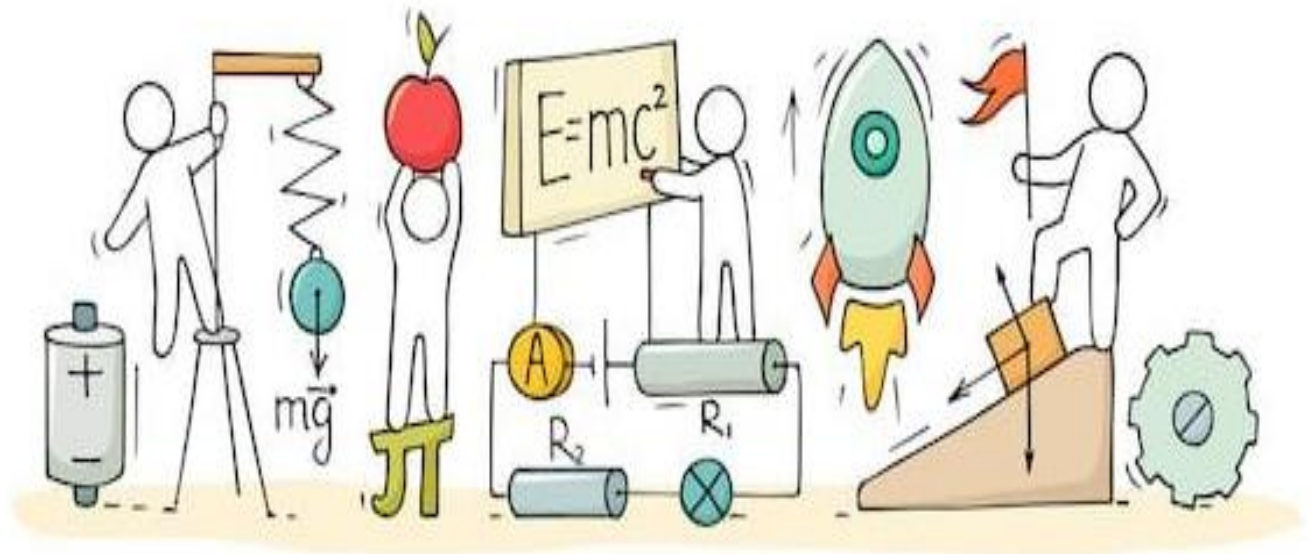


# SCIENCE

## Chapter 16: Light



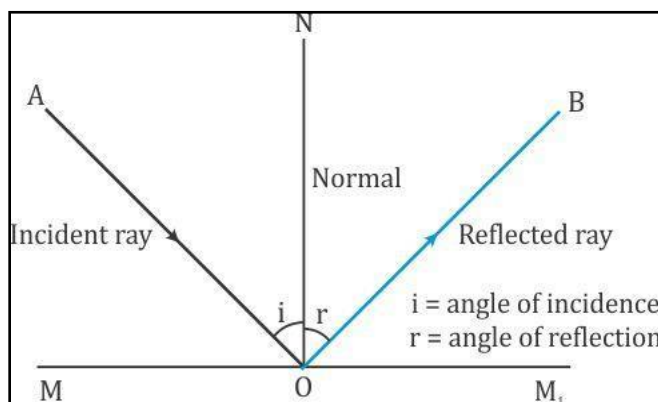
# Light

## Light

- Light is a form of energy.
- It helps us see different colourful objects around us.
- The natural source of light is the Sun.
- We see objects around us because light is either emitted by objects or reflected from objects and enters our eyes.
- Luminous objects give or emit light of their own. Example: Sun
- Non-luminous objects reflect light. Examples: Moon, mirrors

## Reflection

- It is the process where the incident light on an object bounces back into the same medium.
- All objects reflect light incident on them to different extents.
- Objects which have a smooth surface reflect the incident light to the maximum extent.
- An object which reflects 100% of the incident light is called a mirror.
- A mirror changes the direction of light which falls on it.
- The light ray which falls on a mirror is called the incident light ray.
- The ray which gets reflected from the surface is called the reflected light ray.
- The point where the incident ray strikes the reflecting surface is called the point of incidence.
- A line drawn perpendicular to the mirror at the point of incidence is called the normal.
- The angle between the normal and the incident ray is known as the angle of incidence ( $i$ )



- The angle between the normal and the reflected ray is known as the angle of reflection ( $r$ )

### Laws of Reflection

- The angle of incidence is equal to the angle of reflection.
- The incident ray, the reflected ray and the corresponding normal all lie in a plane.

## Lateral Inversion

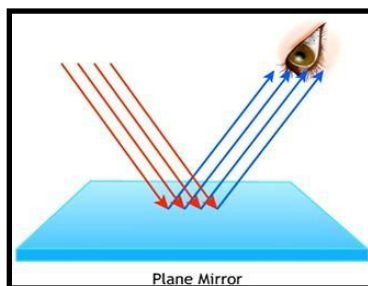
- Lateral inversion is the effect produced by a plane mirror in reversing images from left to right, i.e. the right part of an object appears to the left in its image, and the left part of the object appears to the right.



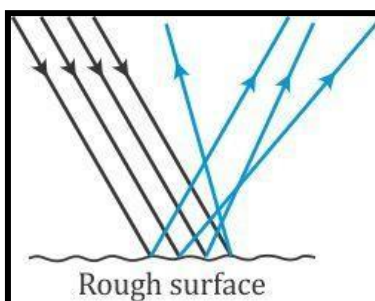
## Regular and Diffused Reflection

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- Light rays are visualized as parallel rays.
- If the reflected rays from a surface are parallel, then the reflection is termed regular reflection.  
Example: Reflection from a plane mirror



- If the surface is not a plane surface, then the reflected rays are not parallel to each other and the reflection is called diffused reflection or irregular reflection.



## Multiple Reflection

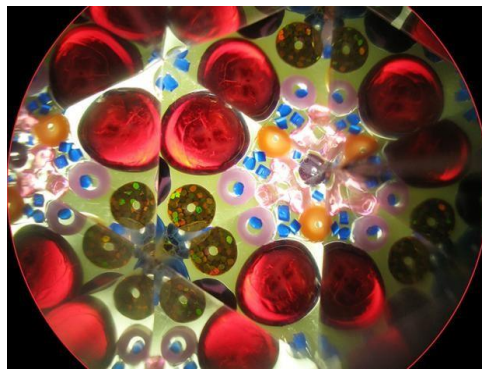
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- If a reflected light ray is reflected again on being incident on another surface, it is termed multiple reflection.
- Multiple reflection is used in periscopes.
- Periscopes are used in submarines, war tanks and by soldiers in bunkers to see objects

which are not visible directly.



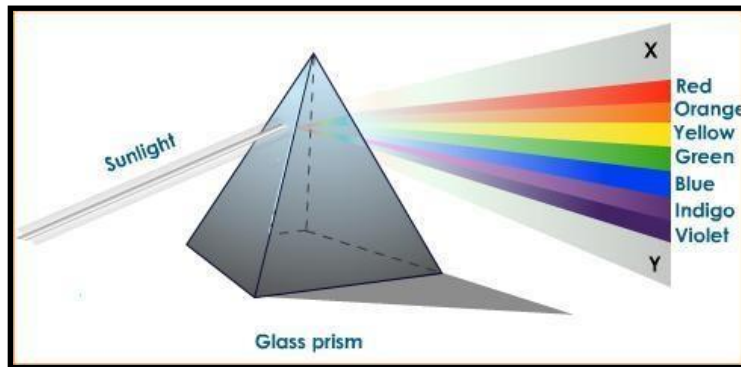
- Multiple reflection is also seen in kaleidoscopes.



## Sunlight–White or Coloured

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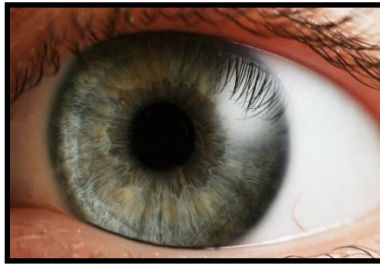
- A rainbow is arch-shaped and appears after the rain in the morning or evening when the Sun is low in the sky.
- It is formed when sunlight passes through tiny prism-like water droplets and splits into different colours. This indicates that sunlight is made of different coloured lights.
- The order of colours from the lower end is violet, indigo, blue, green, yellow, orange and red, i.e. VIBGYOR.
- The phenomenon of splitting of a beam of white light into its constituent colours on passing through a prism is called the dispersion of light.



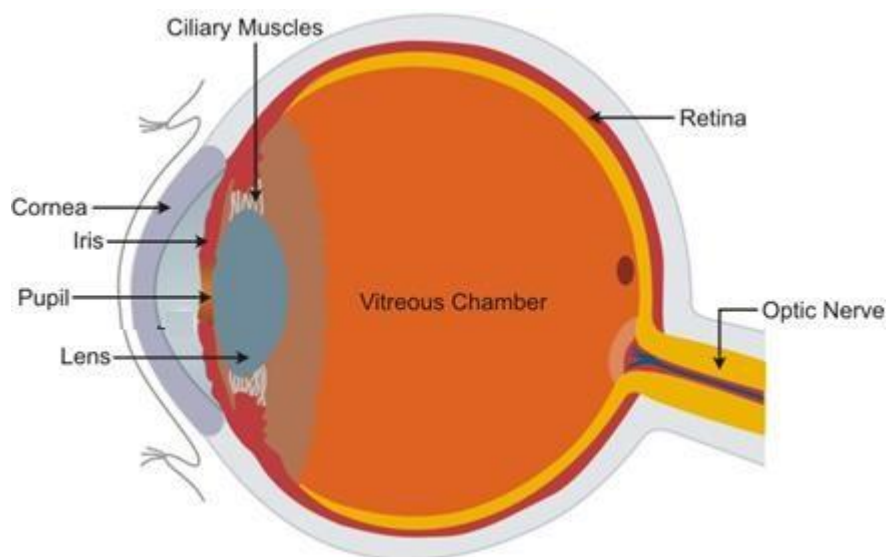
## Light and Eyes

### The Human Eye

- We see objects around us with our eyes.
- The eye is an important sense organ and is roughly spherical.



- Its transparent front part is called the cornea.
- Behind the cornea, there is a dark muscular structure called the iris.
- In the Iris, there is a small opening called the pupil. The iris controls the size of the pupil. It also controls the amount of light entering the eye.
- The iris also provides colour to the eyes.



- Behind the pupil, the eye has a lens, which is thicker in the centre.
- The lens focuses the light on the retina, which has several nerve cells.
- The nerve cells carry the sensations to the brain through the optic nerve.
- It contains two types of cells:
  - ✓ Cones are sensitive to bright light and distinguish the colour of an object.
  - ✓ Rods are sensitive to dim light.
- The small region where the optic nerve and the retina meet has no sensory cells. This region is called the blind spot.
- The impression of an image does not vanish immediately from the retina. It persists there for about  $1/16^{\text{th}}$  of a second.
- The eye lids protect the eye from dust.
- The eye has the ability to form a clear image of a near and far object, and it is called its power of accommodation.

## Taking Care of the Eyes

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- If advised by a doctor, use suitable spectacles.
- Too little or too much light is bad for the eyes. Do not look at the Sun or a powerful light directly.
- Never rub your eyes if any dust particles go into them. Wash your eyes with clean water.
- Always read at the normal distance for vision. Do not read by bringing the book too close or by keeping it too far.
- Eat a well-balanced diet. It should include vegetables and fruits which are rich in Vitamin A such as raw carrots, broccoli, spinach, papaya and mango. Cod liver oil can be taken as a Vitamin A supplement.

## Defects of Human Eye

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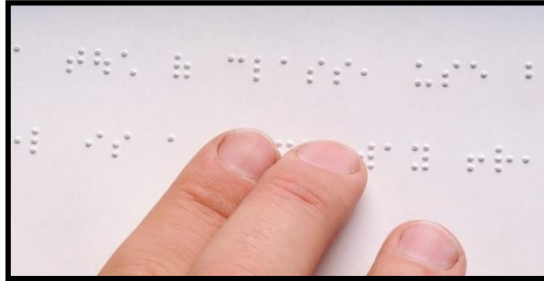
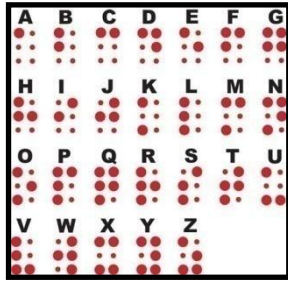
- For a normal eye, the distance for clear vision is 25 cm. This distance differs from person to person and varies with age.
- Some people see near objects clearly and some see distant objects clearly.
- The defects can be corrected using suitable corrective lenses.
- Eyesight of people becomes foggy in their old age, and objects appear dim because of cataract.

## Visual Impairment

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- Some people, including children, are visually handicapped, i.e. they have very limited vision and some have no vision, since birth.
- Visually handicapped people develop their other senses more sharply. They use Braille to

read and communicate.



- Braille was developed in 1821 by Louis Braille, a visually challenged person.

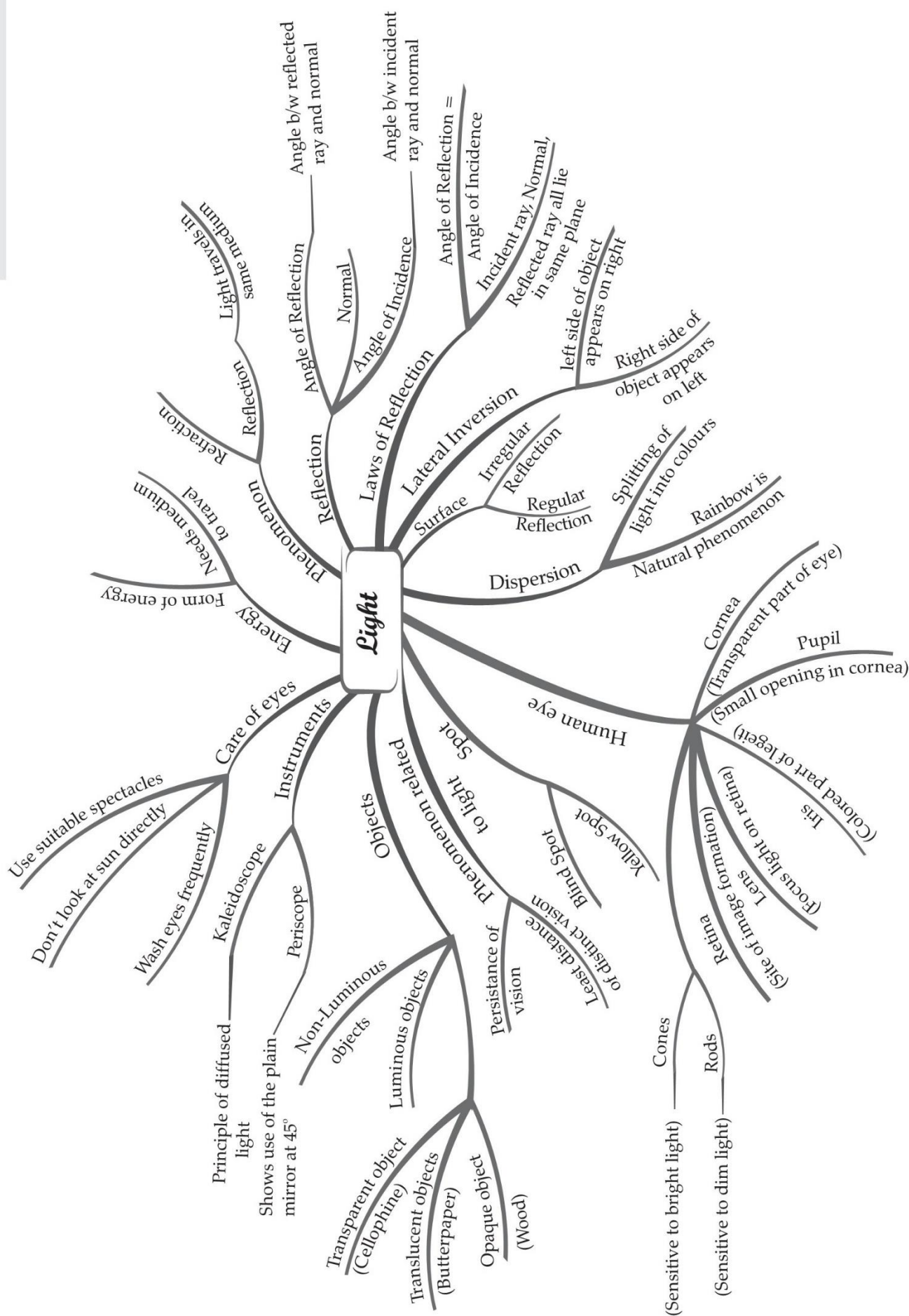


- This system was adopted in 1932. Braille code is used for common languages, Mathematics and scientific notations.
- Many Indian languages can be read using the Braille system. It has dot patterns or characters, and each character represents a letter or a combination of letters, a common word or a grammatical sign.



# MIND MAP : LEARNING MADE SIMPLE

## CHAPTER-13





# Important Questions

## Multiple Choice Questions-

Question 1. A smooth shining surface, which rebounds the light back in same or in different direction, is called

- (a) a mirror
- (b) a lens
- (c) reflection of light
- (d) point of incidence

Question 2. Beam of light striking the reflecting surface is called

- (a) reflecting ray
- (b) incident ray
- (c) refracted ray
- (d) normal ray

Question 3. Band of seven colours is called

- (a) VIBGYOR
- (b) spectrum
- (c) dispersion
- (d) reflection

Question 4. Front bulged part of the eyeball is called

- (a) cornea
- (b) choroid
- (c) pupil
- (d) retina

Question 5. Which one of the following statements is correct regarding rods and cones in the human eye?

- (a) Cones are sensitive to dim light
- (b) Cones are sensitive to bright light
- (c) Rods are sensitive to bright light
- (d) Rods can sense colour

Question 6. In case of reflection of light, the angle of incidence (i) and the angle of reflection (r) are related as

- (a)  $i = r$
- (b)  $i < r$
- (c)  $i > r$
- (d) no definite relation

Question 7. Name the type of mirror used as a backview mirror.

- (a) Plane mirror
- (b) Concave mirror
- (c) Convex mirror
- (d) Any of these

Question 8. Visually impaired people can read and write using

- (a) electronic writer
- (b) digital pens
- (c) braille system
- (d) hearing aids

Question 9. The image formed by a camera and a simple microscope are respectively

- (a) real and real
- (b) real and virtual
- (c) virtual and virtual
- (d) virtual and real

Question 10. What is the angle of incidence of a ray if the reflected ray is at an angle of  $90^\circ$  to the incident ray?

- (a)  $60^\circ$
- (b)  $45^\circ$
- (c)  $90^\circ$
- (d)  $180^\circ$

Question 11. The splitting of white light into its seven constituent colours is called

- (a) refraction

- (b) dispersion
- (c) deviation
- (d) reflection

Question 12. The defect due to which a person is not able to see the distant objects clearly:

- (a) Myopia
- (b) Hypermetropia
- (c) Cornea
- (d) Cataract

Question 13. The amount of light entering the eye is controlled by

- (a) eye lens
- (b) cornea
- (c) iris
- (d) ciliary muscle

Question 14. Myopia can be corrected by using a

- (a) concave lens
- (b) convex lens
- (c) opaque lens
- (d) micro lens

Question 15. Light enters the eye through

- (a) eye lens
- (b) pupil
- (c) cornea
- (d) retina

### Very Short Questions :

1. What makes things visible?
2. Can you see an object in the dark?
3. What is mirror?
4. What kind of image is formed by a plane mirror?
5. Where is the image formed by a plane mirror?

6. Where does the image form in our eye?
7. Where is no image formed?
8. For what time the image stays on the retina?
9. Which bird is called night bird?
10. Which surface shows regular reflection?

### Short Questions :

1. Define light. Discuss its importance.
2. Why we are not able to see any object in the dark?
3. Why the image formed by concave mirror is sometimes real, while sometimes virtual?
4. Why convex mirrors are used in vehicles?
5. Explain the two laws of reflection.
6. What kind of image is formed by a plane mirror?
7. What do you mean by lateral inversion?
8. "Reflected light can be reflected again". Give an example to justify this statement.
9. Explain all parts of a human eye.
10. Explain the function of retina of eyes.

### Long Questions :

1. Write a short note on Braille system.
2. Explain the phenomenon of dispersion of light.
3. Write a note on 'The Human Eye'
4. Write the ways to protect your eyes.
5. Explain some common eye defects in human.

## ANSWER

### MCQ Answer:

1. Answer: (a) a mirror
2. Answer: (b) incident ray
3. Answer: (b) spectrum
4. Answer: (a) cornea
5. Answer: (b) Cones are sensitive to bright light
6. Answer: (a)  $i = r$
7. Answer: (c) Convex mirror

8. Answer: (c) braille system
9. Answer: (b) real and virtual
10. Answer: (b)  $45^\circ$
11. Answer: (b) dispersion
12. Answer: (a) Myopia
13. Answer: (c) iris
14. Answer: (a) concave lens
15. Answer: (c) cornea

### Very Short Answer:

1. Answer: Light.
2. Answer: No.
3. Answer: A smooth and shiny surface is called a mirror.
4. Answer: Virtual and erect image.
5. Answer: Behind the mirror.
6. Answer: At Retina.
7. Answer: Blind spot.
8. Answer: About  $1/16$ th of a second.
9. Answer: Owl is called night bird.
10. Answer: Smooth or regular surface.

### Short Answer :

1. Answer: Light is an electromagnetic radiation that is visible to the human eye, and is responsible for the sense of sight. Visible light has a wavelength in the range of about 380 nanometres to about 740 nm between the invisible infrared.
2. Answer: We can see any object when light reflected by that object reaches our eyes, but in dark room no light is reflected by the object thus we are not able to see in the dark.
3. Answer: In case of concave mirror the image depends upon the distance of the object from the mirror. If the object is beyond the focus then real image is formed and if the object is closer than the focus then virtual image is formed
4. Answer: Convex mirrors are used in vehicles because the image formed by convex mirror is always erect and smaller in size.
5. Answer: There are two laws of reflection: the angle of incidence is equal to the angle of reflection and incident rays, reflected rays and normal rays drawn at the point of incidence to the reflecting surface lies in the same plane.
6. Answer: Image formed by plane mirror is virtual, upright and of the same shape and size as

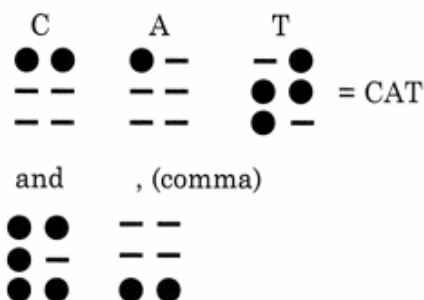
of the object.

7. Answer: Lateral inversion is the reversal experienced by the image formed in a flat mirror. Although the image is the correct way up, its left and right sides are transposed.
8. Answer: Sit in front of a mirror, tell your friend to hold a mirror behind you to see your hair cut, your hair image will be shown in the mirror in front of you, this is the best example of reflected light can be reflected again.
9. Answer: The eye has roughly spherical surface. The outer coat of eyes is white and tough to protect the interior of eyes from any kind of accident. Its transparent front part is called cornea, behind the cornea there is a dark muscular structure called iris. In the iris there is small opening called pupil. The size of the pupil is controlled by the iris, the iris control the amount of light entering into the eye.
10. Answer: The lens focuses light on the retina which contains several nerve cells. Sensations felt by the nerve cells are then transmitted to brain through the optic nerve.

### Long Answer:

#### 1. Answer:

The most popular resource for visually challenged persons is Braille. Braille system was developed by Louis Braille. He himself was a visually challenged person. There is Braille code for common languages, mathematics and scientific notation. Many Indian languages can be read using the Braille system.



► Fig. 16.26

Braille system has 63 dot patterns or characters. Each character represents a letter, a combination of letters, a common word or a grammatical sign. Dots are arranged in cells of two vertical rows of three dots each. Patterns of dots to represent some English letters and some common words are shown in Fig. 16.26.

These patterns when embossed on Braille sheets help visually challenged persons to recognise words by touching. To make them easier to touch, the dots are raised slightly. Visually challenged people learn the Braille system by beginning with letters, then special characters and letter combinations. Methods depend upon recognition by touching. 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.

#### 2. Answer:

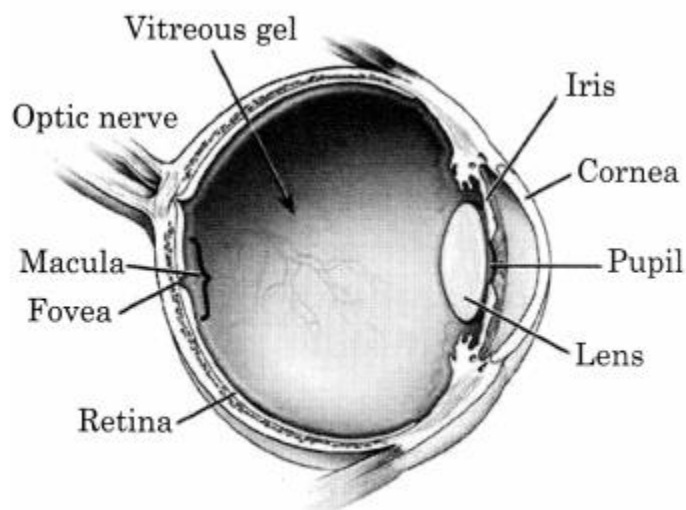


Dispersion is defined as the phenomenon of splitting of white light into different colours on passing through a transparent medium such as prism. When white light is passed through a prism, it splits into seven colours. It is observed that the colours are in the following order:

Violet (V), Indigo (I), Blue (B), Green (G), Yellow (Y), Orange (O) and Red (R). The order of colours can be remembered by the acronym VIBGYOR. This coloured band is called spectrum of white light.

### 3. Answer:

Eye is a sense organ that enables us to see the world around us. It is roughly spherical in shape



► Fig. 16.27 Human eye

- The first part that is bulged outward is called 'cornea. It protects the eye.
- Behind the cornea, the coloured part of the eye, iris is present. It controls the size of the pupil.
- Pupil is a small opening in the cornea which allows the light to enter the eye.
- Behind the iris, eye lens is present which is a convex lens. It focus the image on retina, by bending the light rays.
- Retina is the inner back surface of the eye which acts as a screen to form image. It is sensitive to light.
- The sensation of the image formed on the retina is carried to the brain by the optic nerve.
- Optic nerve is connection between the eye and the

### 4. Answer:

Eyes are very delicate organ that enable us to see this colourful world. Thus, we must protect our eyes and take proper care of them.

Following are the ways to protect the eye:

- Always sit straight while reading or writing.

- Never read while walking or lying down.
- Wash your eyes frequently with clean water.
- Never read in the dim or too much bright light.
- Never rub your eyes with hands.
- Never bring the book too close to your eyes.
- Eat foods rich in vitamin A.

## 5. Answer:

Some eye diseases are:

(i) Cataract: A cataract is a clouding of the lens in the eye leading to a decrease in vision. It can affect one or both eyes. Often it develops slowly. Symptoms may include faded colours, blurry vision, halos around light, trouble with bright lights, and trouble seeing at night. This may result in trouble driving, reading, or recognising faces. Cataracts are the cause of half of blindness and 33% of visual impairment worldwide. Cataract is treated by replacing the opaque lens with a new artificial lens.

(ii) Myopia: Near-sightedness or myopia, is the most common refractive error of the eye. Myopia occurs when the eyeball is too long, relative to the focusing power of the cornea and lens of the eye. This causes light rays to focus at a point in front of the retina, rather than directly on its surface. It can be corrected using spectacles made of concave lens.

(iii) Hypermetropia: Hypermetropia or long-sightedness occurs when eyeball is too short or the cornea or crystalline lens does not refract the light enough. This lead to formation of the image of a nearby object behind the retina. A hypermetropic person may have blurred vision when looking at objects close to them, and clearer vision when looking at objects in the distance. By placing a convex (plus powered) lens in front of a hypermetropic eye, the image is moved forward and focuses correctly on the retina.

(iv) Astigmatism: It is a defect in the eye or in a lens caused by a deviation from spherical curvature, which results in distorted images, as light rays are prevented from meeting at a common focus. It can be corrected by using a convex lens or concave lens or both.