EngineeringRise

Lenses, prism and optical instruments

Formulas and units, JEE Main. Status: Reviewed on 2026-11-20.

Result	Formula	Units or note
Thin lens formula	1/v - 1/u = 1/f Valid when: thin lens, paraxial rays, same medium both sides; Cartesian signs	cm or m (inverse length)
Lens magnification	m = v/u Valid when: thin lens, paraxial rays; negative means inverted image	dimensionless
Lens maker formula	1/f = (n - 1)(1/R1 - 1/R2) Valid when: thin lens in air; R1, R2 with Cartesian signs	inverse length
Lens in a medium	1/f = (n_lens/n_medium - 1)(1/R1 - 1/R2) Valid when: thin lens immersed in a medium of index n_medium	inverse length
Power of a lens	P = 1/f (f in metre) = 100/f (f in cm) Valid when: f in metre for dioptre; f in cm gives 100/f	dioptre (D)
Lenses in contact	P = P1 + P2; 1/f = 1/f1 + 1/f2 Valid when: thin lenses in contact, same axis	D
Prism relations	A = r1 + r2; D = i + e - A Valid when: any prism; A is refracting angle, i and e incidence and emergence	degrees
Prism at minimum deviation	n = sin((A + D)/2)/sin(A/2) Valid when: prism at minimum deviation, i = e, symmetric ray	dimensionless
Thin prism	D = (n - 1)A Valid when: thin prism, small A and small angles of incidence	degrees or radian
Compound microscope, image at near point	M = (v_o/u_o)(1 + D/f_e), D = 25 cm Valid when: final image at near point 25 cm; object near focus of objective	dimensionless
Compound microscope, image at infinity	M = (v_o/u_o)(D/f_e); tube length v_o + f_e Valid when: final image at infinity; eye relaxed	dimensionless; cm
Astronomical telescope, normal adjustment	M = f_o/f_e; length f_o + f_e Valid when: final image at infinity; distant object	dimensionless; cm

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/physics/optics/lenses-prism-and-optical-instruments

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