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Reflection, mirrors and refraction

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

Result	Formula	Units or note
Mirror formula	1/v + 1/u = 1/f Valid when: spherical mirror, paraxial rays, Cartesian signs	cm or m (inverse length)
Focal length of a mirror	f = R/2 Valid when: spherical mirror, small aperture (paraxial)	cm or m
Mirror magnification	m = -v/u Valid when: spherical mirror, paraxial rays; positive means upright image	dimensionless
Snell law	n1 sin i = n2 sin r Valid when: refraction at a plane boundary between two transparent media	dimensionless
Speed and wavelength in a medium	v = c/n; lambda_medium = lambda/n Valid when: light of fixed frequency entering a medium of index n	m/s (m)
Apparent depth (near-normal, from air)	d_apparent = d/n Valid when: viewed near-normally from air, object in medium of index n	m
Refraction at a spherical surface	n2/v - n1/u = (n2 - n1)/R Valid when: single spherical surface, paraxial rays, Cartesian signs	cm or m (inverse length times index)
Critical angle	sin(theta_c) = n_rarer/n_denser Valid when: light from denser to rarer medium, at incidence angle theta_c or more	dimensionless
Lateral shift in a slab	d = t sin(i - r)/cos r Valid when: parallel-sided slab with same medium both sides; i incidence, r refraction	cm or m
Optical fibre acceptance	sin(i_max) = square root of (n1^2 - n2^2) Valid when: fibre with core n1 and cladding n2, light entering from air	dimensionless
Two mirrors at angle A	images = 360/A - 1 Valid when: two plane mirrors at angle A; 360/A an integer (symmetric object if odd)	count

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/physics/optics/reflection-mirrors-and-refraction

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