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Resistance, resistivity, combinations and power

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

Result	Formula	Units or note
Resistance of a wire	R = rho L/A Valid when: uniform wire at constant temperature, current along its length	ohm (rho in ohm m)
Conductivity and conductance	sigma = 1/rho; G = 1/R	S/m (S)
Series	R = R1 + R2 + ... Valid when: same current flows through every resistor	ohm
Parallel	1/R = 1/R1 + 1/R2 + ...; two resistors R1 R2/(R1 + R2) Valid when: same voltage across every branch	ohm
Electrical power	P = V I = I^2 R = V^2/R Valid when: P = VI always; I^2R and V^2/R for a resistor	W
Energy	W = P t; 1 kWh = 3.6 x 10^6 J Valid when: constant power over time t	J (kWh)
Rated appliance	R = V_rated^2/P_rated; P = P_rated (V/V_rated)^2 Valid when: appliance resistance stays constant when voltage changes	ohm (W)
Stretching at constant volume	R2/R1 = (L2/L1)^2 Valid when: uniform stretch at constant volume and material	dimensionless
Temperature dependence (metals)	R_t = R_0 (1 + alpha t); alpha = (R2 - R1)/(R1 (t2 - t1)) Valid when: metals over a modest temperature range	per degree C
Zero temperature drift (series pair)	R1 alpha1 + R2 alpha2 = 0 Valid when: two resistors in series, small temperature range; alphas of opposite sign	ohm per degree C

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/physics/current-electricity/resistance-resistivity-combinations-and-power

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