

CHAPTER-9
Ray Optics and Optical Instruments
ASSIGNMENT-2

1 MARK QUESTIONS

- Q1. What happens to the focal length of a lens when it is immersed in water?
- Q2. What happens to the power of a lens immersed in water?
- Q3. How can a convex lens behave like a diverging lens?
- Q4. An object is placed at the focus of a concave lens, where will be the image formed?
- Q5. Two lenses having focal lengths f_1 and f_2 are placed in contact. what is the focal length of the combination?
- Q6. A converging and the diverging lens of equal focal lengths are placed co-axially in contact. Find the focal length and power of the combination?
- Q7. A double convex lens made from a material of refractive index n_2 is immersed in a liquid of refractive index μ_1 ($n_2 > n_1$) what change if any would occur in the nature of the lens?
- Q8. A glass lens of refractive index 1.45 is placed in a liquid, what must be the refractive index of the liquid in order to make the lens disappear?
- Q9. For the same value of angle of incidence, the angles of refraction in three media are 15° , 25° and 35° respectively. In which medium would the velocity of light be minimum?
- Q10. A biconvex lens made of a transparent medium of refractive index 1.5 is immersed in water of refractive index 1.33. Will the lens behave as a converging or diverging lens. Give reason?
- Q11. Draw the path of ray of light suffering minimum deviation while passing through a prism?
- Q12. Plot a graph to show the variation of angle of deviation as a function of angle of incidence for light rays passing through a prism?
- Q13. Write down the relation between the refractive index of the material of the prism, angle of prism and angle of minimum deviation?
- Q14. What do you mean by angle of minimum deviation?
- Q15. What is the relation between refractive index and wavelength of light?
- Q16. Write down the expression for magnifying power of a compound microscope?

MCQ

- Q17. A convex lens of focal length 10 cm is placed in contact with a concave lens of focal length 20cm. What is the nature and focal length of the combination?
- a) Concave, 10cm
 - b) Convex, 10cm
 - c) Concave, 20cm
 - d) Convex, 20cm
- Q18. A convex lens of focal length 16cm forms a virtual image of double the size of the object. What is the distance of the object from the lens?
- a) 8cm
 - b) 16cm
 - c) 24cm
 - d) 32cm
- Q19. The angle of prism is 30° and ray incident at 60° on one refracting surface suffers a deviation of 30° . What is the angle of emergence?
- a) 0°
 - b) 15°
 - c) 30°
 - d) 45°
- Q20. A ray of light passes through an equilateral prism such that the angle of incidence is equal to angle of emergence and the later is equal $3/4^{\text{th}}$ the angle of prism. The angle of deviation is
- a) 45°
 - b) 39°
 - c) 20°
 - d) 30°
- Q21. A convex length of focal length 15cm is made of material having refractive index 1.2. When placed in water of refractive index 1.3 it will behave as
- a) Converging lens of focal length 15cm
 - b) Converging lens of focal length different than 15 cm
 - c) Diverging lens of focal length 15cm
 - d) Diverging lens of focal length different than 15 cm

ASSERTION AND REASON

Q22. **Assertion (A):** We cannot get diffraction pattern from a wide slit illuminated by monochromatic light.

Reason (R): In diffraction pattern, all the bright bands are not of the same intensity.

Q23. **Assertion (A):** When a light wave travels from a rarer to a denser medium, it loses speed. The reduction in speed imply a reduction in energy carried by the light wave.

Reason (R): The energy of a wave is proportional to velocity of wave.

Q24. **Assertion (A):** The film which appears bright in reflected system will appear dark in the transmitted light and vice-versa.

Reason (R): The conditions for film to appear bright or dark in reflected light are just reverse to those in the transmitted light.

Q25. **Assertion (A):** In Young's double slit experiment, the fringes become indistinct if one of the slits is covered with cellophane paper.

Reason (R): The cellophane paper decrease the wavelength of light.

Q26. **Assertion (A):** One of the conditions for interference is that the two sources should be very narrow.

Reason (R): One broad source is equal to large number of narrow sources.

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MARKS QUESTION

Q27. Give reasons to explain why a reflecting telescope is preferred over a refracting telescope?

Q28 Draw a ray diagram to show as to how a right isosceles prism made of crown glass can be used to obtain an inverted image?

Q29 A ray of light incident on a equilateral prism propagates parallel to the baseline of the prism inside it. Find the angle of incidence of this ray, given the refractive index of the material of the prism is $\sqrt{3}$?

Q30. What is total internal reflection and what are the conditions under which it occurs?

Q31. The objective of a telescope is of larger focal length and of larger aperture compared to the eyepiece. Give reasons?

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MARKS QUESTION

Q32.(a) With the help of a ray diagram, show how a concave mirror is used to obtain an erect and magnified image of an object.

(b) Using the above ray diagram, obtain the mirror formula and the expression for linear magnification. (CBSE 18C, 19C)

Q33. Draw the ray diagram showing refraction of light through a glass prism and hence obtain the relation between the refractive index n of the prism, angle of prism and angle of minimum deviation. (CBSE F 17) **OR**

(i) Trace the path of a ray of light PQ which is incident at an angle i on one face of a glass prism of angle A . It then emerges out from the other face at an angle e . Use the ray diagram to prove that the angle through which the ray is deviated is given by $\angle \delta = \angle i + \angle e - \angle A$

(ii) What will be the minimum value of δ if the ray passes symmetrically? (CBSE F 2022)

Q34. (a) Draw a ray diagram showing the image formation by a compound microscope.

(b) Derive an expression for total magnification when the image is formed at infinity.

(c) Write the considerations that you keep in mind, while choosing lenses to be used as eyepiece and objective in a compound microscope. (CBSE 19C)

Q35. (a) Draw a labelled diagram of refraction type telescope in normal adjustment.

(b) Give its two shortcomings over reflecting type telescope.

(c) Why is eyepiece of a telescope of short focal length, while objective is of large focal length? Explain. (CBSE 17; SP 19)

Q36. (a) Draw a labelled diagram of a reflecting type telescope.

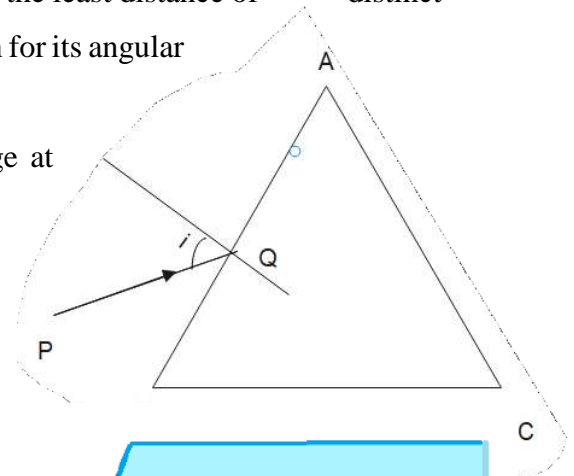
(b) Write two important advantages justifying why reflecting type telescopes are preferred over refracting telescopes. (CBSE F 17)

(c) The objective of a telescope is of larger focal length and of larger aperture (compared to the eye-piece). Why? Give reasons. (CBSE F 13; OD 17)

Q37. Draw a ray diagram to show the formation of an image at the least distance of distinct vision, by a compound microscope. Hence, obtain an expression for its angular magnification. (CBSE COMPT 2022)

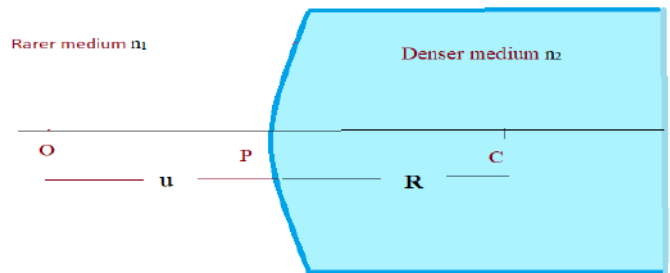
Q38. Draw a ray diagram to show the formation of an image at infinity, by a compound microscope. Explain the working of compound microscope.

Q39. Draw a ray diagram to show the formation of an image at infinity, by an astronomical telescope. Explain the working of an astronomical telescope.



5 MARKS QUESTION

Q40. (a) A point object 'O' is kept in a medium of refractive index n_1 in front of a convex spherical surface of radius of curvature R which separates the second medium of refractive index n_2 from the first one, as shown in figure.



Draw the ray diagram showing the image formation and deduce the relationship between the object distance and the image distance in terms of n_1 , n_2 and R (CBSE F 17)

(b) When the image formed above acts as a virtual object for a concave spherical surface separating the medium n_2 from n_1 ($n_2 > n_1$), draw this ray diagram and write the similar relation. Hence obtain the expression for the Lens Maker's formula. (CBSE D 15)

Q41. (a) A ray 'PQ' of light is incident on the face AB of a glass prism ABC and emerges out of the face AC. Trace the path of the ray. Show that $\angle i + \angle e = \angle A + \angle \delta$ where δ and e denote the angle of deviation and angle of emergence respectively.

Plot a graph showing the variation of the angle of deviation as a function of angle of incidence. State the condition under which $\angle \delta$ is minimum.

(b) Find out the relation between the refractive index (n) of the glass prism and A for the case when the angle of prism(A) is equal to the angle of minimum deviation (δ_m). Hence obtain the value of the refractive index for angle of prism $A = 60^\circ$ (CBSE OD 15)

Q42. Draw a ray diagram for the formation of image by a compound microscope. Define its magnifying power. Deduce the expression for the magnifying power of the microscope. Explain, (i) Why must both the object and the eyepiece of a compound microscope have short focal lengths? (ii) While viewing through a compound microscope, why should our eyes be positioned not on the eyepiece but a short distance away from it for best viewing? [Foreign 2008]

Q43. Draw a ray diagram showing the image formation of a distant object by a refracting telescope. Define its magnifying power and write the two important factors considered to increase the magnifying power. Describe briefly the two main limitations and explain how far these can be minimized in a reflecting telescope. (CBSE F 15, 16)

Q44. Draw a ray diagram for the formation of image of a distant object by an astronomical telescope in normal adjustment position. Deduce the expression for its magnifying power. Write two basic features which can distinguish between a telescope and compound microscope.

Q45. Draw a labelled ray diagram showing the image formation of a distant object by refracting telescope. Deduce the expression for its magnifying power when the final image is formed at infinity.

(ii) The sum of focal lengths of the two lenses of a refracting telescope is 105 cm. The focal length of one lens is 20 times that of the other. Determine the total magnification of the telescope when the final image is formed at infinity. [All India 2014]