

**CHAPTER-9**  
**Ray Optics and Optical Instruments**  
**ASSIGNMENT-3**

**1-Mark Questions**

- Q1. On what factors does the magnifying power of a compound microscope depend?
- Q2. What is the nature of final image formed in a compound microscope?
- Q3. What do you mean by normal adjustment of a telescope?
- Q4. The focal length of the objective and eyepiece of a telescope are  $f_o$  and  $f_e$  respectively what is the magnifying power of the telescope in normal adjustment?
- Q5. Name the two types of reflecting telescopes?
- Q6. Write the important features of a good telescope?
- Q7. Define the term magnifying power of a compound microscope?
- Q8. Write the expression for magnifying power of a telescope when the final image is formed at the least distance of distinct vision
- Q9. In a telescope objective lens is of large focal length while eyepiece is of small focal length. Why
- Q10. Out of blue and red light which is deviated more by a prism? Give reason?

**MCQ**

- Q11. To increase the magnifying power of a telescope, we should increase
- a) Focal length of the objective
  - b) Focal length of the eyepiece
  - c) Aperture of the objective.
  - d) Aperture of the eyepiece.
- Q12. In a compound microscope, the objective produces a magnification of 10, while the eyepiece produces a magnification of 5, then the overall magnification achieved by a compound microscope is
- a) 2
  - b) 50
  - c) 0.5
  - d) 25
- Q13. If  $f_o$  and  $f_e$  are the focal lengths of the objective and eyepiece of an astronomical telescope, the length of the tube is
- a)  $f_o + f_e$
  - b)  $f_o - f_e$

c)  $\sqrt{f_o \times f_e}$

d)  $\frac{f_o f_e}{f_o + f_e}$

Q14. An astronomical telescope is set for normal adjustment and the distance between the objective and eyepiece is 1.05 metre. The magnifying power of the telescope is 20. What is the focal length of the objective?

- a) 2m                      b) 1m                      c) .5m                      d) .25m

Q15. When a telescope is in normal adjustment, the distance of the objective from the eyepiece is 100cm. if the magnifying power of the telescope in normal adjustment is 24, the focal length of the lenses are

- a) 96cm, 4cm              b) 90cm, 10cm      c) 80cm, 20cm      d) 50cm, 50cm

**2MARKS**

Q16. Draw a ray diagram to show the image formation by a concave mirror when the object is placed between its focus and pole. Using this diagram, derive the magnification produced in the image.

Q17. Draw a labelled diagram for the formation of image by a compound microscope when the final image is formed at the near point or the least distance of distinct vision?

Q18. Draw a ray diagram to obtain the image at the least distance of distinct vision using an astronomical telescope?

Q19 Draw a schematic ray diagram of a reflecting type telescope (Cassegrain)?

Q20. Draw a ray diagram to obtain the image by an astronomical telescope in normal adjustment position?

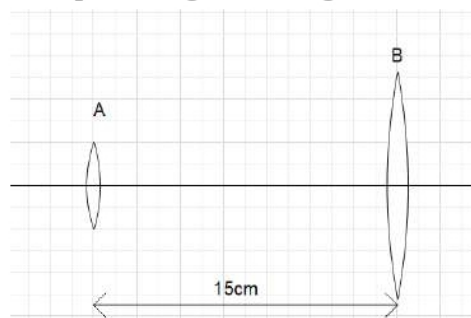
**3MARKS**

Q21. Two convex lenses A and B of an astronomical telescope having focal lengths 5cm and 20 cm respectively, are arranged as shown in the figure:

(i) Which one of the two lenses you will select to use as the objective lens and why?

(ii) What should be the change in the distance between the lenses to have the telescope in its normal adjustment position?

(iii) Calculate the magnifying power of the telescope in the normal adjustment position. (CBSE SAMPLE PAPER 2003)



Q22. Which two of the following lenses  $L_1$ ,  $L_2$  and  $L_3$  will you select as objective and eyepiece for constructing best possible (i) telescope (ii) microscope? Give reason to support your answer. (CBSE D 09, 15C; OD 17)

Lenses	Power (P)	Aperture(A)
$L_1$	3 D	8cm
$L_2$	6 D	1 cm
$L_3$	10 D	1 cm

Q23. Four double convex lenses, with the following specifications are available:

Lenses	Focal length	Aperture(A)
A	100 cm	10 cm
B	100 cm	5 cm
C	10 cm	2cm
D	5 cm	2 cm

Which two of the given four lenses, should be selected as the objective and eyepiece to construct an astronomical telescope and why? What will be the magnifying power and normal length of the telescope tube so constructed?

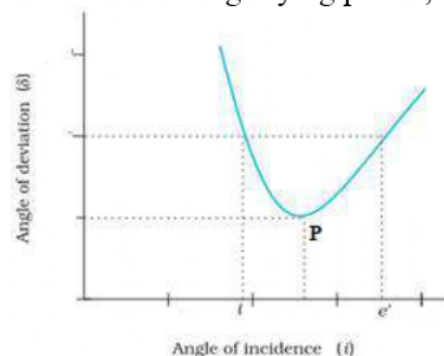
Write the advantages of reflecting type telescope over such a telescope.

Or

Which two of the above four lenses should be selected as objective and eyepiece of a compound microscope and why? How can the magnifying power of such a microscope be increased? Draw a labelled ray diagram for the image formation in such a microscope. (CBSE SAMPLE PAPER 2005)

Q24. An optical instrument uses eye-lens of power 12.5 D and object lens of power 50D and has a tube length of 20 cm. Name the optical instrument and calculate its magnifying power, if it forms the final image at infinity. (CBSE D 17)

Q25. A plot, between the angle of deviation ( $\delta$ ) and angle of incidence ( $i$ ), for a triangular prism is shown in figure:



Explain why any given value of ' $\delta$ ' corresponds to two values of angle of incidence. State the significance of point P on the graph. (CBSE SAMPLE PAPER 2011)

Q26. Define power of the lens. Why is the power of a lens measured as the reciprocal of its focal length? Give its SI unit and define it. Sun glasses have curved surfaces but they do not have any power. Why?

### **5MARKS**

Q27. (a) Derive mirror equation for a convex mirror.

(b) Using it, show that a convex mirror always produces a virtual image, independent of the location of the object. (CBSE SP 20)

Q28. Draw a ray diagram showing the formation of the image by a point object on the principal axis of a spherical convex surface separating two media of refractive indices  $n_1$  and  $n_2$ , when a point source is kept in the rarer medium of refractive index  $n_1$ . Derive the relation between object and image distance in terms of refractive index of the medium and radius of curvature of the surface. Hence obtain the expression for Lens Maker's formula in the case of thin convex lens.

(CBSE D 09, 14, 14C, OD 16)

Q29. Draw a ray diagram to show the working of a compound microscope. Deduce an expression for the total magnification when the final image is formed at the near point.

In a compound microscope, an object is placed at a distance of 1.5 cm from the objective of focal length 1.25 cm. If the eye piece has a focal length of 5 cm and the final image is formed at the near point, estimate the magnifying power of the microscope. (CBSE D10)

Q30.(a) Draw a ray diagram for final image formed at distance of distinct vision (D) by a compound microscope and write an expression for its magnifying power.

(b) An angular magnification of 30X is desired for a compound microscope using an objective of focal length 1.25 cm and eyepiece of focal length 5cm. How will you set up the compound microscope? (CBSE SP 20)

Q31.(i) What is meant by 'normal adjustment' in case of an astronomical telescope? Trace the paths of three rays from a distant object through an astronomical telescope in normal adjustment.

(ii) A small telescope has an objective lens of focal length 140 cm and an eye-piece of focal length 5.0 cm. What is the (a) magnifying power of telescope for viewing distant objects when the telescope is in normal adjustment (i.e., when the final image is at infinity)?

- (b) the final image is formed at the least distance of distinct vision ( $D = 25\text{cm}$ )? (CBSE OD13)
- (c) What is the separation between the objective and eye lens when final image is formed at infinity?
- (d) If this telescope is used to view a 100m tall tower 3km away, what is the height of the image of the tower formed by the objective lens?
- (e) what is the height of the final image of the tower if it is formed at the least distance of distinct vision  $D = 25\text{ cm}$ .