

Chapter 1: Electric Charges and Fields

Short • Exam-ready • CBSE 2026–27 syllabus focused

Core ideas

- Charge is quantised: $q = ne$. Charge is conserved and additive.
- Coulomb's law: $F = (1/4\pi\epsilon_0) |q_1q_2|/r^2$. In a medium, $\epsilon = K\epsilon_0$.
- Superposition: net force/field is the vector sum of contributions from all charges.

Key formulas

- $E = F/q$; point charge: $E = (1/4\pi\epsilon_0) q/r^2$.
- Electric dipole moment: $p = q(2a)$, directed from $-q$ to $+q$.
- Far axial dipole field: $E = (1/4\pi\epsilon_0) 2p/r^3$; far equatorial field: $E = (1/4\pi\epsilon_0) p/r^3$, opposite to p .
- Torque on dipole: $\tau = pE \sin\theta$; potential energy: $U = -pE \cos\theta$.
- Electric flux: $\Phi = \int \mathbf{E} \cdot d\mathbf{A}$; for uniform field, $\Phi = EA \cos\theta$.
- Gauss law: $\oint \mathbf{E} \cdot d\mathbf{A} = Q_{\text{enclosed}}/\epsilon_0$.

Gauss-law results to remember

- Infinite line charge: $E = \lambda/(2\pi\epsilon_0 r)$.
- Infinite plane sheet: $E = \sigma/(2\epsilon_0)$.
- Thin spherical shell: inside $E = 0$; outside $E = (1/4\pi\epsilon_0)Q/r^2$.

Exam focus

- Vector direction in Coulomb/superposition problems; dipole torque and fields; choosing Gaussian surfaces; field-line properties.

Revision tip: learn the formula, understand the symbols, then practise 2–3 application questions from NCERT/CBSE-style problems.