Chapter 11
The Human Eye and The Colourful World

Multiple Choice Questions

Question 1

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:

is (b) – 0.5 D Explanation:
The person is Myopic and he need a concave mirror hence the power would be in negative.
P= $\frac{1}{f} = \frac{1}{2m}$= 0.5 D

Question 2

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 has 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 has receded away

Answer:

(a) The near point of his eyes has receded away

Explanation:
Near point of eye move away for 25 cm in hypermetropia. Hence person should keep the book 25 cm apart to read properly.

Question 3

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 11.1. In which of the following cases, after dispersion, the third colour from the top corresponds to the colour of the sky? The Human Eye and the Colourful World.

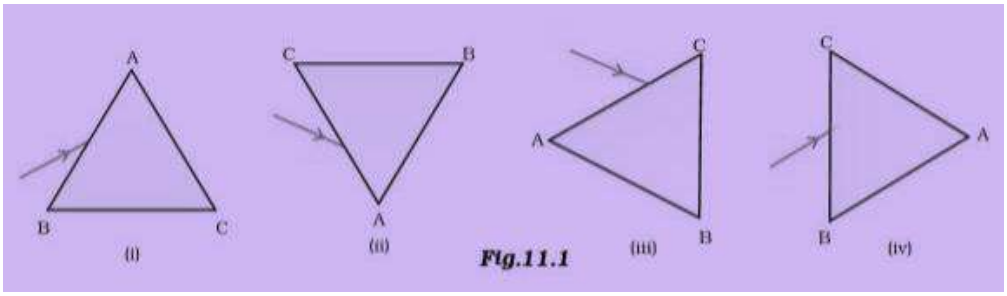


Fig.11.1

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

Answer:

(b) (ii)

Explanation:
Band of color show violet at the bottom if prism is kept with BC in the bottom. if prism is kept with BC in the top, then violet will be in the top followed by indigo and blue.

Question 4

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:

(b) all the colours of the white light are scattered away
Explanation:
This is due to dispersion of light by the atmosphere.

Question 5

Which of the following phenomena 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:

is (c) Refraction, dispersion and internal reflection

Explanation:

Dispersion of light leads to scattering of white light into different color to an angle to cause internal reflection.rs. Refraction bends incident light leading to the formation of rainbow.

Question 6

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:

(b) refraction of light by different layers of varying refractive indices

Explanation:
Refraction of light keeps the position of source of light change. This will make the stars sparkle.

Question 7

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 Thenlights of all other colours by the atmosphere

(d) light of all other colours is scatteredmore than the violet and blue colour lights by theatmosphere

Answer:

(c) violet and blue lights get scattered more than lights of all other colors by the atmosphere.

Question 8

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 the same speed

(d) Yellow light moves with the mean speed as that of the red and the violet light

Answer:

(c) All the colours of the white light move with the same speed

Question 9

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:

(b) is scattered the least by smoke or fog

Explanation:

Wavelength of red color is the largest thus it can easily be seen from a distance. It is the color which is least scattered by the smoke or smog.

Question 10

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:

(b) Scattering of light

Explanation:

Because red color scatters the least it travels long distance. During sunset or sunrise light has to travel long distance to reach the earth. Hence light will be red when it reaches us.

Question 11

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:

(b) reflection of sky in water

Explanation:

Water is colorless water attains the color it is reflected by. Hence sea appears blue.

Question 12

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:
b) outer surface of the cornea

Explanation:
Cornea is a thin membrane through which light is entered. The incident light rays are bent due to cornea and are converged which results in image formation at retina. So, most of the refraction occurs at the iris of the eye.

Question 13

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 becomes thicker (d) contract and lens become thinner

Answer:

(a) are relaxed and lens becomes thinner

Question 14

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:

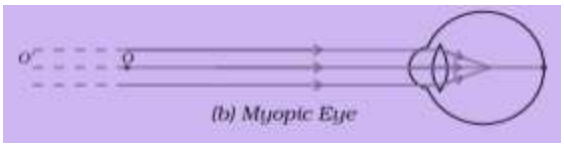
(c) A person with myopia can see nearby objects clearly

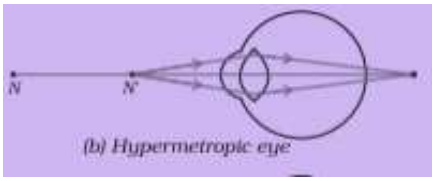
Explanation:
Myopia is a condition where a person cannot see the distant objects clears and he can see nearer objects clearly.
Hypermetropia is a condition in which a person cannot see the nearer object clearly but he can see the distant objects clearly

Short Answer Questions

Question 15

Draw ray diagrams each showing (i) myopic eye and (ii) hypermetropic eye.



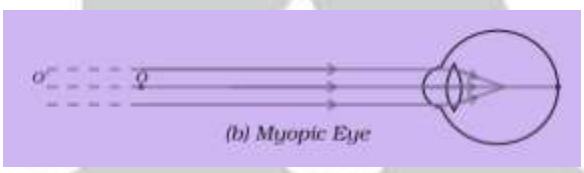


Question 16

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:

If student cannot see the blackboard distant to her, she is suffering from Myopia. Hence doctor advices concave lens of suitable focal length'



Question 17

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

Answer:

Our eyes can focus on the images from varied distance by changing its focal length of lens. Action of Ciliary muscle helps changing focal length of the lens.

Question 18

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) Answer is Myopia
b) P=$\frac{1}{f}$ $f = \frac{1}{p} = \frac{1}{4.5\ D}$ = 0.22 m
c) Negative sign shows that it is a concave lens.

Question 19

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:

By placing two identical prisms inverted with respect to the other we get a narrow beam of white light incident on one prism emerges out of the second prism as white light.'

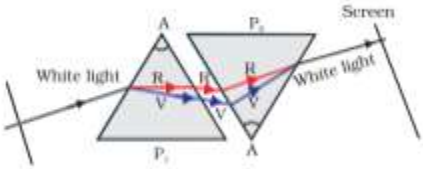


Figure 11.6 *Recombination of the spectrum of white light*

Question 20

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:

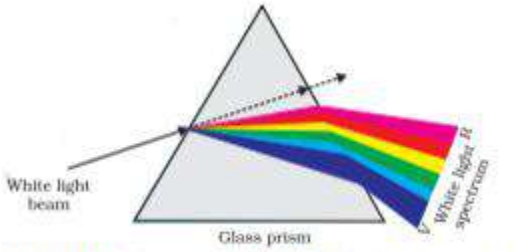


Figure 11.5 *Dispersion of white light by the glass prism*

Question 21

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

Answer:

Star light undergo continuous refraction on entering earth's atmosphere. Refraction occurs in a medium of gradually changing refractive index. Since the atmosphere bends starlight towards the normal, the apparent position of the star is slightly different from its actual position. The star appears slightly higher (above) than its actual position.

Question 22

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

Answer:

Rainbow is caused by dispersion of sunlight by tiny water droplets, present in the atmosphere. A rainbow is always formed in a direction opposite to that of the Sun. The water droplets act like small prisms. They refract and disperse the incident sunlight, then reflect it internally, and finally refract it again when it comes out of the raindrop.

Question 23

Why is the colour of the clear sky blue?

Answer:

Blue is the colour in visible spectrum which is having maximum scattering. This makes the blue colour to reach us and the sky appears blue.

Question 24

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

Answer:

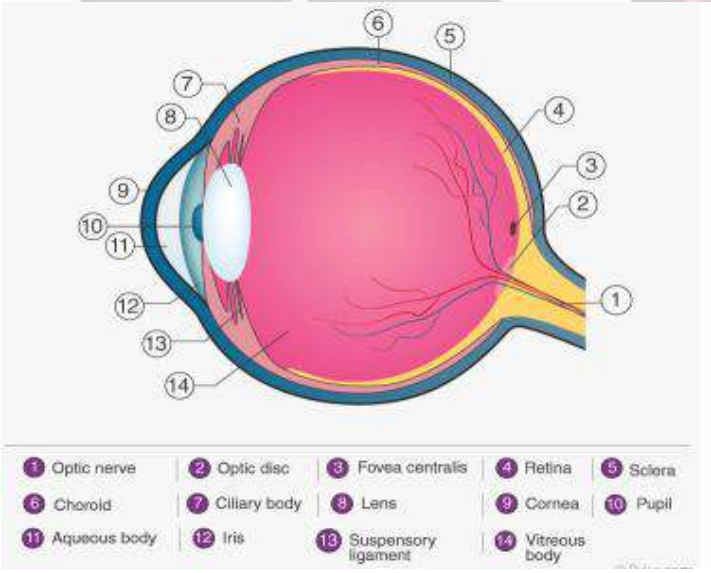
Sun appears red at sunrise and sunset: At sinrise and sunset, sun is closer to the horizon. The sunlight passes through denser layer of air and covers larger distance before reaching our eyes. Most of the blue light gets scattered. And red color reaches us which make the sun appears red at sunrise.
At noon, the sun is overhead. The sunlight passes through layers of air and covers shorter distance before reaching our eye. So, almost all colours of light are scattered equally. Hence the sun appears white

Question 25

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

Answer:

The human eye is one of the most valuable and sensitive sense organs. It enables us to see the wonderful world and the colours around us. On closing the eyes, we can identify objects to some extent by their smell, taste, sound they make or by touch. It is, however, impossible to identify colours while closing the eyes. Thus, of all the sense organs, the human eye is the most significant one as it enables us to see the beautiful, colourful world around us.
The human eye is like a camera. Its lens system forms an image on a light-sensitive screen called the retina. Light enters the eye through a thin membrane called the cornea. It forms the transparent bulge on the front surface of the eyeball as shown in Fig. The eyeball is approximately spherical in shape with a diameter of about 2.3 cm. Most of the refraction for the light rays entering the eye occurs at the outer surface of the cornea. The crystalline lens merely provides the finer adjustment of focal length required to focus objects at different distances on the retina. We find a structure called iris behind the cornea. Iris is a dark muscular diaphragm that controls the size of the pupil. The pupil regulates and controls the amount of light entering the eye. The eye lens forms an inverted real image of the object on the retina. The retina is a delicate membrane having enormous number of light-sensitive cells. The light-sensitive cells get activated upon illumination and generate electrical signals. These signals are sent to the brain via the optic nerves. The brain interprets these signals, and finally, processes the information so that we perceive objects as they are.
Our eyes can focus on the images from varied distance by changing its focal length of lens. Action of Ciliary muscle helps changing focal length of the lens.

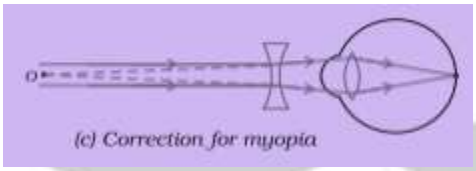


Question 26

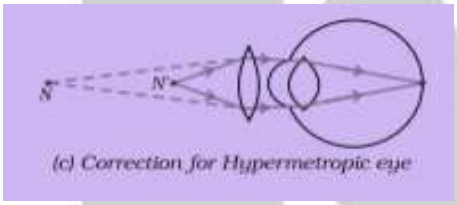
When do we consider a person to be myopic or hypermetropic? Explain using diagrams how the defects associated with myopic and hypermetropic eye can be corrected?

Answer:

When a person cannot see the distant objects clearly, he is said to be myopic. Myopia is a condition where image is formed in front of retina.
When a person cannot see the nearer objects clearly, he is said to be hypermetropic. Hypermetropia is a condition where image is formed behind the retina.
Correction of Myopia
Myopia can be corrected by using a concave lens of suitable power. A concave lens of suitable power will bring the image back on to the retina and thus the defect is corrected.



Hypermetropia can be corrected by using a convex lens of suitable power. Eye-glasses with converging lenses provide the additional focussing power required for forming the image on the retina.

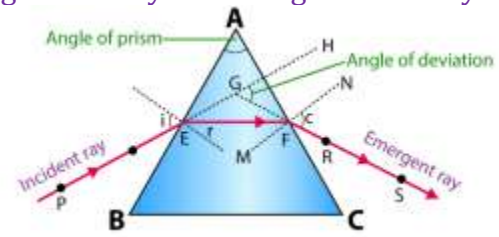


Question 27

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 shown below. A ray of light PE is entering 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 has entered from glass to air and bent away from normal. The angle made by extending incident ray with the emergent ray is called angle of deviation.



Question 28

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

Answer:

Sun appears red at sunrise and sunset: At sunrise and sunset, sun is closer to the horizon. The sunlight passes through denser layer of air and covers larger distance before reaching our eyes. Most of the blue light gets scattered. And red color reaches us which make the sun appears red at sunrise.
During noon sunlight has to travel less distance to reach us. Because most of the colors get scattered, we see sun white in color during noon

Question 29

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

Answer:

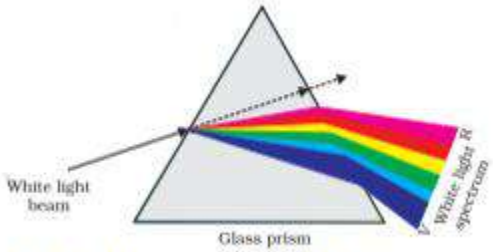


Figure 11.5 *Dispersion of white light by the glass prism*

When ray of light enters a prism, it bends because of refraction of light. When the ray of light finally emerges out of the prism. it deviates drastically from its original path. This happens because of unique shape of prism. Different colours in the visible spectrum have different speeds. Due to this, different colours bend at different angles of deviation. As a result, the emergent light appears as a band of seven colours: the colours which are the components of white light. These colours are Violet. Indigo, Blue, Green, Yellow, Orange and Red. Segregation of white light into its different components is called dispersion of light.