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Coulomb law, electric field and the dipole

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

Result	Formula	Units or note
Coulomb law	F = k q1 q2/r^2, k = 9 x 10^9 N m^2/C^2 = 1/(4 pi epsilon_0) Valid when: point charges at rest, in vacuum or air; r in metres, q in coulombs	N (q in C, r in m)
In a medium	F = k q1 q2/(K r^2) Valid when: point charges in a uniform, infinite dielectric of constant K	N
Field of a point charge	E = k q/r^2; F = q E Valid when: point source charge, or a spherically symmetric charge outside it; F = qE for any field	N/C = V/m
Axis of a ring	E = k Q x/(R^2 + x^2)^(3/2); maximum at x = R/sqrt(2) Valid when: point on the axis of a uniformly charged ring, x measured from the centre	N/C
Centre of a semicircle	E = 2 k Q/(pi R^2) Valid when: uniformly charged semicircular wire, field at its centre of curvature	N/C
Dipole moment	p = q x 2a, from -q to +q Valid when: p points from -q to +q; a is half the separation of the charges	C m
Short dipole field	axial 2 k p/r^3; equatorial k p/r^3 (opposite to p) Valid when: short dipole (r much larger than the dipole length), point far from the centre	N/C
Torque on a dipole	tau = p x E, magnitude p E sin(theta) Valid when: dipole in a uniform field, theta the angle between p and E	N m
Null point of like charges	distances in ratio sqrt(q1) : sqrt(q2) Valid when: two like point charges on a line, null point lies between them	m

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/physics/electrostatics/coulomb-law-electric-field-and-the-dipole

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