



CHAPTER TEST – 6

STD: XII

PHYSICS – RAY OPTICS

TIME: 1 HR 15 MIN

MARKS:35

Answer all the questions. Section *A* carries 1 mark, Section *B* carries 2 marks, Section *C* carries 3 marks, Section *D* carries 5 marks, Section *E* carries 4 marks.

SECTION-A

- The velocity of the light in a medium is $1.5 \times 10^8 \text{ms}^{-1}$. The critical angle c for a ray going from the medium into air is:
a) 30° b) 45° c) 60° d) 90°
- A Symmetric double convex lens of power $4D$ is cut into two halves by a plane containing the principle axis. The power of each half is:
a) $2D$ b) $4D$ c) $8D$ d) zero
- The angle of medium deviation for a prism is 30° and the angle of prism 60° . The refractive index of the prism material is:
a) 2 b) $\sqrt{2}$ c) $3/2$ d) $3/\sqrt{2}$
- The objective in a reflecting telescope is:
a) Concave mirror b) Convex mirror
c) Prism (d) Convex lens
- Assertion (A): The formula connecting u, v and f for a spherical mirror is valid only for mirrors whose size are very small compared to their radii of curvature.
Reason (R): Laws of reflection are strictly valid for plane surfaces, but not for large spherical surfaces.
a) Both *A* and *R* are true and *R* is the correct explanation of *A*.
b) Both *A* and *R* are true and *R* is not the correct explanation of *A*.
c) *A* is true but *R* is false.
d) *A* is false but *R* is true.
- Assertion (A): When white light passes through a glass prism, the emergent ray bends towards the base of the prism.
Reason (R): The angle of deviation in a prism is minimum for red light and maximum for violet light due to their different refractive indices.
a) Both *A* and *R* are true and *R* is the correct explanation of *A*.
b) Both *A* and *R* are true and *R* is not the correct explanation of *A*.
c) *A* is true but *R* is false.
d) *A* is false but *R* is true.

SECTION – B

- Define critical angle for an interface of two media.
- State the factors on which the deviation produced by a prism depends.



9. The ray of light is incident on a 60° prism glass of refractive index 1.5 at an angle of 40° . Find the angle of emergence of ray.

10. Draw ray diagram to illustrate formation of image in a compound microscope.

SECTION – C

11. The angle of prism is 60° and the angle of minimum deviation is 39° . What is the refractive index of the material of the prism? ($\sin 49.5^\circ = 0.76$).
12. Draw a ray diagram of an astronomical telescope and derive an expression for its magnifying power when:
- (i) The image is formed at infinity.
 - (ii) The image is formed at the least distance of distinct vision.
13. A convex spherical refracting surface of refractive index 1.5 forms the image of an object distant 10 cm from it at a distance of 40 cm on the same side as the object. what is the radius of curvature of the surface?
14. When two thin lenses of focal lengths f_1 and f_2 are kept in contact, prove that their combined focal length ' f ' is given by $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$.

SECTION – D

15. Derive the formula $\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$ for refraction of light for a (concave or convex) spherical surface symbol have usual meanings.

SECTION – E

16. Case Study Based Questions:

A physics student is given a triangular glass prism with a refractive index of 1.52 for the green light (wavelength 550 nm). The prism has an apex angle of 60° . The student directs a narrow beam of green light towards one of the prism's faces at an angle of incidence of 45° . The prism is placed in air (refractive index 1.0).

During the experiment, the student measures the angle of deviation of the emergent light and observes that when white light passes through the prism, the emergent beam shows a spectrum of colors.

Answer the following:

- i) Define the minimum angle of deviation for a prism and state the condition under which it occurs.
- ii) Write the expression relating the refractive index μ , prism angle A , and minimum deviation angle δ_m .
- iii) Calculate the minimum angle of deviation for green light passing through the given prism.
- iv) Explain why white light splits into a spectrum of colors when passed through a prism. Name the phenomenon and discuss the physical cause in terms of refractive index variation.