamps (CFLs) and light emitting diodes (LEDs).

Luminous objects

- The objects which emit their own light are called 'luminous objects'.
Examples : Sun and other stars,
- lamp (bulb), tube light, candle flame, etc.



Non-luminous objects

- The objects which do not emit their own light but only reflect the light which falls on them are called 'non-luminous' Objects (or illuminated objects).
- Examples : Table, chair, animals, plants, planets, satellites, moon, etc.



Types of Objects

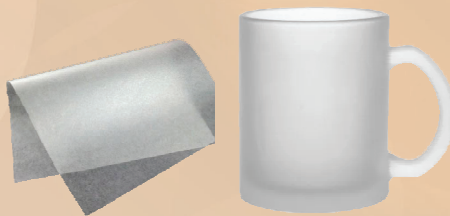
Opaque object

An opaque object or material only absorbs and reflects light, no light passes through it. You cannot see through opaque objects.



Translucent Object

Object or material that allows small portion of light to pass through them are described as translucent. you cannot see clearly through the translucent objects.



Transparent object

Transparent object or material transmits almost all the light striking them. You can see objects clearly through them.



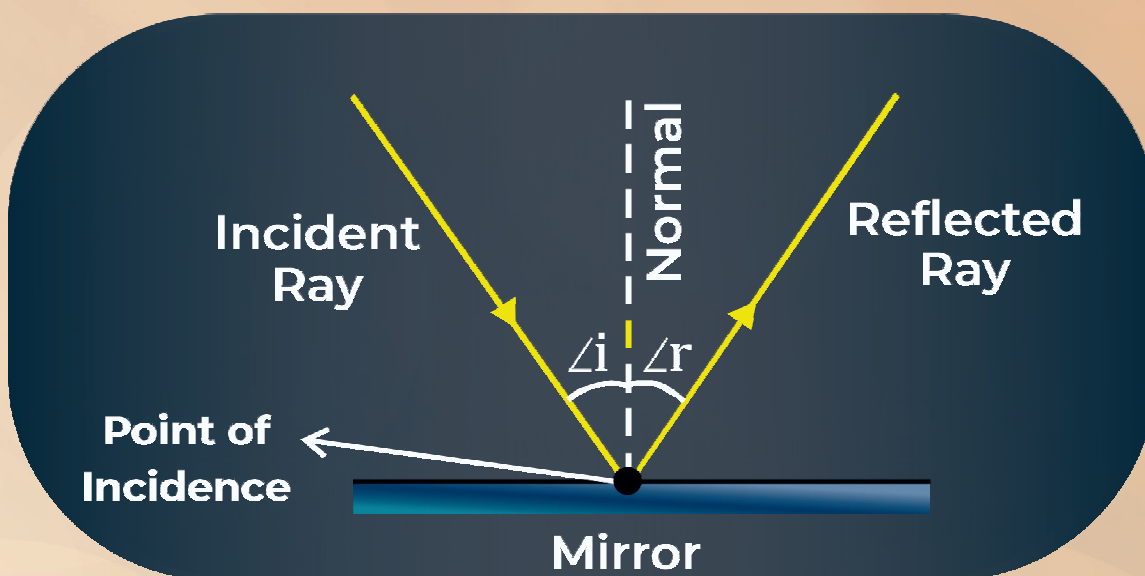
Properties of light

- Light is a form of energy that travels in the form of waves.
- Light waves spread out in all directions as they move away from a source.
- Light can travel through empty space (vacuum), without needing a solid, liquid, or gas medium.
- Light rays from any source always travel in straight lines. This is called rectilinear propagation of light.
- Light travels through space at the fastest speed, about 300000 km/s or 3×10^8 m/s.

Reflection of light

Reflection is the bouncing of light rays off a surface. In other words 'reflection is the sending back of all or a part of a beam of light as it strikes a surface'.

Some basic terms related to reflection of light



Incident ray

The ray of light which falls on the mirror surface is called incident ray.

Reflected ray

The ray of light which is sent back by the mirror is called 'reflected ray'.

Point of incidence

The point at which the incident ray falls on the mirror is called 'point of incidence'.

Normal

A line perpendicular to the surface of mirror passing through the point of incidence is called 'normal'.

Angle of incidence

The angle made by incident ray with the normal at the point of incidence is called 'angle of incidence'.

Angle of reflection

The angle made by reflected ray with the normal at the point of incidence is called 'angle of reflection'.

Laws of reflection

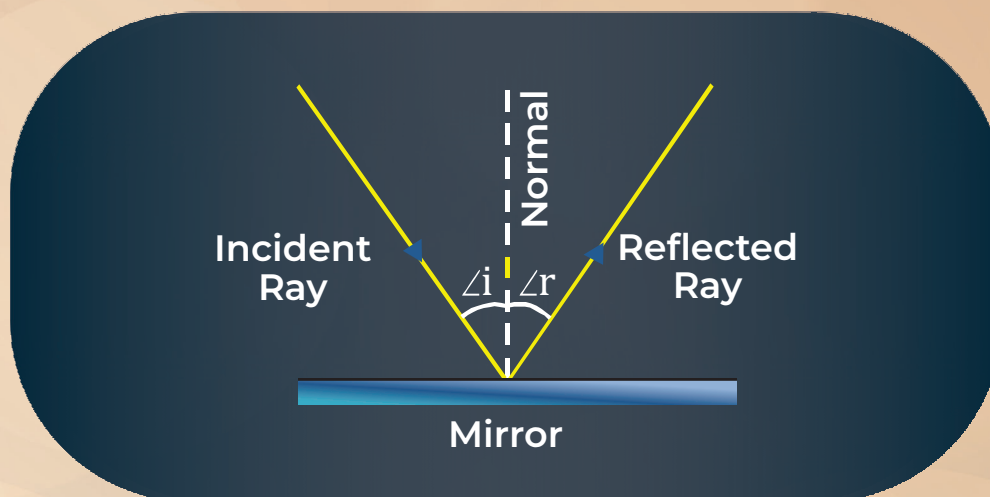
First Law

The incident ray, the reflected ray and the normal at the point of incidence, all lie in the same plane.

Second Law

Angle of incidence is always equal to the angle of reflection.

$$\angle i = \angle r$$



Reflection from plane mirrors

A plane mirror is a highly polished surface used to reflect the light falling on it, and is usually made by depositing a thin layer of silver metal on one side of a plane glass sheet.

POINT OBJECT

An object whose dimensions are negligibly small is called point object.

EXTENDED OBJECT

An object whose dimensions are quite large is called extended object.

Point Objects	• } Symbols used in ↑ } ray diagrams
Extended Objects	

Formation of Images

An image of an object is formed when light rays coming from the object meet or appear to meet at a point after reflection from a mirror or refraction from a lens.

Real image

A real image is one formed when the light rays actually meet at a point and which can be obtained on a screen.



Virtual image

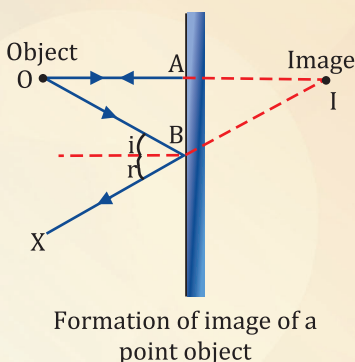
A virtual image is one formed when the rays do not actually meet at a point but they appear to meet at a point. Such images cannot be obtained on the screen.



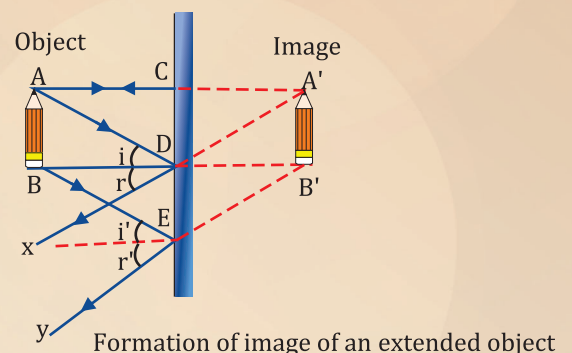
Image formed by a plane mirror are

- (1) The image is **virtual and erect**.
- (2) The distance of image from mirror is equal to distance of object from mirror.
- (3) The size of image is exactly equal to the size of object.
- (4) The image is **laterally inverted**.

Formation of image of a point object

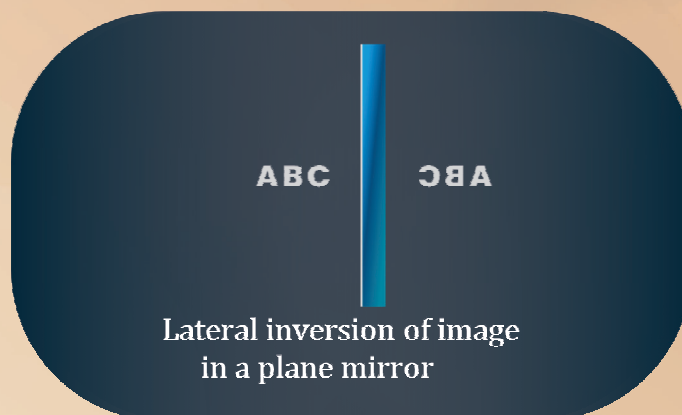


Formation of image of an extended object



Lateral inversion

When an asymmetric object is placed in front of a plane mirror, then the right side of the object appears to be the left side of image and the left side of the object appears to be the right side of its image. This change of sides of an object seen in the image is called 'left - right inversion' or 'lateral inversion'.

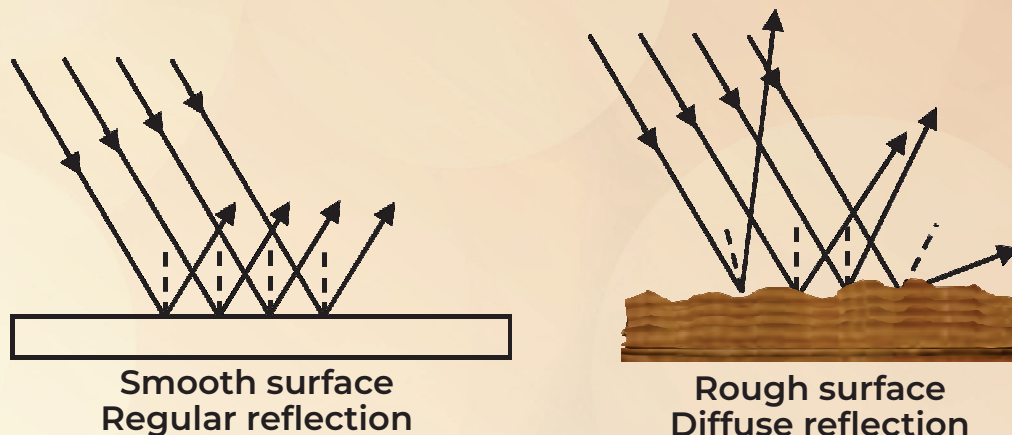


Regular reflection (Specular Reflection)

If a parallel beam of light is incident on a smooth plane mirror, the reflected beam is also a parallel beam, as all the normals are parallel to each other on a smooth surface.

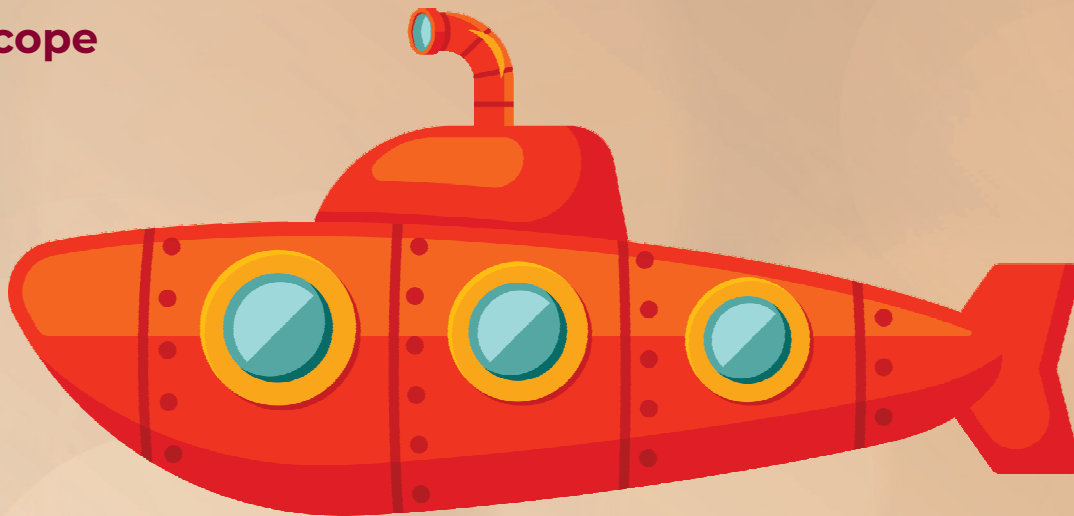
Diffuse reflection (irregular reflection)

If a parallel beam of light is incident on a rough surface or mirror, the rays of reflected light becomes non-parallel to each other, as all the normals are not parallel to each other on a rough surface.



Reflected light can be reflected again

Periscope



Kaleidoscope

This child's toy is a visual delight of changing colours as the toy is rotated.



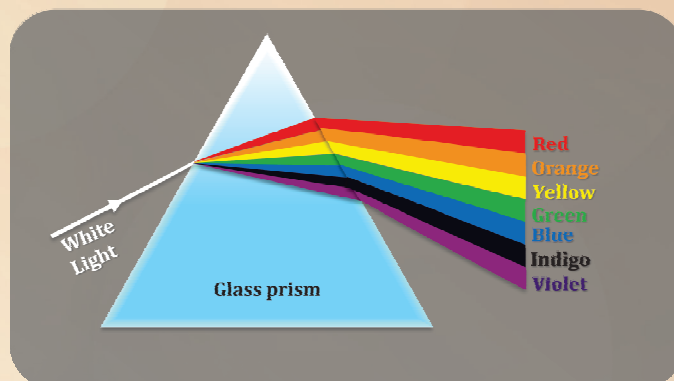
A kaleidoscope



A view inside a kaleidoscope

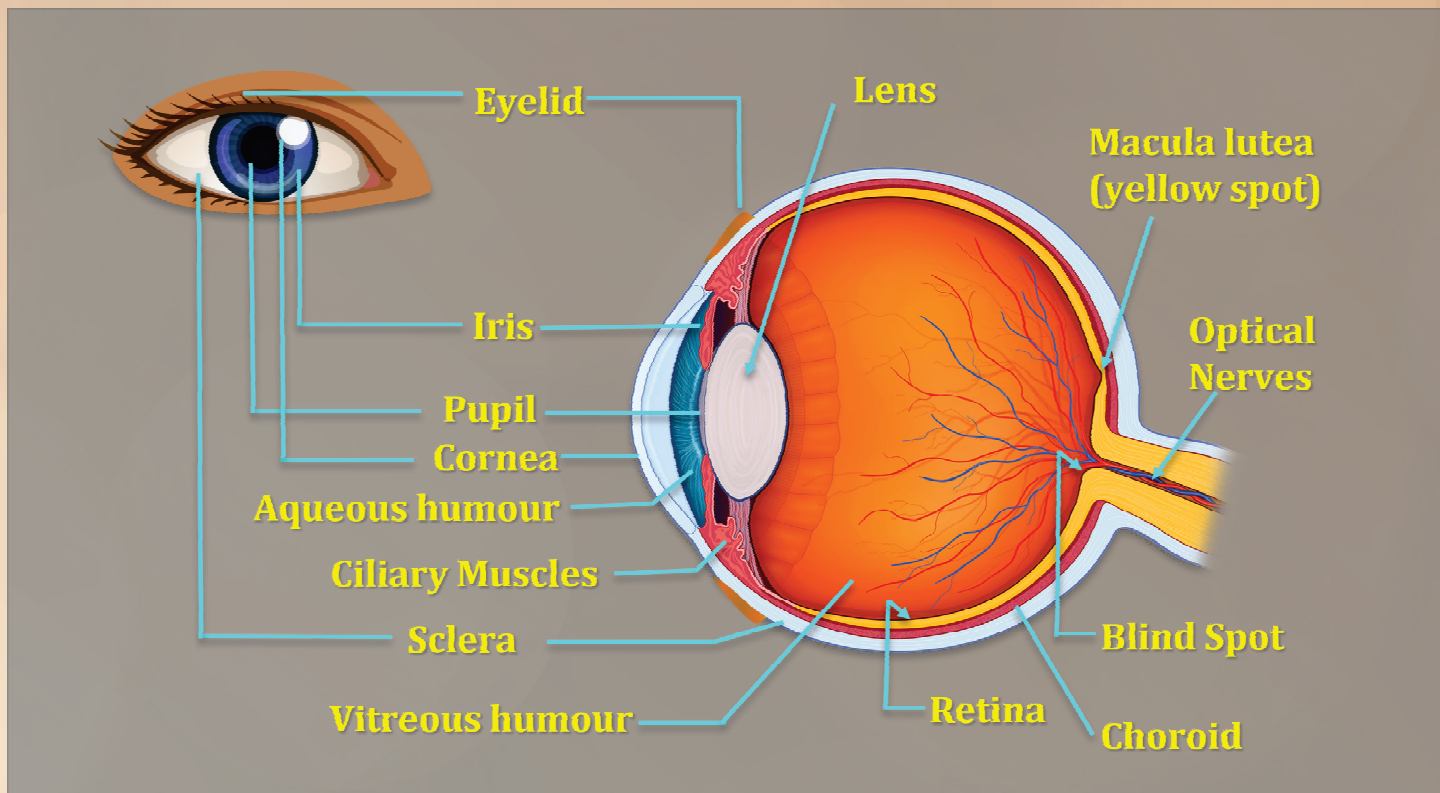
Dispersion of white light

- The phenomenon of splitting up of white light into its constituent colours is called 'dispersion of light'.



The human eye

Components and structure



Sclera or sclerotic

The outermost covering of eye and it is made of white fibrous tissue.

- It is tough so that it can protect the interior of the eye from accidents.

Aqueous humour

- Liquid between Cornea and Crystalline lens.

Vitreous humour

- Space between lens and the 'Retina' is filled with this liquid.

Cornea

- Thin transparent protective membrane visible from the outside.

- It is a muscular diaphragm, which gives distinctive colour to the eye.

Role of iris

- Iris controls the size of the pupil.
- When the light is very bright, iris contracts the pupil and the pupil becomes very small, thus, only a small amount of light enter into the eye.
- In low intensity of light, iris expands the pupil to allow more light to enter into the eye.

Eye lens

- A fibrous, jelly like material which is hard in the middle and soft at the edges.

Choroid

- A grey membrane attached to sclera.

Ciliary muscles

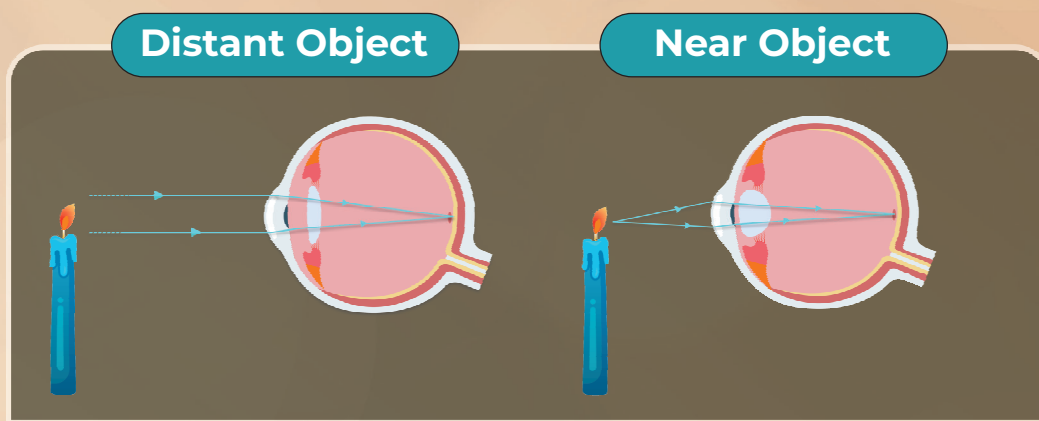
- The curvature of the lens is altered by the 'Ciliary muscles' to which it is attached.

Distant Object

- 01 | Parallel light rays reach eye
- 02 | Cornea refracts light rays
- 03 | Ciliary muscle relaxes, Lens flattens
- 04 | Suspensory ligament under maximum tension

Power of Accommodation

- The shape of lens can be changed by contracting or relaxing the ciliary muscles, such that we can see the nearby as well as the distant objects clearly. This process is called 'power of accommodation'.
- The ability or property of the eye to change the shape of lens so as to see the object clearly is called 'accommodation'.



Near point

- The nearest point for which the image can be formed clearly on the retina.

Least distance of distinct vision

- The minimum distance at which objects can be seen clearly without strain.

For young adult – 25 cm

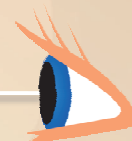
For a child of 7 to 8 year – 7 to 8 cm

For old man of 60 year – 200 cm

Far point

- The farthest point up to which the eye can see objects clearly.
- For normal eye, far point is at infinity.

Normal Eye



Persistence of Vision

- The continuance of the sensation of the eye for a fraction of second even after the removal of the object is called 'persistence of vision'.
- It is the ability of an eye to continue to see the image of an object for a very short duration even after the removal of the object.
- We are able to see the movie pictures in a cinema due to the persistence of vision.

Eyes of animals

- Eyes of a crab are quite small, but they enable the crab to look all around.
- Butterfly has large eyes that seem to be made up of thousands of little eyes.
- Colour perception of different animals is different due to different structure of rods and cones.
- A night bird (owl) can see very well in the night but not during the day.
- The day light birds (kite, eagle) can see well during the day but not in the night.

Visually challenged people

People, including children, can be visually handicapped. They may have very little vision to see things or they or the may not see at all since birth.

Resources for visually challenged people

- (1) Non-optical aids
- (2) Optical aids.

Non-optical aids : It include visual aids, tactual aids (using the sense of touch), auditory aids (using the sense of hearing) and electronic aids.

Visual aids : Can be used for those people who have little vision.

Tactual aids: can be used for partly blind or completely blind people.

Auditory aids : include cassettes, tape recorders, talking books and other such devices.

Electronic aids : Closed circuit television is an electronic aid that enlarges printed material with suitable contrast and illumination. Such television can be used for partially blind people.

Optical aids: Optical aids are used for any person who is suffering from minor eye defect or for a partly blind person.

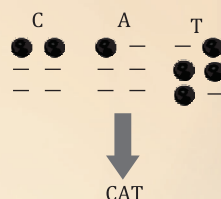
Cataract : the crystalline lens of some people in old age becomes hazy or even opaque due to development of membrane over it. This defect is called 'cataract' which leads to decrease or loss of vision of the eye.

Braille System (Braille script)

Braille is used to transcribe text in natural languages by encoding individual letters, abbreviations, and shorthand contractions per language. Braille is also used to transcribe mathematical and musical notation, and there are several standards for each.

a	b	c	d	e	f	g	h	i	j
k	l	m	n	o	p	q	r	s	T
u	v	x	y	z	W				
,	;	:	.	en	!	0	"	om	"

Some symbols of Braille system



Example of dot patterns used in Braille system