

CLASS 12

PHYSICS

REVISION NOTES

Class 12 Physics Chapter 9 Ray Optics and Optical Instruments – Revision Notes

Quick revision notes for Class 12 Physics Chapter 9 – Ray Optics and Optical Instruments, covering every formula from reflection at spherical mirrors through compound microscopes and telescopes — ideal for last-minute board exam revision.

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Quick revision notes for **Class 12 Physics Chapter 9 – Ray Optics and Optical Instruments**, covering every formula from reflection at spherical mirrors through compound microscopes and telescopes — ideal for last-minute board exam revision.

Reflection at Spherical Mirrors

Mirror formula: $1/v + 1/u = 1/f$, where $f = R/2$ (R = radius of curvature). Sign convention (Cartesian): distances measured from the pole, along the direction of incident light taken as positive; for concave mirrors f is negative, for convex mirrors f is positive.

Linear magnification: $m = -v/u = h'/h$. Negative m means a real, inverted image; positive m means a virtual, erect image.

Refraction at Plane and Spherical Surfaces

Snell's law: $n_1 \sin i = n_2 \sin r$.

Refraction at a single spherical surface: $n_2/v - n_1/u = (n_2 - n_1)/R$.

Apparent depth: Real depth / Apparent depth = n (refractive index of the denser medium the observer is looking through, from a rarer medium).

Total Internal Reflection

Condition: light travels from denser to rarer medium, angle of incidence $>$ critical angle C .

Critical angle: $\sin C = 1/n$ (n = refractive index of denser medium w.r.t. rarer medium).

Applications: totally reflecting prisms (90° - 45° - 45°), optical fibres (core of higher refractive index than cladding), mirage and sparkle of diamond.

Refraction Through a Prism

Prism formula: $n = \sin[(A + D_m)/2] / \sin(A/2)$, where A = prism angle, D_m = angle of minimum deviation.

At minimum deviation, the ray passes symmetrically through the prism ($r_1 = r_2 = A/2$, and the ray inside is parallel to the base).

Refraction and Lenses (Thin Lens)

Lens formula: $1/v - 1/u = 1/f$.

Lens-maker's formula: $1/f = (n-1)(1/R_1 - 1/R_2)$, where n = refractive index of lens material relative to the surrounding medium.

Linear magnification: $m = v/u$.

Power of a lens: $P = 1/f$ (f in metres), unit dioptre (D). For lenses in contact: $P = P_1 + P_2 + \dots$, and $1/F = 1/f_1 + 1/f_2 + \dots$

Refraction Through a Small-Angle Prism / Dispersion

For a thin prism, deviation $\delta \approx (n-1)A$. Different colours (wavelengths) have slightly different refractive indices, so white light disperses into its spectrum (violet deviates most, red least, since $n_{\text{violet}} > n_{\text{red}}$ for ordinary glass).

The Human Eye

Normal near point $\approx 25\text{cm}$, far point at infinity. **Myopia (short-sightedness)**: far point is finite – corrected with a concave (diverging) lens. **Hypermetropia (long-sightedness)**: near point is farther than 25cm – corrected with a convex (converging) lens. **Presbyopia**: reduced accommodation with age, often needs bifocal lenses.

Simple Microscope (Magnifying Glass)

Magnifying power, image at near point: $m = 1 + D/f$.

Magnifying power, image at infinity: $m = D/f$. (D = near point distance, usually 25cm .)

Compound Microscope

Magnifying power (image at near point): $M = m_o \times m_e = (v_o/u_o) \times (1 + D/f_e)$.

Approximation for image at infinity: $M \approx (L/f_o) \times (D/f_e)$, where L = tube length (distance between the objective's image and the eyepiece's focal point).

Telescopes

Astronomical (refracting) telescope, image at infinity: $M = f_o/f_e$, tube length $L = f_o + f_e$.

Reflecting telescope (e.g. Cassegrain): uses a concave parabolic mirror as objective (no chromatic aberration, larger apertures possible, less spherical aberration than a lens); a smaller convex secondary mirror reflects light back through a hole in the primary to the eyepiece, reducing the physical tube length needed for a given effective focal length.

One-Line Summary

Chapter 9 builds the complete geometrical-optics toolkit — mirror and lens formulas with sign convention, refraction and total internal reflection, prisms and dispersion, and finally applies all of it to real optical instruments (eye, microscope, telescope), where magnifying power and resolving power determine how well we can see small or distant objects.

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