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INTRODUCTION

In previous class, we have learnt some important facts about light. Now, we will learn more interesting facts about light. We know that light always travels in a straight line and can form images. It has been found that when light ray travels from one medium to another, it deviates from its original path. You can see this if you look on object that is both in and out of water looks bent at the point where it enters the water. Obviously the spoon is not bent, the light reflecting from spoon is, as it passes from more dense water to the less dense air.

What Makes Things Visible?

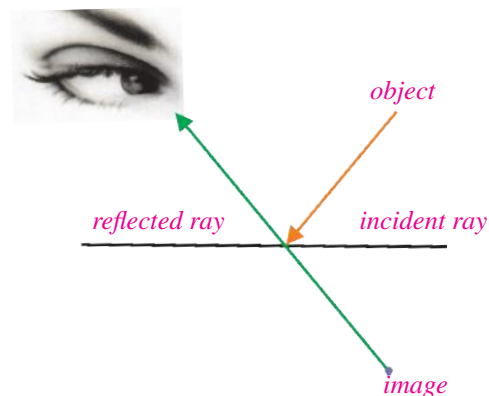
Have you ever thought how we see the various objects? You may say that eyes see that object. But, can you see an object in the dark? it means that eyes alone cannot see any object. It is only when light from an object enters our eyes then we see object. The light may have been emitted by the object, or may have been reflected by the object.

You learnt in class VII that a polished or a shiny surface can act as a mirror. A mirror changes the direction of light that falls on it. Can you tell in which direction the light falling on a surface will be reflected ?

REFLECTION OF LIGHT

In our daily life we see many examples of reflection of light. When light falls on a mirror or a shiny surface, some part of the light comes back in a different direction. This is called reflection of light.

So, when a ray of light goes from one optical medium to another optical medium, bouncing off the light from the surface with a change in direction is called reflection of light.

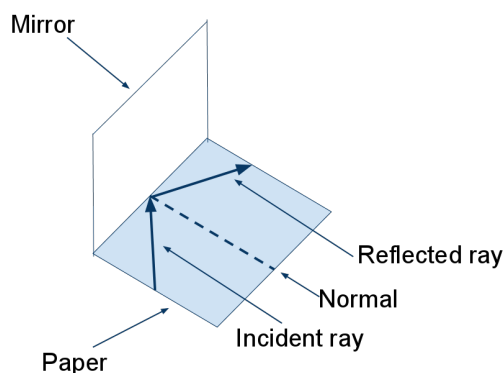


All objects reflect light, but the amount of light reflected is different for different object. The rest part of the light is absorbed by the surface. A highly polished and smooth surface such as a shiny stainless steel surface reflects almost all light that falls on it.

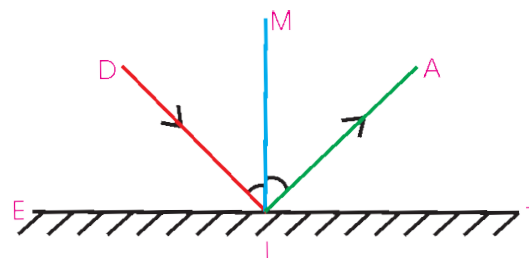
Reflection from a Plane Surface

When, a ray of light is reflected from a surface, the reflected ray obeys certain laws. First we should know certain terms to understand the laws :

1. **Normal** : Normal is the perpendicular at the plane.



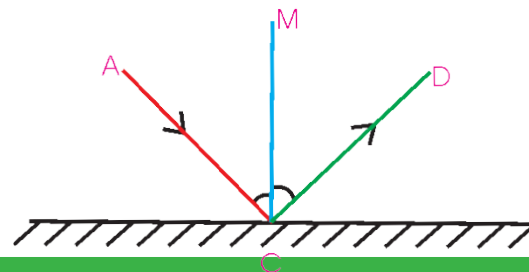
2. **Incident Ray** : The falling ray of light is called incident ray.
3. **Reflected Ray** : The sent-back ray of light from the surface is called reflected ray of light.
4. **Angle of Incidence** : The angle between the incident ray and normal of the plane is called angle of incidence. It is represented by the letter 'i'.
5. **Angle of Reflection** : The angle between the reflected ray and the normal of the plane is called angle of reflection. It is represented by the letter 'r'.



Laws of Reflection

There are two laws of reflection :

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

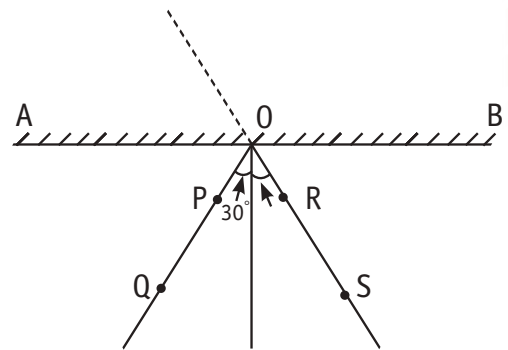


Activity Time

To verify laws of reflection.

To verify the laws of reflection, you will need a plane mirror, some plasticine, a white drawing paper, four common pins, a drawing board and board pins.

First fix the sheet of drawing paper on a drawing board with the help of board pins. After it, fix the mirror on the middle line AB of the paper with the help of plasticine. Now fix two common pins P and Q in front of the mirror up straight. Looking from the side B, we see the images P_1 and Q_1 of the pins in the mirror. Now fix the two pins R and S in the same line as that of images P_1 and Q_1 .



Now remove the mirror and draw small circles around P, Q, R and S. Join PQ and RS up to the line AS of the mirror. Let them meet at the point O. Draw a perpendicular ON from the point O of the plane. This is normal. Now measure the angle of incidence $\angle PON$ and angle of reflection $\angle SON$ it is found that angle of incidence and angle of reflection are equal. And the normal NO, the incident ray PO and reflected ray SO all lie in the same plane.

So both the laws are verified.

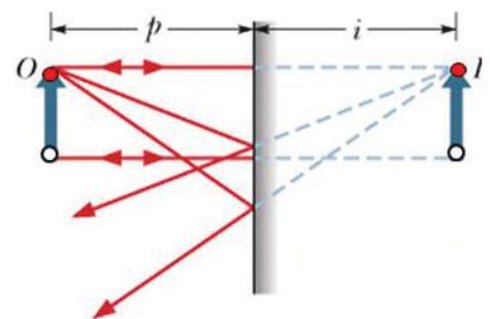
When any object is placed in front of a plane mirror, image of the object is seen in the mirror. When ray is reflected from a mirror, it goes to our eyes and we see the image of the object. We generally think that the image is inside in the mirror. But actually it is not like that. If we place a screen behind the mirror. The image is not the received on the screen. This image is called the virtual image. So the virtual image is not formed on the screen. The image which is formed on the screen is called real image.

- 1. When object is Point Source of Light :** Consider a tiny object O, place in front of plane mirror PQ, From point O, rays travel in all the direction. Consider two rays OA and OB strike the mirror and reflect in the direction AC and BD, by obeying laws of reflection. These rays AC and BD appear to come from the point I. Thus I is the image of the object. Now construct the line OI through point L of the mirror. If we measure the distance OL and LI, i.e. $OL = LI$

So in other words, the distance of the image from the mirror is equal to the distance of the object from the mirror. Thus, the image is formed as far behind the mirror as the object is in front of it.

- 2. When Object is an Extended Source of Light:** An extended source or a bigger source, is the collections of large number of point objects. Now consider a pencil AB is placed in front of a plane mirror.

Take two rays from the point A and two rays from the point "B. These rays are reflected from the mirror and the image A, and B is obtained in the mirror. Thus A, B, is the virtual image of extended object AB. It is laterally inverted.



If we measure the size of the image, we will find it equal to the size of the object.

LATERAL INVERSION

When we look at our own image in the mirror, we see that the size of image is same as that of us but left hand side is seen on the right hand side and right hand side is seen on the left hand side.

This phenomenon is called lateral inversion.

When we write a letter 'F' on a paper, we see the image of 'F' is like, '1' i.e. it is laterally inverted.

Thus we conclude that the image seen in a plane mirror has the following characteristics :

1. The image is virtual.
2. The image is formed behind the mirror.
3. The size of the image is same as that of object.
4. The image is as far behind as the object is in front of it.
5. The image is laterally inverted.



Regular and Irregular Reflection

We see the objects around us only because of reflection of light.

Reflection of light depends upon the surface, on which it falls. On the basis of the reflecting surfaces, reflection of light are of two kinds.

1. **Regular Reflection** : When a parallel beam of ray of light falls on a smooth and polished surface, then reflected ray is also a parallel beam of light. This is regular reflection.

Reflection from mirror, still water on furniture is regular reflection. It is not good for eyes.

2. **Irregular Reflection** : When a parallel beam of light strikes on a rough surface, it is reflected in different directions, then such a reflection is called irregular reflection.

Due to reflection in different directions, we see the object from various directions. The eye placed anywhere will receive light reflected from such surfaces. Irregular reflection is also called diffused reflection.

The reflection spread the light over a vast area. Most of the things which we see are due to irregular reflection. It is good for eyes.

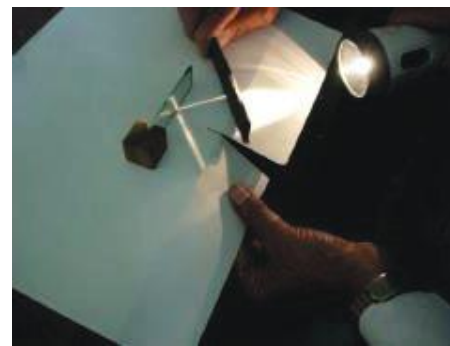


Activity Time

To show the regular reflection.

Take a comb with all its openings open. Using a torch, throw light on all the openings of the

comb. What do you observe? Parallel rays of light come out of the comb. Place a strip of plane mirror in the path of the light rays. What do you observe? All the light rays are reflected and they are parallel to one another. Now change the direction of the incident rays by changing the direction of the comb or the mirror. You will observe that the reflected rays are parallel to one another again. This kind of reflection is known as regular reflection. It takes place from a surface which is plane with no defects.



Now use a surface which is not quite regular, such as a polished steel plate with some design on it. Throw light through comb as before. Observe the reflected rays. Are they all parallel ?

MULTIPLE IMAGES

You are aware that a plane mirror forms only a single image of an object. What happens if two plane mirror in combination are used? Will there still be a single image? Let us see.

Sunlight : White or Coloured

In class VII you have learnt that white light consists of seven colours. Here is another activity showing that sunlight consists of several colours.



Human Eye

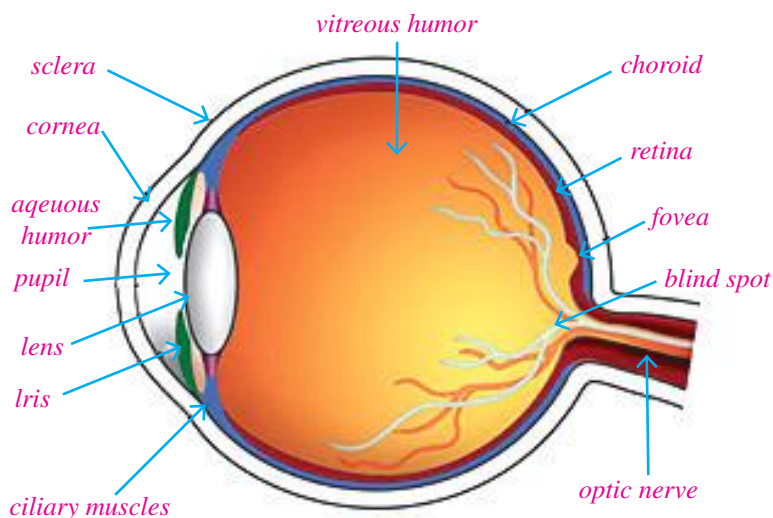


The human eye is also a wonderful optical instrument. Eye is similar to the photographic camera, which have a lens on the side and sensitive screen called **retina** on the other side.

The human eye consists several parts. Each part has a specific structure and function. The front bulging transparent part of the eye is **cornea**, it allows the light to enter in the eye ball. **Sclerotic** is the white outermost cover of the eye, it protects vital internal parts of the eye.

Behind the cornea there is a crystalline lens, which is held in position by the ring of muscles, called ciliary muscles. The lens focus the image of the objects clearly on the retina. The ciliary muscles change the focal length of the lens as desired. Retina is the sensitive, hemispherical screen, it receives the optical image of the object.

The space between the cornea and the lens is filled with a watery fluid called



the aqueous humour, it prevents the front part of the eye from collapsing during change in atmospheric pressure. The space between the lens and the retina is filled with a transparent fluid called the **vitreous humour**. Its function is in focusing the rays clearly on the retina.

The coloured part of the eye behind the cornea is called the Iris. Iris has a small hole, which is called the **pupil**. It controls the amount of light entering in eye, by decreasing or increasing the diameter of the pupil.

So all these part form a real, inverted and diminished image of the object on the retina. At the last optic nerves carry the impressions on the retina to the brain. The brain changes inverted images to erect images.

Do You Know ?

The most sensitive point on the retina is called the yellow spot, it is situated in the centre of the retina. It helps to focus and form very clear images.

Care of Eyes

It is necessary that you should take proper care of your eyes. If there is any problem, you should go to an eye specialist. Have a regular checkup :

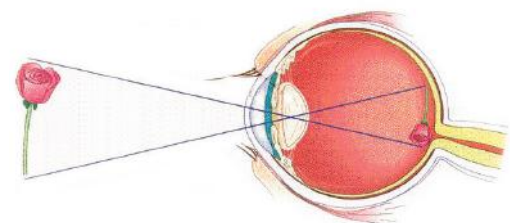
1. If advised use suitable spectacles.
2. Too little or too much light is bad for the eyes. Insufficient light causes eyestrain and headache. Too much light, like that of the sun, or powerful lamps, can injure retina, which is very delicate.
3. Do not look at the sun or a powerful light.
4. Never rub your eyes if any small particle or dust goes into your eyes. Wash your eyes with clean water. If condition does not improve, go to a doctor.
5. Wash your eyes frequently with clean water.
6. Always read at the normal distance for vision. Do not read by bringing your book too close or keeping it too far.

You have learnt about balanced diet in class VI. If food is deficient in some components, eye may also suffer. Lack of vitamin A in foodstuff is responsible for many eye troubles. Most common amongst them is night blindness.

One should, therefore, include in the diet components which have vitamin A. Raw carrots **broccoli** and green vegetables such as spinach (Palak), methi, amarnath and cod liver oil are rich in vitamin A. Eggs, milk, curd, paneer, butter, ghee and fruits such as papaya, banana, mango, apple, dates, etc. also contain plenty of vitamin A.

Visually Challenged Persons Can Read and Write

Some persons, including children are visually handicapped. They have very limited vision to see things. Some persons cannot see at all since birth. Some persons lose their eyesight because of certain disease. Such persons, on their



own try to identify things by touching, listening to the voices more carefully and bringing the things more closely to the eyes. In this way they try to develop their senses more sharply. However, additional resources can further enable them to develop their capabilities.

Resources can be of two types : Non-optical aids and optical aids.

Non-optical aids include visual aids, tactual aids (using the sense of touch), auditory aids (using the sense of hearing) and electronic aids. With the help of visual aids, required size of words, suitable intensity of light and material at proper distances can be provided. Tactual aids including Braille writer, slate and stylus help the visually challenged persons in taking notes, reading and writing and in learning mathematics. Auditory aids include cassette, tape recorders, talking. Books and other such programs. Electronic aids such as talking calculators are also available for performing many compositions. Closed circuit television is also an electronic aid which enlarges printed material with suitable contrast and illumination. Nowadays, use of audio CDs and voice boxes with computers are also very helpful for listening and writing the desired text.

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

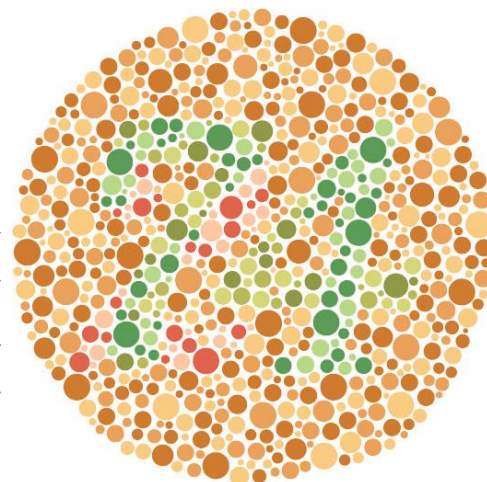
What is Braille System?

The most popular resource for visually challenged person is known as **Braille**.

Louis Braille, himself a blind person, developed a system for visually challenged persons and published in 1821.

The present system was adopted in 1932. There is a Braille and scientific notation. Indian languages such as Hindi, Sanskrit, Marathi, Gujarati, Bengali, Tamil, Telugu and Urdu can be read using the Braille system.

Braille system has 63 dot patterns of characters. Each character represents a letter, combination of letters, common word or grammatical sign. Dots are arranged in cells of two vertical rows of three dots each. To identify the dot patterns, dot positions are numbered 1, 2, 3 downward on the left and 4, 5, 6 downward on the right.



Use the above notations pattern of dots to represent English alphabets and some common words.

These dots when embossed on Braille sheet help visually challenged to recognize words by touching. For the purpose, the dots are slightly raised.

Visually challenged people learn the above system by beginning with letters and then to special characters and letter combinations. Methods depend upon recognition by touching. Each

character has to be memorized. Braille texts can be produced by hand or by machine. To write braille by hands, a slate is used consisting of two metal plates hinged together with a paper in between them. A writer inserts a stylus to make dot patterns through cell size opening on the upper plate. Type-writer like devices and printing machines which use embossed zinc plates to make coded impressions on paper, have also been developed.

Some visually challenged Indians have great achievements to their credit. Diwakar, a child prodigy has given amazing performances as a singer.

Mr. Ravindra Jain, born completely blind, obtained his Sangeet Prabhakar degree from Allahabad. He has shown his excellence as a lyricist, singer and music composer. Mr. Lal Advani, himself usually challenged, established an rehabilitation of disabled in India. Besides, he represented India on Braille problems to UNESCO.

Helen Keller, an American author and lecturer, is perhaps the most well-known and inspiring visually challenged person. She became blind when she was only 18 month old.

But because of her resolve and courage, she could complete her graduation from a university. She wrote a number of books including the **Story of My Life** (1903).



Know the Keywords :

Reflection of Light : When light falls on the mirror or a Shiny surface, some part of the light comes back in a different direction is called Reflection of light.

Sclerotic : It is the white outermost cover of the eye, it protects vital internal parts of the eye.

Braille : The most popular resource for visually challenged person is known as Braille.



Point to Remember

- Light reflected from all surfaces.
- Diffused/irregular reflection takes place when light is incident on rough surfaces.
- Image formed in a plane mirror undergoes lateral inversion.
- Two mirrors inclined to each other give multiple images.
- Beautiful patterns are formed in a kaleidoscope because of multiple reflections.
- Sunlight known as white light consists of seven colours.
- Prism can split light into its constituent colours.
- Splitting of light into its constituent colours is known as dispersion.
- Visually challenged persons can read and write using Braille system.
- Important parts of the eye are cornea, iris, pupil, lens, retina, nerve endings and optic nerve.
- Muscles attached to the eye lens can change its thickness to enable to see nearby and distant objects. This feature of the eye is called accommodation.

EXERCISE TIME

A. Answer the following questions :

1. Describe the construction of kaleidoscope.
2. Draw a labelled sketch of human eye.
3. How can you take care of your eyes ?
4. What is the angle of incidence of a ray if incident and reflected rays are at an angle of 90° ?
5. What is Braille system ?
6. Write the laws of reflection ?
7. What is reflection from a plane surface ?

B. Fill in the blanks :

1. A person 1 m in front of a mirror seems to be _____ m from his image.
2. If you touch your _____ ear with right hand in front of a plane mirror it will be seen that your right ear is touched with _____ in the mirror.
3. The muscles attached to the eye lens makes it thicker to see _____ objects.
4. Night birds have _____ cones than rods in their eyes.

C. Write 'T' for true and 'F' for false statement :

1. Sunlight known as white light consists of nine colours.
2. Two mirrors inclined to each other give multiple images.
3. Light is reflected from all sides.
4. The falling ray of light is called reflected ray.

D. Tick (✓) the correct option :

1. Angle of incidence is equal to the angle of reflection :
(i) always (ii) sometimes
(iii) under special conditons (iv) never
2. The coloured part of the eye behind the cornea is called the :
(i) iris (ii) pupil
(iii) retina (iv) humour



Creative Work

- **Make your mirror. Take a glass strip of glass slab. Clean it and put it on a white sheet of paper. See yourself in glass. Next put the glass slab on a black sheet of paper. Again look into the glass. In which case you saw yourself better and why ?**