

# Light

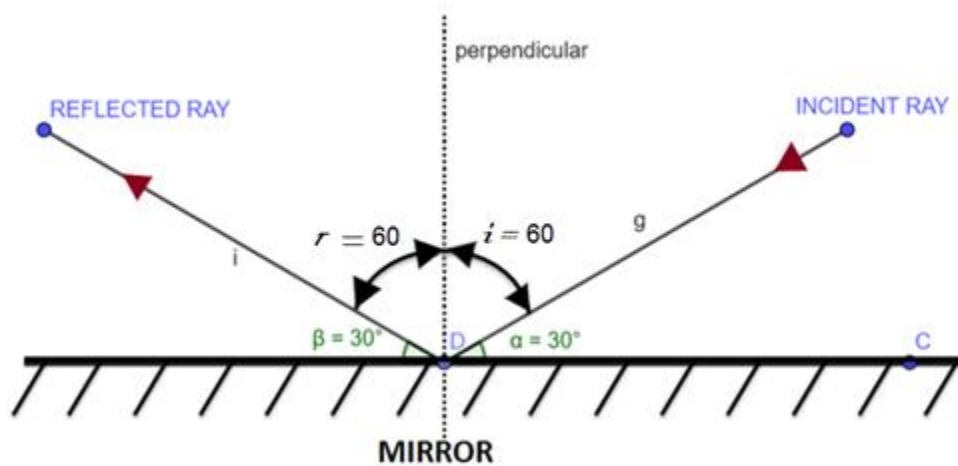
## Check point 1

**Q. 1. A ray of light is incident on a plane mirror at an angle of  $30^\circ$ . What is the angle of reflection?**

**Answer:** According to the law of reflection

The angle of incidence = Angle of reflection

Let's draw a figure for this question –



According to the given question, incident ray is making an angle of  $30^\circ$  with the plane mirror ( $\alpha = 30^\circ$ )

So angle of incidence  $\angle i + 30^\circ = 90^\circ$

Angle of incidence  $\angle i = 60^\circ$

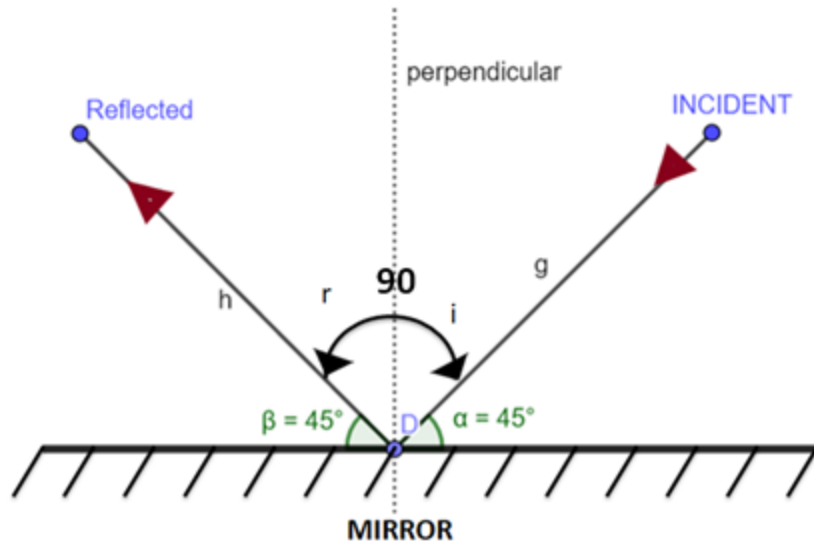
From law of reflection, Angle of reflection  $\angle r = 60^\circ$

**Q. 2. Determine the angle of incidence of a ray of light, if the reflected ray is at an angle of  $90^\circ$  to the incident ray?**

**Answer:** According to the law of reflection

The angle of incidence = Angle of reflection

Let's draw the figure –



According to question reflected ray is making an angle of  $90^\circ$  with the incident ray.

So angle of incidence + angle of reflected =  $90^\circ$

Since both angle of incidence is equal to angle of reflected

Angle of incidence + angle of incidence =  $90^\circ$

Angle of incidence =  $45^\circ$

**Q. 3. Mention how many reflected rays can be obtained for a given single incident ray falling on a plane mirror?**

**Answer:** We are having only one plane mirror as per given in the question. For every incident ray, there is only one reflected ray. There will be only one reflected ray for a single ray falling on a plane mirror.

## Check point 2

**Q. 1. Mention the type of reflection of light takes place from**

- (a) a rough surface
- (b) a smooth surface

**Answer:** (a) For rough surface irregular reflection or diffused reflection takes place.

(b) For smooth surface regular reflection takes place.

**Q. 2. Is the image of an object in plane mirror virtual or real?**

**Answer:** Image formed by an object in a plane mirror is virtual because the image is formed behind the mirror and we cannot take this image on a screen.

**Q. 3. Explain, why the virtual image cannot be taken on screen.**

**Answer:** Virtual image is formed by an extension of reflected ray where the ray never meets in real.

That is a reason virtual image cannot be taken on screen.

**Q. 4. Is law of reflections valid for irregular reflection?**

**Answer:** Law of reflection means the angle of incidence is equal to the angle of reflection. For irregular reflection law of reflection does not hold true.

**Q. 5. Soldiers use the periscope while sitting in a bunker. Why?**

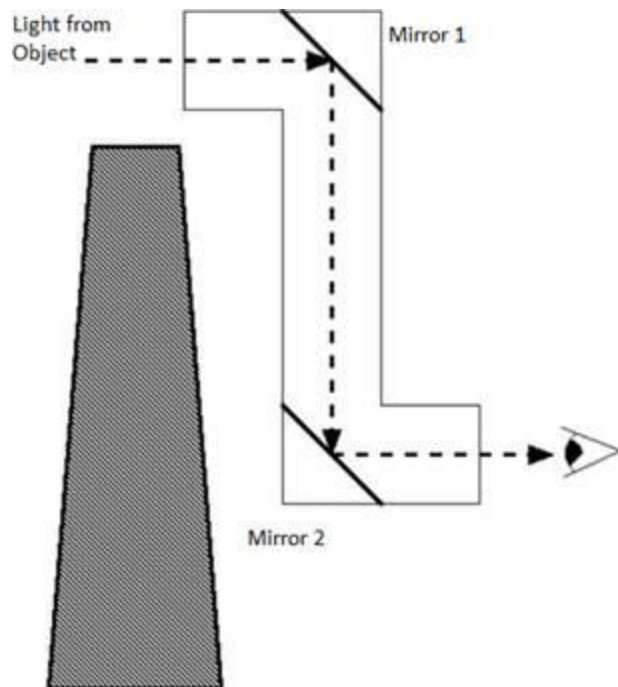
**Answer:** Periscope is used by a soldier while sitting in a bunker to see the things outside. Periscope makes use of two plane mirrors.

Additional Information:

**Periscope:** A periscope is an instrument which helps in viewing the objects which are not in the line of sight of the observer. It is used in submarines to look at objects above the water surface.

The principle behind periscope is reflection between two parallel plane mirrors. It consists of a long cylindrical hollow tube bent at right angles and two plane mirrors are kept parallel and facing each other. The mirrors are fixed at 45 degrees with the framework at the top and the bottom of the tube.

Let us see the simple structure of periscope –



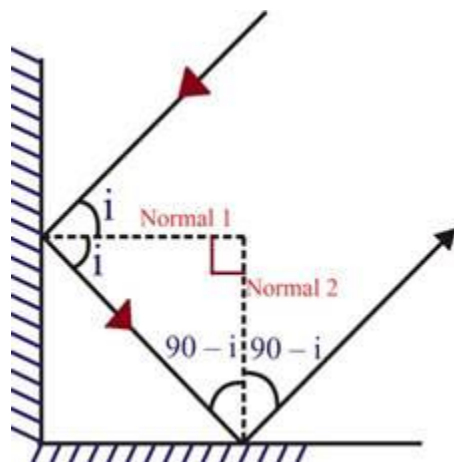
### Check point 3

**Q. 1. Determine the number of images formed when an object is placed between two parallel plane mirrors facing each other.**

**Answer:** Infinite number of the image is formed when an object is placed between two parallel plane mirrors facing each other.

**Q. 2. Draw a ray diagram of the formation of images when two mirrors as placed at an angle of  $90^\circ$  to each other.**

**Answer:** When two plane mirror placed at an angle of  $90^\circ$  to each other-



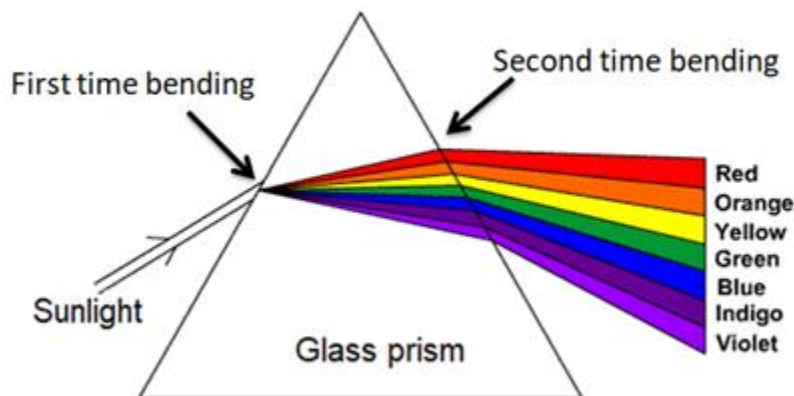
Here in the above diagram we suppose incidence angle is.

**Q. 3. Mention the name of a phenomenon which takes places when patterns are formed in a kaleidoscope.**

**Answer:** Kaleidoscope is based on the phenomenon of multiple reflections when plane mirror is place together making some angle.

**Q. 4. Explain, what happens when a beam of sunlight is passed through a glass prism.**

**Answer:** Sunlight is the combination of seven components. When sunlight is allowed to pass through the glass prism it blends and gets split into seven colours. All the seven colour has different wavelength and while entering through a prism it bends (due to refraction) and angle of bending is different for all the colour. And while coming out from the prism light again get bend and we can see the entire different colour. This is also called Dispersion means spreading of white light into its full spectrum.



#### Check point 4

**Q. 1. Mention type of lens is present in the human eye.**

**Answer:** Human eye have crystalline lens called convex lens.

**Q. 2. Name the point inside the human eye where the image is not visible.**

**Answer:** Blind spot

**Q. 3. Name the phenomenon which enables us to see movies in a cinema hall.**

**Answer:** The phenomenon which is responsible for seeing movies in a cinema hall is Persistence of vision.

**Q. 4. Explain what happens to the size of the pupil of our eye in bright.**

**Answer:** The pupil is the part of your eye that controls how much light gets in. When we enter in an area of bright light, size of pupil gets smaller (contract) because to control the amount of light.

Additional information:

While entering the dark room pupil becomes large (expands) so that more and more light can enter the eye. Size of the pupil is controlled by iris. Thus we can say that iris controls the amount of light entering into the eye.

**Q. 5. Name the part of our eye that gives it as distinctive colour.**

**Answer:** Cone cell

Our eye contains two types of cells – cone cell and rod cell.

Cone cell is responsible for the colour and it is sensitive to bright light.

Rod cell is sensitive to dim light.

## **Check point 5**

**Q. 1. Name some auditory aids which are useful for visually changed persons.**

**Answer:** Braille (Braille is named after its creator- Louis Braille)

**Q. 2. Explain in brief about Braille with the help of some example.**

**Answer:** Braille is a system of touch reading and writing for blind persons in which raised dots to represent the letters of the alphabet. There is a rectangular block called cells that represent a certain alphabet or number or another symbol. Each cell contain risen tiny dot and different combination of this dot is used to represent a different symbol.

Let take one example –

Louis Braille is a creator of Braille. He uses 3x2 dot in each cell to represent the alphabet.

Here is an image that shows how to represent 'A' in Braille (only one dot is raised) –

**Q. 3. Mention the name of the most popular resource for visually challenged persons which can make them read and write.**

**Answer:** Best way to learn and write Braille system is - The Hadley Institute for the Blind and Visually Impaired.

**Q. 4. What happens to the size of the pupil of our eye in bright?**

**Answer:** The pupil is the part of your eye that controls how much light gets in. When we enter in an area of bright light, size of pupil gets smaller (constrict) because to control the amount of light.

Additional information:

In entering the dark room pupil become large (expand) so that more and more light can enter. Size of the pupil is control by iris. Thus, we can say that iris controls the amount of light entering into the eye.

**Q. 5. Which part of the eye gives it as distinctive colour?**

**Answer:** Cone cell

Our eye contains two types of cells – cone cell and rod cell.

Cone cell is responsible for the colour and it is sensitive to bright light.

Rod cell is sensitive to dim light.

## **Chapter Test**

**Q. 1. State the information that you get about sunlight from the formation of a rainbow.**

**Answer:** A rainbow is a spectrum of sunlight. By seeing a rainbow we come to know that sunlight is consist of any colours.

We can say that sunlight = (Red + orange + yellow + green + blue + indigo + violet) here we only consider the basic colour.

**Q. 2. Name the part of the eye**

**(a) Which controls the amount of light entering the eye.**

**(b) Which converges light rays to form the image.**

**Answer:** (a) Iris control the amount of light entering the eye.

(b) Lens converges (focus) light ray on a layer called retina.

**Q. 3. Name the cells on the retina of an eye**

**(a) Which are sensitive to bright light.**

**(b) Which are sensitive to dim light.**

**Answer:** (a) Cone cell are sensitive to bright light.

(b) Rod cell are sensitive to dim light.

**Q. 4. Name any four food items (including two fruits) which are rich in vitamin A.**

**Answer:** Mango (fruit), Watermelon (fruit), green vegetable and Carrots.

**Q. 5. What is the value of the speed of light?**

**Answer:** Speed of light in vacuum is  $3 \times 10^8$  m/s.

**Q. 6. If two plane mirrors make an angle of  $60^\circ$ , how many images will you find?**

**Answer:** Given the angle between the two plane mirror =  $60^\circ$

Number of the image formed =  $\frac{360}{\text{angle between the plane mirror}} - 1$

So number of image will be =  $\frac{360}{60} - 1$

=  $6 - 1$

= 5

**Q. 7. What controls the amount of light entering the eye?**

**Answer:** The pupil regulates the amount of light entering the eye. However, the size of the pupil is controlled by the Iris. So, we can say that the iris controls and regulates the amount of light entering the eye

**Q. 8. What controls the size of the pupil?**

**Answer:** Iris control the size of the pupil.

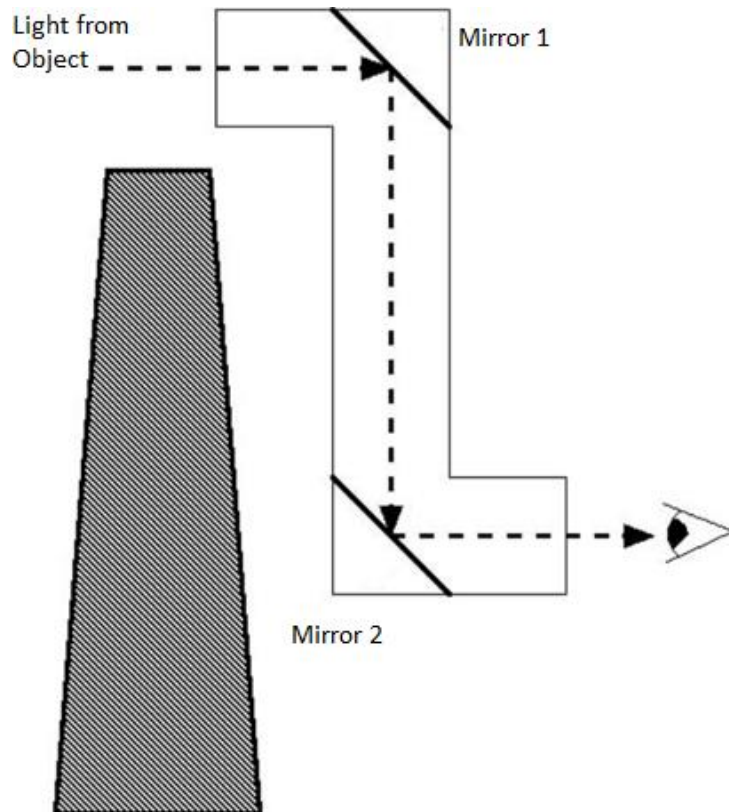
**Q. 9. Describe the functioning of the periscope. Also, tell that how many mirrors are there in a periscope.**

**Answer:** A periscope is an instrument which helps in viewing the objects which are not in the line of sight of the observer. It is used by the submarines to look at objects above the water surface.



The principle behind periscope is reflection between two parallel plane mirrors. It consists of long cylindrical hollow tube bent at right angles and two plane mirrors are kept parallel and facing each other. The mirror is fixed at 45 degrees with the framework at the top and the bottom of the tube.

Let see the simple structure of periscope –



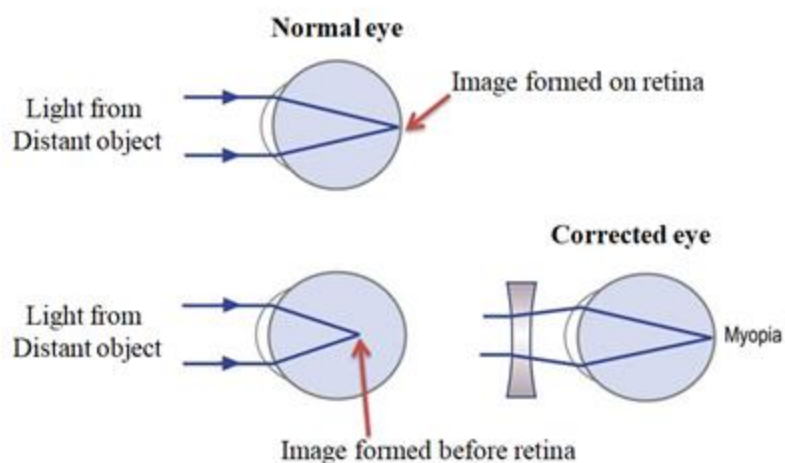
We use two mirrors in a simple periscope.

**Q. 10. Name any one defect of the eye. How is it corrected?**

**Answer:** Myopia or Nearsightedness is one defect of the eye. (A person sees near objects clearly while distant objects appear blurred)

Light from a distant object forms an image before it reaches the retina. This could be because the eye is too long, or the cornea or crystalline lens is too strong.

Let see in figure-

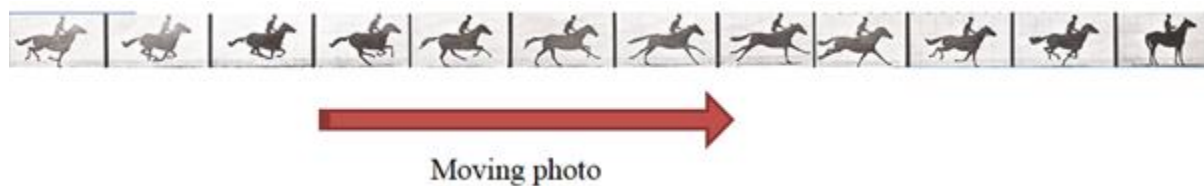


Myopia is corrected by using a concave (diverging) lens of appropriate power. Property of concave lens is to divert the light which helps in forming an image on the retina.

**Q. 11. Briefly explain the term persistence of vision.**

**Answer:** Persistence of vision is a phenomenon of the eye by which an image is thought to persist for about one-sixteenth  $\left(\frac{1}{16}\right)^{th}$  part of a second on retina after the actual image is formed.

It is the ability eyes to keep seeing the object an image for a fraction of a second after the object has disappeared from view. For example, while seeing a movie which is a collection of the frame (frame my photo). Each frame (photo) is moving so fast that our eye cannot differentiate between two consecutive photos. When the speed of frames moving is reduced to below 16 frames (photo) per second, we can easily differentiate between two consecutive images.

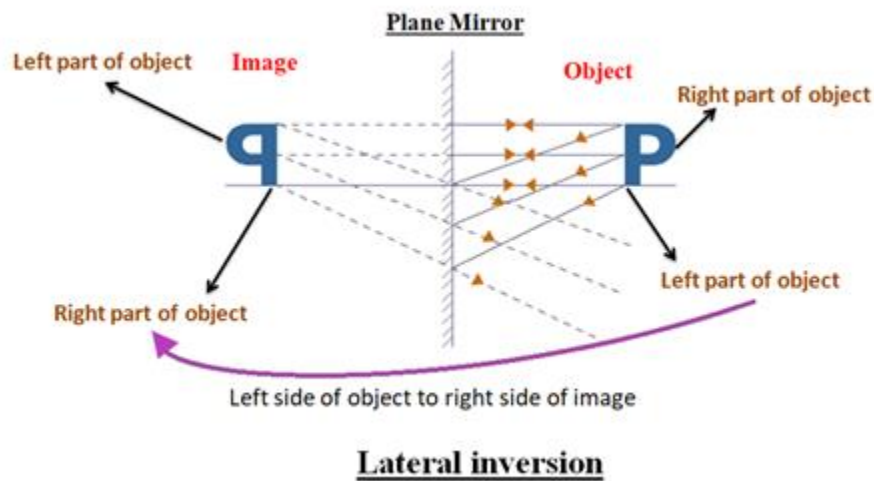


While seeing the above moving photo our eye persist as a movie clip.

**Q. 12. Explain lateral inversion with an example.**

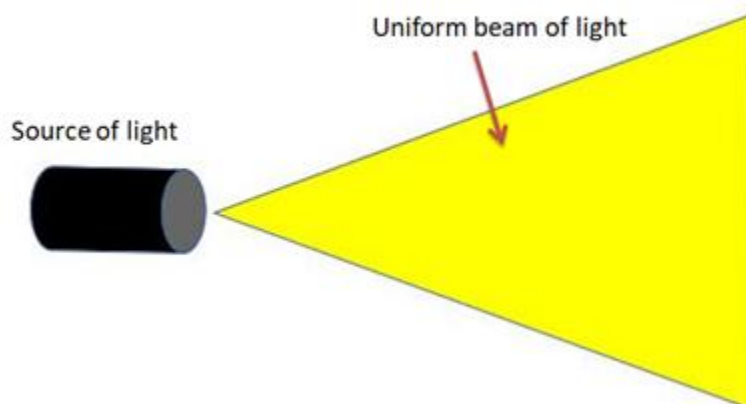
**Answer:** Lateral inversion means the reversal of image i.e. left side of the object to appear right side in image and right side of the object appear left side in the image. For example letter, 'b' and its image formed by a plane mirror is 'd' (lateral inversion).

Example:



**Q. 13. What do you mean by sources of light?**

**Answer:** Source of light means any object which continuously emits light by the natural or artificial way. For example, the SUN is a natural source of light, the bulb is an artificial source of light (convert one form of energy to light energy).

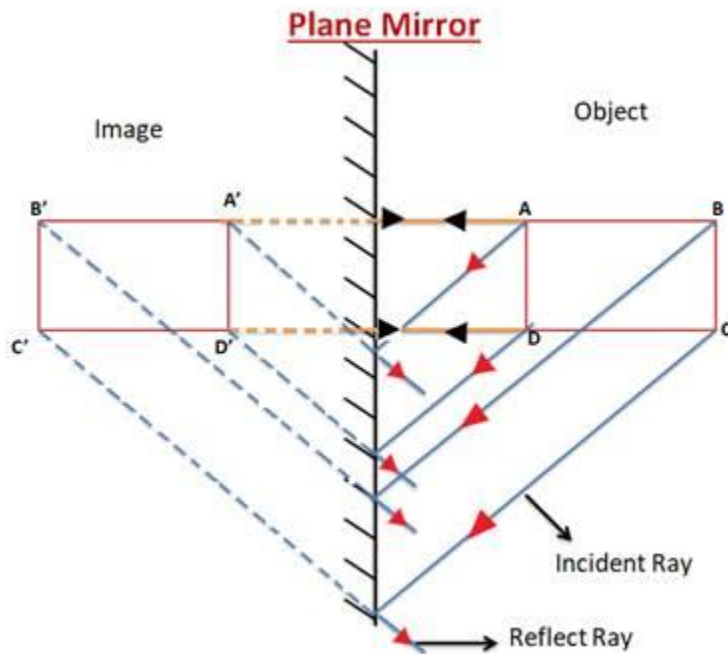


**Q. 14. How does lateral inversion occur?**

**Answer:** Lateral inversion means the reversal of image i.e. left the side of the object to appear right side in image and the right side of the object appear left side in the image.

Let suppose the object is placed in front of the plane mirror. Its image will be formed behind the mirror and front side of the object & front side of image will face each other. This is due to the lateral inversion.

Let consider an object be in a rectangle shape (ABCD)-



By seeing the image (A'B'C'D') point B' appear in the leftmost and an object point B is at right side (lateral inversion) same with all the point of the rectangle.

#### Q. 15. What are the functions of optic nerve and retina?

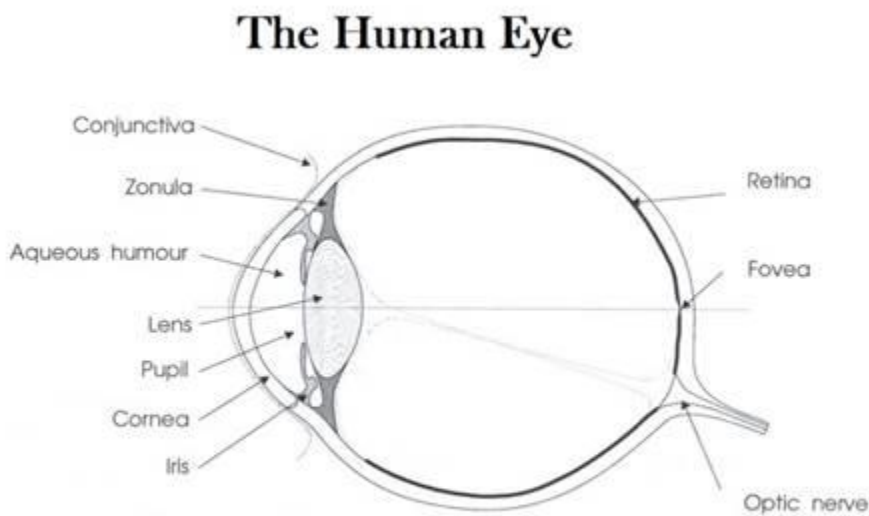
**Answer:** Optic nerve: Also called cranial nerve II (second cranial nerve). The optic nerve is present in the back of the eye. The function of the optic nerve is to transfer visual information from the retina to the vision centers of the brain. The information is carried in the form of electrical impulses.

Retina:

The retina is the membrane (tissue) that covers most of the inner surface of the eyeball. It contains hundreds of millions of light-sensitive cells, called cones and rods. Rod and cone cells are also called receptors (or photoreceptors). When a ray of light is falling on the retina, the cells present over the retina get activated and convert it into nervous signals (electrical impulse) which are transported to visual centers in the brain by the optic nerve.

#### Q. 16. Draw a diagram of the human eye.

**Answer:** Here is a diagram showing major part of human eye –



**Q. 17.A. Briefly mention, which of the following will cause regular reflection of light and which diffuse reflection of light.**

**Polished wooden table**

**Answer:** Regular reflection of light takes place.

When a ray of light fall on a surface and angle of incidence is equal to the angle of reflection (law of reflection hold true) we called regular reflection.

In case of polished wooden table law of reflection hold true because the surface is polished (smooth). Thus there will be a regular reflection.

**Q. 17.B. Briefly mention, which of the following will cause regular reflection of light and which diffuse reflection of light.**

**Chalk powder**

**Answer:** Diffuse reflection of light takes place.

When a ray of light fall (strike) on the surface of Chalk powder, reflected ray get scatted in a different direction with a different angle. So, the law of reflection doesn't hold true. Thus, diffuse reflection.

**Q. 17.C. Briefly mention, which of the following will cause regular reflection of light and which diffuse reflection of light.**

## **Cardboard**

**Answer:** Diffuse reflection of light takes place.

Surface of cardboard is not smooth. Law of reflection doesn't hold.

**Q. 17.D. Briefly mention, which of the following will cause regular reflection of light and which diffuse reflection of light.**

## **Mirror**

**Answer:** Regular reflection of light takes place.

In mirror (any type of mirror can be plane or concave or convex) law of reflection holds. So regular reflection takes place.

**Q. 17.E. Briefly mention, which of the following will cause regular reflection of light and which diffuse reflection of light.**

## **Paper**

**Answer:** Diffuse reflection of light takes place.

The surface of paper is not smooth. Law of reflection doesn't hold.

Additional information:-

If you are thinking the paper is smooth then just remember - it is impossible to write on a smooth surface. Smooth surface means no friction. So, on the surface of mirror, we can consider as friction = 0. If the paper has zero friction that implies we cannot write on the paper.

**Q. 17.F. Briefly mention, which of the following will cause regular reflection of light and which diffuse reflection of light.**

## **Marble floor with water spread over it.**

**Answer:** Regular reflection of light takes place.

The surface of the marble floor is covered with water and on the water surface law of reflection holds true.

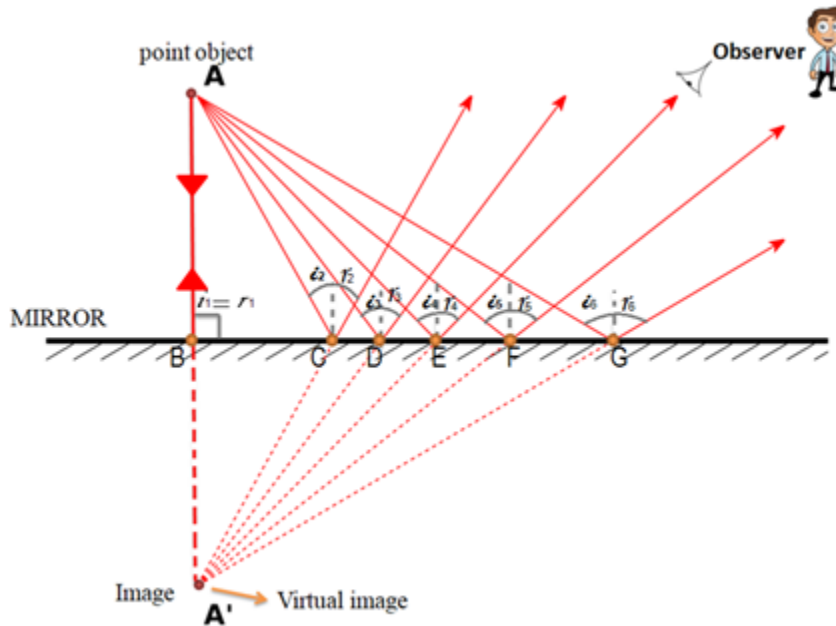
Additional information:-

When the light falls on the surface of the water some part gets reflected and some part gets refracted.

Both laws of reflection and law of refraction hold true for water.

**Q. 18. Draw a labeled diagram showing how a plane mirror an image of a point placed in front of it.**

**Answer:**



Let start drawing the diagram before start drawing we must know where the observer is placed.

Here point object is A and the ray of light from the object fall on the plane mirror. It gets reflected, here one incident ray strike at a perpendicular to the mirror and gets reflected along the same path ( $i_1=r_1=90^\circ$  at point B) and five ray strike at a different angle (point B, C, D, E, F, G). In each case, the law of reflection holds true so –

At point C  $i_2=r_2$ , at point D  $i_3=r_3$ , at point E  $i_4=r_4$ , at point F  $i_5=r_5$ , at point G  $i_6=r_6$

**Q. 19. State the characteristics of the image of the image formed in a plane mirror.**

**Answer:** Characteristics of the image –

- 1) The image formed by a plane mirror is a virtual image. (i.e. cannot be formed on a screen)
- 2) The image formed by a plane mirror is an erect image. (Upside)
- 3) Size of image and object is the same.

4) The distance between image & mirror is the same as the distance between object & mirror.

5) The image formed is a laterally inverted image i.e., right-hand side of the object seems to be the left-hand side and vice-versa.

Now extend all the reflected ray in the backward direction. The point (A') where all the line meet is called Image point (A').

The image formed by a plane mirror is virtual means we cannot take on a screen. (We cannot place screen behind the mirror)

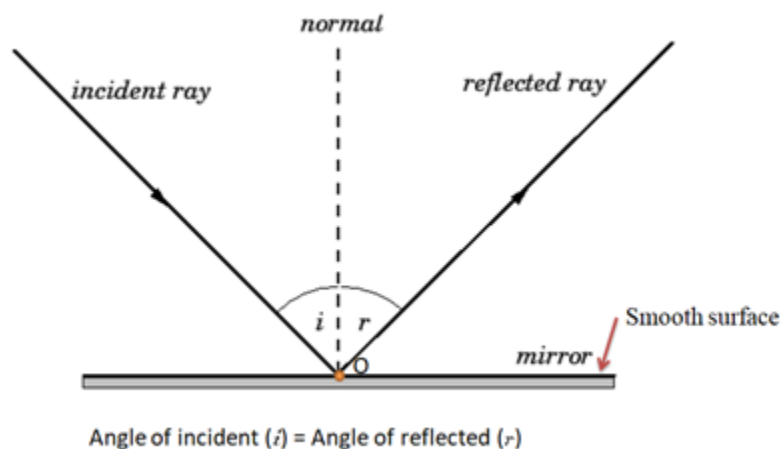
**Q. 20. Explain the laws of reflection with the help of a diagram.**

**Answer:** According to Law of Reflection,

1- The angle of the incident light ray is equal to the angle of the reflected light ray:-

When a ray of light strikes on the smooth surface it gets reflected. We draw a perpendicular line at the point of incidence, this line is called normal ray. The angle between the incident ray and normal ray is called angle of incident and angle between the reflected ray and normal ray is called angle of reflection. Both the angle is equal.

2- The incident ray, the normal ray at the point of incidence and the reflected ray all lie in the same plane. (The same plane means the same side of the mirror)



In the above figure, at point O all the three rays normal, incident and reflected are coinciding i.e. lies in the same plane.