

# Class 12 Physics - Ray Optics and Optical Instruments

NEET track | Short Notes + 5 CBSE-based questions + 5 NEET PYQ-based questions with solutions

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Format: Quick revision + solved practice	Chapter scope: Class 12 Physics

## 1. Quick Short Notes

- Reflection follows two laws: angle of incidence = angle of reflection, and the incident ray, reflected ray and normal lie in one plane.
- Mirror formula:  $1/f = 1/v + 1/u$  for spherical mirrors with Cartesian sign convention.
- Lens formula:  $1/f = 1/v - 1/u$  for thin lenses. Power  $P = 1/f$  (in metre).
- Refractive index  $n = c/v$ . Snell's law:  $n_1 \sin i = n_2 \sin r$ .
- For total internal reflection, light must travel from denser to rarer medium and angle of incidence must exceed critical angle.
- Critical angle relation for denser to rarer medium:  $\sin i_c = n_{\text{rarer}} / n_{\text{denser}}$ .
- Magnification for mirrors:  $m = -v/u$ . For lenses:  $m = v/u$ .
- Combination of thin lenses in contact:  $P = P_1 + P_2 + \dots$
- Apparent depth = real depth / refractive index for near-normal viewing.
- Board tip: sign convention and diagram are the highest-scoring parts of ray optics answers.

## 2. CBSE-based Board Practice

**Q1. A convex lens of focal length 20 cm forms an image of an object placed 30 cm from it. Find the image position and magnification.**

Solution: Using sign convention,  $u = -30$  cm,  $f = +20$  cm.  $1/f = 1/v - 1/u$  gives  $1/20 = 1/v + 1/30$ . So  $1/v = 1/60$  and  $v = +60$  cm. Magnification  $m = v/u = 60/(-30) = -2$ .

**Q2. Define critical angle. Calculate the critical angle for light going from glass ( $n = 1.5$ ) to air.**

Solution: Critical angle is the angle of incidence in denser medium for which angle of refraction is 90 degrees.  $\sin i_c = 1/1.5 = 2/3$ , so  $i_c$  approx 41.8 degrees.

**Q3. An object is placed at 30 cm in front of a concave mirror of focal length 15 cm. Find the position and nature of image.**

Solution: For concave mirror,  $u = -30$  cm and  $f = -15$  cm.  $1/f = 1/v + 1/u$  gives  $-1/15 = 1/v - 1/30$ . So  $1/v = -1/30$  and  $v = -30$  cm. Image is real, inverted and same size.

**Q4. Two thin lenses of powers +2 D and -0.5 D are placed in contact. Find the equivalent power and focal length.**

Solution:  $P_{eq} = 2 + (-0.5) = 1.5$  D. So  $f = 1/1.5$  m = 0.667 m approx 66.7 cm.

**Q5. Write two applications of total internal reflection.**

Solution: Uses: optical fibre communication and right-angle prisms in periscopes/binoculars.

### 3. NEET PYQ-based Practice

#### Q1. Where is the image formed by a plane mirror?

Solution: The image is formed behind the mirror at the same distance as the object is in front of it.

#### Q2. What is the sign of power of a convex lens?

Solution: A convex lens is a converging lens, so its power is positive.

#### Q3. State the essential condition for total internal reflection.

Solution: Light must travel from a denser medium to a rarer medium and the angle of incidence must be greater than the critical angle.

#### Q4. The real depth of an object in water is 12 cm. If refractive index of water is $\frac{4}{3}$ , find the apparent depth.

Solution: Apparent depth =  $12 / (\frac{4}{3}) = 9$  cm.

#### Q5. What is the magnification produced by a plane mirror?

Solution: Magnification of a plane mirror is +1, meaning the image is erect and of the same size as the object.

Practice tip: First revise the short notes, then attempt CBSE board questions in written format, and finally solve the exam-specific section in timed mode.