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Capacitors and dielectrics

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

Result	Formula	Units or note
Capacitance	C = Q/V Valid when: any capacitor; C depends only on geometry and medium, not on Q or V	F = C/V
Parallel plate, air	C = epsilon_0 A/d Valid when: two parallel plates with gap d much smaller than plate size, vacuum or air between	F (epsilon_0 = 8.85 x 10^-12 F/m)
With full dielectric	C = K epsilon_0 A/d Valid when: dielectric of constant K filling the whole gap, edge effects ignored	F
Partial slab	C = epsilon_0 A/(d - t + t/K) Valid when: slab of thickness t parallel to the plates, partly filling the gap, edge effects ignored	F
Layers and side-by-side	layers: C = epsilon_0 A/(sum of d_i/K_i); side by side: C = epsilon_0 (sum of K_i A_i)/d Valid when: layers stacked along the field (series form); side by side across the plates (parallel form); K_i uniform	F
Parallel	C = C1 + C2 + ... (same V) Valid when: capacitors joined across the same potential difference	F
Series	1/C = 1/C1 + 1/C2 + ... (same Q) Valid when: capacitors joined in a chain, uncharged initially, so each carries the same charge	F
Stored energy	U = (1/2) C V^2 = Q^2/(2 C) = (1/2) Q V Valid when: any charged capacitor; use the form that suits what is held fixed (Q or V)	J
Charge sharing	V = (Q1 + Q2)/(C1 + C2) for signed charges (with magnitudes: + for like plates joined, - for opposite); loss = C1 C2 (V1 -+ V2)^2/(2 (C1 + C2)) Valid when: conducting wires join the plates, no charge lost; heat or radiation accounts for the energy loss	V (J)

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/physics/electrostatics/capacitors-and-dielectrics

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