

Very Short Answer Type Questions

[1 Mark]

Q. 1. The ciliary muscles of a normal eye are in their (i) most relaxed (ii) most contracted state. In which of the two cases is the focal length of the eye-lens more?

Ans. In most relaxed state.

Q. 2. Write in one word or at the most in one sentence about the following

(i) Mirrors used by dentists to examine teeth.

(ii) The smallest distance, at which the eye can see objects clearly without strain.

Ans. (i) Concave mirror (i) Near point or 25 cm.

Q. 3. Which defect of the eye can be corrected by using a cylindrical lens?

Ans. Astigmatism.

Q. 4. A person is advised to wear spectacles with concave lenses. What type of defect of vision is he suffering from?

Ans. Near-sightedness/Short-sightedness/Myopia.

Q. 5. Person is advised to wear spectacles with convex lenses. What type of defect of vision is he suffering from?

Ans. Far-sightedness/Long-sightedness/Hypermopia.

Q. 6. What is colour blindness?

Ans. Colour blindness is that defect of the eye due to which a person is unable to distinguish certain colours, sometimes even the primary colours.

Q. 7. When a monochromatic light having only one wavelength, passes through a prism, will it show dispersion?

Ans. No it will not show dispersion. It will only show deviation.

Q. 8. What do you understand by spectrum of white light?

Ans. The band of seven colours formed on white screen when a beam of white light (or sunlight) is passed through a glass prism is called spectrum of white light.

Q. 9. The sun can be seen about two minutes before actual sunrise. Give reason.

Ans. The sun can be seen about two minutes before actual sunrise because of atmospheric refraction.

Q. 10. Name the component of white light that deviates the least and the component that deviates the most while passing through a glass prism.

Ans. Least deviated component: Red
Most deviated component: Violet

Q. 11. Why does the sky appear dark to astronauts?

Ans. For scattering of light, particles are required. Since there are no particles in space, the sky appears dark to astronauts.

Short Answer Type Questions – I

[2 marks]

Q. 1. How do we see colours?

Ans. The retina of a human eye has a large number of light sensitive cells. These cells are of two types, i.e., rod cells and cone cells. The rod shaped cells show response towards the intensity of light rays, while the cone shaped cells respond to colours. It is these cone cells, which make it possible for a person to see different colours and distinguish between them.

Q. 2. What is colour-blindness? What kind of retinal cells are lacking in person suffering from this defect?

Ans. The defect of the eye due to which a person is unable to distinguish between certain colours, is known as colour blindness. Cone shaped retinal cells are responsible for making a person differentiate between colours. The colour blind persons do not possess cone cells that respond to certain colours.

Q. 3. Why there is no dispersion of light refracted through a rectangular glass slab?

Ans. After refraction at two parallel faces of a glass slab, a ray of light emerges in a direction parallel to the direction of incidence of white light. As rays of all colours emerge in the same direction, i.e., the direction of the incidence of white light, there is no dispersion. However, there is lateral displacement.

Q. 4. Why are 'danger' signal lights red in colour?

Ans. Danger signal lights are red in colour because the red coloured light having longer wavelength is scattered the least by fog or smoke. Therefore, it can be seen clearly from a distance.

Q. 5. What is meant by dispersion of white light? Name the various colours of spectrum of white light in proper sequence.

Ans. The splitting of white light into its component colours is called dispersion of light. The band of the coloured components formed due to dispersion of white light is called 'spectrum'. Seven colours of spectrum are violet, indigo, blue, green, yellow, orange and red also known as 'VIBGYOR'.

Q. 6. What is the cause of dispersion?

Ans. All colours of light travel at the same speed in a vacuum. When these enter a transparent, substance like prism, all slow down by different amounts depending on their wavelength. As these slow down by different amounts, different colours are refracted through different angles.

Q. 7. Why do different rays deviate differently in the prism?

Ans. Different wavelengths deviate differently in the prism because the angle of refraction for different colours having different wavelength is different while passing through the glass prism.

Q. 8. How will you use two identical prisms so that a narrow beam of white light incident on one prism emerges out of the second prism as white light?

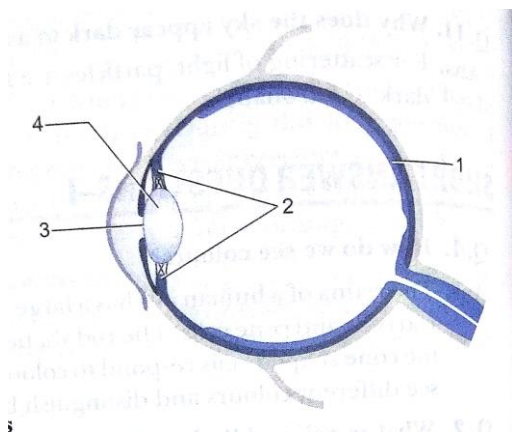
Ans. By using two identical prisms, one placed inverted with respect to the other we get a narrow beams of white light incident on one prism emerges out of the second prism as white light.

Short Answer Type Questions – II

[3 marks]

Q. 1. (a) Name the four parts labelled as 1, 2, 3 and 4 in the given diagram.

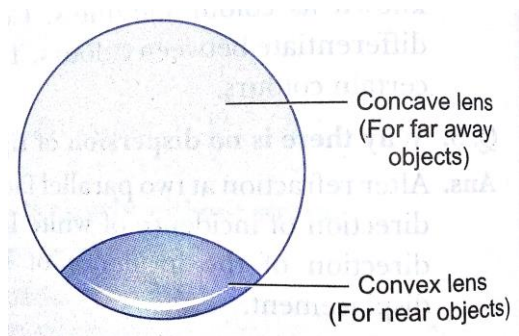
(b) At which place is the image of an object formed?



Ans. (a) 1. Retina
2. Ciliary muscles
3. Pupil
4. Crystalline lens
(b) Retina.

Q.2. What is presbyopia? What causes presbyopia? How is presbyopia corrected?

Ans. The power of accommodation of the eye decreases with ageing. For most people, the near point gradually recedes and the far point comes closer. This defect is called presbyopia. It arises due to the gradual weakening of the ciliary muscles and diminishing flexibility of the eye lens. Such a person may suffer from myopia and hypermetropia. This defect is then corrected by using bi-focal lenses of suitable focal lengths. The upper part of the lens is concave lens which corrects myopia to see the distant objects clearly, while the lower part of the lens has convex lens which corrects the hypermetropia to see the nearby objects clearly.



Q. 3. What is astigmatism? What causes astigmatism? How is astigmatism corrected?

Ans. In this defect, a person cannot focus on both horizontal as well as vertical lines at the same time. So he can see the objects clearly only in one plane. This defect is mainly due to to

the cornea that is not perfectly spherical. As a result, the cornea has different curvatures in different directions of the horizontal and vertical planes. This defect can be corrected by using cylindrical lenses of suitable focal length and suitable axis in the spectacles.

Q. 4. What is meant by ‘persistence of vision’? We are able to see the movie picture in a cinema hall. How does this happen?

Ans. The ability of the human eye to continue to see the image of an object for a very short duration even after the removal of that object is called persistence of vision.

It is due to persistence of vision that we are able to see movie pictures in a cinema hall. The pictures in the form of a long film are projected on the screen at a rate of about 24 pictures per second. Under these conditions, the image of one picture persists on the retina of the eye till the image of the next picture falls on the screen, and so on. Due to this, the slightly different images of the successive pictures present on the film merge smoothly with one another and give us the feeling of continuity and moving images.

Q. 5. What is meant by scattering of light? Use this phenomenon to explain why the clear sky appears blue or the sun appears reddish at sunrise.

Ans. The phenomenon in which a part of the light incident on a particle is redirected in different direction is called the scattering of light.

At the time of sunrise and sunset, when the Sun is near the horizon, sunlight travels a greater distance through the atmosphere to reach us. During this, most of the shorter wavelengths present in it are scattered away from our line of sight by the molecules of air and other fine particles in the atmosphere. So, light reaching us directly from the rising or setting Sun consists mainly of the longer wavelength red colour because of which the Sun appears red.

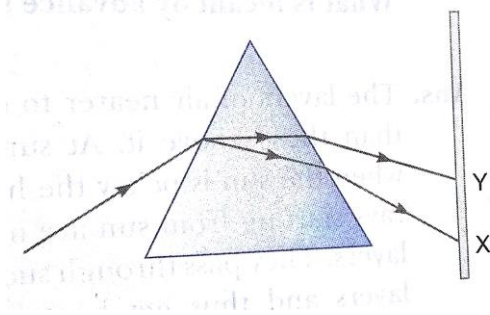
Q. 6 Why does it take some time to see objects in dim room when you enter the room from bright sunlight outside?

Ans. In the bright sunlight, iris causes the pupil to become smaller so that only a small portion of light enters the eye and rods of the retina are also adjusted in the same way. But, when a person enters into a dimly lighted room, each iris takes some time to increase the diameter of the pupil, so that more amount of light can enter the eyes to see the object clearly and rod cells of the retina also take some time to adjust themselves to get the picture of the dim light.

Q. 7 In the given figure, a narrow beam of white light is shown to pass through a triangular glass prism. After passing through the prism it produces a spectrum XY on a screen.

(a) State the colour seen at X and Y.

(b) Why do different colours of white light bend through different angles with respect to the incident beam of light?



Ans. (a) X- Violet

Y-Red

(b) Different colours of white light bend through different angles with respect to the incident beam of light due to difference in speed of light of different wavelengths.

Q. 8. Explain giving reason why the sky appears blue to an observer from the surface of the Earth. What should the appearance of the sky be during the day for an astronaut staying in the international space station orbiting the Earth? State reason to justify your answer.

Ans. The fine particles in the atmosphere scatter light of shorter wavelength (blue colour) more strongly than the light of longer wavelength (red colour). Therefore, the sky appears blue from the surface of the Earth. For an astronaut the sky would appear dark because in space there is no atmosphere for scattering light.

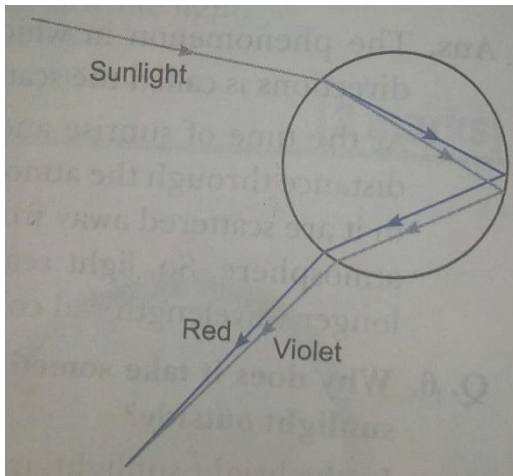
Q. 9. Why is the colour of sky blue?

Ans. The molecules of air and other fine particles in the atmosphere have size smaller than the wavelength of visible light. These are more effective in scattering light of shorter wavelength at the blue end than light of longer wavelengths at the red end. When sunlight passes through the atmosphere, the fine particles in air scatter the blue colour more strongly than red. The scattered blue light enters our eyes. Since we see the blue light from everywhere overhead, the sky appears blue.

Q. 10. What is Tyndall effect? Explain with an example.

Ans. The scattering of light by particles in its path is called Tyndall effect. When a beam of light enters a smoke-filled dark room through a small hole, then its path becomes visible to us. The tiny dust particles present in the air of room scatter the beam of light all around the room. Thus, scattering of light makes the particles visible. Tyndall effect can also be observed when sunlight passes through a canopy of a dense forest. Here, tiny water droplets in the mist scatter light.

Q. 11. Describe the formation of rainbow in the sky with the help of a diagram.



Ans. A rainbow is a natural spectrum appearing in the sky after a rain. It is produced by dispersion of sunlight by tiny water droplets, present in the atmosphere. The water droplets act like small prisms. When a ray of light falls on water drop (or raindrop) it undergoes refraction and dispersion to form a spectrum. This spectrum undergoes internal refraction (inside the raindrop) and finally refracted again when it comes out of the raindrop. After the dispersion of light and internal reflections, the band of colours reaches observer's eye in the form of a rainbow.

A rainbow is always formed in the direction opposite to that of the sun.

Q. 13. A person needs a lens of power 4.5 D for correction of her vision.

(a) What kind of defect in vision is she suffering from?

(b) What is the focal length of the corrective lens?

(c) What is the nature of the corrective lens?

Ans. (a) Myopia

(b)

$$f = \frac{1}{-4.5} = -\frac{2}{9} \text{ m}$$

$$= -0.22 \text{ m}$$

(c) Concave lens

Q. 14. How are we able to see nearby and also the distant objects clearly?

Ans. This is due to the ability of the eye lens to adjust its focal length which is known as accommodation. When the ciliary muscles are relaxed, the lens becomes thin. Thus, its focal length increases. This enables us to see distant objects clearly. When we are looking at objects closer to the eye, the ciliary muscles contract. This increases the curvature of the eye lens. The eye lens becomes thicker. The focal length of the eye lens decreases. This enables us to see nearby objects clearly.

Long Answer Type Questions

[5 Marks]

Q. 1. State the function of each of the following parts of the human eye:

- (i) Cornea (ii) Iris
(iii) Pupil (iv) Retina

Millions of people of the developing countries are suffering from corneal blindness. This disease can be cured by replacing the defective cornea with the cornea of a donated eye. Your school has organised a campaign in the school and its neighbourhood in order to create awareness about this fact and motivate people to donate their eyes after death. How can you along with your classmates contribute in this noble cause? State the objectives of organising such campaigns in schools.

Ans. (i) Cornea: Refraction of the light rays falling on the eye.

(ii) Iris: To control the size of the pupil.

(iii) Pupil: To regulate and control the amount of light entering the eye.

(iv) Retina: To act as a screen to obtain the image of object and generate electrical signals which are sent to the brain via optic nerves.

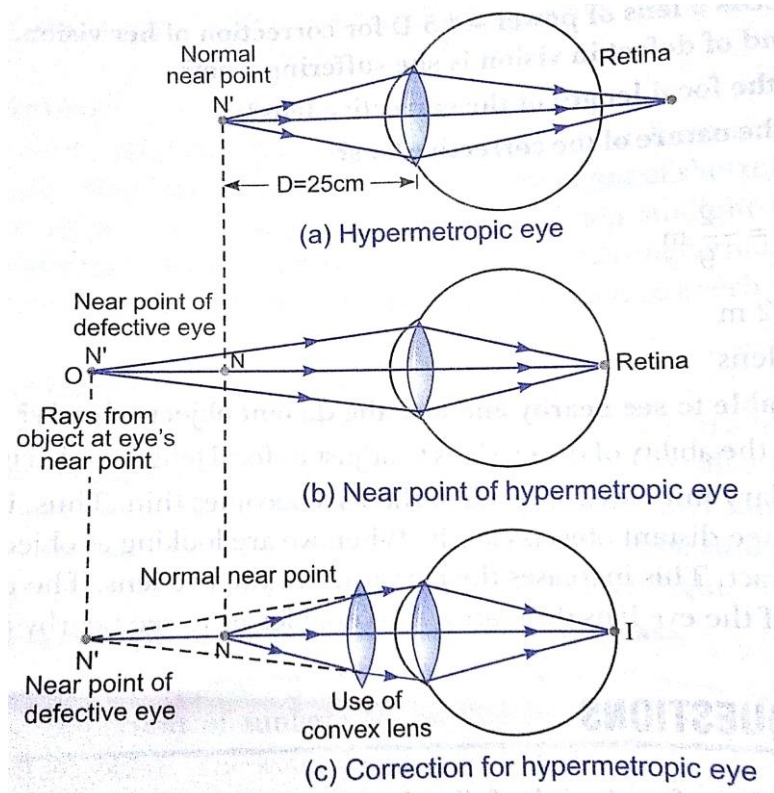
We can contribute by participating in different ways of motivating people for the noble cause of eye donation such as, street play, banners, poster, door to door campaign, etc.

Objectives of organising such campaigns:

- (i) To develop the habit of group work,
(ii) To work for a common cause,
(iii) To understand social issues and problems.

Q.2. What is hypermetropia? Write two causes for development of this defect. Describe with a ray diagram how this defect of vision can be corrected by using spectacles.

Ans. A person can see distant objects distinctly but cannot see nearby objects so clearly in this case, the image is formed behind the retina. This defect of the eye is hypermetropia.



Causes of hypermetropia: This defect arises because either

- (i) the focal length of the eye lens is too long, or
 - (ii) the eyeball becomes too short, so that light rays from the nearby object, say at point N, cannot be brought to focus on the retina to give a distinct image.
- Hypermetropia can be corrected by using convex lens of suitable focal length in spectacles.

Q.3. (a) What is myopia? State the two causes of myopia. With the help of labelled ray diagrams show

- (i) the eye defect myopia
- (ii) correction of myopia using a lens.

(b) Why is the normal eye unable to focus on an object placed within 10 cm from the eye?

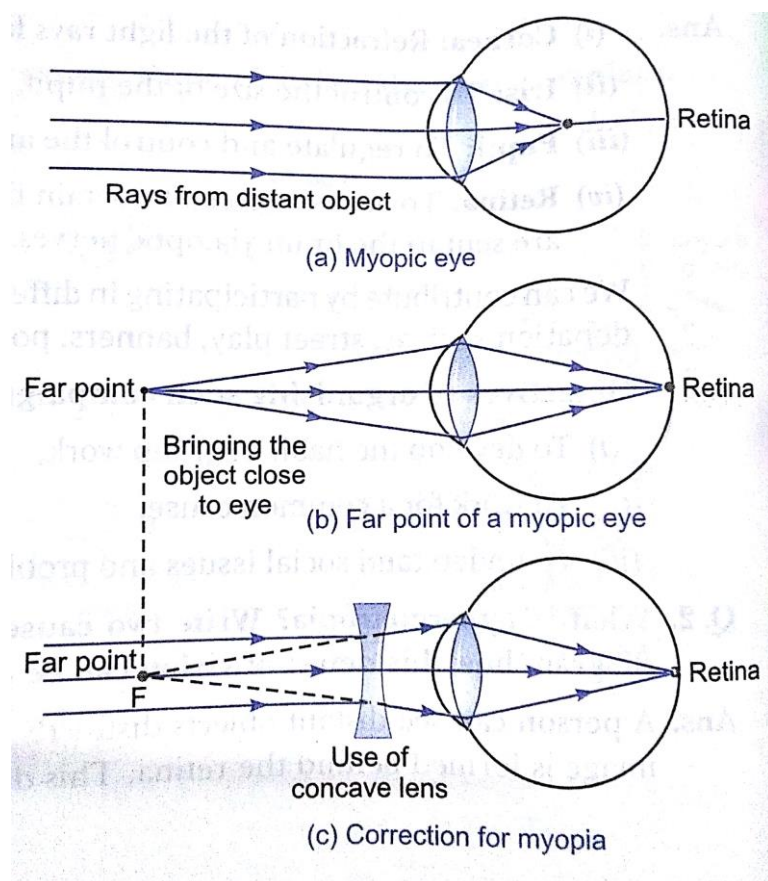
Ans. (a) Myopia is the defect of the eye vision due to which a person can see the near by objects clearly but cannot see the far objects so distinctly.

Causes of myopia: Myopia is caused:

- due to the elongation of the eyeball.
- due to decrease in the focal length of the eye lens.

Myopia can be corrected by using a concave lens of suitable focal length in the spectacles of such a person.

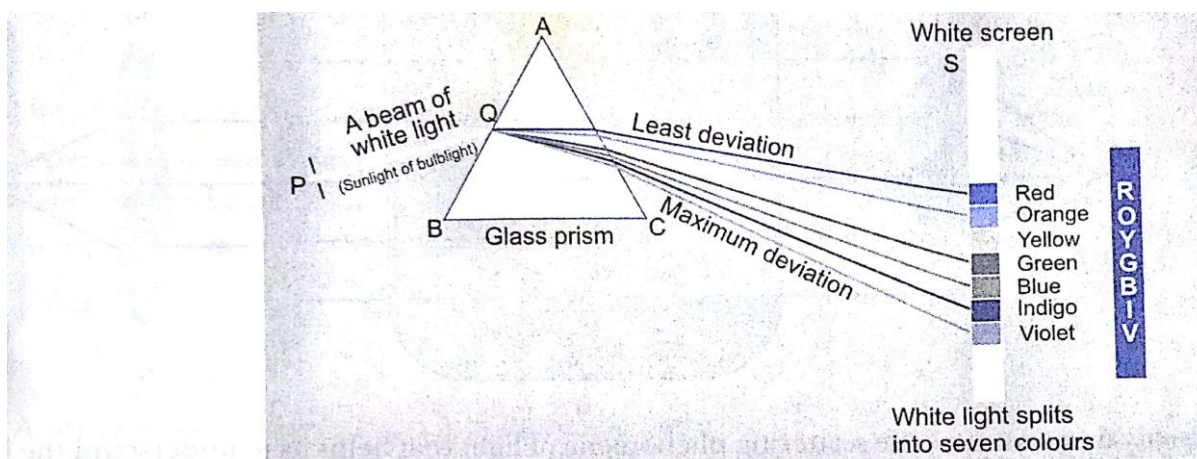
(b) The ability of the eye lens to adjust its focal length is called automatic accommodation. However, the focal length of the eye lens cannot be decreased below a certain limit. The maximum accommodation of a normal the object is at a distance of 25 cm from the eyes. Thus, the normal eye is unable to focus an object placed within 10 cm from the eye because all the power of accommodation has already taken place.



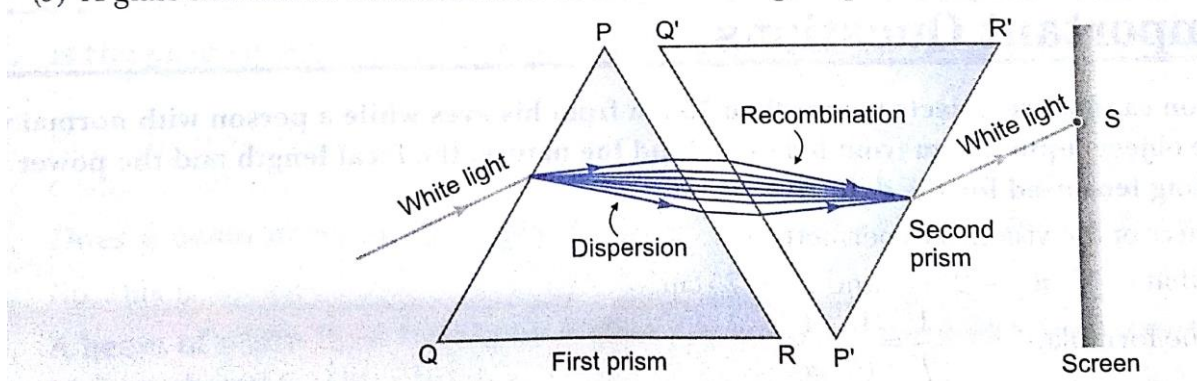
Q. 4. (a) What is dispersion of white light? What is the cause of dispersion? Draw a diagram to show the dispersion of white light by a glass prism.

(b) A glass prism is able to produce a spectrum when white light passes through it but a glass slab does not produce any spectrum. Explain why it is so.

Ans. (a) The splitting up of white light into its constituent colours on passing through a refracting medium like a glass prism is called dispersion of light. The dispersion of white light occurs because different colours of light bend through different angles with respect to the incident ray, as they pass through a prism. The red light bends the least while the violet the most as shown below.



(b) A glass slab acts as a combination of two identical glass prisms.



The second prism can be considered to be placed in an inverted position with respect to the first. The first prism splits the white light into its seven colour components. When these colour components fall on the second prism, it recombines them to form white light.

Q.5. With the help of an activity show the blue colour of the sky and the reddish appearance of the sun at the sunrise or sunset.

Ans. Activity:

(i) Place a source of light S such as an electric bulb at the focus of a converging lens L_1 . This lens provides a parallel beam of light.

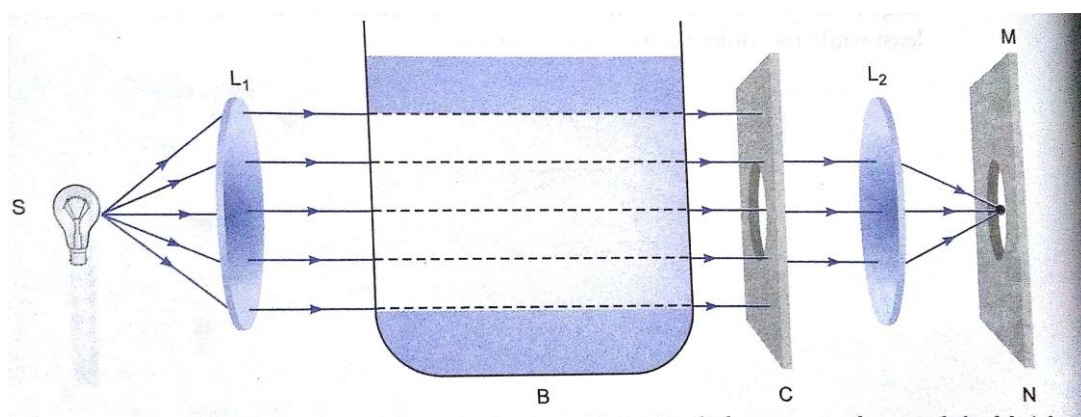
(ii) Allow the light beam to pass through a transparent glass beaker B of capacity 500 mL.

(iii) After passing through the beaker containing about 400 mL of water allow the light beam to pass through a circular hole made in cardboard C. Obtain a sharp image of the hole on a screen MN using another convex lens L_2 .

(iv) Dissolve about 200 g of sodium thiosulphate (hypo) in water taken in the beaker B. ADD about 1 to 2 ml of concentrated sulphuric acid with the help of an injection syringe dropwise in the beaker containing hypo solution.

(v) What do you observe?

You will notice fine microscopic sulphur particles precipitating in about seconds. As the sulphur particles begin to form, you can observe the blue light from the sides of the beaker. This is due to scattering of short wavelengths by minute colloidal sulphur particles. Observe the colour of the light patch on the screen. It is interesting to observe the change in colour of the patch—from orange red colour in the beginning to bright crimson red colour later on the screen.



This activity demonstrates the scattering phenomena of light that helps us to understand the bluish colour of the sky in general and the reddish appearance of the sun at the sunrise or the sunset.

HOTS (Higher Order Thinking Skills)

Q. 1. Is the position of a star as seen by us in its true position? Justify your answer.

Ans. No, light from stars undergoes atmospheric refraction which occurs in medium of gradually changing refractive index.

Q. 2. Does a beam of white light give a spectrum on passing through a hollow prism?

Ans. No, this is because dispersion of light cannot occur through a hollow prism containing air.

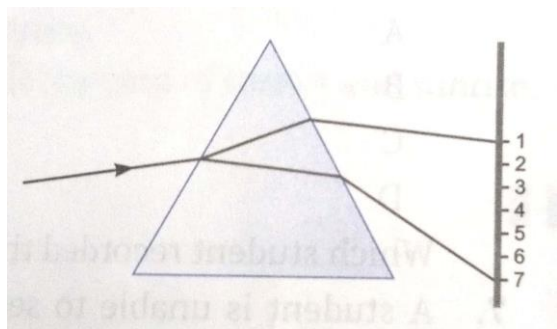
Q.3. A beam of white light falling on a glass prism gets split up into seven colours marked 1 to 7 as shown in the diagram.

A student makes the following statements about the spectrum observed on the screen.

(a) The colours at positions marked 3 and 5 are similar to the colour of the sky and the colour of gold metal respectively.

Is the above statement made by the student correct or incorrect? Justify.

(b) Which two positions correspond closely to the colour of (i) brinjal, (i) 'danger' or stop signal lights?



Ans. (a) The statement made by the student is incorrect. Positions marked 3 (yellow) and 5 (blue) are similar to the colour of gold metal and the colour of the sky respectively. The student is stating the nature of colours in reverse order.

(b) (i) The position marked 7 corresponds closely to the colour of a brinjal.

(ii) The position marked 1 (red) corresponds closely to the colour of 'danger' or stop signal lights.

Q.4. Why sometimes haloes or rings are observed round the moon or sun?

Ans. When the moon or the sun is observed through a thin layer of the high clouds, reflection of light from fine icy crystals, present in the clouds, result in the formation of haloes.

Q.5. Can an observer see a rainbow on the moon?

Ans. No, since there is no atmosphere on the moon.

Q.6. Why does a person suffering from hypermetropia prefer to remove his spectacles while looking at distant objects? Explain.

Ans. A hypermetropic eye can have normal far point. If he uses spectacles of converging lens, he will have more converging power than needed for parallel rays so the distant object may get focused in front of the retina and so distant objects will appear blurred.

Value Based Questions

Q. 1. News spread in the school that a student of Class IX-A has expired due to heart attack, but he has donated his beautiful eyes to one of his friends. All the members of school felt very sad for his untimely death, but on the other hand they were overwhelmed on hearing the donation of his eyes to his friend, who would now be able to see this beautiful nature.

Answer the following questions based on the situation given above.

- (i) Do you think that the student who expired had done good job? Is it worth to donate vital organs?
- (ii) What values are promoted here?
- (iii) What other organs can be donated after dying?

Ans. (i) Yes. Donating vital organs can make the life of a living person easier.
(ii) Social welfare, kind-hearted, selfless, friendship.
(iii) Kidneys, heart, liver, etc.

Q. 2. On the rainy day, Ram reached his grandfather's place in village. On the way to house he saw a beautiful rainbow in the sky. In night, he saw lots of twinkling stars in the clear sky. He was very excited to see these beautiful natural phenomena, which he was not able to see in the city, where he lived with his father.

Answer the following questions based on the situation given above.

- (i) Do you think that pollution in atmosphere affects the formation of rainbow and twinkling of stars?
- (ii) Do you agree with the fact that pollution-free environment will strengthen such natural phenomena in the cities as well?
- (iii) What steps can be taken so that the natural phenomena can be enjoyed in cities as well?

Ans. (i) Yes. Though rainbow formation and twinkling of stars are the phenomena of light but these won't be visible if there is a lot of pollution in the stratosphere.
(ii) Yes.
(iii) Keeping the city clean and pollution-free, plant more trees.

Q. 3. Sania and Shreya are best friends and study in grade 4. Recently, Sania has been facing difficulty in reading the blackboard text from the last desk. Shreya is little uncomfortable and wonders why Sania complains sitting on the last desk. On observation she found that Sania often carries junk food in her lunch. Shreya has started sharing her lunch – full of green vegetables and fruits with her. Sania is now better and has also started taking a 'balanced diet'.

Answer the following questions based on the above situation:

(i) Name the eye defect Sania is suffering from? What are the two possible reasons related to her eye defect?

(ii) What value is displayed by Shreya and Sania?

(iii) How can this value be promoted? Suggest one activity.

Ans. (i) Myopia/short sightedness. Lens defect (increased thinness), eye ball defect (elongation).

(ii) Friendship, concern for each other, appreciation for balanced diet.

(iii) Sharing common things; helping each other in studies.

Q. 4. A team of eye specialists visited a village and examined number of villages for any vision defects. They observed that many villagers suffered from different defects of vision. They left and came back after a month with required medicines and equipment for treatment. The eye treatment camp continued for one week. The doctors as well as villagers were extremely happy after the event.

Answer the following questions based on the above information:

(i) Which values made the doctors happy? Name any two actions on your part as an individual which you can take to get similar kind of happiness in other everyday life situations.

(ii) Assuming yourself to be a doctor in this event, suggest one more help or action related to eye defects to help the villagers further.

Ans. (i) Empathy, service to others, concern for fellow beings.

Adopting a needy individual or group and contributing towards their free education.

Spreading awareness about health care. (Any other)

(ii) Follow-up check-up; awareness about eye-care, free distribution of required spectacles, etc.

Q. 5. (a) Write the function of each of the following parts of human eye:

Cornea; iris; crystalline lens; ciliary muscles.

(b) Millions of people of the developing countries of world are suffering from corneal blindness. These persons can be cured by replacing the defective corner with cornea of a denoted eye. A charitable society of your city has organised a campaign in your neighborhood in order to create awareness about this fact. If you are asked to participate in this mission how would you contribute in this noble cause?

(i) State the objective of organising such campaigns.

(ii) List two arguments which you would give to motivate the people to donate their eyes after death.

(iii) List two values which are developed in the persons who actively participate and contribute in such programmes.

Ans. (a) Cornea: Refracts the rays of light falling on the eye.

Iris: Controls the size of the pupil

Crystalline lens: Focuses the image of the objects on the retina.

Ciliary muscles: Holds the eye lens and adjusts its focal length.

(b) (i) These campaigns are organised to make people aware and realise their duties towards society.

(ii) Following arguments can be given:

One person can give sight to two people.

Our eyes can live even after our death.

(iii) Values: Concern for others/Responsible behavior/Group work.

Q. 6. Write the importance of ciliary muscles in the human eye. Name the defect of vision that arises due to gradual weakening of the ciliary muscles in old age. What type of lenses are required by the persons suffering from this defect to see the objects clearly?

Akshay, sitting in the last row in his class, could not see clearly the word written on the blackboard. When the teacher noticed it, he announced if any student sitting in the front row could volunteer to exchange his seat with Akshay. Salman immediately agreed to exchange his seat with Akshay. He could now see the words written on the blackboard clearly. The teacher thought it fit to send the message to Akshay's parents advising them to get his eyesight checked.

In the context of the above event, answer the following questions:

(a) Which defect of vision is Akshay suffering from? Which type of lens is used to correct this defect?

(b) State the values displayed by the teacher and Salman.

(c) In your opinion, in what way can Akshay express his gratitude towards the teacher and salman?

Ans. Ciliary muscles adjust the curvature of the eye lens and change its focal length.

Weakening of ciliary muscles leads to presbyopia. This can be corrected by a bifocal lens.

(a) Akshay is suffering from myopia or near-sightedness. A concave lens can be used to correct this defect.

(b) The teacher displayed presence of mind and pro-activeness, and a considerate nature. Salman displayed the virtue of friendship and caring nature.

(c) Akshay should thank the teacher and Salman in front of the entire class.