



## CHAPTER- 16

### LIGHT

#### SOLUTIONS:

#### EXERCISES

Q1. Suppose you are in a dark room. Can you see the object in the room? Can you see objects outside the room? Explain.

Ans: Eye alone cannot see any object. It is only when light from the object enters our eye that we see the object. The light may have been emitted by the object or may have been reflected by it. Thus, we cannot see an object which is placed in a dark room if it does not emit light of its own. We can see objects outside the dark room if there is light or the object emits its own light.

Q2. Differentiate between regular and diffused reflection. Does diffused reflection mean the failure of the laws of reflection?

Ans:

| Sl. No | Regular reflection                        | Diffused reflection                           |
|--------|---|---|
| 1      | Occur from smooth surface                 | Occur from rough or irregular surface         |
| 2      | Reflected rays are parallel to each other | Reflected rays are not parallel to each other |

Diffused reflection does not mean the failure of the laws of reflection. It is caused by the irregularities in the reflecting surface.

Q3. Mention against each of the following whether regular or diffused reflection will take place when a beam of light strikes. Justify your answer in each case.

- a) Polished wooden table    b) Chalk powder    c) cardboard surface  
d) Marble floor with water spread over it    e) Mirror    f) Piece of paper

Ans.

- a) Polished wooden table: Regular reflection will take place because it will have a plane surface.  
b) Chalk powder: Diffused reflection because it has uneven surface.  
c) Cardboard surface: Diffused reflection because it has rough surface.  
d) Marble floor with water spread over it: Regular reflection as it will act like a plane surface.  
e) Mirror: Regular reflection because mirror has a shiny even surface.  
f) Piece of paper: Diffused reflection because it has uneven surface.

Q.4 State the law of reflection

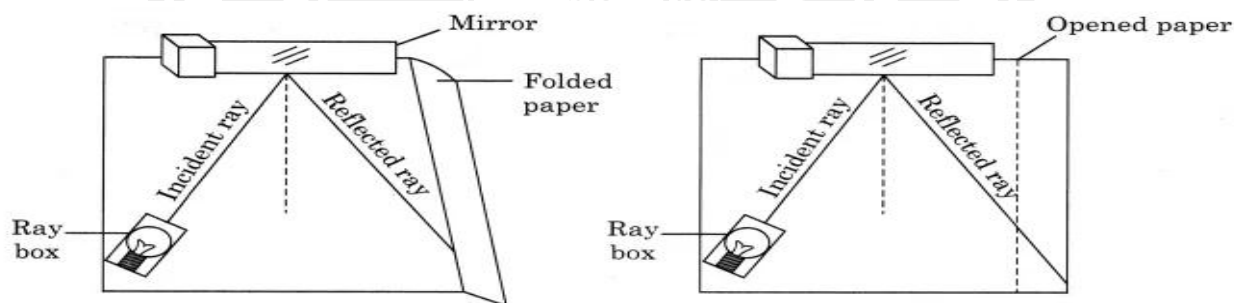
Ans. The two law of reflection are:

- 1) The incident ray, the normal at the point of incidence and reflected ray all lie in the same plane.
- 2) The angle of incident is always equal to the angle of reflection.

Q5. Describe an activity to show that the incident ray, the reflected ray and the normal at the point incidence lie on the same plane.

Ans. For this activity take a chart paper or stiff paper. Let the sheet of stiff paper project a little beyond the edge of the table. Cut the projecting portion of the sheet in the middle. Look at the reflected ray. Make sure that the reflected ray extends to the projected portion of the portion. Bend that part of the projected portion on which the reflected ray falls. Bring the paper back to the original position.

When the whole sheet of paper is spread on the table, it represents one plane. The incident ray, the normal at the point of incidence and the reflected ray are all in this plane. When you bend the paper you create a plane different from the plane in which the incident ray and the normal lie. Then you do not see the reflected ray. It indicates that the reflected, the normal at the point of incidence and the reflected ray all lie in the same plane.



Q6. Fill in the blanks in the following

- a) A person 1m in front of a plane mirror seems to be ..... in always from his image.
- b) If you touch your.....Ear with right hand in front of a plane mirror, it will be seen in the mirror that your right ear is touched with.....
- c) The size of the pupil becomes..... when you see in dim light.
- d) Night birds have ..... cones than rods in their eyes.

Ans. a) 2m    b) left, left hand    c) large    d) lesser (fewer)

Q7. Angle of incidence is equal to the angle of reflection.

- a) Always
- b) Sometimes
- c) Under special conditions
- d) Never

Ans. a) Always

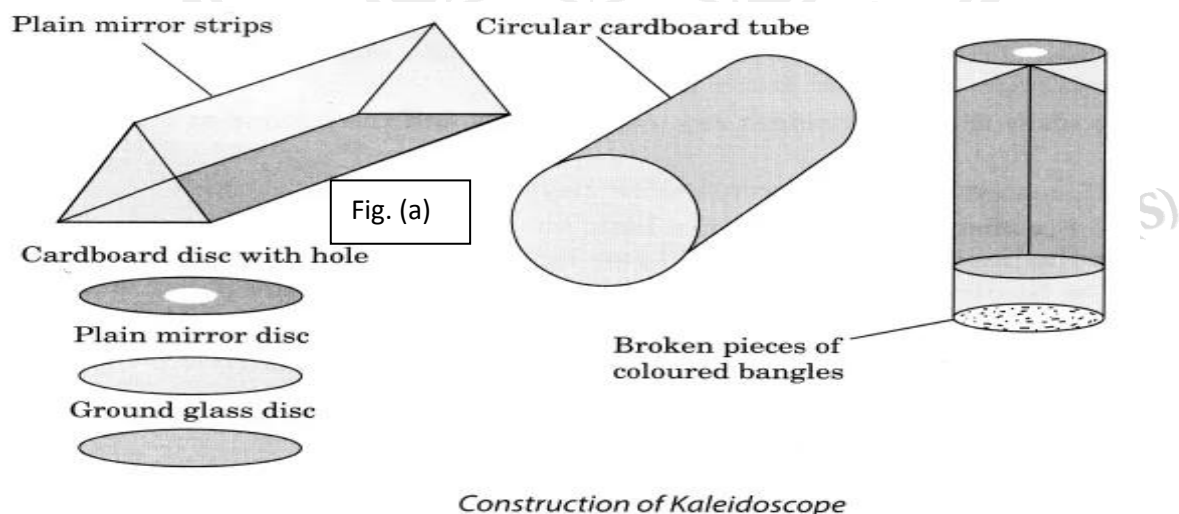
Q8. Image formed by plane mirror is

- a) virtual, behind the mirror and enlarged.
- b) virtual, behind the mirror and of the same size as the object.
- c) real at the surface of the mirror and enlarged.
- d) real, behind the mirror and of the same size of the object.

Ans. b) Virtual, behind the mirror and of the same size as the object.

Q9. Describe the construction of a Kaleidoscope

Ans: Kaleidoscope is made up of three rectangular mirror strips each about 15cm long and 4 cm wide. Join them together to form a prism as shown in Fig.(a). Fix this arrangement of mirrors in a circular cardboard tube or tube of a thick chart paper. Make sure that the tube is slightly longer than the mirror strips. Close one end of the tube by a cardboard disc having a hole in the centre, through which you can see. To make the disc durable, paste a piece of transparent plastic sheet under the cardboard disc. At the other end, touching the mirrors, fix a circular plane glass plate. Place on this glass plate several small pieces of coloured glass ( broken pieces of coloured bangles). Close this end of the tube by a ground glass plate. Allow enough space for the colour pieces to move around.



Q10. Draw a labelled sketch of the human eye.

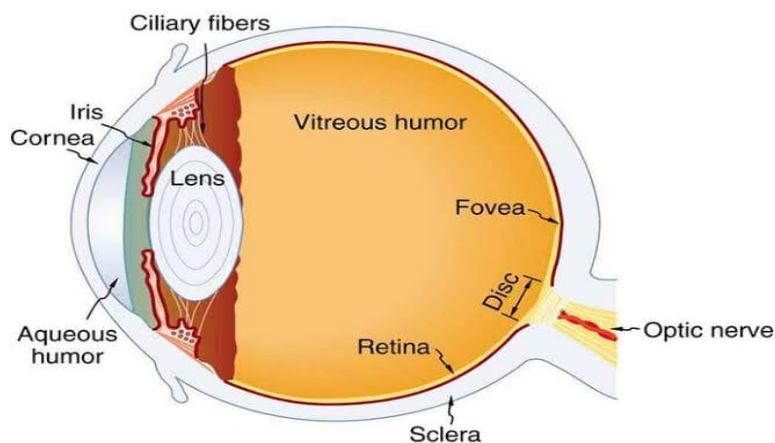


Fig. Human eye

Q11. Gurmit wanted to perform activity 16.8 using a laser torch. Her teacher advised her not to do so. Can you explain the basis of teacher's advise?

Ans. Laser light is harmful for eye and can cause a permanent defect in the eye. She can lose her eye-sight also. So the teacher advised Gurmit not to perform the activity using a laser torch.

Q12. Explain how you can take care of your eyes.

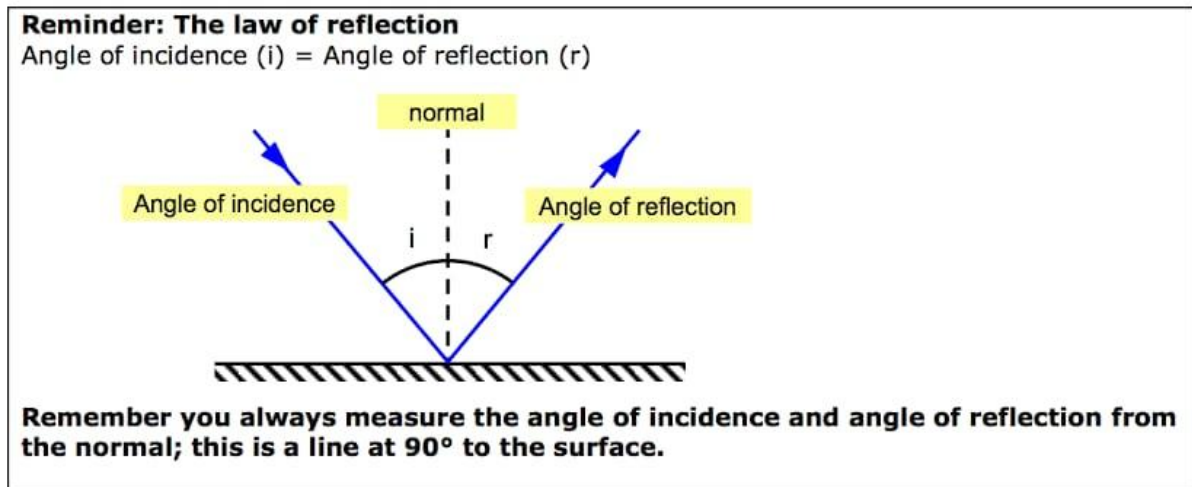
Ans: It is necessary that we take proper care of our eyes. If there is any problem we should go to an eye specialist. We should have a regular checkup. If advised, use suitable spectacles. Too little or too much light is bad for eyes. Insufficient light causes eye strain and headaches. Too much light, like that of the sun, a powerful lamp or a laser torch can injure the retina. Do not look at the sun or a powerful light directly. Never rub your eye. If the particular of dust go into your eyes, wash your eye with clean water. If there is no improvement, go to a doctor. Always read at the normal distance for vision. Do not read by bringing the book too close to your eyes or keeping it too far.



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Q13. What is the angle of incidence of a ray if the reflected ray is at an angle of 90 degree to the incident ray?

Ans.



Given that  $\angle i + \angle r = 90^\circ$  .....(a)

We know that  $\angle i = \angle r$

Replacing  $\angle r$  in the equation (a) with  $\angle i$ ,

$$\angle i + \angle i = 90^\circ$$

$$\text{Or } 2\angle i = 90^\circ$$

$$\text{Or } \angle i = 90^\circ / 2 = 45^\circ$$

The angle of incidence ray will be  $45^\circ$

Q14. How many images of a candle will be formed if it is placed between two parallel plane mirrors separated by 40 cm?

Ans. Infinite number of images will be formed.

Q15. Two mirrors meet at right angles. A ray of light is incident on one at an angle of 30 degree as shown in fig 16.19. Draw the reflected ray from the second mirror.

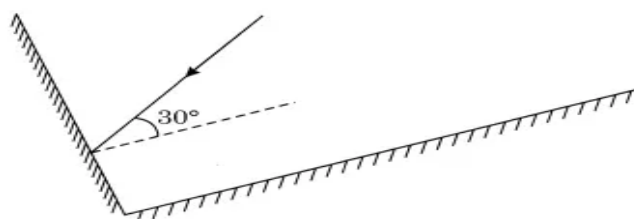


Fig.16.19

Ans.

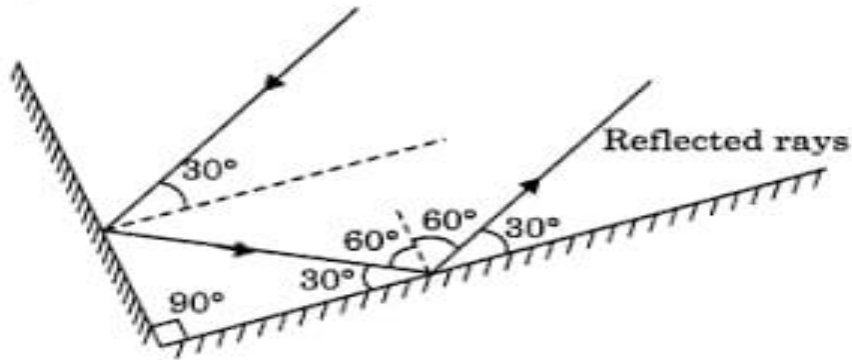
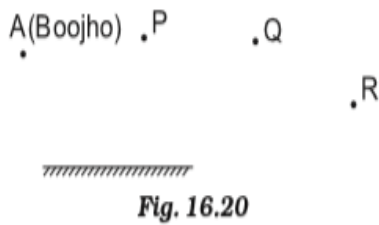
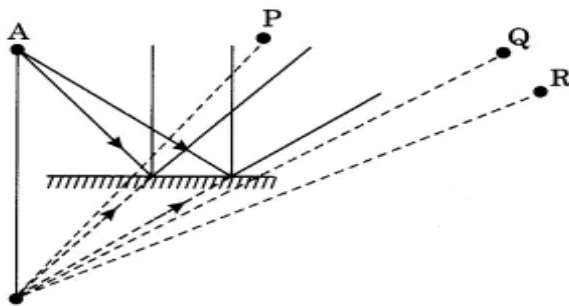


Fig.16.19

Q16. Boojho stands at 'A' just on the side of a plane mirror as shown in fig 16.20. Can he see himself in the mirror? Also can he see the image of objects situated at P, Q and R?



Ans: No, he cannot see his image himself. He can see only the image of P but not of Q and R.



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Q17. a) Find out the position of the image of an object situated at A in the plane mirror (fig: 16.21)

- b) Can Paheli at B see this image?
- c) Can Boojho at C see this image?
- d) When Paheli moves from B to C, where does the image A move?

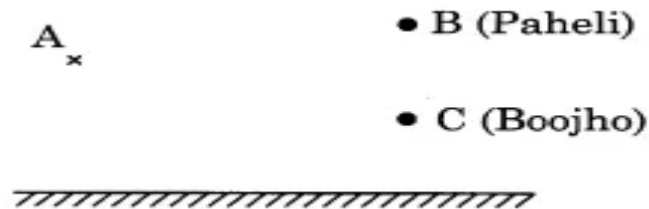


Fig.16.21

Ans. (a) Image of an object placed at A is formed behind the mirror. The distance of the image from the mirror is equal to the distance of A from the mirror.

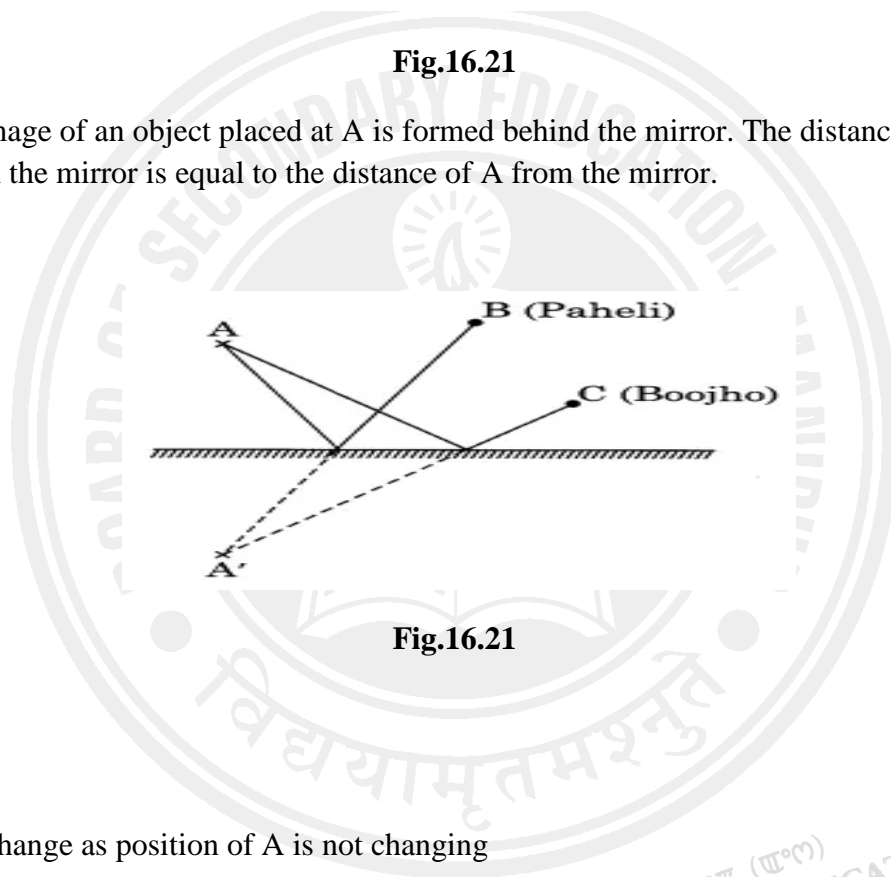


Fig.16.21

- b) Yes
- c) Yes
- d) No change as position of A is not changing



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## **EXTRA QUESTIONS AND ANSWERS:**

Q1. What makes things visible?

Ans- When light coming from an object enters our eyes then we can see that object. It is light which makes things visible. Light enables us to see things from which it comes or from which it is reflected.

Q2. What is incident ray?

Ans – The light ray, which strikes any surface is called the incident ray.

Q3. What is reflected ray?

Ans- The ray that comes back from the surface after reflection is known as the reflected ray.

Q4. What are angle of incidence ( $\angle i$ ) and angle of reflection ( $\angle r$ )?

Ans. The angle between the normal and incident ray is called the angle of incidence ( $\angle i$ ) and the angle between the normal and the reflected ray is known as the angle of reflection ( $\angle r$ ).

Q5. What are the characteristics of image formed by plane mirror?

Ans. The characteristics of image formed by plane mirror are-

- i. Plane mirror forms erect image.
- ii. Image formed is of the same size as the object.
- iii. The distance of image from the mirror is equal to the distance of object from the mirror.
- iv. Virtual image is formed and cannot be obtained on the screen.
- v. Image is laterally inverted.

Q6. Define the following terms.

- a. Lateral inversion      b. Illuminated objects      c. Luminous objects.

Ans.

- a. Lateral inversion : In an image formed by a mirror the left of the object appears on the right and the right appears on the left. This is known as lateral inversion.
- b. Illuminated objects: The objects, which shine in the light of other objects are called illuminated objects.
- c. Luminous objects: The objects, which emit their own light are called luminous objects.



Q7. Draw a ray diagram to explain the formation of a virtual image in a plane mirror.

Ans

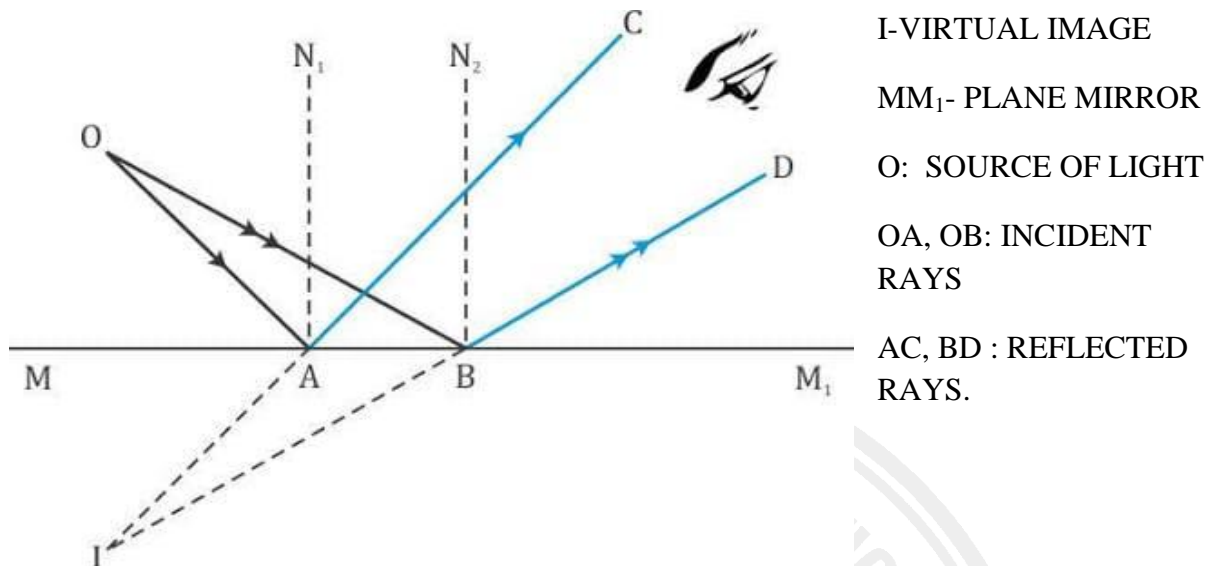


Fig. Image formation in a Plane mirror

Q8. What is dispersion of light?

Ans- Splitting of light into its constituent colours is known as dispersion of light.

Q9. Explain the internal structure of human eye and also discuss the formations of various parts of the eye.

Ans. The eye has a roughly spherical shape. The outer coat of the eye is white. It is tough so that it can protect the interior of the eye from accidents. Its transparent front part is called cornea. Behind the cornea, we find a dark muscular structure called iris. In the iris, there is a small opening called the pupil. The size of the pupil is controlled by the iris. The iris is that part of eye which gives it its distinctive colour. The iris controls the amount of light entering into the eye. Behind the pupil of the eye is a lens which is thicker in the centre. The lens focuses light on the back of the eye, on a layer called retina. The retina contains several nerve cells. Sensation felt by the nerve cells are then transmitted to the brain through the optic nerve.

Q10. How many kinds of nerve endings are found in human eyes? What are their functions?

Ans. There is two kinds of nerve endings. They are

- i. Cones which are sensitive to bright light and
- ii. Rods which are sensitive to dim light.

Q11. What is the comfortable distance at which one can read with a normal eyes?

Ans. 25cm

Q12. Why in old age the eye sight becomes foggy? How can this defect be removed?

Ans. In old ages, eye sight becomes foggy. It is due to the eye lens becoming cloudy. The persons are said to have cataract. There is a loss of vision sometimes extremely severe. This defect can be treated by removing the opaque lens and a new artificial lens is inserted.

Q13. How does a night bird see the objects? What is the difference in the structure of the eyes of night bird and day light birds?

Ans. Night bird (owl) can see very well in the night but not during the day. On the other hand, day light birds (kite, eagle) can see well during the day but not in the night. The owl has a large cornea and a large pupil to allow more light in its eye. Also, it has on its retina a large number of rods and only a few cones. The day birds on the other hand, have more cones and fewer rods.

Q14. What are the optical and non- optical aids for visually impaired persons?

Ans. For visually impaired persons, optical aids include bifocal lenses, contact lenses, tinted lenses, magnifiers and telescopic visual limitations, telescopic aids are used to rectify visual limitation, telescopic aids are available to view chalkboard and class demonstrations.

Non- optical aids include visual aids, textual aids (using the sense of touch), auditory aids using the sense of hearing) and electronic aids. Visual aids, can magnify words, can provide suitable intensity of light and material at proper distances. Tactual aids, including Braille writer slate and stylus, help the visually challenged persons in taking notes, reading and writing. Auditory aids include cassettes, tape recorders talking books and other such devices. Electronic aids, such as talking calculators and computers, are also available for performing many computational tasks, closed circuit television, also an electronic aids, enlarges printed material with suitable contrast and illumination. Use of audio CDs and voice boxes with computers are also very helpful for listening and writing the desired text.

Q15. What is the Braille System?

Ans. Braille system is the most popular resource for visually challenged persons. 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. These patterns when embossed on Braille sheets help visually challenged persons to recognize words by touching. To make them easier to touch, the dots are raised slightly.