

# CHAPTER 11

## Human Eye and The Colorful World

### 1. ONE MARK QUESTIONS

1. Name the essential parts of human eye,

**Ans :** [CBSE 2016]

(a) Retina (b) Eye lens (c) Cornea (d) Pupil (e) Iris

2. Which liquid fills the space behind the cornea?

**Ans :** [Delhi 2016]

Aqueous humour is filled in the space behind the cornea.

3. Which part of the eye controls the amount of light entering the eye?

**Ans :** [CBSE 2016]

Pupil controls the amount of light entering the eye.

4. What is eye lens made of ?

**Ans :** [CBSE 2016]

Eye lens is made of transparent and flexible jelly like material.

5. How is the sense of vision carried from the eye to the brain?

**Ans :** [CBSE 2016]

Through optical nerve, sense of vision is carried from eye to the brain.

6. Which liquid fills the space between eye lens and retina?

**Ans :** [All India 2015]

Vitreous humour.

7. Why is blind spot so called?

**Ans :** [CBSE 2015]

An image formed at this point is not sent to brain.

8. What is the number of receptors contained in the retina?

**Ans :** [CBSE 2015]

Retina contains more than 125 millions receptors which are of two types, rods and cones.

9. What is meant by far point?

**Ans :** [CBSE 2015]

The farthest point upto which an normal human eye can see objects clearly is known as far point.

10. Why can you not see an object clearly if it is placed very close to your eye?

**Ans :** [All India 2015]

For a human eye, there is a near point, 25 cm. If the distance of the object is lesser than this distance, eye cannot see object clearly.

11. When you enter from a bright sunshine into a dark room, you are not able to see clearly for sometime, why?

**Ans :** [Delhi 2015]

In bright light, pupil had become small.

12. On what factor the colour of the scattered light depends?

**Ans :** [CBSE 2015]

The colour of the scattered light depends on the size of scattered particles.

13. What is Presbyopia ?

**Ans :** [CBSE 2014]

Presbyopia is a kind of eye defect in old persons due to ageing. It happens due to decrease in flexibility of eye lens and weakening of ciliary muscles.

14. What is twinkling of stars due to?

**Ans :**

Twinkling of star is due to atmosphere refraction.

15. Define dispersion of white light.

**Ans :** [CBSE 2014]

The splitting of white light into its constituents seven colours is called dispersion of light.

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

**Ans :** [CBSE 2014]

A diverging lens/concave lens is used for a person suffering from near sightedness/ myopia.

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

**Ans :** [All India 2013]

Ciliary muscles help in changing the focal length of the eye lens.

18. Write the value of near point of distinct vision for normal eye.

**Ans :** [CBSE 2013]

For a normal human eye the value of near point of distinct vision is 25 cm.

19. What is the role of pupil in a human eye?

**Ans :** [CBSE 2013]

Pupil regulates and controls the amount of light entering in the eyes.

20. What is the range of vision for a normal human eye?

**Ans :** [CBSE 2013]

Range of vision is 25 cm to infinity.

21. Name the two phenomena involved in the formation of rainbow.

**Ans :** [CBSE 2012]

The phenomena involved in formation of rainbow are dispersion and total internal reflection and refraction.

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

**Ans :** [CBSE 2012]

Red colour deviates the least and violet colour deviates the most.

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

**Ans :** [CBSE 2012]

Myopia.

24. Name the part responsible for the power of accommodation of the eye.

**Ans :** [CBSE 2012]

Ciliary muscles help for the power accommodation of the eye.

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

**Ans :** [CBSE 2012]

Cataract.

26. Why sky appears dark to the passengers flying at high altitudes?

**Ans :** [CBSE 2012]

There is no atmosphere at high altitudes. Hence no scattered light can reach to the eye.

27. A person suffering from an eye defect uses lenses of power  $-1D$ . Name the defect he is suffering from and the nature of lens used.

**Ans :** [CBSE 2012]

He uses a concave lens (negative power) because he is suffering from myopia.

28. Which colour of white light suffers (i) least deviation and (ii) maximum deviation when a beam of white light passes through a glass prism?

**Ans :** [CBSE 2011]

Longer wavelength light (red) suffers least deviation and shorter wavelength (violet) suffers maximum deviation when white light is passed through a prism.

depends. Why does the sky appear dark in space?

**Ans :** [CBSE 2016]

Scattering of light depends on the presence of atmosphere which contains water droplets, molecules of air, smoke and dust particles.

In the space, there is no atmosphere to scatter light.

30. How can change of size of eyeball be one of the reason for: (a) Myopic (b) Hypermetropic

Compare the size of eyeball with that of a normal eye in each case. How does this change of size affect the position of image in each case?

**Ans :** [All India 2016]

(a) The eye suffering from myopia, has long eye ball than that of normal eye due to which the retina is at a larger distance from the eye lens. This results in the formation of the image in front of the retina.

(b) The eye suffering from hypermetropia has short eye ball than that of normal eye due to which the retina is smaller distance from the eye lens. This results in the formation of the image behind the retina.

31. Sushil went to an eye specialist for check up. He prescribed him to use spectacle lens of  $+0.5D$  power.  
a. Name the defect of vision he is suffering from.  
b. Find the focal length of spectacle lens.

**Ans :** [CBSE 2015]

- a. Hypermetropia.  
b. Power of spectacle  $P = +0.5D$

$$f = \frac{1}{P} = +\frac{1}{0.5} m$$

or  $f = +2 m$  positive sign means it is a convex lens.

32. State the function of pupil and ciliary muscles.

**Ans :** [CBSE 2015]

- a. Pupil controls the amount of light entering the eye.  
b. Ciliary muscles help in accommodation of power of eye lens.

33. A child sitting in a classroom is not able to read clearly the writing on the blackboard.

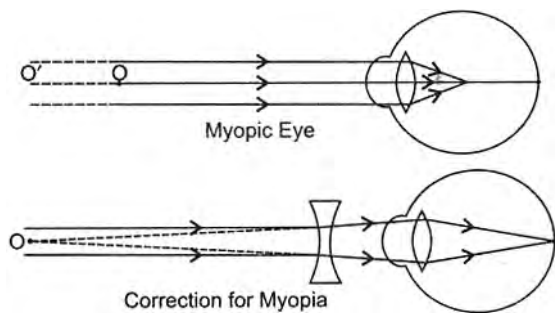
- a. Name the type of defect from which his eye is suffering.  
b. With the help of a ray diagram show how this defect can be remedied.

**Ans :** [Delhi 2015]

- a. Myopia  
b. Myopia can be remedied by using concave lens.

## TWO MARKS QUESTIONS

29. Mention the factor on which scattering of light



34. What is meant by persistence of vision?

**Ans :** [All India 2014]

On removing object seen, its impression persists on the retina for  $\frac{1}{16}$  th second. The inability of human brain to perceive more than two images formed on the retina within interval of  $\frac{1}{16}$  th of a second is called persistence of vision. In this case, both the images merge and give a sensation of continuity.

35. List four common defects of vision that can be corrected with the use of spectacles.

**Ans :** [Delhi 2013]

(i) Myopia (ii) Hypermetropia (iii) presbyopia (iv) Astigmatism.

36. (a) Explain how a normal human eye is able to see distinctly the object placed at a distance as well as those placed at a nearer distance.

(b) What is the far point and near point of a normal human eye?

**Ans :** [CBSE 2013]

(a) Ciliary muscles change the curvature of eye lens as per requirement of the eye. This changes the focal length of eye lens. When muscles are relaxed, lens becomes thin and distant objects are seen clearly. While seeing closer objects, muscles contract, this thickens the eye lens and focal length decreases.

(b) Far point — Infinity. Near point — 25 cm from the eye.

37. What is meant by least distance of distinct vision? How does this vary between the very young and old people?

**Ans :** [CBSE 2013]

Least distance of distinct vision is the minimum distance between eye and object to see it clearly.

In young, the least distance of distinct vision is lesser and for old people it is more.

38. Define dispersion of white light and name the colours of white light in order.

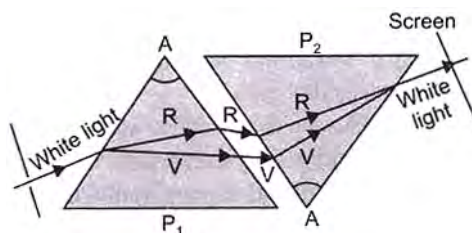
**Ans :** [CBSE 2012]

When white light is passed through a prism, it splits into its seven constituent colours. Splitting of white light into its constituent colours is called dispersion. Seven constituent colours are – violet, indigo, blue, green, yellow, orange and red. (VIBGYOR).

39. Describe an experiment to discuss the recombination of dispersed light.

**Ans :** [CBSE 2012]

If another identical prism is placed in inverted position in front of a prism then dispersed colours obtained from first prism get recombine to produce white light.



40. Explain why do stars twinkle and planets do not?

**Ans :** [CBSE 2012]

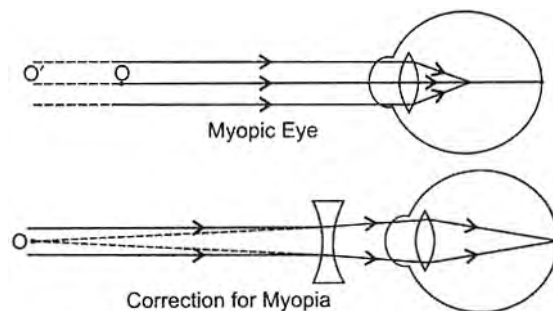
The light coming from star get refracted through the atmospheric layers. Due to this, the star appear slightly higher than its actual position. Since the densities of atmospheric layers changes frequently and hence the position of the star appear changes continuously stars are very distant point-sized objects. As the path of rays of light coming from star is continuously changes. So sometimes light enters into our eyes and some times it faints. This is twinkling of the star. Since planets are closer to us, their size is also big. Our eyes receive light from different points of the planets. Hence planets do not twinkle.

41. List two causes leading to myopia of the eye. Draw ray diagrams to show the image formation in case of defective eye and corrected eye.

**Ans :** [CBSE 2012]

Causes of Myopia

- Excessive curvature of cornea
- Elongation of eye ball.



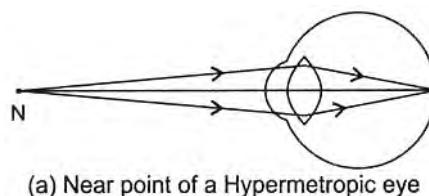
42. (a) What is the least distance of distinct vision for the normal eye?

(b) Does the above distance increase or decrease for long sighted eye? Give reason for your answer with diagram.

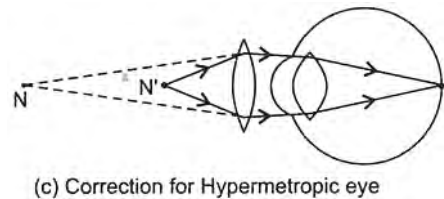
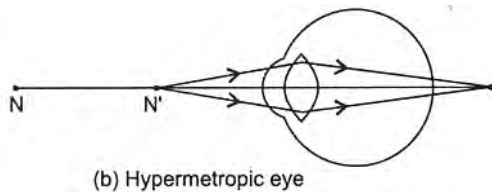
**Ans :** [CBSE 2012]

(a) For a normal human eye, the least distance of distinct vision is 25 cm.

(b) Least distance of distinct vision increases for long sighted eye. A hypermetropic eye can see upto infinite distance, which is more than 25 cm.



(a) Near point of a Hypermetropic eye



43. A person needs a lens of power  $-2.5$  dioptres for correcting his vision. Name the defect of vision he is suffering from. Which lens will he be using for the correction? Also, find the focal length of lens.

**Ans :** [CBSE 2012]

$$P = -2.5D$$

The person using a lens of negative focal length

$$f = \frac{1}{P} = -\frac{1}{2.5} = -0.4 \text{ m} = -40 \text{ cm}$$

Here negative focal length means he uses a concave lens.

44. Name the part of the eye where image is formed by the eye lens. What is the nature of the image formed? How is this image sent to the brain?

**Ans :** [CBSE 2012]

Retina.

Image on the retina is inverted and real. Optic nerve sends the image to the brain.

45. Explain how a normal human eye is able to see distinctly the object placed at a distance as well as those placed at a nearer distance. What is the far point and near point of a normal human eye?

**Ans :** [CBSE 2012]

To see a near object, the focal length of the eye should be small and vice versa. The focal length of the eye lens can be adjusted by ciliary muscles. When one see near object, ciliary muscles decreases the focal length and for distant object, ciliary muscles increases the focal length. Far point — Infinity.

Near point — 25 cm from the eye.

46. An old person is unable to see clearly nearby object as well as distant objects, (i) What defect of vision is he suffering from? (ii) What kind of lens will be required to see clearly the nearby as well as distant objects? Give reason.

**Ans :** [CBSE 2012]

(i) Old person is suffering from presbyopia.

(ii) He cannot see near objects as well as distant objects, so he has to use bifocal lenses which consists of concave and convex lenses both.

47. What is dispersion of light? Name the (i) component of white light that deviates the least, (ii) component of white light that deviates the most, while passing

through a glass prism.

**Ans :** [CBSE 2012]

- Splitting of white light into its constituent colours when passed through a prism called dispersion of light.
- Violet colour deviates the most while passing through the glass prism.

48. Why does it take sometimes to see the objects in a dim room when we enter the room from bright sunlight outside?

**Ans :** [CBSE 2011]

In bright sunlight, pupil of eye contracts to control the light. When we enter a dim room, pupil takes some time to expand to allow more light to see the objects clearly.

49. Why does the clear sky appear blue? How would the sky appear in the absence of earth's atmosphere?

**Ans :** [CBSE 2011]

Scattering of light  $\propto \frac{1}{\lambda^4}$  where  $\lambda$  is the wavelength of light, i.e. least wavelength will scatter more and vice versa. Blue colour light has shorter wavelength and hence scattered more than other colours. In space, there is no atmosphere hence no scattering of light happens in the space so space appears black.

50. Why do we observe difference in colours of the sun during sunrise, sunset and noon?

**Ans :** [CBSE 2011]

During the sunrise or sunset, the sun is at horizon. Most of the blue light and other light of shorter wavelength are scattered most. Only the longer wavelength (red) reaches to us. That's why sun appears red during the sunrise or sunset.

At noon, the Sun appears white because it is at our head and all wavelength reaches to us due to little of the blue and violet colours are scattered due to least distance travelled by light.

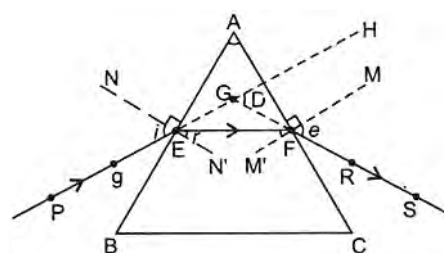
51. Why do we observe the seven colours when white light passes through a glass prism? Which component of white light deviates the least?

**Ans :** [CBSE 2011]

Since angle of deviation for different colour is different hence different colour suffers different deviation. Deviation for red colour is minimum.

52. Draw a neat diagram to show the refraction of a light ray through a glass prism, and label on it the angle of incidence and angle of deviation.

**Ans :** [CBSE 2011]



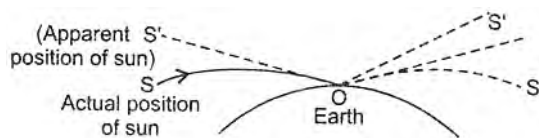
PE—Incident ray

$\angle i$ —Angle of incidence



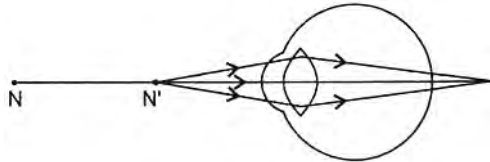


actually set. Thus the duration of day time increases by 4 minutes (2 minutes each time at the time sunrise or sunset).



59. Study the diagram and answer the questions the follows :

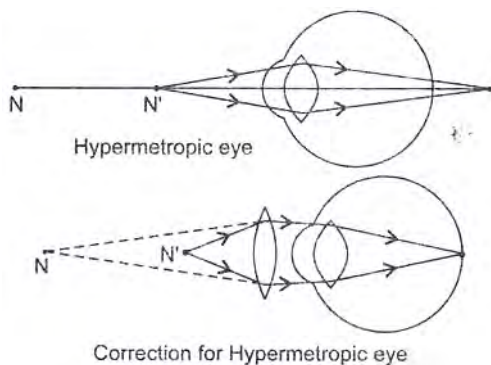
Ans :



- Identify the defect of vision represented by this diagram.
- List the two possible causes of this defect.
- With the help of ray diagram explain how this defect can be corrected.

Ans : [Delhi 2016]

- The defect of vision is hypermetropia.
- (i) increase in focal length of eye lens  
(ii) shortening of eye ball.
- Hypermetropia can be corrected by using convex lens.

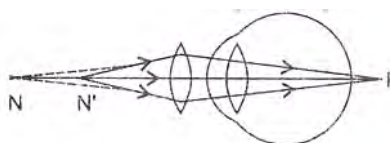


60. A person can see distant signboards clearly but cannot read clearly a book which is at 25 cm from his eye. Giving reason identify the defect. Draw a labelled ray diagram to illustrate this defect and its correction.

Ans : [CBSE 2016]

Eyes defect is hypermetropia. Its causes are due to

- shortening the eye ball
- increase in focal length of eye lens.



61. 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 : [CBSE 2015]

- Scattering of light is phenomenon by which beam of light is spreaded in many direction when it

interacts with particle of matter. When sunlight strikes molecules in atmosphere, the light is redirected in many direction.

- Scattering of blue colour is most due to shorter wavelength, where as scattering of red colour is least. All colours scattered in the sky and red colour light reaches to earth, due to this sun appears reddish.

62. With the help of scattering of light, explain the reason for the difference in colours of the Sun as it appears during sunrise/sunset and noon.

Ans : [CBSE 2015]

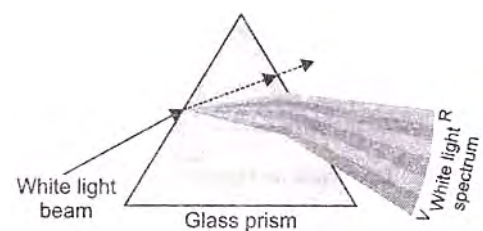
At the time of sunrise or sunset it appears red where as at noon it appear white when it is overhead because at sunrise or sunset blue colour and other shorter wavelength light get scattered away while passing through the atmosphere. Scattering of longer wavelength is least which reach to the earth. Due to this sun appears red during morning and evening time.

When sun is overhead at noon, sun rays travels smaller distance, due to little scattering of blue and violet colour wavelength almost all wavelengths reach to earth and due to this sun appears white.

63. State the cause of dispersion, when white light enters a glass prism. Explain with a diagram.

Ans : [All India 2014]

When white light passes through a prism it splits into its constituent colours, because each coloured light has different speed in prism. Prism has different refractive index for these light rays and so deviates through different angles when emerge out from the prism. Deviation for violet colour (shortest wavelength) is most and for red colour (largest wavelength) deviation is least.



- Calculate maximum power of accommodation of a person having normal vision.
- A person needs to use glasses for reading newspaper. Identify the defect in her vision and the type of lens she would need to correct it.
- Sometimes when we enter into a dark room from bright sunlight we are unable to see objects clearly. Why?

Ans : [CBSE 2014]

- Least distance of distinct vision for a normal eye  $D = 25 \text{ cm}$ .

$$P = \frac{1}{f} = \frac{100}{25} = 4D$$

For a person having normal vision, the power of accommodation is 4 D.

- Hypermetropia, to correct hypermetropia convex lens is needed.

- (c) In bright light the pupil contract its size becomes small to control the light, but when we enter into a dark room it take sometime for the pupil to expand to allow more light in dark room.

65. State one function each of iris, pupil, and cornea.

**Ans :** [CBSE 2014]

- Iris:** It controls the amount of light entering the eye by changing the size of pupil.
- Pupil:** Pupil is a part of the eye through which light enters in the eye.
- Cornea:** It is a thin membrane which covers the eye ball. Light enters the eye through cornea where it is refracted most.

66. (a) Explain the phenomenon of scattering of light. State the factor on which colour of scattered light depends.
- (b) List any two natural phenomenon based on scattering of light.

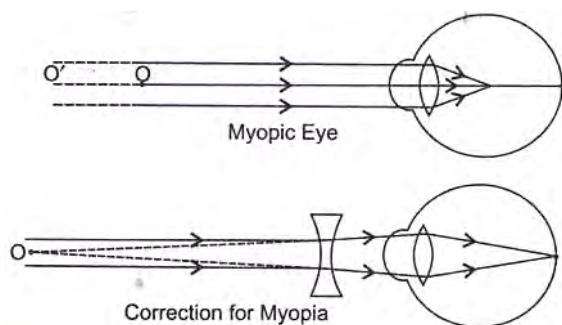
**Ans :** [CBSE 2014]

- (a) Scattering of light is the phenomenon due to which light gets deflected by the atoms or molecules of different atmospheric gases and suspended particles present in atmosphere. Scattering depends upon size of the particles of the medium through which light passes.
- (b) Two natural phenomenon based on scattering are (i) Reddish colour of sky during sunrise and sunset, (ii) Blue colour of sky.

67. A person cannot see objects farther than 12 m from the eye clearly. Name the defect of vision he is suffering from and the lens that should be used for correction of this defect. Illustrate with the help of a diagram, how this lens will correct the defective vision?

**Ans :** [CBSE 2011, 2013]

He is myopic. Myopia can be corrected by using concave lens.

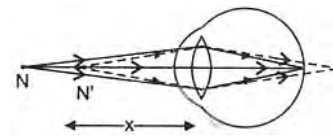


68. A person cannot read a book at distances less than 50 cm. Name the defect of vision he is suffering from. How can it be corrected? Draw ray diagrams to show the image formation:

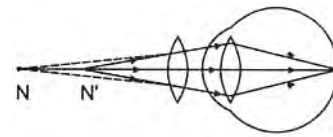
- by defective eye and
- after using corrective lens.

**Ans :** [CBSE 2011, 2013]

- Either the hypermetropic eyeball is too short or
- The ciliary muscle is unable to change the shape of the lens enough to properly focus the image i.e., the focal length of the eye lens is too long. This defect is called hypermetropia.



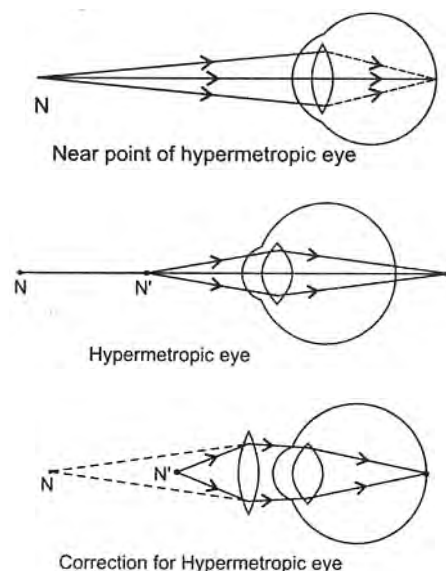
It can be corrected with the help of a convex lens as shown.



69. A person is unable to read a book clearly when kept at a distance of 25 cm from his eye. Name the defect. How can it be corrected? Draw ray diagrams for (i) defective eye (ii) corrected eye and explain them.

**Ans :** [CBSE 2013]

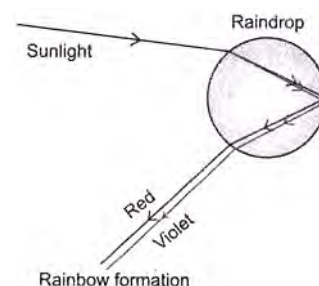
The person cannot read a book at a distance of 25 cm from his eyes. So he is suffering from long sightedness/hypermetropia. It can be corrected by using convex lens of suitable focal length.



70. With the help of a diagram, explain the formation of a rainbow in the sky.

**Ans :** [CBSE 2012]

The water droplets in the atmosphere act like small prisms. These droplets refract and disperse the incident sunlight, then reflect it internally and finally refract it again when it comes out of the rain drop. Due to distortion of sunlight and internally reflection, different colours reach to the observer.



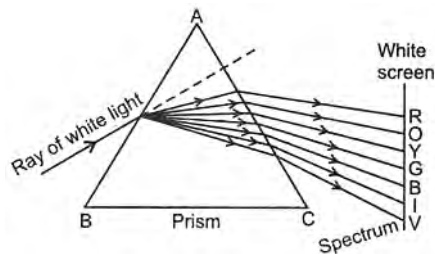
71. (a) What is meant by dispersion of white light? Draw a diagram to show the dispersion of white light by

a glass prism.

- (b) Light of two colours A and B pass through a prism. A deviates more than B from its path of incidence. Which colour has a higher speed in the prism?

**Ans :** [CBSE 2011]

- (a) Splitting of white light into its constituent colours when it is passed through a prism is called dispersion of white light.



- (b) B

## FIVE MARKS QUESTIONS

72. (a) A student is unable to see clearly the words written on the black board placed at a distance of approximately 3 m from him. Name the defect of vision the boy is suffering from. State the possible causes of this defect and explain the method of correcting it.

- (b) Why do stars twinkle? Explain.

**Ans :** [CBSE 2017]

- (a) He is suffering from myopia.

Causes of myopia:

- (i) elongation of eye ball.
- (ii) excessive curvature of cornea.

Concave lens of suitable power is used to correct myopia.

- (b) Light coming from stars when enter in the Earth's atmosphere suffers refraction from the atmospheric layers. Since the densities of atmospheric gases changes frequently. Since the stars are point sized and at a far distance so sometimes star appear brighter and sometimes dimmer which gives the impression as the stars twinkling.

73. Account for the following:

- a. Part of the human eye that helps in changing the focal length of the eye lens.
- b. The condition resulting due to the eye lens becoming cloudy.
- c. The factors on which colour of the scattered white light depends.
- d. The range of vision of a normal eye.
- e. The sky appears dark to the astronauts in the space.

**Ans :** [CBSE 2016]

- a. Ciliary muscles.
- b. Cataract.
- c. Size of the suspended particles in the medium through which white, light passes.
- d. 25 cm to infinity is the range of vision of normal eye.

- e. Due to absence of atmosphere in the space, there is no scattering and hence space appears black/dark.

74. (a) If a person wears lens of power - 6D for distant vision and for correcting his near vision he needs a lens of +2D. Determine the focal length of the lenses in both the case.
- (b) Give reason for the following natural phenomenon:
- (i) Stars twinkle
  - (ii) Planets do not twinkle
  - (iii) Stars appear raised in the sky.

**Ans :** [CBSE 2016]

(a) (i)  $P_1 = -6D$  as  $f_1 = \frac{1}{P_1} = -\frac{1}{6}$  m

$$f_1 = -\frac{100}{6} \text{ cm} = -16.66 \text{ cm}$$

(ii)  $P_2 = +2D$  as  $f_2 = \frac{1}{P_2} = +\frac{1}{2}$  m

$$f_2 = 50 \text{ cm}$$

- (b) (i) Due to continuous changes in the densities of the atmospheric layers the apparent position of the star also changes; which make the light coming from the distant point sized star brighter and dimmer. The light coming from the stars therefore gives a shaking appearances, which gives the impression of twinkling of a star.

- (ii) Since the planets are closer to us. Due to this they appear a combination of large point-sizes source of light, and change in the path of light coming from the planets is not significant. So planets do not appear twinkling.

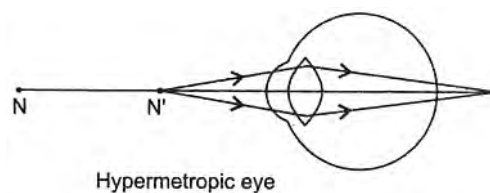
- (iii) Due to atmospheric refraction, a star appears to be slightly higher than its actual position in sky.

75. (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 experimental arrangement for observing scattering of light in colloidal solution. Name the two chemicals used in this activity.

**Ans :** [All India 2015]

- a. In hypermetropia a person cannot see near by objects clearly. Its is due to shortening of the eye ball or due to increase in focal length of eye lens. To correct hypermetropia, a convex lens of suitable focal length is needed.

- b.



Hypermetropic eye

76. What is meant by scattering of light? Mention the factor on which it depends. Explain why the colour of the clear sky is blue? An Astronaut in space finds sky to be dark. Explain reason for this observation.

**Ans :** [CBSE2015]

- (a) Scattering of light is the phenomenon due to



which light gets deflected by the atoms, molecules or particles of the medium when light falls on them. These are known as scatterer particles.

- Factors on which scattering depends are the size of the atoms, molecules of the scatterer.
- When sunlight falls on the atoms or molecules of the gases shorter wavelengths like of blue colour get scattered more due to which sky appears blue.

In space there is no atmosphere, so there is no scattering hence the sky appears dark/black.

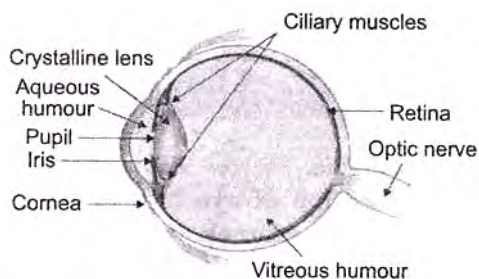
- How does refraction take place in the atmosphere? Why do stars twinkle but not the planets?
  - State any two effects of atmospheric refraction on the sun as observed from the earth.

**Ans :** [CSE2015]

- Due to change in the density of atmospheric layers when light travel through them gets refracted. It is known as atmospheric refraction. Due to this atmospheric refraction intensity of light, coming from a point sized star same times becomes more and sometimes less, which gives the appearance of twinkling of the star.
- Sun can be seen two minute prior it rises and two minute before it sets.
  - Twinkling of star.

- Draw a neat labelled diagram of the structure of the human eye and mention the functions of any four parts.

**Ans :** [CBSE 2015]



- Cornea:** A thin membrane which covers the eye ball which allows the light to enter and refracts the light to focus it as the crystalline lens.
- Eye Lens:** It is a convex lens made of transparent and flexible jelly like material. Its curvature is adjusted by ciliary muscles.
- Iris:** It controls and regulates the light entering the eye by changing the size of pupil.
- Pupil:** It is a hole in the middle of the iris through which light enters the eye.

- Demonstrate an activity with a well labelled diagram to prove that white light is made up of seven colours.
  - Which colour of light bends least and which one the most while passing out from the prism. Also state the reason for the same.

**Ans :** [CBSE 2014]

- To demonstrate that white light is made up of seven colours, take a prism. Allow white light to fall on its one focus through a pin hole. Rotate the prism until the coloured light emerge out from the

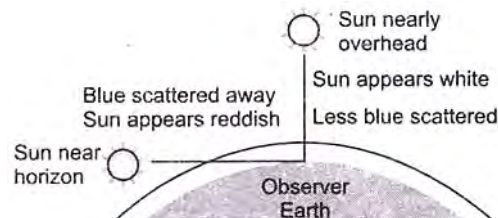
prism. Collect these coloured lights on a screen or white sheet of paper. This prove that white light is made up of seven colours.

- Violet colour deviates most whereas red colour deviates least because they have different speeds in prism they have different refractive indices and hence have different angle of deviation.

- Explain why colour of clear sky appears blue during the day with the help of diagram.
  - Explain why Sun looks reddish at the time of sunrise and sunset.

**Ans :** [CBSE 2014]

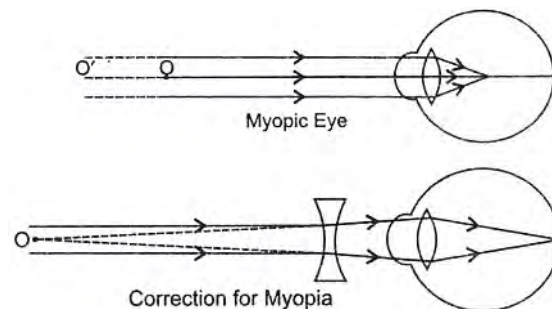
- Due to scattering of blue colours by the dust particles present in the atmosphere.
- During the Sunrise or Sunset, Sun is at the horizon, and sunlight travels a longer distance in the atmosphere. Due to this all colours get scattered except red which reaches to the eye of the observer to whom sun appears reddish in the morning or evening.



- A person cannot see the objects distinctly, when placed beyond 2 m.
  - Identify the eye defect.
  - Give two reasons for this defect.
  - Calculate the power and nature of the lens he should be using to see the distant objects clearly.
  - Draw the ray diagrams for the defective and the corrected eye.

**Ans :** [CBSE 2011, 2013]

- Myopia.
- Elongation of eye ball or excessive curvature of cornea.
- $P = \frac{1}{f} = \frac{1}{-2} = -0.5D$   
He will be advised to used a concave lens of power  $-0.5 D$ .
- 



- A person cannot see the objects distinctly, when placed at a distance less than 50 cm.
  - Identify the defect of vision.
  - Give two reasons for this defect.
  - Calculate the power and nature of the lens he

should be using to see clearly the object placed at a distance of 25 cm from his eyes.

- d. Draw the ray diagrams for the defective and the corrected eye.

**Ans :** [CBSE 2011]

- a. Hypermetropia.  
b. Decrease in power of eye lens or shortening of eye ball.

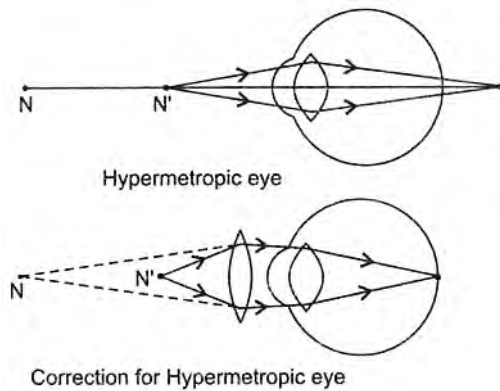
c.  $u = -25 \text{ cm}, v = -50 \text{ cm}$

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = -\frac{1}{50} + \frac{1}{25}$$

$$= \frac{-1 + 2}{50} = \frac{+1}{50} \text{ cm}^{-1}$$

$$P = \frac{1}{f} = \frac{100}{50} + 2D$$

d.



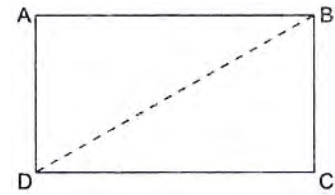
83. (a) What is dispersion of white light? What is the cause of such dispersion? Draw a diagram, to show the dispersion of white light by a glass prism.  
(b) A glass prism is able to produce a spectrum when white light passes through it but a glass slab does not produce any spectrum. Explain why it is so.

**Ans :** [CBSE 2009]

- (a) **Dispersion :** When white light is passed through a prism it splits into its constituent colours splitting of white light into its constituent colours is known as dispersion.

Light of all wavelengths in vacuum travel with the same speed but have the different speeds in a medium due to different refractive indices for them. As a result different wavelength, deviate at different angle. Red colour deviates least when as violet colour deviates most.

- (b) In glass slab also, dispersion takes place at AB surface, but these splitted colours emerge out in the form of a parallel beam which becomes white. A glass slab whose faces are parallel can be considered as comprising two prisms of same refractive angle. The second identical prism can be considered in an inverted position w.r.t. first prism. When a beam of white light passes from one prism it get dispersed, but on passing through the second inverted prism, the spectrum recombine to form a white light.



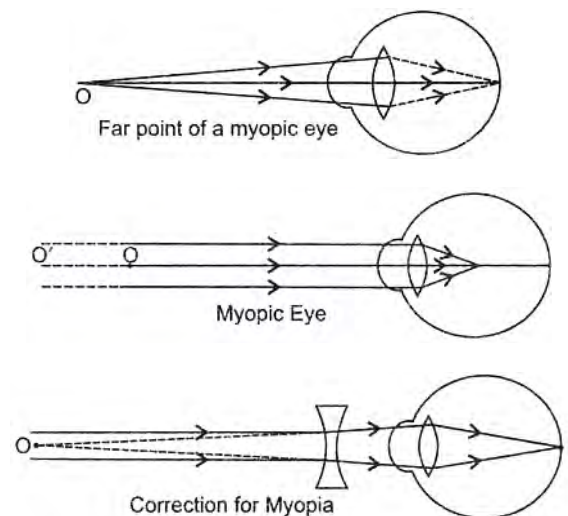
84. (a) Explain the following terms used in relation to defects of vision and corrections provided for them:

- (i) Myopia  
(ii) Astigmatism  
(iii) Bifocal lenses  
(iv) Far sightedness.

- (b) Describe with a ray diagram how a person with myopia can be helped by spectacles.

**Ans :** [CBSE 2006]

- (a) (i) Myopia is a kind of defect in human eye due to which a person can see near by objects clearly but unable to see the distant objects. Myopia is due to (i) excessive curvature of cornea (ii) elongation of eye ball.  
(ii) Astigmatism is a kind of human eye defect in which he cannot see simultaneously horizontal and vertical lines both. This defect arises either when the cornea or the eye lens or both are not perfectly spherical. It can be corrected by using cylindrical lenses.  
(iii) Bifocal lenses with the ageing a person may suffer myopia and hypermetropia. For correction of these defects he is advised to use bifocal lenses whose upper half is concave and lower part is convex to see distant and reading purposes respectively.  
(iv) Far sightedness, a person suffering from this defect can see distant objects but unable to see nearby objects clearly. The image of an objects is formed beyond the retina. Such defects can be corrected by using a convex lens.
- (b) A person with myopic eye may be advice to use a concave lens of suitable power/ focal length.



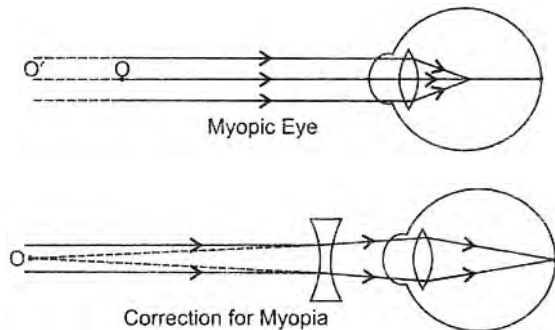
85. (a) State two main causes of a person developing near sightedness. With the help of a ray diagram, suggest how he can be helped to overcome this

disability?

- (b) The far point of a myopic person is 150 cm in front of the eye. Calculate the focal length and power of a lens required to enable him to see distant objects clearly.

**Ans :** [CBSE 2004]

- a. Elongation of eye ball, and excessive curvature of cornea. He may be advised .to use a concave lens of suitable focal-length.



- b.  $f = -150$  cm  
 $P = \frac{1}{f} = \frac{100}{-150} = -0.66$  D

86. A person with a defective eye-vision is unable to see the objects nearer than 1.5 m. He wants to read books at a distance of 30 cm. Find the nature, focal length and power of the lens he needs in his spectacles.

**Ans :** [CBSE 2016]

Defect is hypermetropia

$$v = -1.5 \text{ m or } -150 \text{ cm, } u = -30 \text{ cm}$$

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{f} = \frac{1}{-150} - \frac{1}{-30}$$

$$= -\frac{1}{150} + \frac{1}{30} = \frac{-1+5}{150}$$

$$f = +\frac{150}{4} = +37.5 \text{ cm}$$

A convex lens of focal length 37.5 cm is required

$$\text{Power} = \frac{100}{f(\text{cm})} = \frac{100}{37.5} = +2.67 \text{ D}$$

87. The far point of a myopic person is 80 cm in front of the eyes. What is the nature and power of the lens required to enable him to see very distant objects distinctly?

**Ans :** [CBSE 2016]

Concave lens is used for myopic eye for point  $x = 80$  cm.

For viewing fat distant object, focal length of lens.

$$f = -x = -80 \text{ cm}$$

$$P = \frac{100}{f(\text{cm})} = \frac{100}{-80} \text{ D}$$

$$= -1.25 \text{ D}$$

88. Far point of a myopic person is 40 cm. What type of lens, should he wear so as to see the distant objects clearly? Calculate the focal length and the power of

the lens he should use.

**Ans :** [All India 2015]

The person should wear a concave lens. For myopic eye  $u = \infty, v = -40$

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{f} = \frac{1}{-40} - \frac{1}{\infty}$$

$$\frac{1}{f} = -\frac{1}{40}$$

$$P = \frac{100}{f(\text{cm})} = -\frac{100}{40} = -2.5 \text{ D}$$

89. The far point of a myopic person is 150 cm in front of the eye. Calculate the focal length and the power of a lens required to enable him to see distant objects clearly.

**Ans :** [CBSE 2014]

For myopic person

$$u = \infty, v = -150 \text{ cm}$$

$$f = ?$$

From lens formula  $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$$= \frac{1}{-150} - \frac{1}{\infty} = -\frac{1}{150}$$

$$P = \frac{100}{f(\text{cm})} = -\frac{100}{150} = -0.66 \text{ D}$$

$$= -0.66 \text{ D}$$

90. A person needs a lens of power  $-0.5$  dioptre for correcting his distant vision he needs a lens of power  $+1.5$  dioptre for correcting his near vision. What is the focal length of the lens required for correcting his (i) distant vision, (ii) near vision?

**Ans :** [CBSE 2011]

- i. For correcting his distant vision.

$$P = -0.5 \text{ D}$$

$$f = \frac{1}{P} = \frac{1}{-0.5} = -2.0 \text{ m}$$

- ii. For correcting his near vision

$$f = \frac{1}{P} = \frac{1}{+1.5} = +0.67 \text{ m}$$

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