Class 8 Physics Light

Introduction

Introduction

We see so many things around us - a colorful rainbow, bright flowers during spring, a night lit sky, a serene scenery. We read books, admire paintings, see TV etc. We are able to **'see'** all this because of **Light and Sight** So, in this chapter we will explore the characteristics of Light and Sight.

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No light No sight

No light, No sight

We see objects around us due to 2 factors (i)**Eyes** (ii) **Light**.

With eyes and no light, (as in night), we cannot see objects around us. Similarly, if there was light and an individual is visually impaired, he/she still cannot see. Therefore, we need both factors ie Eyes and Light to see objects around us.

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Reflection of Light

Reflection of Light

Bouncing back off a ray of light when it strikes a boundary between different media through which it cannot pass.



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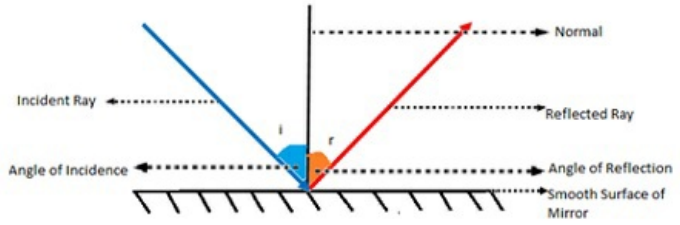
Laws of Reflection

Laws of Reflection



Before we study the Laws of Reflection, let us understand some basic terminologies

Definitions:

Ray of Light: A single thin light along a line. A ray of light is hypothetical. It is an ideal scenario. In reality, we have many rays which make a beam of light.

Incident Ray: The light ray, which strikes any surface, is called the incident ray.

Reflected Ray: The ray that comes back from the surface after reflection is known as the reflected ray.

Normal: A line drawn perpendicular to the line representing the mirror at the point where the incident ray strikes the mirror.

Angle of incidence: The angle between the normal and the incident ray is called the angle of incidence. It is denoted as **i.**

Angle of reflection: The angle between the normal and the reflected ray is called the angle of reflection. It is denoted as **r**.

Laws of Reflection

Law 1 : The incident ray, the normal at the point of incidence and the reflected ray all lie in the same plane.

Law 2 : Angle of incidence is equal to the angle of reflection

Law 3 or Law of Lateral Inversion: In a image formed by a mirror, the left of the object appears to be the right and the right of the object appears to be the right. (Stand in front of the mirror and lift your right hand. In the mirror, it appears like you have lifted the left hand and viceversa)

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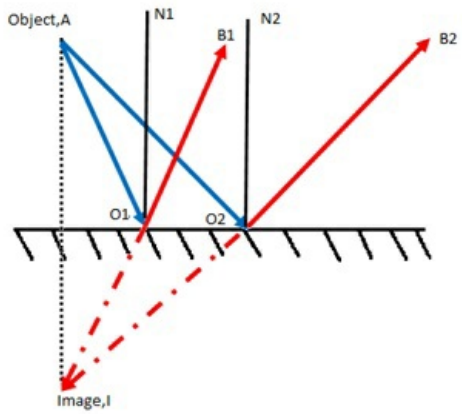
Image formation in a plane mirror

Image formation in a plane mirror



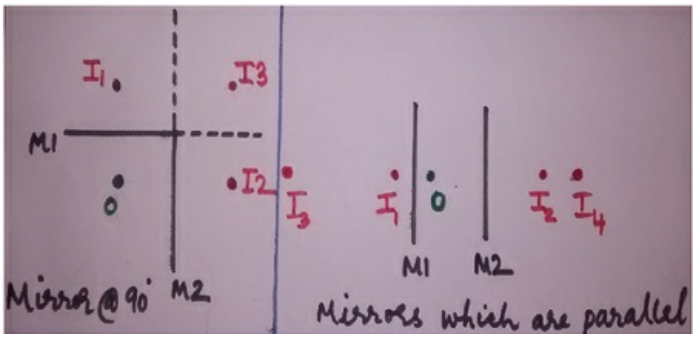
Note: A clear still surface of water behaves like a plane mirror. This explains why we see reflection of sceneries in a river

- The object is placed at **A**.
- The object could emit many rays of light, which are the **incident rays**. Now let us assume **A-O1** and **A-O2** are 2 incident rays.
- **O1-N1** and **O2-N2** are the **normals** at the point O1 and O2 for the incident rays.
- Draw the **reflected rays** (according to the laws of reflection) **O1-B1 and O2-B2**.
- **Extend** the reflected rays behind the surface of the mirror.
- The point at which they meet I, is the point a which the **image of Object A** is formed.
- Note that the distance from the object to the mirror is the same as the distance of the image to the mirror.

Class 8 Physics Light — Image formation at angled Mirrors

Image formation at angled Mirrors

When two mirrors are placed a various angles w.r.t each other, the light gets reflected over and over again it forms, multiple images.



Let M1 and M2 be 2 mirrors. Object O is the object.

If of angle between the mirrors is 90 degrees : Three images are formed. (Case i)

- Image I1 of Object O due to Mirror M1 is formed
- Image I2 of Object O due to Mirror M2 is formed
- Now Object is I2 and I1. The image of I1 is formed at position I3 due to mirror M1. The image of I2 is formed at position I3 due to mirror M2.

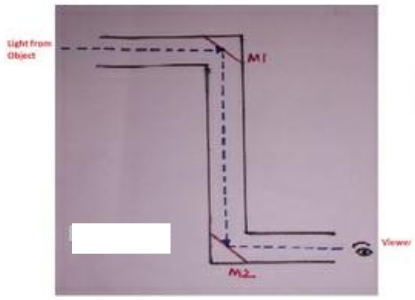
If the angle between the mirrors is 0 degrees ie mirrors being parallel to each other: Infinite images are formed.(Case ii)

- Image I1 of Object O due to Mirror M1 is formed
- Image I2 of Object O due to Mirror M2 is formed
- Now Object is I2 and I1. The image of I1 is formed at position I3 due to mirror M2. The image of I2 is formed at position I4 due to mirror M1.

- Now Object is I3 and I4. The image of I3 is formed at position I5 due to mirror M2. The image of I4 is formed at position I6 due to mirror M1. And it continues...

Going by this, as the angle decreases from 90 to 0, the number of images keeps increasing. Recall the case of a **Kaleidoscope** wherein the angle between the mirrors is 60 degrees. So, many images(>3, 3 images are formed for 90 degrees) are formed.

Periscope: Periscope is an example wherein mirrors are placed at 45 degrees w.r.t each other.



- The light from the object is incident on the mirror M1 at an angle of 45 degrees.
- The light is reflected away from the mirror M1 at an angle of 45 degrees.
- It is again incident on mirror M2 at the same angle 45 degrees.
- Mirror M2 reflects it back to your eye at the same angle.

Periscopes are commonly used in **submarines and military** mainly for spying that is for observation from concealed positions. For a submarine which is deep inside the water, the surface and the objects above cannot be seen otherwise. But, by fitting a periscope, objects on the surface and outside can be viewed inside the submarine

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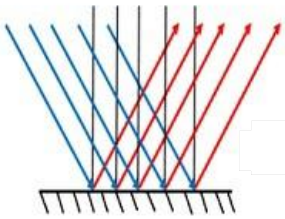
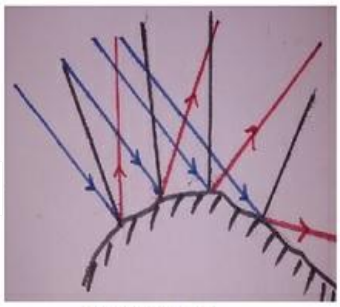
Regular and Diffused Reflection

Regular and Diffused Reflection

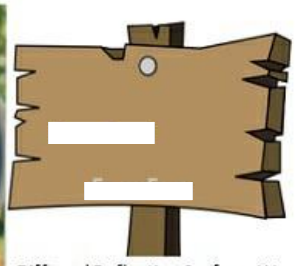


Regular Reflection



Diffused Reflection

Regular Reflection Surface: Rear View Mirror



Diffused Reflection Surface: Wood

Note: The **Blue color** rays are **Incident Rays**, the **Black** are the **Normals** and the **Red color rays** are the **Relected Rays**.

Regular Reflection: When light falls on a **smooth uniform surface (like a mirror)**, all the **parallel incident rays are reflected perfectly parallel** This is called **Regular Reflection**.

Diffused Reflection: When light falls on a **rough surface (like a stone, your body, your clothes etc)** all the parallel incident rays are **not reflected parallel** to each other. This is called **Diffused Reflection.**

Note: Both Regular and Diffused Reflection obey the Laws of Reflection. Diffused reflection is caused by irregularities in the reflecting surface and not due to the failure of Laws of Reflection.

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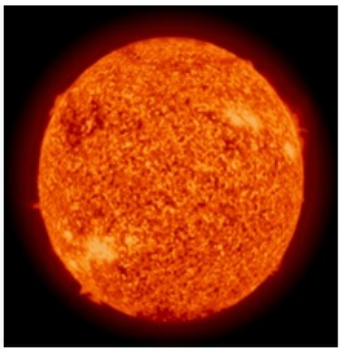
Luminous and Non-Luminous objects

Luminous and Non-Luminous objects

All the objects that we see around us can be categorized into 2 categories

- **Luminous** : Object which emit light of their own. Eg: Sun, Bulb, Candle, Fire
- **Illuminated or Non-luminous**: Objects which donot have light of their own, but reflect off the light of luminous objects that fall on them to our eyes . They are visible due to the light they reflect. Moon, Blue Sky, Clouds, Trees, Car, Table



Luminous Object: Sun

Non-luminous Object: Moon

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Components of White Light

Components of White Light

Sunlight or White Light is made of 7 colors as in**VIBGYOR(Violet, Indigo, Blue, Green, Yellow, Orange, Red).**Pass white light through a prism and see it split into the components that it is made of.

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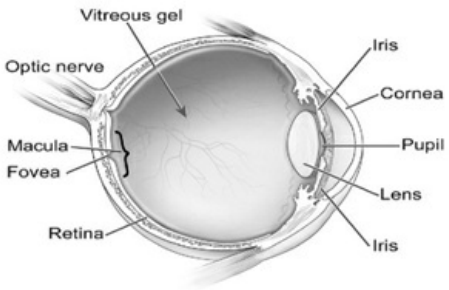
Human Eye

Human Eye

Let's understand how the human eye helps us in seeing objects. The eye is roughly spherical in shape.



- Light mainly falls on the **cornea** - the white clear front part of the eye. It is tough and protects the interior of the eye from accidents.
- The **iris** (a muscular structure behind the cornea) of the eye controls the amount of light reaching the interior of the eye by automatically adjusting the size of the **pupil**. (The iris is that part of the eye which gives it the colour such as black, brown, green eyes commonly called cat-eyes etc)
- The eye's crystalline biconvex shaped **lens** is located behind the pupil. It further focuses the light on the retina. The retina contains several nerve cells which convert the optical images to signals to the brain via the optic nerve.
- There are 2 types of **nerve cells**. (i) **Cones** : which are sensitive to bright light and help us recognize color (ii) **Rods**: which are sensitive to dim light.
- The brain then decodes this signal as the image we see!

Note : The light is focused by the cornea, then the iris by controlling the opening of the pupil and then the lens. In dim light, your pupil expands to allow more light to enter your eye. In bright light, it contracts.

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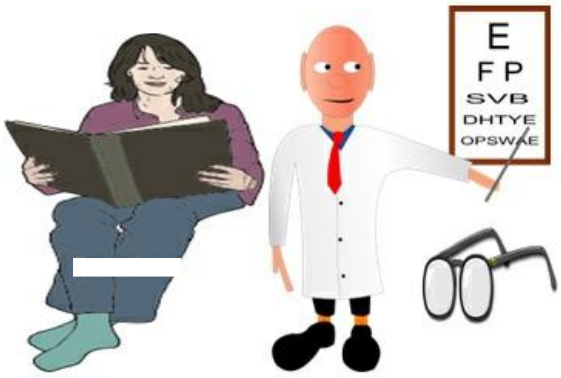
Care of Eyes

Care of Eyes

Eyes are very sensitive and very important too. So, it becomes necessary that we take care of them well.

- If there is a eye pain, irritation or poor visibility, see a **doctor immediately**.
- If advised, use suitable **spectacles, lenses**.
- Prolonged usage of insufficient or too little lighting to do our daily work can cause eye strain, irritation, headaches. Similarly, prolonged exposure to powerful lighting too can cause harm to the eye. **So, always use appropriate lighting**.
- While reading, read at **nominal distance** of approximately **25cm**. Holding the book too close or too far can cause strain.
- Exercise similar precaution while **watching TV, using laptops, iPads, Tablets**
- **Never rub** your eyes too hard. Wash your eyes frequently with clean water. If the irritation persists, see a doctor immediately.
- **Balanced diet** which includes Vitamin A is an integral part of eyecare. Vitamin A food components such as raw carrots, green vegetables, eggs, milk, curd, cheese, paneer, butter can keep eye problems at bay.



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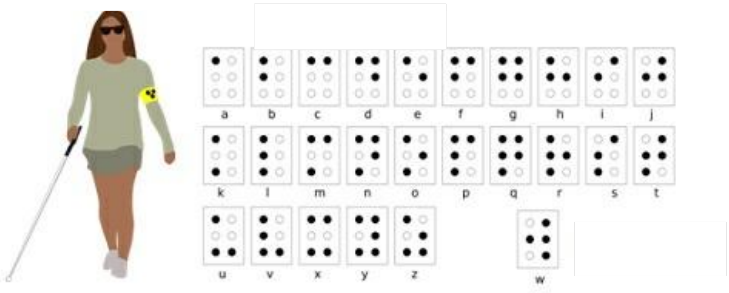
Braille System

Braille System for Visually Challenged Persons

Some persons could be visually handicapped. They could be born with no or poor eyesight, or in some cases, they would have lost their eyesight due to an accident or a disease. But these people, use other sensory organs like touch, hearing, speech to identify, listen, talk and communicate. They could be either Non-optical aids(Hearing Aids, Braille Kit, Audio cassettes/CDs etc) or Optical Aids (Lenses Spectacles, Bifocals). The **Braille** is the most commonly used by blind to read.

The **Braille script** is an alphabet set used by the blind for reading and writing. Each Braille character is made up of a combination of 6 dots arranged in a matrix form. A dot may be raised or flat and the blind touch and feel these combinations of raised and flat dots to encode the alphabets.



This system was developed by **Louis Braille**, a visually handicapped person in 1821.