EngineeringRise

Nucleus, mass defect, binding energy, fission and fusion

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

Result	Formula	Units or note
Nuclear radius	R = R0 A^(1/3), R0 = 1.2 fm Valid when: empirical nuclear size law for nuclei of mass number A; R0 about 1.2 fm	fm
Nuclear density	rho = u/((4/3) pi R0^3) = 2.3 x 10^17 Valid when: uniform nuclear matter with mass about A u; result independent of A	kg/m^3
Neutron number	N = A - Z	number
Mass defect	delta m = Z m_p + N m_n - M Valid when: nuclear masses, or atomic masses with electron masses balanced on both sides	u
Binding energy	B = delta m x 931.5 Valid when: delta m in u gives B in MeV	MeV (delta m in u)
Energy-mass unit	1 u = 931.5 MeV/c^2 = 1.66 x 10^-27 kg	MeV (kg)
Binding energy per nucleon	B/A, about 8.7 MeV at A near 56	MeV
Energy released	Q = B(products) - B(reactants) = (m_before - m_after) x 931.5 Valid when: nuclear reaction or decay; use nuclear masses or atomic masses with electrons balanced	MeV
Fissions for a given power	N per second = P/(E x 1.6 x 10^-13), E in MeV Valid when: all released energy comes from fission; P in watt, E in MeV per fission	per second
Two-body split from rest	K1 : K2 = m2 : m1 Valid when: two products from rest, momentum conserved, non-relativistic speeds	ratio

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/physics/atoms-and-nuclei/nucleus-mass-defect-binding-energy-fission-and-fusio

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