

Ray optics

Question 5

Concept: Magnifying power of an astronomical telescope

- Formula:

$$M = \frac{f_o}{f_e} \left(1 + \frac{D}{f_e} \right) \text{ at least distance of distinct vision } D = 25 \text{ cm.}$$

- Tests understanding of **lens combinations** and **magnification**.
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Question 6

Concept: Lens and mirror combination

- Image formation involving a **converging lens** followed by a **concave mirror**.
 - Uses **lens formula**, **mirror formula**, and **distance tracking** through the optical system.
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Question 7

Concept: Shift due to a glass plate (optical path)

- A **glass plate** shifts the focal point:

$$\text{Shift} = t \left(1 - \frac{1}{\mu} \right)$$

- The object must be **moved accordingly** to restore sharp focus.
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Question 8

Concept: Total internal reflection in a cylindrical rod

- Uses geometry of rays and **critical angle** concept for a cylindrical geometry.
 - Light ray grazes the inner wall: derive the incident angle based on path geometry.
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Question 9

Concept: Minimum deviation in an equilateral prism

- Special case: $i = e$, and given $\delta = \frac{3A}{4}$.
 - Requires use of **prism formula**:
 $\delta = 2i - A$ and geometry of **minimum deviation**.
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Question 10

Concept: Angular resolution of eye (Rayleigh criterion)

- Formula: $\theta = 1.22 \frac{\lambda}{D}$
 - λ in meters, D is aperture.
 - Test of **diffraction limit** of vision.
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Question 11

Concept: Image in a plane mirror and angular subtension

- Mirror forms **virtual image** symmetrically.
 - Uses **geometry** and **trigonometry** to find height when image and object subtend a known angle.
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Question 12

Concept: Total internal reflection in a rectangular glass slab

- Apply **Snell's law** and **critical angle condition** for TIR at vertical surface.
 - Use angle of incidence and geometry.
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Question 13

Concept: Lens in different media

- Focal length in medium:

$$f = \frac{f_{\text{air}} \cdot n_{\text{glass}}}{n_{\text{glass}} - n_{\text{medium}}}$$

- Examines effect of **medium on lens power**.
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