Date: 25/9/2021

Q1. What is the function of retina in the human eye?

Q2. Name the part of human eye having light sensitive layer.

Q3. Name the part of the eye: (i) that controls the amount of light entering into the eye, and (ii) that has real, inverted image of the object formed on it.

Q4. What is the function of the crystalline lens of the eye?

Q5. Write the function of Iris in the human eye.

Q6. What is a pupil?

Q7. Although image formed on retina is inverted and diminished, we are able to perceive objects as they are. Which part is responsible for it?

Q8. What is the function of pupil in human eye?

Q9. What is the name given to the ability of the eye lens to adjust its focal length?

Q10. Name the part of the human eye that helps in changing the focal length of the eye lens.

Q11. State the role of ciliary muscles in accommodation of eye.

Q12. When is the focal length of eye lens less, at the time of seeing a distant object or a nearby object?

Q13. What is the least distance of distinct vision?

Q14. What happens to the image distance from the eye lens in the normal eye when we increase the distance of an object from the eye?

Q15. Name the condition resulting due to the eye lens becoming cloudy.

Q16. When a person is suffering from both myopia and hypermetropia, then what type of corrective lens are required?

Q17. A person is able to see objects clearly only when these are lying at distances between 50 cm and 300 cm from his eys. Name the kind of defects of vision he is suffering from.

Q18. A person is advised to wear spectacles with convex lenses. State the defect of vision he is suffering from.

Q19. Name two possible causes for hypermetropia.

Q20. What is the name given to the defect of the eye in which a person can see distant objects distinctly but cannot see nearby objects so clearly?

Q21. Name two possible causes of myopia.

Q22. What kind of lens is used in the spectacles of a person suffering from myopia (near-sightedness)?

Q23. A person can see nearby objects but cannot see the distant objects. What is the name given to this defect of vision?

Q24. In the human eye, name the following parts:

(a) a thin membrane which allows light to enter into the eye.

(b) the muscles which help in changing the focal length of the eye lens.

Q25. Define power of accommodation of eye.

Q26. What are the values of: (a) near point and (b) far point of vision of a normal adult person?

Q27. On which principle does a prism form the image of an object?

Q28. In which direction a ray of light bends while emerging out of a prism?

Q29. Draw a figure to show a prism and mark the angle of prism.

Q30. What is dispersion of light?

Q31. Mention the colours for which each letter in the word VIBGYOR stand for.

Q32. Why do we get colours when white light passes through a prism?

Q33. Name the component of white light that deviates (i) the least and (ii) the most while passing through a glass prism.

Q34. What is a rainbow?

Q35. Name the two phenomenon involved in the formation of rainbow.

Q36. Name the type of particles which act as prisms in the formation of rainbow in the sky.

Q37. Give an example of optical phenomena which occur in nature due to atmospheric refraction.

Q38. On what factor does the colour of the light depends?

Q39. Name the phenomena due to which we get light from the Sun before actual sun rise.

Q40. Why does the Sun appear reddish at sunrise?

Q41. Which light has more wavelength, red light or blue light?

Q42. What is Tyndall effect?

Q43. Give an example of a phenomenon where Tyandall effect can be observed.

Q44. List the factors on which scattering of light depends.

Q45. Which light is scattered easily?

Q46. What will be the colour of the sky when it is observed from a place in the absence of any atmosphere?

Q47. What is the colour of scattered sunlight when the size of the scattering particle is relatively large?

Q48. The sky appears dark to the passengers flying at very high altitudes. Why?

Q49. Why is red colour selected for danger signal lights?

Q50. To an astronaut why does the sky appear dark instead of blue?

Q51. Draw a neat labelled diagram of a human eye.

Q52. Briefly discuss how the light rays from an object are focused on the retina.

Q53. What is the function of iris and pupil of the eye?

Q54. When one enters a less lighted room from a place of intense light, he is not able to see anything for sometime but after sometime the things become somewhat visible. Explain how this happens.

Q55. Identify and name that part of the human eye: (a) where image of an object is formed, and (b) which controls size of pupil.

Q56. How does the focal length of the eye lens change as per distance of the object in front of eye?

Q57. (a) Mention the role of crystalline lens in the human eye.

(b) How does the focal length of the eye lens changes when we shift looking from a nearby object to a distant object?

Q58. What is power of accommodation of eye? What are the limits of accommodation for a normal eye?

Q59. How does near point of eye change with advancing age?

Q60. Explain the term myopia.

Q61. State two main causes of a person developing near-sightedness.

Q62. What type of lens is used to rectify myopia? What should be the focal length of the lens?

Q63. What is long-sightedness? List two causes for development of long-sightedness?

Q64. A boy uses spectacles of focal length – 60 cm. Name the defect of vision he is suffering from. Which lens is used for the correction of this defect? Compute the power of this lens.

Q65. Priya prefers to sit in the front row as she finds it difficult to read the blackboard from the last desk of her class room.

(a) State the defect of vision she is suffering from. How is this defect corrected?

(b) List two reasons for this defect.

Q66. An old person is unable to see clearly nearby objects as well as distant objects clearly.

(a) What defect of vision he is suffering from?

(b) What kind of lense will be required to see clearly the nearby as well as distant objects?

Give reasons. How is this lens made?

Q67. Draw a neat diagram to show refraction of a light ray through a prism. Mark angle of incidence, angle of emergence, incident ray, refracted ray, emergent ray and the angle of deviation.

Or

Draw a ray diagram to show the refraction of light through a triangular glass prism and mark angle of deviation on it.

Q68. What is meant by the dispersion of white light? Draw a diagram to show dispersion of white light by the glass prism.

Q69. A star sometimes appears brighter and some other times fainter. What is this effect called? State the reason for this effect.

Q70. What is atmospheric refraction? How can you show it?

Q71. When we place a glass prism in the path of a narrow beam of white light a spectrum is obtained what happens when a second identical prism is placed in a inverted position with respect to the first prism? Draw a labelled ray diagram to illustrate it.

Or

Illustrate by drawing a ray diagram how seven colours of white light can be recombined to form white light.

Q72. Briefly explain the cause of dispersion.

Q73. Apparent duration of a day from sunrise to sunset is 4 minutes more than its actual duration. How?

Q74. Explain with the help of a diagram, why a pencil partly immersed in water appears to be bent at the water surface.

Q75. Explain with the help of a diagram, how we are able to observe the sunrise about two minutes before the sun gets above the horizon.

Q76. At noon, the Sun appears as white but in morning or evening appears as reddish. Why?

Q77. (a) Draw a diagram to show the formation of image of a distant object by a myopic eye. How can such an eye-defect be remedied?

(b) State two reasons due to which this eye-defect may be caused.

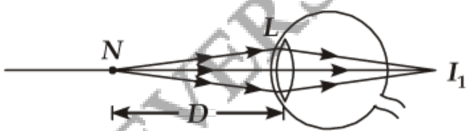
(c) A person with a myopic eye cannot see objects beyond a distance of 1.5 m. What would be the power of the corrective lens used to restore proper vision?

Q78. A student cannot see a chart hanging on a wall placed at a distance of 3 m from him. Name the defect of vision he is suffering from. How can it be corrected? Draw ray diagrams for the (i) defect of vision, and also (ii) for its correction.

Q79. What eye defect is myopia? Describe with a neat diagram how this defect of vision can be corrected by using a suitable lens.

Q80. Briefly describe cause and remedy of presbyopia.

Q81. Study the given diagram (see figure) and answer the questions that follow it:



(a) Which defect of vision is represented in this case? Give reason for your answer.

(b) What could be the two causes of this defect?

(c) With the help of a diagram show how this defect can be corrected by the use of a suitable lens.

Q82. Briefly describe an experimental arrangement for observing scattering of light in colloidal solution.

Q83. What is scattering of light? How does it take place in Earth's atmosphere? How does colour of scattered light depend on the size of scattering particles?

Q84. Explain why the planets do not twinkle but the stars twinkle.

Q85. The stars appear higher from horizon than they actually are. Explain why it is so.

Q86. Describe the formation of rainbow in the sky with the help of a diagram.

Q87. Draw a diagram to show dispersion of white light by a glass prism. What is the cause of the dispersion?

Q88. Draw a diagram to show dispersion of white light by a glass prism. What is the cause of the dispersion?

Q89. The near point of a hypermetropic eye is 60 cm. What is the nature and power of the lens required to enable him to read a book placed at 25 cm from the eye?

Q90. (a) What is meant by the power of accommodation of an eye?

(b) A person with a myopic eye cannot see objects beyond 1.2 m directly. What should be the type of corrective lens used? What would be its power?

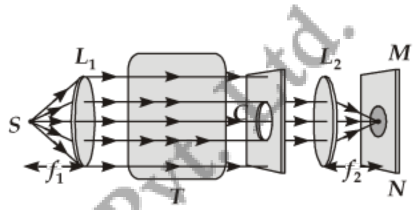
Q91. What eye defect is hypermetropia? Describe with a ray diagram how this defect of vision can be corrected by using an appropriate lens.

Q92. An old man cannot see objects closer than 1 m from the eye clearly. Name the defect of vision he is suffering from . How can it be corrected? Draw ray diagram for the (i) defect of vision and also (ii) for its correction.

Q93. Distinguish between presbyopia and hypermetropia.

Q94. Briefly explain the observed blue colur of clear sky. What would have happen if there is not atmosphere on the Earth?

Q95. The figure shows an experimental set up for observing a phenomenon of light in colloidal solutions. A student dissolves about 200 g of sodium thiosulphate (hypo) in about 2 L of clean water in the tank and adds about 1 to 2 mL of concentrated H_2SO_4 to the water. What would he observe after the source of light S is switched on



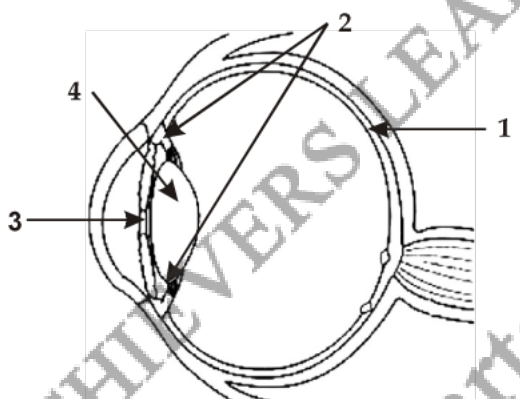
(a) from the three sides of the glass tank?

(b) from the fourth side of the glass tank facing the circular hole? Give reason.

Q96. (a) Label the four parts indicated by question marks and labelled 1, 2, 3, 4 as shown in the figure.

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

(c) Define power of accommodation and colour blindness.



Q97. Explain myopia with the help of suitable ray diagrams. How can this defect of vision be corrected?

A boy uses spectacles of focal length – 50 cm. Name the defect of vision, he is suffering from. Compute the power of this lens.

Q98. (a) A person cannot read newspaper placed nearer than 50 cm from his eyes. Name the defect of vision he is suffering from. Draw a ray diagram to illustrate this defect. List its two possible causes. Draw a ray diagram to show how this defect may be corrected using a lens of appropriate focal length.

(b) We see advertisements for eye donation on television or in newspapers. Write the importance of such advertisements.

Q99. What is long-sightedness? List two causes for development of long-sightedness. Describe with a ray diagram, how this defect may be corrected by using spectacles.

Q100. (a) A student cannot see clearly a chart hanging on a wall placed at a distance of 3 m from his eyes. Name the defect of vision he is suffering from. Draw a ray diagram to illustrate this defect. List its two possible causes.

(b) Draw a ray diagram to show how this defect may be corrected using a lens of appropriate focal length.

(c) An eye donation camp is being organised by social workers in your locality. How and why would you help in this cause?

Q101. Give reasons for the following:

(a) Colour of the clear sky is blue.

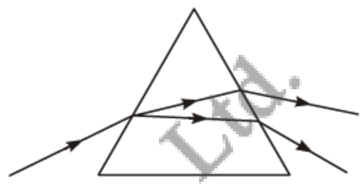
(b) The Sun can be seen about two minutes before actual sunrise.

(c) We cannot see an object clealy if it is placed very close to the eyes.

(d) What is presbyopia? Write two causes of this defect.

Q102. (a) In the figure, mark the angle of prism, angle of deviation of red and violet colours and incident ray.

(b) Explain how the components of white light can be recombined after a prism has separated them. Explain with the help of figure.



Q103. (a) State the reasons which lead to hypermetropia. With the help of suitable diagram explain this defect of vision and its correction.

(b) Draw diagram of an experiment arrangement for observing scattering of light in colloidal solution. Name the two chemicals used in this activity.

Q104. A 14 years old student is not able to see clearly the questions written on the black board placed at a distance of 5 m from him.

(a) Name the defect of vision he is suffering from.

(b) With the help of a labelled ray diagram show how this defect can be corrected.

(c) Name the type of lens used to correct this defect.

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S1. The retina behaves like a light sensitive screen, on which real and inverted image of any object situated in front of eye is formed.

S2. Retina.

S3. (i) Pupil (ii) Retina.

S4. It provides the fine adjustment of focal length of eye lens system so as to focus objects at different distances on the retina.

S5. Iris controls the size of the pupil.

S6. The pupil is a small circular transparent aperture whose size is controlled by iris.

S7. The optic nerves and the brain.

S8. It regulates and controls the amount of light entering the eye.

S9. Accommodation or the accommodating power.

S10. Ciliary muscles.

S11. To adjust/modify the shape (curvature) of eye lens so that its focal length can be increased or decreased.

S12. Focal length of the eye lens is less at the time of viewing an object situated near the eye.

S13. The minimum distance at which objects can be seen most distinctly without strain on the eye.

S14. Image distance remains unchanged.

S15. Cataract.

S16. Bi-focal lenses (this defect is common in old age), converging lens for reading and diverging lens for distant vision.

S17. The person is suffering from 'presbyopia'.

S18. Hypermetropia.

S19. (a) The focal length of eye lens is too long. (b) Eyeball has become too small.

S20. Long-sightedness or hypermetriopia.

S21. (a) Excessive curvature of the eye lens. (b) Elongation of the eyeball.

S22. Concave lens (or a diverging lens).

S23. Near-sightedness (myopia).

S24. (a) Cornea (b) Ciliary muscles.

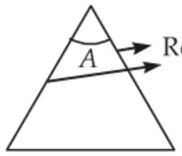
S25. It is the property of eye lens to adjust its focal length so as to focus various objects situated at different distances in front of eye at the retina.

S26. (a) 25 cm, (b) infinity.

S27. On the basis of refraction of light.

S28. The light ray on emerging out of a prism always bends towards the base of the prism.

S29. A prism has been shown in the figure. Here $\angle A$ = angle of prism.



S30. Dispersion of light is the splitting of light into its component colours on passing through a dispersive medium *e.g.*, a prism.

S31. V – violet, I – indigo, B – blue, G – green, Y- yellow, O – orange and R – red.

S32. Because light of different colours bend through different angles while passing through a prism.

S33. (i) Red light is deviated the least and (ii) Violet light is deviated the most.

S34. Rainbow is a natural spectrum formed in the sky after rain shower due to suspended water droplets in atmosphere.

S35. Dispersion and reflection of light.

S36. Tiny water droplets hanging in the sky.

S37. The apparent duration of day from sunrise to sunset is increased by 4 minutes on account of atmospheric refractin.

S38. On wavelength of light.

S39. Atmospheric refraction

S40. At sunrise Sun is at the horizon. Due to scattering most of blue-violet light is scattered away and only light of longer wavelength reaches the observers eye. It gives reddish apperance of Sun.

S41. Red light has a greater wavelength than that of blue light.

S42. Tyndall effect is the scattering of light by matter particles in the path of light, thus, making a visible light beam.

S43. Tyndall effect is seen when a fine beam of sunlight enters a smoke filled room through a small hole.

S44. Scattering of light depends on the size of scattering particle an the wavelength of light.

S45. Light of shorter wavelengths is easily scattered as compared to light of longer wave-lengths.

S46. Black (dark).

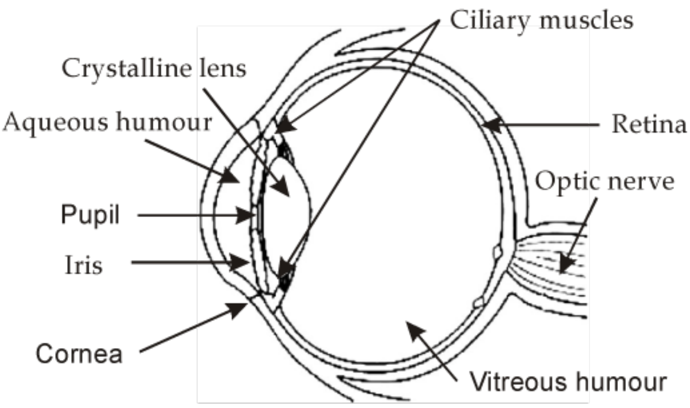
S47. Scattered sunlight appears white.

S48. Because there is no scattering of light due to lack of atmosphere.

S49. Because red light is least scattered by fog or smoke and can be easily seen from a distance.

S50. Due to lack of scattering of light in the absence of atmosphere.

S51. A neat labelled diagram of a human eye has been shown in following figure:



Human Eye

S52. Our human eye is like a camera. Light enters the eye through cornea, which is a transparent bulge on the front surface of eyeball. Most of the refraction for the light rays entering the eye takes place at the outer surface of the cornea. The crystalline lens provides the fine adjustment of focal length required to focus objects situated at different distances on the retina.

S53. The iris controls the size of the pupil. It adjusts in size, and therefore, helps in regulating the amount of light entering the eye through a variable aperture 'pupil'. When the light is very bright, the pupil becomes very small. However, in dim light, it opens up completely through the relaxation of the iris.

S54. The pupil of eye controls the amount of light entering into the eye. In bright sunlight the size of the pupil is small. When one enters a less lighted room, it takes sometime for the pupil to expand in size to adjust for dimlight. Hence, the person feels difficulty in seeing for sometime but later on he is able to see objects.

S55. (a) Image of an object formed by human eye is formed on the retina.

(b) Iris controls the size of pupil.

S56. The eye lens consists of a fibrous, jelly-like material. Its shape (curvature) can be modified to some extent by the ciliary muscles. The change in the curvature of eye lens can change its focal length. When the muscles are relaxed, the lens is thin and its focal length is more (about 2.5 cm). When the ciliary muscles contract and the eye lens becomes thicker. Consequently, the focal length of eye lens decreases.

S57. (a) The crystalline lens provides the finer adjustment of focal length required to focus objects at different distances at the retina.

(b) When one shifts looking from a nearby object to a distant object, the focal length of the eye lens increases.

S58. The power of accommodation is the property (or capability) of the eye lens to adjust its focal length so as to focus objects situated at different distances from the eye on the retina. It is also known as the "accommodating power" of eye.

A normal eye can accommodate objects lying between near point (or least distance of distinct vision), D = 25 cm, and infinity.

S59. Although the value of near point for a young adult is 25 cm, with advancing age, the eye lens gradually loses its flexibility. As a result, the near point gradually recedes. For example, at an age of 60 years, the near point is about 200 cm in most cases.

S60. Myopia or short-sightedness (or near-sightedness) is a defect of vision, in which a person can see nearby objects clearly but cannot see the distant objects so clearly. If a person can see distinctly an object situated at a farthest distance 'x', it means that far point of myopic eye has shifted from infinity to a distance x. Myopia defect can be rectified by the use of concave lenses.

S61. Two main causes of a person developing near-sightedness or myopia are:

(a) The size of eyeball is elongated, or

(b) The curvature of the eye lens is excessive due to which its focal length has decreased (or power of eye lens has increased).

S62. A diverging (concave) lens is used to rectify myopia. If the defective eye's far point is situated at x, then the person should use concave lens of focal length $|f| = x$.

S63. Long-sightedness or hypermetropia is a defect of vision, in which a person can see distant objects distinctly but cannot see nearby objects so clearly. It means that the near point of defective eye has shifted away from the eye.

Two possible causes of hypermetropia are:

(a) The focal length of the eye lens is too long, or (b) The eyeball has become too small.

S64. The boy using spectacles of focal length – 60 cm is suffering from myopia (or near sightedness) defect. A diverging lens is used for correction of this defect.

$$\text{Power of the lens } P = \frac{1}{f\text{ (in m)}} = \frac{100}{f\text{ (in cm)}} = \frac{100}{(-60)} = -1.67\,\text{D}.$$

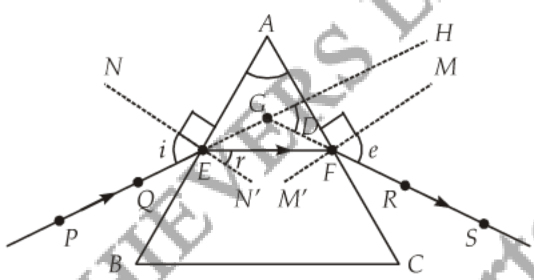
S65. (a) Priya is suffering from myopia and she must use concave lenses of appropriate power to correct the defect.

(b) The possible reasons are (i) the focal length of eye lens is less due to its excessive curvature, or (ii) the eyeball is elongated.

S66. (a) The old person is suffering from presbyopia.

(b) He must use convex lens to see nearby objects and concave lens to see distant objects. For this purpose bifocal lenses are usually prepared. Upper part of lens is concave and is used to see distant object. The power part of the lens is convex lens and is used to see nearby objects.

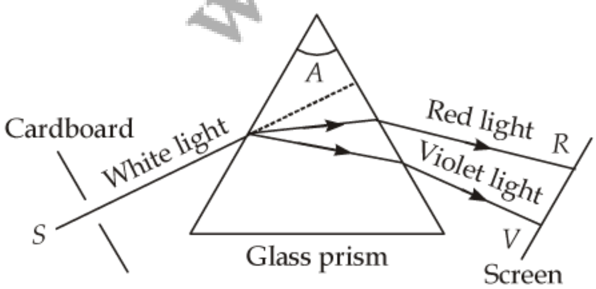
S67. The labelled diagram shown in the figure below:



PE – Incident ray	$\angle i$ – Angle of incidence
EF – Refracted ray	$\angle r$ – Angle of refraction
FS – Emergent ray	$\angle e$ – Angle of emergence
$\angle A$ – Angle of the prism	$\angle D$ – Angle of deviation

S68. When a beam of white light passes through a glass prism it splits up into its constituent seven colours. The splitting of white light into its constituent spectrum is called dispersion of white light.

The ray diagram showing dispersion is given in figure below



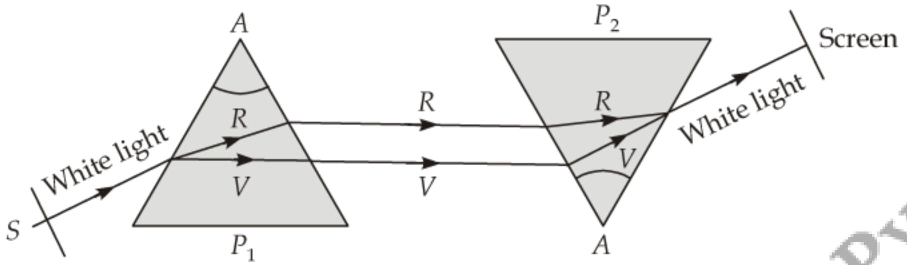
S69. The effect is called twinkling of a star.

Stars are very far away from the earth and behave as almost a point object. The atmosphere is made of several layers and their refractive indices keep on changing continuously. The light rays from the star keep on changing their paths continuously. As a consequence, the number of rays (or the light energy) entering in the pupil of the eye goes on changing with time and the stars appear twinkling.

S70. Apparent position of distant object, as seen through the atmosphere fluctuates. This wavering is an effect of atmospheric refraction.

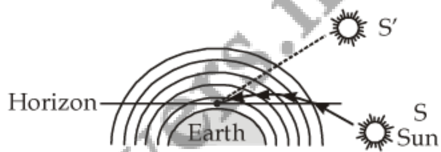
To observe apparent random wavering of objects, see them through a turbulent stream of hot air rising above a fire or a radiator. The hotter air is less dense than the cooler air above it. So, refractive index of hotter air is less than that of cold air. As the physical condition of air go on changing, the apparent position of an object seen through hot air wavers.

S71. When a second identical prism P_2 is placed in an inverted position with respect to the first prism P_1, as shown in figure, the seven coloured rays recombine to form white light again.

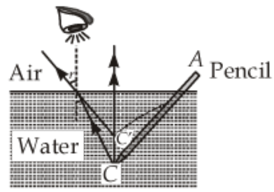


S72. When a beam of white light enters a glass prism (or any other dispersive medium), the light ray bends towards the normal on entering into glass. However, different colours of light bend through different angles with respect to the incident ray. The red light bends the least while the violet light bends the most. So, rays of different colours emerge along different paths and, thus, become distinct. Hence, dispersion is caused and spectrum is formed.

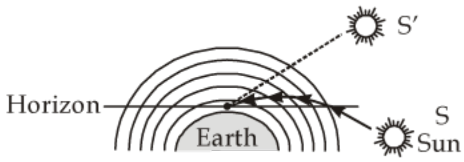
S73. Due to atmospheric refraction (see figure) Sun is seen approximately 2 minutes even before actual sunrise, when Sun is slightly below the horizon. Similarly, even after actual sunset, Sun is seen by us for about 2 minutes. Thus, in effect Sun is seen for 4 minutes more. It means that apparent duration of day (from sunrise to sunset) has increased by 4 minutes than its actual duration.



S74. A pencil ABC partly immersed in water appears to be bent at the water surface as shown in the figure. It is on account of bending of light ray away from the normal when refraction of light takes place from water (optically denser medium) to air (optically rarer medium).

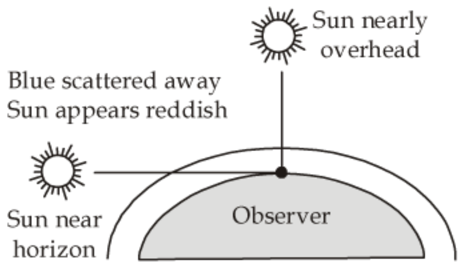


S75. The air becomes rarer as its height above the earth increases. Its refractive index decreases. A ray of light from the Sun when it enters the atmosphere at the horizon gets refracted from a rare to a denser medium. The rays, therefore, gradually bend towards the normal and the Sun appears to be raised. As a result, the Sun is visible to an observer nearly two minutes before actual sunrise at the horizon.

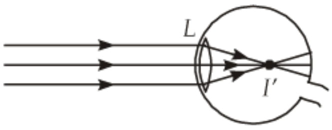


S76. As shown in figure, at noon the sunlight would travel relatively shorter distance before reaching us. As a result, scattering of blue and violet light is very less and the Sun appears white.

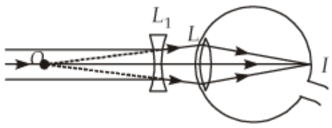
In early morning or evening, Sun is near the horizon and sunlight passes a longer distance in Earth's atmosphere before reaching us. So most of the blue-violet light is scattered away. It gives reddish appearance to the Sun.



S77. (a) The following diagram to show the formation of image of a distant object by a myopic eye



It can be remedied by use of a concave lens as shown in figure.



(b) Myopia eye-defect arises due to either (i) excessive curvature of the cornea, or (ii) elongation of the eyeball.

(c) Focal length of lens $f = -1.5 \text{ m}$

$\therefore$ Power $P = \frac{1}{f} = \frac{-1}{1.5 \text{ m}} = -0.67 \text{ D}.$

S78. The student is suffering from myopia (near sightedness). It can be corrected by using a concave (diverging) lens of an appropriate power.

(a) (b)

S79. Myopia is that defect of vision in which defective eye can see nearby objects distinctly but is unable to see distant objects distinctly.

In myopia, the image of distant object is formed in front of retina as shown in figure (a). Therefore, a concave (diverging) lens of appropriate power is used so as to focus the rays coming from the distant object at the retina as shown in figure (b).

(a) (b)

S80. Presbyopia is a defect of vision generally occurring in persons of advanced age.

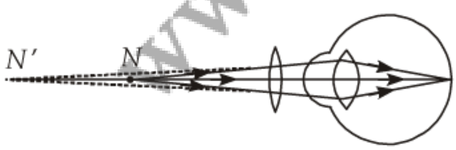
With ageing, the ciliary muscles are gradually weakened and the flexibility of the crystalline lens diminishes. Consequently, the power of accommodation of eye decreases and the person cannot read comfortably and distinctly.

Presbyopia can be rectified by the use of convex lens of appropriate power. Sometimes due to weakening of ciliary muscles, the old persons develop symptoms of myopia as well as hypermetropia. In such cases, bi-focal lenses are to be used.

S81. (a) The defect is hypermetropia or long-sightedness because image of the object placed at near point N of normal eye is being formed behind the retina.

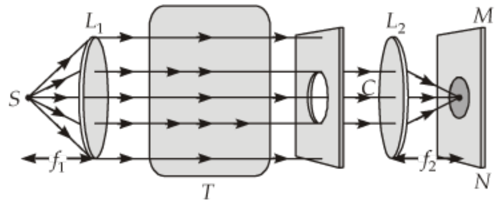
(b) Hypermetropia arises either because (i) the focal length of eye lens is too large, or (ii) contraction of the eyeball.

(c) The defect can be corrected by the use of a convex lens of appropriate power as shown in figure.



S82. To observe scattering of light in laboratory we set up an experimental arrangement shown in figure, S is a strong source of white light and L_1 is a convex lens. Distance between S and L_1 is equal to focal length of lens L_1. So after refraction through L_2 the light beam becomes a parallel beam of light. This light beam passes through a transparent glass tank T containing clear water. Emergent beam of light passes through a circular hole C made in a cardboard sheet. A convex lens L_2 forms a sharp image of the circular hole on a screen MN.

Now dissolve about 200 g of sodium thiosulphate (commonly known as hypo) in about 2 litre of clean water taken in the tank T. Add 1-2 mL of concentrated sulphuric acid to the water. We observe fine microscopic sulphur particles precipitating in about 2-3 minutes. As the colloidal sulphur particles begin to form, we observe the blue light from the three sides of the glass tank.



It is due to scattering of blue light of short wavelengths by colloidal sulphur particles. Consequently, the transmitted light through the tank, which is finally focussed on screen MN, at first appears as of orange-red colour and then of bright crimson red colour.

S83. Scattering of light is the phenomenon of interplay of light with minute sized particles. As a result of such interplay light spreads in different directions and also becomes visible.

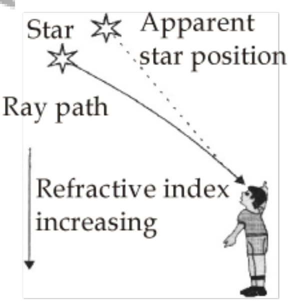
The Earth's atmosphere is a heterogeneous mixture of minute particles including smoke, tiny water droplets, suspended dust particles and molecules of air. When a beam of light strike such fine particles, the path of the beam becomes visible due to scattering.

The colour of the scattered light depends on the size of the scattering particles. Very fine particles scatter mainly blue light but particles of larger size scatter light of longer wavelengths also. For large enough size of scattering particles the scattered light may appear white.

S84. Stars are very far away from the earth and behave as almost a point object. The atmosphere is made of several layers and their refractive indices keep on changing continuously. The light rays from the star keep on changing their paths continuously. As a consequence, the number of rays (or the light energy) entering in the pupil of the eye goes on changing with time and the stars appear twinkling.

For moon (or a planet), it may be regarded as a colllection of large number of point sized objects. It is near to the earth and subtends a larger angle at the eye and the number of rays entering in the eye does not change significantly and no twinkling effect is perceived.

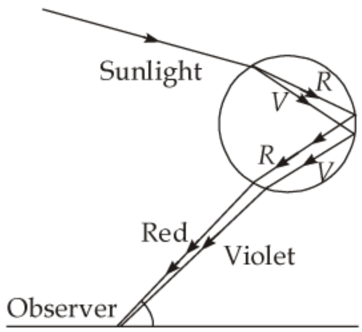
S85. As we go up and up in earth's atmosphere, it goes on becoming rarer and more rarer. As a result, the atmospheric layer near the earth's surface has maximum refractive index and the refractive index gradually decreases with increase in height.



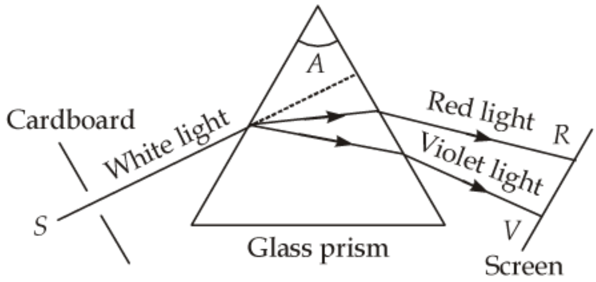
When light ray from a star enters into earth's atmosphere, it travels from rarer to denser medium and hence continues to bend towards the normal. As a result, an observer on earth considers the apparent position of star to be at a higher altitude as shown in figure.

S86. Rainbow is caused by dispersion of sunlight by tiny water droplets hanging in the atmosphere after a rain shower. The water droplets act like small prisms. As shown in figure, the water droplets refract and disperse the incident sunlight. These rays are then reflected internally and finally refracted again and come out of rain drop. Due to the dispersion and internal reflection of light different colours reach the observer's eye and rainbow is seen.

An important point to be noted here is that a rainbow is always formed in a direction opposite to that of Sun.

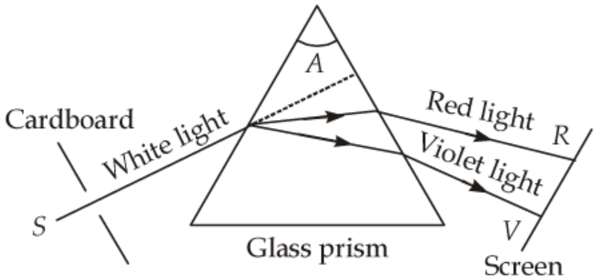


S87.



When a beam of white light enters a glass prism (or any other dispersive medium), the light ray bends towards the normal on entering into glass. However, different colours of light bend through different angles with respect to the incident ray. The red light bends the least while the violet light bends the most. So, rays of different colours emerge along different paths and, thus, become distinct. Hence, dispersion is caused and spectrum is formed.

S88.



When a beam of white light enters a glass prism (or any other dispersive medium), the light ray bends towards the normal on entering into glass. However, different colours of light bend through different angles with respect to the incident ray. The red light bends the least while the violet light bends the most. So, rays of different colours emerge along different paths and, thus, become distinct. Hence, dispersion is caused and spectrum is formed.

S89. Near point of hypermetropic eye x = 60 cm.

As he wants to read a book placed at 25 cm in front of eye lens (*i.e.*, $u = -25$ cm), he should use convex lens. The lens used should form virtual image of book page at near point of defective eye (*i.e.*, $v = -60$ cm) so that now the hypermetropic eye can focus it on retina.

Using lens formulas $$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

We have $$\frac{1}{(-60)} - \frac{1}{(-25)} = \frac{1}{f}$$

$$\Rightarrow \quad \frac{1}{f} = \frac{-1}{60} + \frac{1}{25} = \frac{-5+12}{300} = \frac{7}{300}$$

or $$f = \frac{300}{7}\text{ cm} = \frac{3}{7}\text{ cm}$$

$\therefore$ Power of lens, $$P = \frac{1}{f} = \frac{7}{3}\text{ D} = +2.33\text{ D}.$$

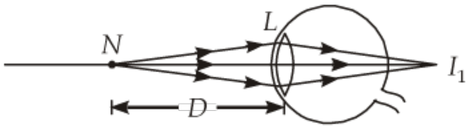
S90. (a) Accommodation power is the property of the eye lens to adjust its focal length so as to focus objects situated at different distances from the eye on the retina.

(b) The myopic person should use a concave (diverging) lens to correct his defect of vision. Since far point of defective eye $x = 1.2$ m

$\therefore$ Focal length of corrective lens $f = -1.2$ m

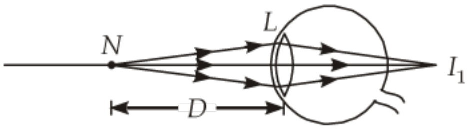
$\therefore$ Power of corrective lens $$P = \frac{1}{f} = \frac{1}{(-1.2)} = -0.83\text{ D}$$

S91. Hypermetropia or long-sightedness is that defect of vision in which the defective eye can see distant objects distinctly but is unable to see distinctly an object placed near this eye. For a nearby object the image is formed behind the retina as shown in figure.

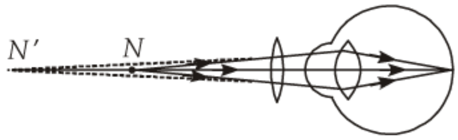


The defect can be corrected by the use of a convex lens of appropriate power.

S92. The old man is suffering from presbyopia (or long-sightedness). The defect can be corrected by using a convex (converging) lens of an appropriate power.



(i)



(ii)

S93. Both are conditions of long-sightedness and are on account of increased focal length of the eye lens. In hypermetropia, the eye lens becomes thin at the centre or the eyeball becomes shorter. On the other hand, if the defect arises due to weakness of ciliary muscles so that they are unable to reduce the focal length, the defect is called presbyopia which is usually present in old age.

Thus, problem and rectification of both the defects of vision is same but their causes are different.

S94. The air molecules and other fine particles present in Earth's atmosphere have size even smaller than the wavelength of visible light. As a result, these are more effective in scattering light of shorter wavelengths at the blue end of spectrum. Amount of scattering of red light is comparatively very small. So when sunlight passes through atmosphere of Earth, blue light is scattered much more and spreads in all directions. As a result, the sky appears as blue to us.

If there had no atmosphere on the Earth then there would have been no scattering of sunlight. Then, the sky would have looked dark.

S95. (a) From three sides of the glass tank blue light is obtained due to scattering of light of short wavlengths by minute colloidal sulphur particles.

(b) From the fourth side of the glass tank facing the circular hole, first the orange-red and then bright crimson red coloured light is observed. It is due to the fact that red light of longer wavelength suffers very little scattering and travels straight through the tank.

S96. (a) The four parts are:

1 — Retina, 2 — Ciliary muscles, 3 — Pupil, 4 — Crystalline lens.

(b) Image of an object is formed on the retina.

(c) Accommodation of power is the property of the eye lens to adjust its focal length so as to focus objects situated at different distances from the eye on the retina.

Colour blindness is now out of syllabus.

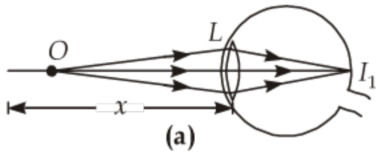
S97. **Myopia or short-sightedness or near-sightedness:** It is that defect of vision in which the suffering person can see nearby objects clearly but cannot see distant objects distinctly. For a myopic eye, the near point is at 25 cm but the far point has shifted from infinity to a position nearer to the eye. If as shown in figure (a), light rays from an object situated at a distance of x or less are correctly focussed at the retina, it means that the far point of the eye has come closer to eye at a distance x from ∞.

Naturally as shown in figure (b), light rays coming from a distant object ($u = \infty$) are focussed in front of retina of eye.

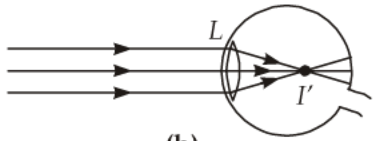
Two possible causes of myopia are:

(i) Either the power of the eye lens has become more than its normal value due to excessive curvature of the cornea, or

(ii) Elongation of the eyeball due to some genetic defect.

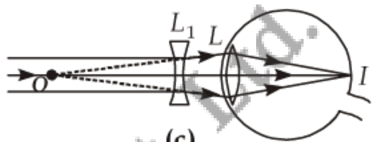


(a)



(b)

To rectify this defect a concave lens of focal length f is used, which may form the virtual image of the distant object at the far point of defective eye (*i.e.*, $u = -\infty$ and $v = -x$) so that now the defective eye may form the image at the retina as shown in figure (c).



(c)

Obviously, by using lens formula, we have

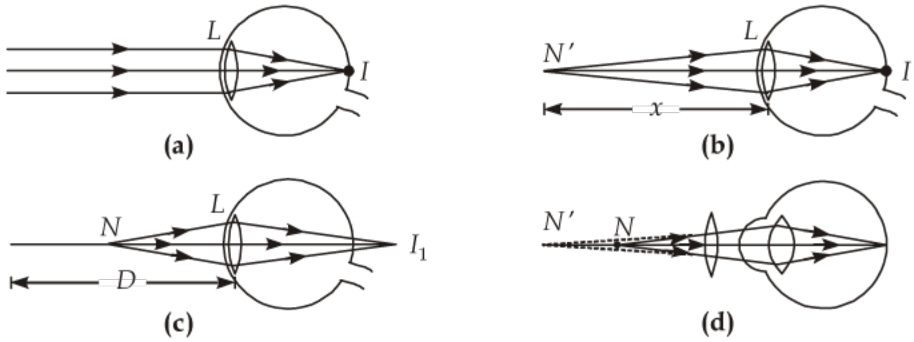
$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{(-x)} - \frac{1}{(-\infty)}$$

$\Rightarrow$ $$f = -x$$

In the given problem as the boy is using spectacles of focal length $f = -50$ cm. It mens he is using concave lens and hence he is suffering from myopia.

$$\text{Power of the lens } P = \frac{1}{f \text{ in metre}} = \frac{100}{(-50 \text{ cm})} = -2\text{D}.$$

S98. (a) Long-sightedness or far-sightedness or hypermetropia is that defect of vision in which the affected person can see distant objects clearly but cannot see nearby objects so clearly. As shown in figure (a) and (b), the eye lens can focus the rays at point I on retina for objects situated at a distance x (where $x > D$) or more from the eye. It means that far point of defective eye is at infinity but near point of defective eye has shifted away to N'.



For object situated at least distance of distinct vision D (*i.e.*, at point N) the light rays are focussed at a point I_1 behind the retina as shown in figure (c)

Two possible causes of hypermetropia are:

(i) Either the power of the eye lens is less (or focal length of eye lens is too long) due to less curvature of cornea, or

(ii) Shortening of eyeball due to some genetic defect.

To rectify this defect we use a convex lens L_1 of focal length f so as to form virtual image of an object situated at the least distance of distinct vision ($u = -D$) at the near point N' of the defective eye ($v = -x$) so that now the eye lens can focus the rays so as to form a sharp image I at the retina.

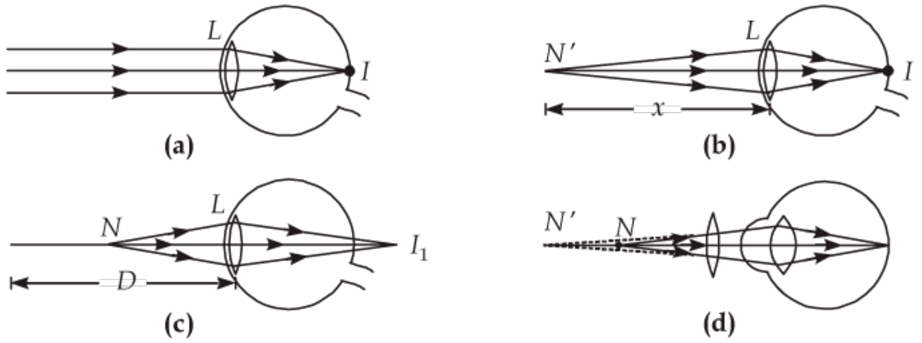
$$\therefore \quad \frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{(-x)} - \frac{1}{(-D)} = \frac{-1}{x} + \frac{1}{D} = \frac{x-D}{Dx}$$

$$\Rightarrow \quad f = \frac{xD}{x-D}.$$

(b) We often see advertisments for eye donation on television or in newspapers. Such advertisements encourage us to think about and pledge eye donation after our death.

A person willing to donate his eyes has to fill up a pledge form. After one's death his relatives inform eye donation society or any nearby hospital. A team of doctors visit the deceased house and remove the eyes within six hours of the death of person. The cornea of these eyes can be transplanted to the eye of a blind person. Thus, a person can give eye sight to two persons even after his death.

S99. Long-sightedness or far-sightedness or hypermetropia is that defect of vision in which the affected person can see distant objects clearly but cannot see nearby objects so clearly. As shown in figure (a) and (b), the eye lens can focus the rays at point I on retina for objects situated at a distance x (where $x > D$) or more from the eye. It means that far point of defective eye is at infinity but near point of defective eye has shifted away to N'.



For object situated at least distance of distinct vision D (*i.e.*, at point N) the light rays are focussed at a point I_1 behind the retina as shown in figure (c)

Two possible causes of hypermetropia are:

(i) Either the power of the eye lens is less (or focal length of eye lens is too long) due to less curvature of cornea, or

(ii) Shortening of eyeball due to some genetic defect.

To rectify this defect we use a convex lens L_1 of focal length f so as to form virtual image of an object situated at the least distance of distinct vision ($u = -D$) at the near point N' of the defective eye ($v = -x$) so that now the eye lens can focus the rays so as to form a sharp image I at the retina.

$$\therefore \qquad \frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{(-x)} - \frac{1}{(-D)} = \frac{-1}{x} + \frac{1}{D} = \frac{x-D}{Dx}$$

$$\Rightarrow \qquad f = \frac{xD}{x-D}.$$

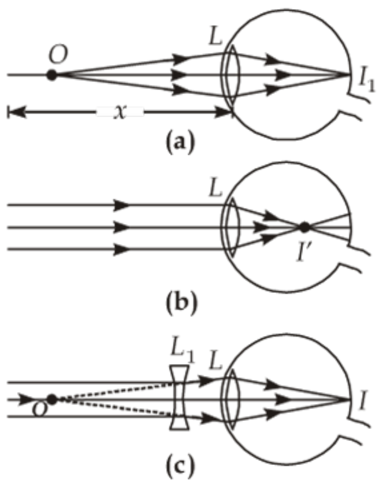
S100. (a) **Myopia or short-sightedness or near-sightedness:** It is that defect of vision in which the suffering person can see nearby objects clearly but cannot see distant objects distinctly. For a myopic eye, the near point is at 25 cm but the far point has shifted from infinity to a position nearer to the eye. If as shown in figure (a), light rays from an object situated at a distance of x or less are correctly focussed at the retina, it means that the far point of the eye has come closer to eye at a distance x from ∞.

Naturally as shown in figure (b), light rays coming from a distant object ($u = \infty$) are focussed in front of retina of eye.

Two possible causes of myopia are:

(i) Either the power of the eye lens has become more than its normal value due to excessive curvature of the cornea, or

(ii) Elongation of the eyeball due to some genetic defect.



(b) To rectify this defect a concave lens of focal length f is used, which may form the virtual image of the distant object at the far point of defective eye (*i.e.*, $u = -\infty$ and $v = -x$) so that now the defective eye may form the image at the retina as shown in figure (c).

(c) If an eye donation camp is being organised by social workers in our locality, we should wholeheartedly participate in the camp. We should fill up forms pledging to donate our eyes after our death. We should also encourage our family members, friends and others to pledge eye donation.

It is because our eye donation could give new light to a number of blind persons. In this way our eyes can see the world even after our death. Eye donation is a noble cause and we should propagate the idea.

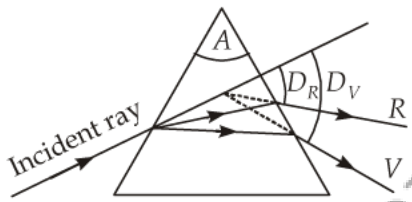
S101(a) The air molecules and other fine particles present in Earth's atmosphere have size even smaller than the wavelength of visible light. As a result, these are more effective in scattering light of shorter wavelengths at the blue end of spectrum. Amount of scattering of red light is comparatively very small. So when sunlight passes through atmosphere of Earth, blue light is scattered much more and spreads in all directions. As a result, the sky appears as blue to us.

(b) The air becomes rarer as its height above the earth increases. Its refractive index decreases. A ray of light from the Sun when it enters the atmosphere at the horizon gets refracted from a rare to a denser medium. The rays, therefore, gradually bend towards the normal and the Sun appears to be raised. As a result, the Sun is visible to an observer nearly two minutes before actual sunrise at the horizon.

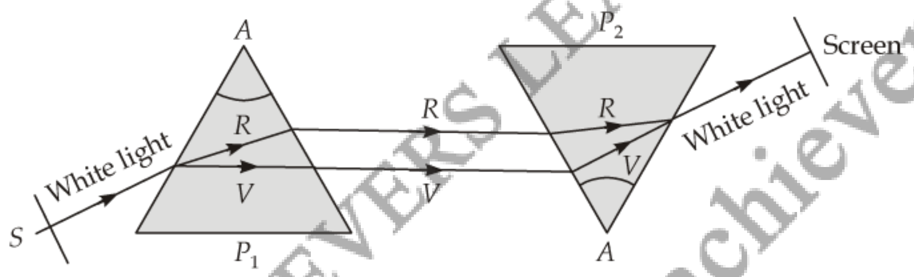
(c) The eyelens has power to adjust its power so as to see objects situated at different distances in front of eye. However, there is a limit for this accommodating power. If an object is situated at a distance even less than 25cm then the eyelens cannot form its image at the retina and consequently one cannot see that object.

(d) The power of accommodation of the eye decreases with ageing due to the gradual weakening of the ciliary muscles and a dminishing flexibility of the eye lens. This defect is called '*presbyopia*', Due to this defect, most people cannot read comfortably and distinctly and need convex (converging) lenses of appropriate power. Some persons suffer from both myopia and hypermetropia. They need ***bi-focal*** lenses.

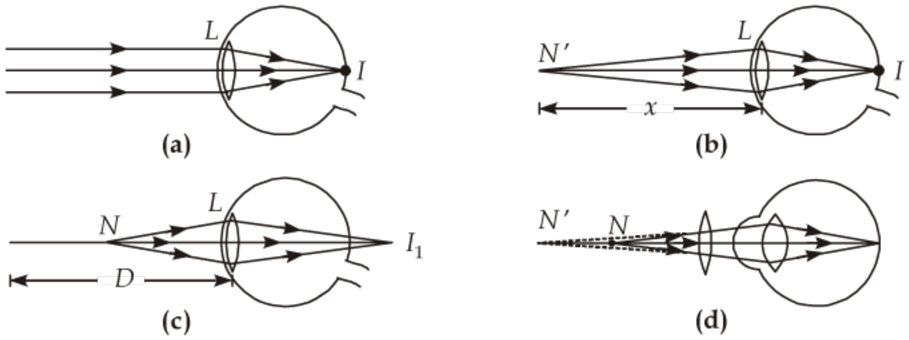
S102(a) The angle of prism A, angle of deviation D_R for red colour, angle of deviation D_V for violet colour ray and the incident ray have been marked as shown in figure.



(b) When a second identical prism P_2 is placed in an inverted position with respect to the first prism P_1, as shown in figure, the seven coloured rays recombine to form white light again.



S103.(a) Long-sightedness or far-sightedness or hypermetropia is that defect of vision in which the affected person can see distant objects clearly but cannot see nearby objects so clearly. As shown in figure (a) and (b), the eye lens can focus the rays at point I on retina for objects situated at a distance x (where $x > D$) or more from the eye. It means that far point of defective eye is at infinity but near point of defective eye has shifted away to N'.



For object situated at least distance of distinct vision D (*i.e.*, at point N) the light rays are focussed at a point I_1 behind the retina as shown in figure (c)

Two possible causes of hypermetropia are:

(i) Either the power of the eye lens is less (or focal length of eye lens is too long) due to less curvature of cornea, or

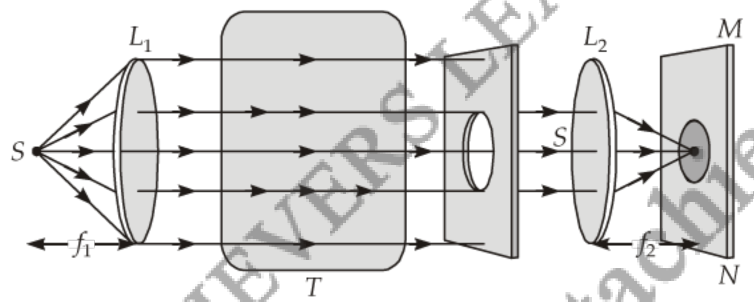
(ii) Shortening of eyeball due to some genetic defect.

To rectify this defect we use a convex lens L_1 of focal length f so as to form virtual image of an object situated at the least distance of distinct vision ($u = -D$) at the near point N' of the defective eye ($v = -x$) so that now the eye lens can focus the rays so as to form a sharp image I at the retina.

$$\therefore \quad \frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{(-x)} - \frac{1}{(-D)} = \frac{-1}{x} + \frac{1}{D} = \frac{x-D}{Dx}$$

$$\Rightarrow \quad f = \frac{xD}{x-D}.$$

(b)

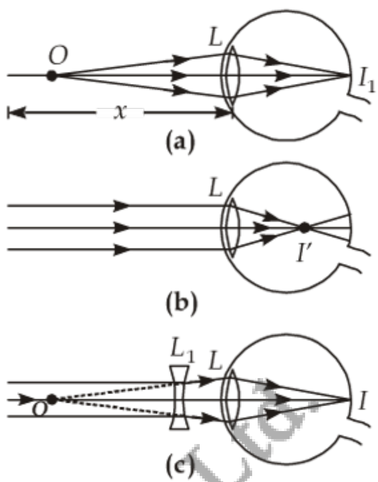


The chemicals used are sodium thiosulphate and sulphuric scid.

S104(a) The student is suffering from 'myopia'.

(b) **Myopia or short-sightedness or near-sightedness:** It is that defect of vision in which the suffering person can see nearby objects clearly but cannot see distant objects distinctly. For a myopic eye, the near point is at 25 cm but the far point has shifted from infinity to a position nearer to the eye. If as shown in figure (a), light rays from an object situated at a distance of x or less are correctly focussed at the retina, it means that the far point of the eye has come closer to eye at a distance x from ∞.

Naturally as shown in figure (b), light rays coming from a distant object ($u = \infty$) are focussed in front of retina of eye.



Two possible causes of myopia are:

(i) Either the power of the eye lens has become more than its normal value due to excessive curvature of the cornea, or

(ii) Elongation of the eyeball due to some genetic defect.

To rectify this defect a concave lens of focal length f is used, which may form the virtual image of the distant object at the far point of defective eye (*i.e.*, $u = -\infty$ and $v = -x$) so that now the defective eye may form the image at the retina as shown in figure (c).

(c) The lens used to correct myopia is a concave (diverging) lens of appropriate power.