Human Eye and The Colourful World

Check Point 01

Q. 1. Name the cells which are responsible for the colour determination.

Answer: Cone cells are responsible for the colour determination. As the name suggests they are cone shaped photoreceptor cells on retina. They help us see and distinguish between different colours hence making colour perception possible.

Q. 2. Name the cells which respond only to the intensity of the light.

Answer: Rod cells respond only to the intensity of light. As the name suggests they are rod shaped photoreceptor cells on retina. Rod shaped cells respond to the brightness of light.

Q. 3. Explain the nature of image formed by human eye lens.

Answer: Image found by a human eye lens is real and inverted.

The eye lens is the convex lens .The object place beyond the focal length always forms a real and inverted image in a convex lens. The image is formed on retina. Although the image formed on retina is inverted out mind interprets the image as an erect object.

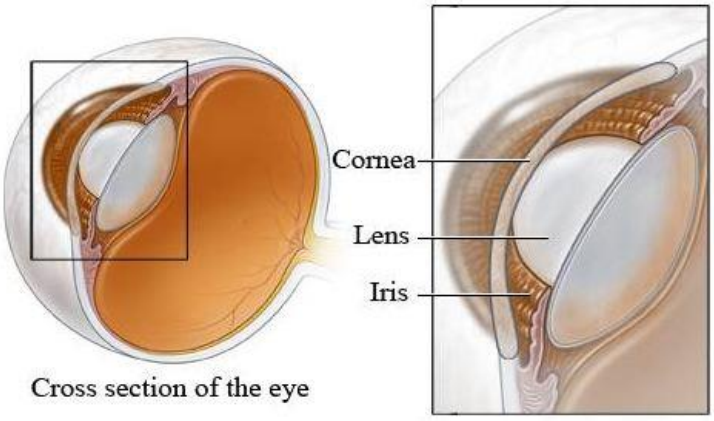
Q. 4. Give the function of the following

(i) Cornea (ii) Iris

Answer: (i) Cornea: The front part of the eye is cornea and it controls and focuses the entry of light into the eye. It also acts as a convex lens and converges most of the light rays entering the eye.

(ii) Iris: The iris automatically adjusts the size of the pupil according to the intensity of light received by the eye. The iris regulates the amount of light entering the eye and falling on the retina.

The diagram is shown below:



Q. 5. Where are light-sensitive cells present in abundance and give their function?

Answer: The light-sensitive cells are present in abundance in the **Retina.**

There are two types of photoreceptor cells on the retina:

(i) Rod cells or Rods

Function: rods are responsible for night vision and respond to the intensity of light.

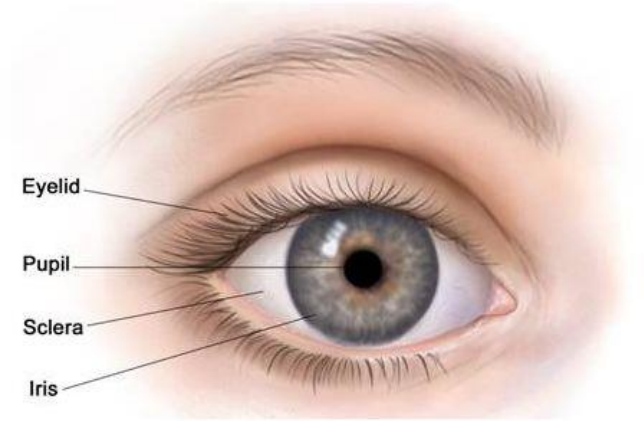
(ii) Cone cells or Cones

Function: cones respond to the colour of objects.

Q. 6. What is the function of sclera?

Answer: The white part of the eye is called Sclera. Its function is to provide strength and structure. It also provides protection to the interior parts of the eye.

The following diagram shows the sclera:



Check Point 02

Q. 1. Name the defect of vision for which

(i) Far point of an eye is less than infinity
(ii) Near point of an eye is more than 25 cm.

Answer: (i) **Myopia** is the defect of vision for which far point of an eye is less than infinity. It is also known as short-sightedness. The person is not able to see distant objects clearly (though he is able to see nearby objects clearly).

(ii) **Hypermetropia** is the defect of vision for which near point of eyes is more than 25 cm. It is also known as far sightedness. The person is not able to see nearby objects clearly (though he is able to see distant objects clearly).

Q. 2. Name the type of lens used to correct

(i) Myopia
(ii) Presbyopia.

Answer: (i) Myopia is corrected using spectacles containing concave lenses. The whole purpose of using concave lenses is to reduce the converging power of the eye lens and hence helping in forming the image of the distant object on the retina of the myopic eye.

(ii) Presbyopia defect is corrected using the spectacles containing convex lenses. The whole purpose of using concave lenses is to increase the converging power of the eye lens and hence helping in forming the image of the nearby object on the retina of the myopic eye.

Q. 3. When we look nearby objects, what happens to the focal length of our eye?

Answer: When we look at nearby objects, the focal length decreases.

The diverging rays from the nearby objects needs the convex lens of high converging power to converge them or focus them to form an image at the retina of the eye. The ciliary muscles get stretched due to which the eye lens becomes thick or more convex and its focal length decreases.

Q. 4. Name the defect which is caused when a person's eye lens hardens.

Answer: Myopia is the defect which is caused when a person's eye lens hardens. The ciliary muscles attached to the eye lens do not relax sufficiently to make the eye lens thinner to reduce its converging power. So, due to the greater converging power of the eye lens in myopic eye, the image of a distant object is formed in front of the retina and hence the eye cannot see it clearly.

Q. 5. If a milky of cloudy membrane grow over the eye lens, then which defect is the person suffering from?

Answer: If a milky of cloudy membrane grows over the eye lens, then which defect is the person suffering from **cataract**. A cataract develops when the eye lens of a person becomes cloudy (or even opaque) due to the formation of a membrane over it. Cataract decreases the vision of the eye gradually. It can even lead to total loss of vision of the eye.

Check Point 03

Q. 1. How many surfaces bound a prism? How many refractions does a beam of white light suffer, when it is passed through a prism?

Answer: Five surfaces bound a prism. In a triangular prism, there are two triangular and three rectangular surfaces. A white light passing through a prism suffers two refractions.

Q. 2. Give the relationship between the wavelength of light and its angle of deviation, when it is passed through a prism.

Answer:

Let,

A = angle of prism

D = angle of deviation

N = refractive index

λ_{vacuum} = wavelength in vacuum

λ_{medium} = wavelength in medium

We know

$$n = \frac{\sin\left(\frac{A+D}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

$n = \lambda_{vacuum} / \lambda_{medium}$

So,

$$\lambda_{medium} = \lambda_{vacuum} \times \frac{\sin\left(\frac{A}{2}\right)}{\sin\left(\frac{A+D}{2}\right)}$$

Q. 3. Name the colour for which angle of deviation while passing through the glass prism is

(i) Maximum
(ii)Minimum

Answer: (i) The angle of deviation while passing through the the glass prism is maximum for violet colour since it has minimum wavelength.

(ii) The angle of deviation while passing through the the glass prism is minimum for red colour since it has maximum wavelength

Q. 4. Which colour of light has

(i) Minimum speed in glass?
(ii) Minimum frequency?

Answer:

(i) Violet colour has minimum speed in the glass, since it has the minimum wavelength.

(ii) Red colour has the minimum frequency.

Q. 5. Name the processes which occur during the formation of the rainbow on a rainy day.

Answer: The formation of a rainbow on a rainy day is due to the dispersion of the sun's light by the raindrops in the atmosphere. Each raindrop acts as a tiny glass prism splitting the sunlight into a spectrum. As white light enters and leaves these raindrops, the various coloured rays present in white light are refracted by different amounts due to which an arc of seven colours called rainbow is formed in the sky.

Q. 6. A glass has a larger refractive index for which colour, violet of green?

Answer: Violet has a larger refractive index than green since it has a lower wave length. On refraction, wavelength and velocity change, whereas frequency does not. The colour of light or the wave having a higher wavelength will get refracted less.

Q. 7. Water in deep sea is blue in colour. Why?

Answer: Sea has many tiny particles to scatter light. The sunlight is made up of seven colours, most of the longer wavelength lights (red, orange, yellow etc.) present in it do not get scattered much and hence pass straight through. The shorter wavelength blue light is however scattered all around. The scattering of the blue component of the white sunlight by tiny molecules causes the blue colour of the sea.

Chapter Exercise

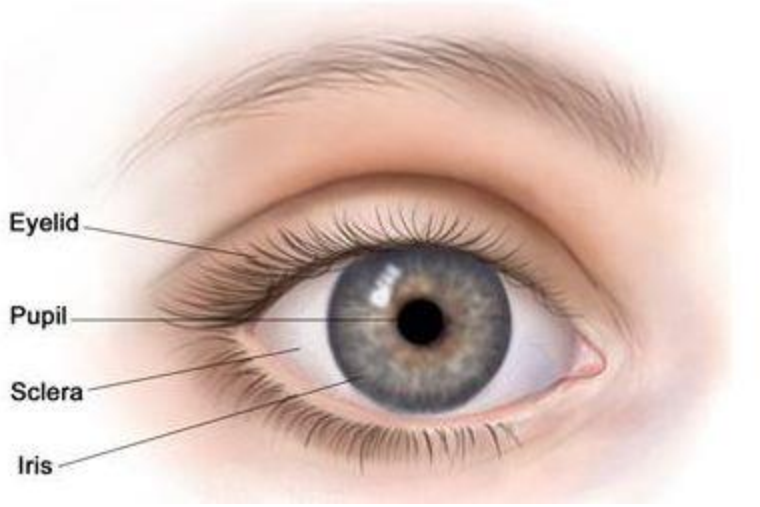
Q. 1. Which part of the eye acts as a cable which connects the eye with the brain?

Answer: The optical nerve acts as a cable which connects the eye with the brain. The image is formed at the retina and retina then sends the electrical signals to the brain through optical nerve and gives rise to the sensation of vision.

Q. 2. What is the black opening between the aqueous humor and the eye lens called?

Answer: The black opening between the aqueous humor and the eye lens is called pupil. It is the hole in the middle of the iris. It is black because no light is reflected from it.

The diagram is shown below:



Q. 3. Which part of the eye acts as the primary lens of an eye through which light enters?

Answer: Cornea acts as the primary lens of an eye through which light enters. It is convex in shape and acts as a convex lens to converge most of the light rays entering the eye.

Q. 4. What will be the focal length of the eye lens when eye muscles are relaxed?

Answer: The focal length of the eye lens is large when eye muscles are relaxed. When the ciliary muscles of the eye are fully relaxed then the eye lens is very thin. Since the eye lens is very thin, its focal length is the maximum in this position.

Q. 5. Name the condition of the eye lens becoming cloudy.

Answer: The condition of the eye lens becoming cloudy is called cataract. It results in blurred vision. It gradually leads to loss of sight.

Q. 6. Our eye is sensitive for which range of wavelength of light?

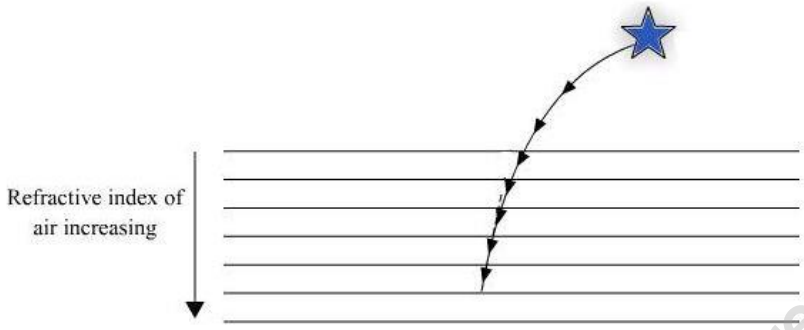
Answer: Our eye is sensitive to a wavelength range of **400 - 700 nanometers.**

This range is called the visible range. Any radiation having a wavelength greater or less is not sensitive to the human eye.

Q. 7. Give an example of optical phenomena which occur in nature due to atmospheric refraction.

Answer: winkling of stars: The twinkling of stars is due to the atmospheric refraction of the star's light

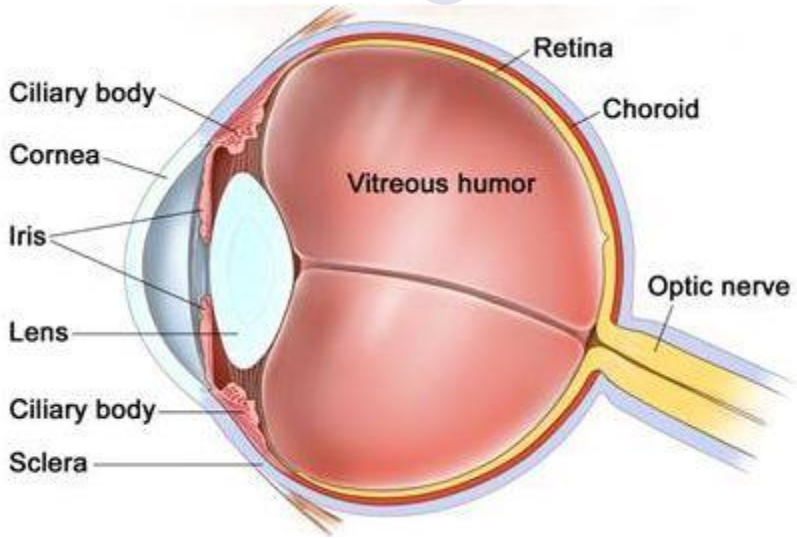
When the light coming from a star enters the earth's atmosphere, it undergoes refraction due to the varying optical densities of air at various altitudes. The atmosphere is continuously changing (due to which the optical densities of air at different levels in the atmosphere keep on changing).



The continuously changing atmosphere refracts the light from the stars by different amounts from one moment to the next. When the atmosphere refracts more star light, the star appears bright and when the atmosphere refracts less star's light then star appears to be dim. This leads to the twinkling of stars.

Q. 8. Name the part of our eyes that help us to focus near and distant objects in quick succession.

Answer: Ciliary muscles help us to focus near and distant objects. The ciliary muscles can change the thickness of the soft and flexible eye lens and hence its focal length which, in turn, change the converging power of the lens.



When looking at the distant object, ciliary muscles are fully relaxed and the eye lens is very thin. Its focal length is maximum in this position and converging power is minimum to focus the parallel rays on the retina.

When looking at the nearby object, ciliary muscles get stretched and the eye lens becomes thick. Its focal length is minimum in this position and converging power is maximum to focus the diverging rays on the retina.

Q. 9. Why does water in deep-sea seem to be bluish?

Answer: Sea has many tiny particles to scatter light. The sunlight is made up of seven colours, most of the longer wavelength lights (red, orange, yellow etc.) present in it do not get scattered much and hence pass straight through. The shorter wavelength blue light is however scattered all around. The scattering of the blue component of the white sunlight by tiny molecules causes the blue colour of the sea.

Q. 10. Name the part of the eye where the image is formed by the eye lens. What is the nature of the image formed? How is this image sent to the brain?

Answer: The eye lens converges the light rays to form the image on the **retina**. The image formed is real and inverted since the eye lens is convex in shape and we know that if the object is kept beyond the focal length the image formed is real and inverted. When the image falls on the retina the light-sensitive cells get activated and generate electrical signals. The retina sends these electrical signals to the brain through the optical nerves and gives rise to the sensation of vision. Although the image formed on the retina is inverted our mind interprets the image as that of an erect object.

Q. 11. State the role of ciliary muscles in accommodation.

Answer: Ciliary muscles help us to focus near and distant objects. The ciliary muscles can change the thickness of the soft and flexible eye lens and hence its focal length which, in turn, change the converging power of the lens.

When looking at the distant object, ciliary muscles are fully relaxed and the eye lens is very thin. Its focal length is maximum in this position and converging power is minimum to focus the parallel rays on the retina.

When looking at the nearby object, ciliary muscles get stretched and the eye lens becomes thick. Its focal length is minimum in this position and converging power is maximum to focus the diverging rays on the retina.

Q. 12. Why we have two eyes to view the objects?

Answer: We have two eyes to view objects because

(i) Two eyes give a wider view

The horizontal field of view having one eye is 150 degree while having both eyes is 180 degree. This means that with two eyes open we can see a wider area.

(ii) Two eyes enable in judging the distance more accurately

Our two eyes are a few centimeters apart from each other, due to this both the eyes see the same object from two slightly different angles and send two slightly different images of the same object to the brain. The brain combines these two slightly different images to create a three dimensional picture of objects which enable us to judge the distance of objects clearly.

Q. 13. A boy uses spectacles of focal length -60cm. Name the defect of vision he is suffering from. Which lens is used for the correction of this defect? Compute the power this lens.

Answer: Focal length = f

f = -60 cm (Given)

= -0.60m

The negative sign of focal length indicates that the lens used is concave hence the boy is suffering from myopia (short sightedness).

Power of the lens = $\frac{1}{\text{f(in m)}}$

= $\frac{1}{(-0.60)}$

= -1.667 D

Q. 14. What is the result of the dispersion of white light?

Answer: The dispersion of white light results in splitting up of white light into seven colours also known as a spectrum of white light. This shows that white light is a mixture of seven colours: red, orange, yellow, green, blue, indigo and violet. The dispersion of white light occurs because the angle of refraction of lights of different colours is different when passing through a glass prism, the red colour deviates the least and blue colour deviates the most.

Q. 15. What is the difference in colours of the Sun observed during sunrise/sunset and noon? Give an explanation for each.

Answer: At the time of sunrise or sunset the sun is near the horizon hence the sunlight has to travel the maximum distance to reach us. Due to this large distance, the most of

the shorter wavelength blue-colour present in the while light gets scattered out and away from our line of sight, leaving behind mainly red color in direct sunlight beam that reaches our eye. Hence the sky appears red at the time of sunrise and sunset.

At noon the sun is overhead in the sky. The light coming from the sun has to travel a shorter distance through the atmosphere to reach us. Due to this short journey, only a little blue light gets scattered. Since the light coming is having almost all the components in right proportion hence the sun in the sky overhead appears white to us at noon.

Q. 16. How does the thickness of the eye lens change when we shift looking from a distant tree to reading a book?

Answer: Distant: The parallel rays of light coming from distant tree needs a convex eye-lens of low converging power to focus then to form an image on the retina. When looking at the distant tree, ciliary muscles are fully relaxed and the eye lens is very thin. Its focal length is maximum in this position and converging power is minimum to focus the parallel rays on the retina.

Nearby: The diverging rays of light coming from book needs a convex eye-lens of high converging power to focus then to form an image on the retina. When looking at the nearby object, ciliary muscles get stretched and the eye lens becomes thick. Its focal length is minimum in this position and converging power is maximum to focus the diverging rays on the retina.

Q. 17. No rainbow could be observed from the surface of Moon by the astronauts. What could be the possible reason?

Answer: The formation of a rainbow on is due to the dispersion of sun's light by the raindrops in the atmosphere. But the moon neither has the atmosphere nor the rain drops to create the dispersion and refraction of light hence the astronauts cannot observe the rainbow from the surface of the moon.

Q. 18. When a light ray passes obliquely through the atmosphere in an upward direction how does its path generally change?

Answer: When a light ray passes obliquely through the atmosphere in an upward direction its path generally changes due to refraction. When the light ray enters the earth's atmosphere, it undergoes refraction due to the varying optical densities of air at various altitudes. The atmosphere is continuously changing (due to which the optical densities of air at different levels in the atmosphere keep on changing). The air higher up in the sky is rarer but that nearer to the earth's surface is denser .The continuously changing atmosphere refracts the light. Hence the path generally changes.

Q. 19. The minimum power of the eye lens is 40 D. If the far point of the normal eye is infinity. Find the size of the eye ball.

Answer: Power of eye lens = P

P = 40 D

Focal length = f

$f = \frac{1}{P} (\text{in meters})$

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

= 0.025 m

= 2.5 cm

Radius of curvature = 2f

= 5 cm

The eye ball has the radius of 5 cm

Q. 20. A person got his eyes tested. The optician prescription for the spectacle read.

Left eye = -3 D are right eye = -3.5 D

Discuss the defects of which person is suffering.

Answer: Optician prescription for the spectacle reading

Left eye = -3 D are right eye = -3.5 D

Powers of the spectacles required to correct both the eyes are negative. This means that the person requires a concave lens for the correction.

Myopia (short-sightedness or near sightedness) is corrected using spectacles containing concave lenses. Hence the person suffers from myopia.

Myopia is the defect of vision due to which a person cannot see the distant objects clearly (although he can see the nearby objects clearly.

The far point of an eye suffering from myopia is less than infinity. It is caused:

(i) Due to the high converging power of the eye lens(because of its short focal length) or

(ii) Due to ye ball being too long.

Q. 21. The power of a lens is + 1.5 D. Name the type of defects vision that can be corrected by using this lens. Find the focal length of the lens.

Answer: Power of a lens is = P = + 1.5 D.

Since power is positive hence the lens used is a convex lens.

Types of defects vision that can be corrected by using this lens Hypermetropia and presbyopia.

A person suffering from any of these defects is not able to see the nearby objects clearly.

The purpose of the convex lens is to increase the converging power of the lens and help to form the image of nearby objects on the retina.

Focal length = f

f = 1/P (in meters)

= 1/1.5 m

= 0.667 m

Q. 22. If the far point of eye lens is 10 m, find power of the lens required to correct the defect.

Answer: Far point of the eye lens = v

v = -10 m

Object distance = u

u = ∞

Lens Formula:

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

$$\frac{1}{f} = \frac{1}{-10} - \frac{1}{\infty}$$

Power of lens, P = 1/f

= -10 D

Hence the power of the lens required to correct the defect is -10 D. The lens used is a concave lens.

Q. 23. Mention the position where the image is focused in the eye of a person having Hypermetropia.

Answer: The image of an object is focused behind the retina in the eye of a person having Hypermetropia.

Hypermetropia is the defect of vision due to which a person is not able to see the nearby objects clearly. It is caused

(i) Due to the low converging power of the lens

(ii) Due to eye-ball being too short.

Hence the image of nearby objects is formed behind the retina due to which the eye cannot see the nearby objects clearly.

Q. 24. A person is able to see objects clearly only when these are lying at distance between 50 cm and 300 cm from his eyes.

Answer: The person is suffering from both myopia and Hypermetropia.

The far point of the person is 300 cm that's less than infinity hence myopic.

The near point of the person is 50 cm that is more than 25 cm hence the person is suffering from Hypermetropia.

The person needs a bifocal lens to clearly see the object.

The upper part of this bifocal lens is concave to correct myopia and the lower part is a convex lens to correct Hypermetropia.

Q. 25. What will be the angle of deviation through a prism and 60°, when angles of incidence and emergence are 45° each?

Answer: Given: Angle of prism, A = 60°

Angle of incidence, i = 45°

Angle of emergence e = 45°

To find: Angle of deviation = D

We know

A + D = i + e

So, D = i + e – A

D = 45° + 45° – 60°

= 30°

Hence angle of deviation is 30°

Q. 26.A. List the parts of the human eye that control the amount of light entering into it. Explain, how they perform this function?

Answer: Iris controls the amount of light entering in the eye. The iris automatically adjusts the size of the pupil according to the intensity of light received by the eye. If the amount of light received by the eye is great, then iris reduces the size of the pupil. If the amount of light received by the eye is small, then iris increases the size of the pupil hence allowing a larger amount of light to enter our eyes.

Q. 26.B. Write the function of the retina in the human eye.

Answer: Retina acts as a screen on which image is formed. The eye lens focuses the rays on the retina to form a real and inverted image. The photoreceptors in retina then convert this into electrical signals. The retina sends these electrical signals through the optical nerve to the brain and hence we see the object.

Q. 26.B. Write the function of the retina in the human eye.

Answer: Retina acts as a screen on which image is formed. The eye lens focuses the rays on the retina to form a real and inverted image. The photoreceptors in retina then convert this into electrical signals. The retina sends these electrical signals through the optical nerve to the brain and hence we see the object.

Q. 26.C. Do you know that the corneal-impairment can be cured by replacing the defective cornea with the cornea of the donated eye? How and why should we organize groups to motivate the community members to donate their eyes after death?

Answer: The eyesight of most of the blind people can be restored if they are given the eyes donated by other people after their death. Two eyes can give a gift of vision to two people.

We should be grateful to God that he has given us the gift of vision to see this wonderful world. Let us pass on this priceless gift of vision to our less fortunate blind brothers and sisters by registering our name for eye donation. We should organize groups to motivate people to donate their eye after death.

Q.27. A student finds the writing on the blackboard as blurred and unclear when sitting on the last desk of the classroom. He, however, sees clearly when sitting on the front desk at an approximate distance 2 m from the blackboard.

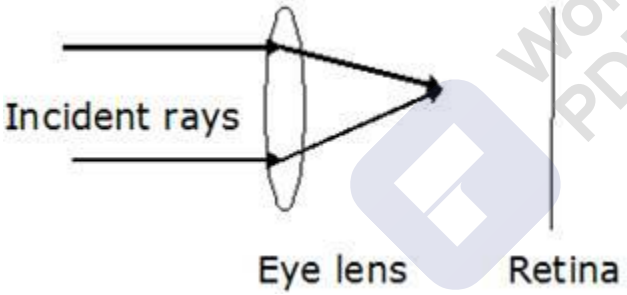
(i) Draw the ray diagram to illustrate the formation of image of the blackboard writing by his eye lens when he sits at the (a) last desk, (b) front desk

(ii) Name the defect of vision the student is suffering from. Also, list two causes of this defect.

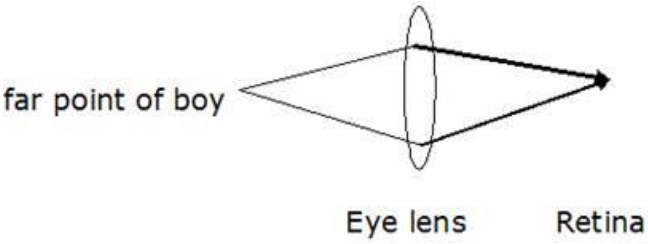
(iii)Name the kind of lens would enable him to see clearly when he is seated at the last desk. Draw the ray diagram to illustrate how this helps him to see clearly.

Answer: (i) The following is the ray diagram to illustrate the formation of image of the blackboard writing by his eye lens when he sits at the

(a) At last desk: due to myopia image is formed in front of retina.



(b) Front desk



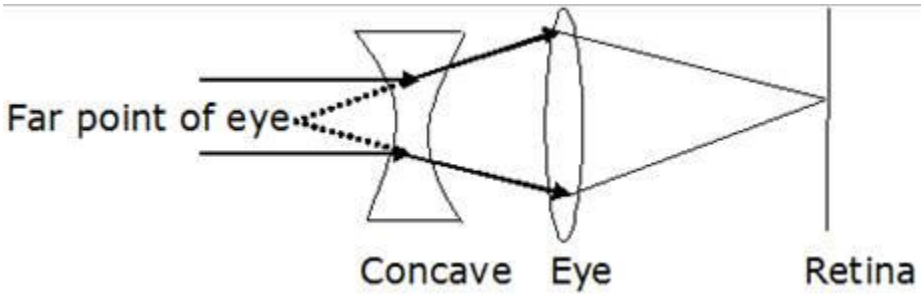
(ii) The student suffers from Myopia. Myopia is the defect of vision due to which a person cannot see the distant objects clearly (although he can see the nearby objects clearly.

The far point of an eye suffering from myopia is less than infinity. It is caused:

● Due to high converging power of the eye lens(because of its short focal length) or

● Due to ye ball being too long.

(iii) The concave lens would help him to see clearly when he is seated at the last desk.



The whole purpose of concave lens is to decrease the converging power of the eye lens and focus the image on the retina.

Q. 28. 'Vision is one of the wonderful gifts given to us by God. But most of the people never take care of their eyes.'

(i) Care for eyes should be taken; suggest some methods for proper eye care.
(ii) What value is associated with a given statement?

Answer: (i) Care of eyes should be taken. Some ways as listed below

● Eating healthy food such as green vegetables and fruits.

● Don't stress your eyes by working on computers or watching television for too long.

● Manage your weight and diet.

● Get proper sleep.

● Keep eyes away from harmful radiations

● Wear sunglasses while going out on a sunny day to protect eyes from UV rays

(ii) Value associated with the given statement is that we should be grateful to the God for giving us the precious gift of vision to see this beautiful world. We should take care of this gift throughout our life. We should also pass this priceless gift of vision by donating our eyes after death to those in need.

Q. 29. Sunil is a student of class VIII in a public school in Delhi. During summer vacation, his parents planned a visit to Haridwar by their car. During the journey from Delhi to Haridwar, Sunil sat on the front seat and his father was driving the

car. Sunil observed that the road ahead on the highway appears to be wet but when the car reached the spot, road is found to be dry. He was perplexed by this observation. He asked his father. His father advised Sunil not to disturb him during driving and said that he will discuss the problem on reaching Haridwar. In the evening, when they were settled in a hotel at Haridwar, Sunil's father told him that the illusion observed by Sunil was on account of atmospheric refraction. Now, Sunil was happy as he knew the real explanation of his observation.

(i) What is atmospheric refraction?
(ii) Name any two phenomena based on atmospheric refraction
(iii)What characteristic was shown by Sunil during his journey?
(iv) What advice was given by Sunil's father to him and why?

Answer: (i) In the atmosphere we have air layers having different optical densities. When the light rays pass through the atmosphere then refraction of light takes place. The refraction of light caused by the earth's atmosphere (having varying optical densities) is called atmospheric refraction.

(ii) Two phenomenon based on atmospheric refraction are

- Twinkling of stars at night

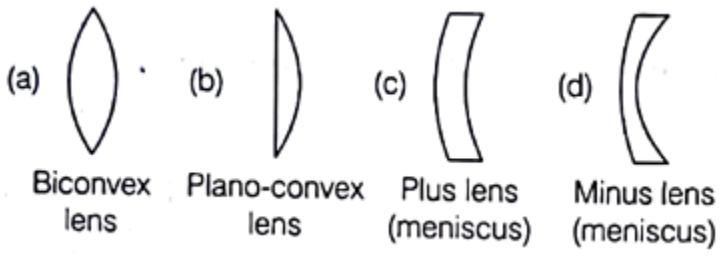
- Advanced sunrise and delayed sunset.

(iii) Curiosity and an urge to learn are shown by Sunil during his journey.

(iv) His father advised Sunil not to disturb him during driving because it may lead to distraction. One should drive very carefully and should not be distracted for a safe journey.

Challengers

Q. 1. For a healthy eye, the rays of light entering the eye form a sharp image on retina. For a myopic eye, the rays from distant objects focus in front of the retina forming a blurred image. Which of the following lenses shown below will help to correct myopia?



A. (a)
B. (b)
C. (c)
D. (d)

Answer: Myopia is caused due to large converging power of eye lens or due to too long eye ball. In both the cases image is formed before the retina. To form image on retina we must use the lens that diverges the ray of light such that the net convergence decreases, also minus power lens that is a concave lens does exactly the same. Whereas the other lens converge the beam. Hence option D is correct

Q. 2. A near sighted person wears eye glass of power 5.5D for distant vision. His doctor prescribes a correction of + ID in near vision part of his bifocals, which is measured relative to the main part of the lens. Then, the focal length of his near vision part of the lens is

A. -18.18 cm
B. -20 cm
C. -22.22 cm
D. + 20.22 cm

Answer: It is given that Power of Lens, P = 5.5 D

Now, since this lens is used for Myopic Eye, so it will be concave lens and hence the sign will be negative. So P = - 5.5 D
Now, for near vision power is to be increased by + 1 D.
Therefore, Power = -5.5 D + 1 D

= -4.5 D

Now, we know,

P = 1/f

f = 1/p

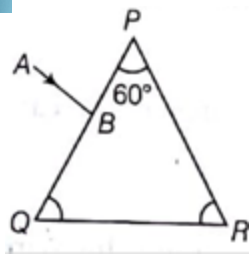
f = 1/ 4.5

= - 22.22 cm

Hence, Option C is correct

Q. 3. In given figure, a light ray AB is incident normally on one face PQ of an equilateral glass prism.

Find out the angles at faces PQ and PR.



A. 60°
B. 30°
C. 45°
D. 90°

Answer: Angle of incidence, i = 0°

Angle of refraction, r = sin (i)×n

Where n = refractive index

So, r1 = 0°

Where,

r1 = angle of refraction at PQ
r2 = angle of incidence from inside on side PR

A = angle of prism

We know that

A = r1 + r2

r2 = A – r1

= 60° – 0°

= 60°

Q. 4. A thin prism p1 with angle 4° and made from glass of refractive index 1.54 is combined with another prism p_2 made from glass of refractive index 1.92 to produce dispersion without deviation. Then the angle of prism P_2 is

A. 2.3°
B. 4.3°
C. 3.2°
D. 2.0°

Answer: The angle of deviation for a prism the is given by

$\Delta = (n - 1) \times A$

Where,

n = refractive index of prism

A = angle of prism

Given: The two prisms when combined produce dispersion without deviation.

Conclusion: For no deviation for the two prism the deviation caused by two prism should be opposite to each other

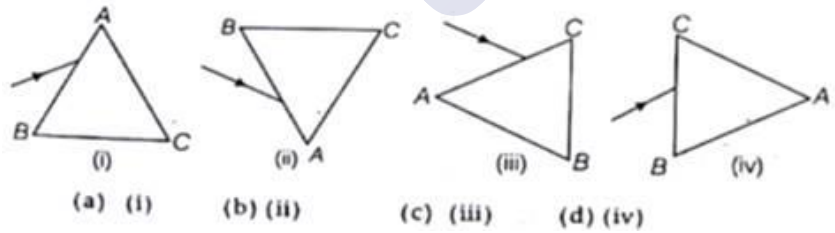
$(n1 - 1) \times A_1 = (n_2 - 1) \times A_2$

$$A_2 = \frac{(n1-1)\times A1}{(n2-1)}$$

$$A_2 = \frac{(1.54-1)\times 4}{(1.92-1)}$$

A2 = 4.3°

Q. 5. A prism ABC (with BC as base) is placed in different orientations. A narrow beam of white light is incident on the prism as shown in figure. In which of the following cases, after dispersion, the third colour from the top corresponds to the colour of the sky?



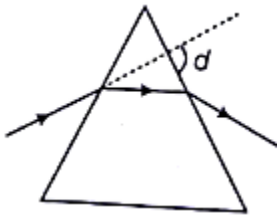
(a) (i) (b) (ii) (c) (iii) (d) (iv)

A. (a)
B. (c)
C. (c)
D. (d)

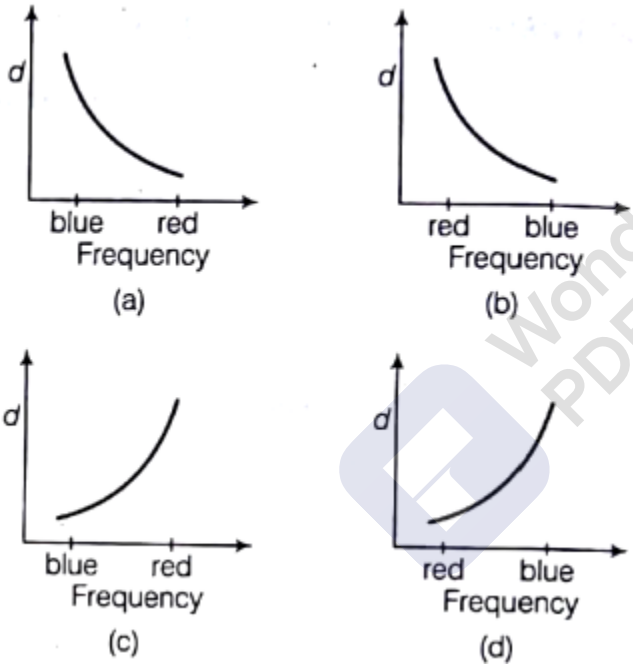
Answer: The colour of sky is blue. The colour having the maximum wavelength is deviated the least. The deviation is towards the base of the prism. The white light consist of seven colours red, orange, yellow, green, blue, indigo, violet .violet is deviated the most and red the least. Blue is the third colour starting from violet. So we

see that image B has based on the top hence having colours in such an order that blue is the third. Hence option B is correct.

Q. 6. Light rays are deviated by a prism



The deviation angle d is measured for light rays of different frequency including blue light and red light. Which graph is correct?



A. (a)
B. (b)
C. (c)
D. (d)

Answer: Since the red light is deviated the least and the violet is deviated the most so we can devise that the wavelength of blue is less than that of red. Wavelength and frequency have inverse relation. Hence red light has minimum frequency and frequency keeps on increasing as we go towards blue light.

Q. 7. Even in absolutely clear water, a diver cannot see very clearly because

A. rays of lights get diffused
B. velocity of light is reduced in water
C. ray of light passing through the water makes it turbid.
D. The focal length of the eye lens in water gets changed and the image is no longer focused sharply on the retina.

Answer: When we are underwater, incoming light rays are hardly bent, or focused, at all. Our eye lens is designed to see in air. The eye lens bends the rays a little, but due to the lost corneal refraction, the light that reaches the retina isn't focused and thus cannot see very clearly underwater even if the water is absolutely clear. Hence diver observes a blurred vision.

Q. 8. A glass slab is placed over a page on which the word VIBGYOR is printed with each letter in corresponding colour. Then, which of the following is correct?

A. The image of all the letters will be in the same place as that on paper
B. Letter V is raised more
C. Letter R is raised more
D. None of the above

Answer: Due to refraction of light an object placed in a denser medium, when viewed from rarer medium appears to be at a lesser depth than its real depth.

This depth is called the apparent depth.

Apparent depth = real depth/ n

Where,

n = refractive index of the denser medium with respect to the rarer medium

Violet light slows down more than red light, so it is refracted at a slightly greater angle, so refractive index (n) is maximum for the violet colour. Hence its apparent depth would be the least, the violet coloured letter V would be raised to the maximum.

Q. 9. Which amongst the given radiation is preferred for taking photographs in fog?

A. Ordinary visible light
B. Infrared
C. Microwave
D. X-rays

Answer: Infrared radiation has the maximum wavelength and minimum frequency.

Energy is directly proportional to frequency; hence energy associated with them is also low.

Thus the infrared radiation gets least scattered by the tiny particles in the fog.

That is why infrared wave is preferred over all others which have a higher frequency and gets scattered hence can't be focused.