AcadPrime
ACADEMY OF EXCELLENCE

Chapter -11 The Human Eye and the Colourful World

Multiple Choice Questions (MCQs)

Q1. A person cannot see distinctly objects kept beyond 2 m. this defect can be corrected by using a lens of power.

a) $+0.5\ D$
b) $-0.5\ D$
c) $+0.2\ D$
d) $-0.2\ D$

Answer: Option b)

As a person has a myopia defect then a concave lens has to be used whose focal length will be, $f = -2\ m$. So,

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

$$P = \frac{1}{-2} = -0.5\ D$$

Q2. A student sitting on the last bench can read the letters written on the blackboard but is not able to read the letters written in his text book.

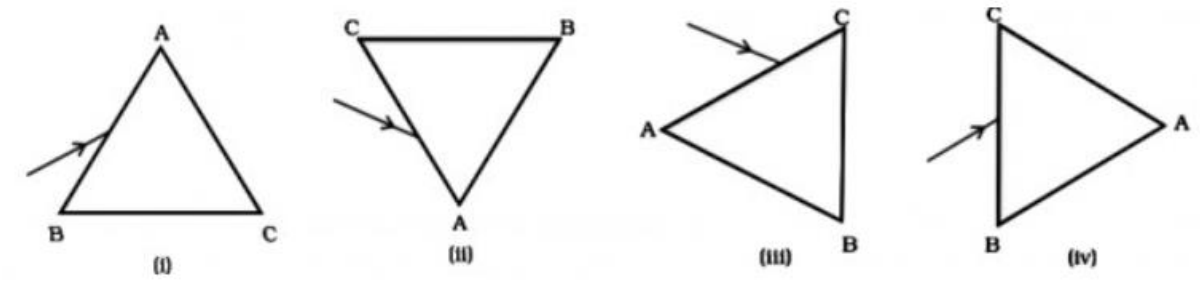
Which of the following statements is correct?

a) **The near point of his eyes receded away**
b) **The near point of his eyes has come closer to him**
c) **The far point of his eyes has come closer to him**
d) **The far point of his eyes receded away**

Answer: Option a)

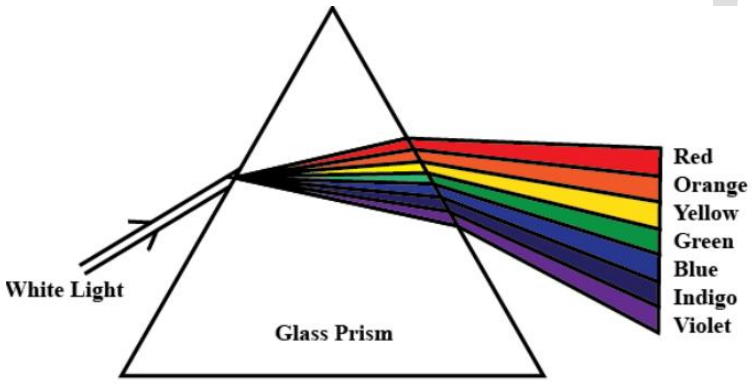
The student sitting on the last bench read the letters written on the blackboard but is not able to read the letters in his text book as he is suffering from hypermetropia or far sightedness i.e., can see distant objects but cannot see nearby objects.

Q3. 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?

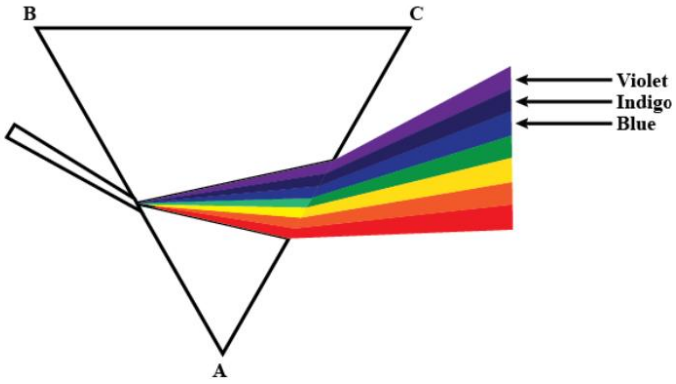


Answer: Option b)

The spectrum formation in ii) prism is shown below:



From top the third colour is yellow, but from bottom the third colour is blue which is the colour of sky. So, can obtain the correct situation by inverting the prism.



Q4. At noon the sun appears white as

a) **Light is least scattered**
b) **All the colours of the white light are scattered away**
c) **Blue colour is scattered the most**
d) **Red colour is scattered the most**

Answer: Option a)

At noon sun appears white because the light from the sun is directly on head and travel shorter distance. The sun appears white as blue and violet colours are scattered.

Q5. Which of the following phenomenon of light are involved in the formation of a rainbow?

a) **Reflection, refraction and dispersion**
b) **Refraction, dispersion and total internal reflection**
c) **Refraction, dispersion and internal reflection**
d) **Dispersion, scattering and total internal reflection**

Answer: Option c)

A rainbow is by dispersion, refraction and internal reflection of sunlight by tiny water droplets and formed in a direction opposite to the sun like small prism. They refract and disperse the incident sunlight.

Q6. Twinkling of stars is due to atmospheric

a) **Dispersion of light by water droplets**
b) **Refraction of light by different layers of varying refractive indices**
c) **Scattering of light by dust particles.**
d) **Internal reflection of light by clouds**

Answer: Option b)

Twinkling of a star is due to atmospheric refraction of lights of stars which on entering the earth's atmosphere, undergoes refraction. The path of rays differ the stars so the star fluctuates and the amount of starlight entering the eye flickers. The stars appear brighter and it appears fainter give twinkling effect.

Q7. The clear sky appears blue, because

a) **Blue light gets absorbed in the atmosphere**
b) **Ultraviolet radiations are absorbed in the atmosphere**
c) **Violet and blue lights get scattered more than light of all other colours by the atmosphere.**
d) **Light of all other colours is scattered more than the violet and blue colour lights by the atmosphere.**

Answer: Option c)

The clear sky appears blue because Rayleigh scattering of sunlight. The molecules in the air scatter blue light from the sun than they scatter red light.

Q8. Which of the following statements is correct regarding the propagation of light of different colours of white light in air?

a) **Red light moves fastest**
b) **Blue light moves faster than green light**
c) **All the colours of the white light move with same speed**
d) **Yellow light moves with the mean speed as that of the red and the violet light**

Answer: Option c)

The propagation of light, of different colours of white light in air or vacuum move with the same speed but different wavelengths and frequencies.

Q9. The danger signals installed at the top of tall buildings are red in colour. These can be easily seen from a distance because among all other colours, the red light

a) **Is scattered the most by smoke or fog**
b) **Is scattered the least by smoke or fog**
c) **Is absorbed the most by smoke or fog**
d) **Moves fastest in air**

Answer: Option b)

The danger signal installed at the top of tall buildings are red in colour as among all other colours, red colour is scattered least by smoke or fog as wavelength of red colour is the largest.

Q10. Which of the following phenomena contributes significantly to the reddish appearance of the sun at sunrise or sunset?

a) **Dispersion of light**
b) **Scattering of light**
c) **Total internal reflection of light**
d) **Reflection of light from the earth**

Answer: Option b)

The reddish appearance of the sun at sunrise is due to scattering of red light as it has the maximum wavelength.

Q11. The bluish colour of water in deep sea is due to

a) **The presence of algae and other plants found in water**

b) **Reflection of sky in water**
c) **Scattering of light**
d) **Absorption of light by the sea**

Answer: Option c)

The bluish colour of water in deep sea is due to scattering of light by fine particles in water scatter blue light. The red, orange, green and yellow have longer wavelengths are absorbed by water than blue which has a shorter wavelength.

Q12. When light rays enter the eye, most of the refraction occurs at the

a) **Crystalline lens**
b) **Outer surface of the cornea**
c) **Iris**
d) **Pupil**

Answer: Option b)

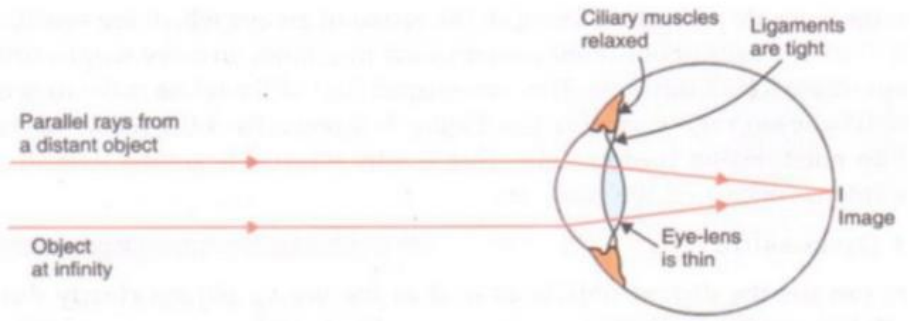
When light rays enter the eye through a thin membrane, forms the transparent bulge on the front surface of the eyeball, called the cornea. Most of the refraction occurs at this outer surface of the cornea.

Q13. The focal length of the eye lens increases when eye muscles

a) **Are relaxed and lens becomes thinner**
b) **Contract and lens become thicker**
c) **Are relaxed and lens become thicker**
d) **Contract and lens become thinner**

Answer: Option a)

The focal length of the eye lens increases when eye muscles are relaxed and thinner. The sharp image of the distant object is formed at the retina. This will enable us to focus on distant objects.



Q14. Which of the following statement is correct?

a) **A person with myopia can see distant objects clearly**
b) **A person with hypermetropia can see nearby objects clearly**
c) **A person with myopia can see nearby objects clearly**
d) **A person with hypermetropia cannot see distant objects clearly**

Answer: Option c)

A person with myopia can see objects, while a person with hypermetropia can see distant objects.

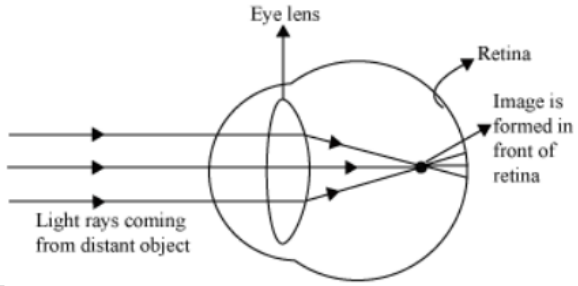
Short Answer Type Questions

Q15. Draw ray diagrams each showing

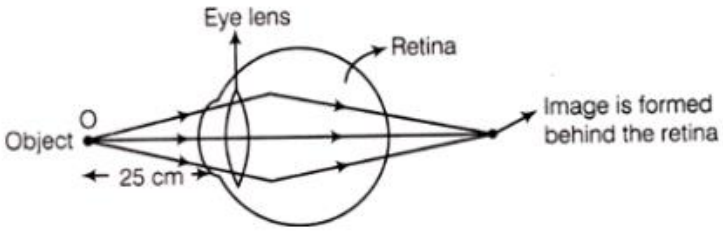
i) Myopic eye, and
ii) Hypermetropic eye

Answer:

i) The ray diagram for myopic eye:



ii) The ray diagram for hypermetropic eye:

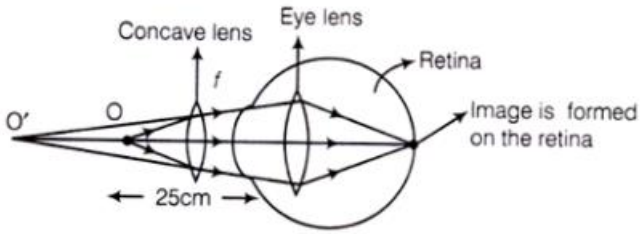


Q16. A student sitting at the back of the classroom cannot read clearly the letters written on the blackboard. What advice will a doctor give to her? Draw ray diagram for the correction of this defect.

Answer:

The student who is suffering from myopia or near-sightedness. In myopia, one can see nearby objects but cannot see distant objects.

A doctor advice a concave lens of suitable power to bring the image on retina.



Q17. How are we able to see nearby and also the distant objects clearly?

Answer:

Due to the ability of the eye lens to adjust its focal length which is known as power of accommodation, we are able to see nearby and also the distant objects clearly. When the muscles are relaxed, the lens become thin and focal length increases. This enables us to see distant objects.

When the ciliary muscles are contract, the curvature of the eye lens increases and become thicker. The focal length of the eye lens decreases, enabling us to see nearby objects.

Q18. A person needs a lens of power $-4.5\ D$ for correction of her vision.

a) What kind of defect in vision is she suffering from?
b) What is the focal length of the corrective lens?
c) What is the nature of the corrective lens?

Answer:

a) As the power of lens is negative, she must be suffering from myopia.
b) Power,

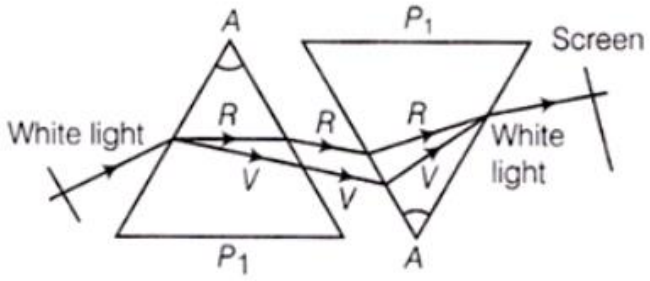
$$P = -4.5\ D$$
$$focal\ length, f = ?$$
$$P = \frac{1}{f}$$
$$f = \frac{1}{P} = \frac{1}{-4.5} = -0.222\ m = -22.2\ cm$$

c) The nature of the corrective lens is concave or divergent.

Q19. How will you use two identical prisms so that a narrow beam of white light incident on one prism emerges out of the second prism as white light? Draw the diagram.

Answer:

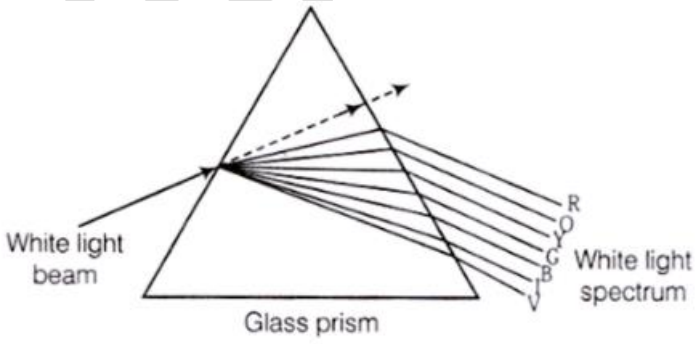
A narrow beam of white light incident on one prism emerges out of the identical prism placed in an inverted position with respect to the first prism close to the first prism.



Q20. Draw a ray diagram showing the dispersion through a prism when a narrow beam of white light is incident on one of its refracting surfaces. Also, indicate the order of the colours of the spectrum obtained.

Answer:

The ray diagram showing the dispersion through a prism when a narrow beam of white light is incident on one of its refracting surfaces:



The order of the colour is violet, indigo, blue, green, yellow, orange and red starting from the base of the prism to upwards.

Q21. Is the position of a star as seen by us its true position? Justify your answer.

Answer:

No, it is not true. The starlight on entering the earth's atmosphere, undergoes refraction and occurs in a medium of changing refractive index.

Because the medium bends starlight towards the normal, the apparent position of the star is slightly different from its actual position. So, stars appears slightly than its actual position.

Q22. Why do we see a rainbow in the sky only after rainfall?

Answer:

Raindrops in atmosphere after rainfall act as prism and refract, disperse and internally reflect the incident sunlight. The dispersion and internal reflection leads to formation of rainbow after rainfall in sky.

Q23. Why is the colour of the clear sky blue?

Answer:

It is caused by Rayleigh scattering of sunlight. The molecules in the air scatter blue light more than red light as blue light has shortest wavelength as compared to red light which has about 1.8 times greater than blue light.

Q24. What is the difference in colours of the sun observed during sunrise/sunset and noon? Give explanation for each.

Answer:

During the sunset or sunrise, the sun looks reddish because rays from the sun have to travel larger part of atmosphere. The red colour have largest wavelength and scattered the least. In the noon, the sun is overhead, the sunlight has to pass through smaller, portion of earth's atmosphere. The scattering is less and the sun looks white.

Long Answer Type Questions

Q25. Explain the structure and functioning of human eye. How are we able to see nearby as well as distant objects?

Answer:

Cornea is transparent. It is responsible for the refraction of light rays towards the retina.

Iris is a dark, circular muscular diaphragm behind the cornea which gives the colour and controls the pupil size and controls the amount of light entering the eye.

Pupil is surrounded by the iris which regulates and controls the amount of light entering the eye.

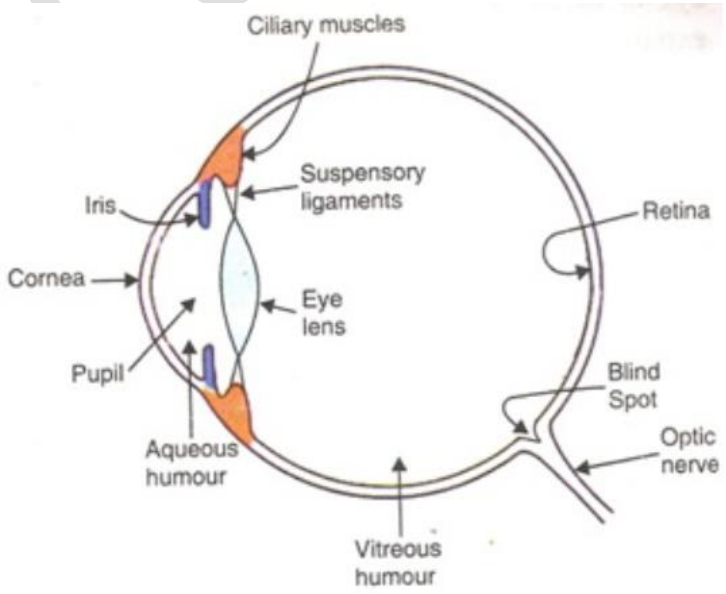
Retina is the innermost layer of the eye which contains an outer pigmented layer and inner nervous layer with photo receptors. Cones cells are coned shaped and rod cells are rod shaped.

Optic nerve connects the eye to the brain. The nerve fibres carry impulses from the retina to the visual cortex.

Eye lens is made up of a fibrous, jelly-like material which is transparent and has biconvex structure and forms an inverted real image of the object on the retina and separates the aqueous and the vitreous humours.

Vitreous humour is clear, semi-solid supporting the eye ball.

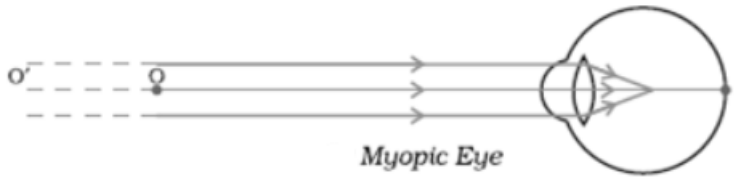
The eye lens forms an inverted real image of the object on the retina which sends image-electric signals to brain through the optic nerves and brain reconstructs erect image of objects.



Q26. When do we consider a person to be myopic and hypermetropic? Explain using diagrams how the defects associated with myopic and hypermetropic eye can be corrected?

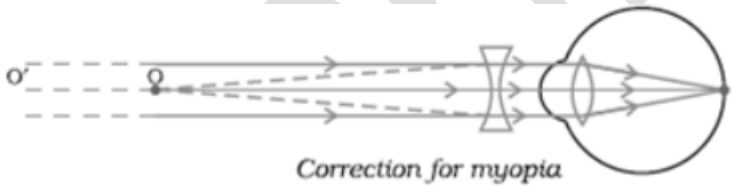
Answer:

Myopic is the short-sightedness, when light from a distant object forms an image before it reaches the retina because the eye is too long or the cornea, crystalline lens is too strong. A myopic person has clear vision when looking at objects close to them but distant objects appear blurred.



Myopic Eye

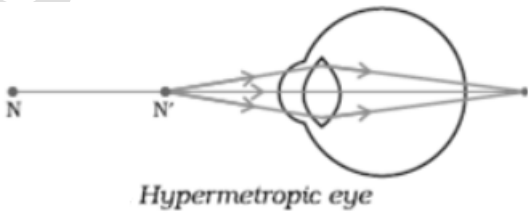
To correct defect a concave lens is placed in front of a myopic eye, moving the image back to the retina and clarifying the image.



Correction for myopia

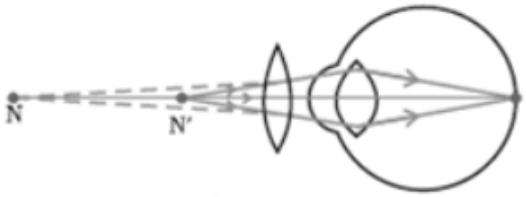
Hypermetropic is long distance-sightedness in which the image of a nearby object is formed behind the retina, because the eye is too short or the cornea, crystalline lens does not refract the light.

A hypermetropic person have blurred vision when looking at objects close to them and clearer vision when looking at objects in the distance.



Hypermetropic eye

To correct this defect a convex lens in front of a hypermetropic eye, the image is moved forward and focuses correctly on the retina.

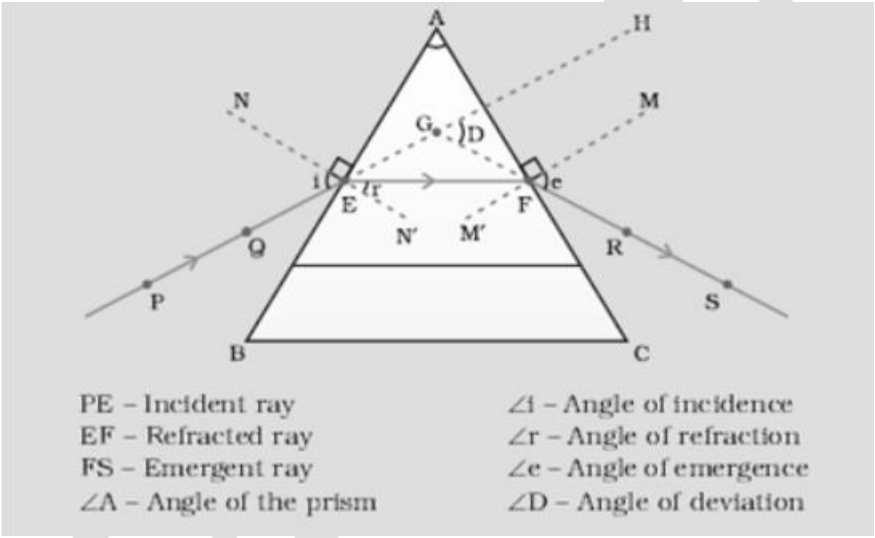


Correction for Hypermetropic eye

Q27. Explain the refraction of light through a triangular glass prism using a labelled ray diagram. Hence, define the angle of deviation.

Answer:

The refraction of light through a triangular glass prism is :



A ray of light PE enters from air to glass at the first surface AB. The light ray EF on refraction has bent towards the normal. At the second surface AC, the light ray FS enter from glass to air and bent away from normal.

The angle made by incident ray with the emergent ray is called angle of deviation.

Q28. How can we explain the reddish appearance of sun at sunrise or sunset? Why does it not appear red at noon?

Answer:

The reddish appearance of the sun at sunrise and sunset is due to scattering of light by the tiny molecules of air particles in the atmosphere have size smaller than the wavelength of visible light from the sun . It will pass thick layer of air and larger distance in the earth's atmosphere and the blue light and shorter wavelengths are scattered away by the particles.

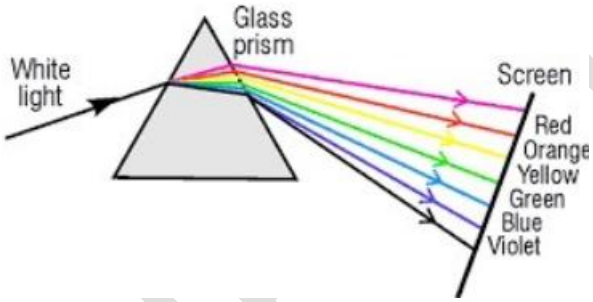
Red light has brighter wavelengths and gives reddish appearances of sun at sunrise or sunset.

At noon, the sun appears white since blue and violet colour are scattered as light from the sun travel shorter distance.

Q29. Explain the phenomenon of dispersion of white light through a glass prism, using suitable ray diagram.

Answer:

When the white light like sunlight pass through a pin like a narrow beam which fall on a triangular glass prism. When a white screen is held on the other side of the prism, it forms a band of 7 colours.



The colours obtained on the screen from its lower end is given by the famous acronym VIBGYOR,

V stands for Violet.

I stand for Indigo

B stands for Blue

G stand for Green

Y stand for Yellow

O stands for Orange

R stands for Red

Red colour bends the least on passing through the prism and violet colour bends through maximum angle. The phenomena of splitting of white light into seven colours on passing through a glass prism as dispersion light.

Q30. How does refraction take place in the atmosphere? Why do stars twinkle but not the planets?

Answer:

Light gets refracted at different layers of atmosphere. The air above the radiator becomes hotter which is less-denser than the cooler air above it and has less refractive index. This is known as atmospheric refraction.

Twinkling of stars is due to atmospheric refraction. The star light after entering the earth's atmosphere undergoes refraction. The atmospheric refraction is due to change in the refraction index at different level in atmosphere. The star light bends towards the normal as atmosphere is not stationary and keeps changing. As path of rays of light varies then the apparent position of star varies and the amount of light entering the eye flickers. If planet is collection of point sources of light, the total amount of light entering the eye on average is zero and the twinkling effect of planets is nullified.