

Class: 10
Subject: Physics
Topic: Human eye and the colorful world
No. of Questions: 24

- Q1. A man can read the number of a distant bus clearly but he finds difficulty in reading a book. Which defect of the eye is he suffering from? What type of spectacles lens should be used to correct the defect?
- Ans. Since the man cannot see the near by objects (letters of book) clearly therefore he is suffering from the defect of vision called hypermetropia. Hypermetropia is corrected by using spectacles containing convex lenses of suitable power.
- Q2. What type of spectacles should be worn by a person having the defects of myopia as well as hypermetropia? How does it help?
- Ans. A person suffering from myopia as well as hypermetropia uses spectacles having bi-focal lenses in which upper part consists of a concave lens to correct myopia used for distant visions and the lower part consists of a convex lens to correct hypermetropia used for reading purposes.
- Q3. The sun near the horizon appears flattened at the sun set and sun rise. Explain why.
- Ans. This is due to atmospheric refraction. The density and refractive index of the atmosphere decreases with altitude, so the rays from the top and bottom portion of the sun on horizon are refracted by different degrees. This causes the apparent flattening of the sun. But the rays from the sides of the sun on a horizontal plane are generally refracted by the same amount, so the sun still appears circular along the sides.
- Q4. Explain why and when the sun is overhead at noon it appears white
- Ans. When the sun is overhead at noon, then the light coming from the sun has to travel a relatively shorter distance through the atmosphere to reach us. During this shorter journey of sunlight, only a little of the blue colour of the white light is scattered. Since the light is coming from the overhead sun has almost all its component colours in the right proportion, therefore the sun in the sky overhead appears white to us.
- Q5. A boy uses spectacles of focal length -50 cm. Name the defect of vision he is suffering from. Compute the power of this lens.
- Ans. The boy uses spectacles of focal length of -50 cm. Negative sign of focal length means he is using concave lens. Thus he has myopic vision defect. The power of lens is given by power of a lens in dioptr = $1/\text{focal length of the lens in meter} = 1/-0.5 = -2$ dioptr

Q6. Give the meaning of the term , VIBGYOR' with which phenomenon is it connected?

Ans. The term , VIBGYOR' represents the seven colours of the spectrum of white light. This is because V stands for violet, I stand for indigo, B stands for blue, G stands for green, Y stands for yellow, O stands for orange and R stands for red. This term is connected with the dispersion of the white light when it passes through a glass prism.

Q7. Explain the following terms connected with the eye. (i) Ciliary muscles (ii) Accommodation.

Ans. (i) Ciliary muscles: These are the muscles, which hold the eye lens.

(ii) Accommodation: The ability of the eye lens to change its focal length is called accommodation.

Q8. What is meant by spectrum of white light?

Ans. When white light comes out of the prism, light is spread in a (band) shaped beam. This shaped beam is termed as a spectrum. Light is said to be dispersed into a spectrum consisting of violet, indigo, blue, green, yellow, orange and red.

Q9. (a) What will be color of the sky in the absence of atmosphere?

(b) Why are the traffic light signals (or danger signals) of red color?

Ans. (a) In the absence of any atmosphere, there will be no scattering of sunlight and the sky will appear dark.

(b) In the visible spectrum, the red color has the largest wavelength. The red color is least scattered by fog or dust particles. Therefore, we can observe red color easily even in foggy and dusty conditions.

Q10. Why does the sky appear dark and black to an astronaut instead of blue?

Ans. This is because there is no atmosphere containing air in the outer space to scatter light. Since there is no scattered light, which can reach our eyes in outer space, therefore, the sky looks dark and black there. This is why the astronauts who go to outer space find the sky to be dark and black instead of blue.

Q12. What is Atmospheric Refraction?

Ans. Atmospheric refraction refers to the refraction of light by the earth's atmosphere due to difference in refractive indices of the different layers of air.

Q13. Describe: Mirage and looming

Ans. Looming: In very cold regions the lower layers of air are cooled so much that its density increases down wards rapidly. Rays from a distant object, bends more and more away from the normal and suffer total reflection. The rays then proceeds downwards depending more and more towards the normal and ultimately appear to an observer to be emanating from an object hanging inverted in the sky.

Mirage– When light rays travel through the hot air in summer days, they are totally internally reflected. Thus, the inverted image of distant object is observed.

Q14. A person with myopic eye cannot see objects beyond 1.2metre distinctly. What should be the nature of corrective lenses to restore proper vision?

Ans. Here, distance of far point, $x = 1.2\text{m}$ For viewing distant objects, focal length of corrective lens, $F = -x = -1.2\text{m}$
 $P = 1 / f = 1 / -1.2 = -0.83\text{D}$

Q15. The far point of myopic person is 80 cm in front of the eye. What is the nature and power of the lens required to enable him to see very distant objects distinctly?

Ans. Concave; -1.25D

Q16. The far point of a myopic person is 150 cm in front the eye. Calculate the focal length and power of a lens required to enable him to see distant objects clearly.

Ans. -1.5m , -0.67D

Q17. By giving reasons state your observations when a parallel beam of white light:

(i) is passed through by hypo-solution and then focused on a white screen

(ii) is passed through hypo-solution (to which few drops of sulphuric acid is added) and then focused on a white screen.

Ans. (i) The path of white light is not visible in the hypo-solution. The beam focuses on the white screen as a bright white spot.

Reason: The white light does not get scattered because the size of particles in the hypo solution is too small compared to the wavelengths in white light.

(ii) (a) In 2-3 minutes, after the addition of sulphuric acid, the sides of container start emitting blue light.

(b) The light coming out of the container is initially orange, then red and focuses on the screen. This light gradually changes to crimson red.

Reason: The sulphuric acid reacts with hypo solution to form colloidal sulphur. Initially these sculpture particles are very small and hence scatter blue light. Thus, the deficient light passing out of the container is orange in colour. However, as the reaction proceeds, more and more colloidal particles of sulphur are formed. These sulphur particles then join to form bigger sulphur particles. These bigger particles scatter red colour and hence the light coming out of the container is crimson red.

- Q18. 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?
Ans. The student is suffering from myopia (near sightedness). Doctor advises her to use a concave lens of appropriate power to correct this defect.
- Q19. How are we able to see nearby and also the distant objects clearly?
Ans. Human eye is able to see nearby and distant objects clearly by changing the focal length of the eye lens using its power of accommodation.
- Q20. 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?
Ans. (a) Negative sign of power of lens indicates that focal length is negative that is only possible in concave lens that is used for correction of Myopia (b) $f = 1/-4.5 = -2/9 = -0.22$ m, (c) The nature of the corrective lens is diverging rays of light.
- Q21. Is the position of a star as seen by us its true position? Justify your answer.
Ans. No. light from stars undergoes atmospheric refraction which occurs due to the variation in air density.
- Q22. Why do we see a rainbow in the sky only after rainfall?
Ans. We see a rainbow in the sky only after rainfall because the water droplets behave like prisms and disperse sunlight due to atmospheric refraction and total internal reflection. 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.
- Q23. Why is the colour of the clear sky blue?
Ans. Blue color gets scattered the maximum due to less wave velocity.
- Q24. Chicken can see only in bright light. What type of cells is present in its retina?
Ans. Its retina has only rod cells and no cone cells.