Physics Formula Sheet

Chapter by chapter, topic by topic. Written by the PadhoNa team for quick revision.

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CHAPTER 30

Nuclear Physics

Nuclear structure and binding energy

RADIUS

$$R = R_0 A^{1/3}, \qquad R_0 \approx 1.2 \text{ fm}; \qquad \text{density is the same for all nuclei}$$

MASS DEFECT

$$\Delta m = Z m_p + (A - Z) m_n - M, \qquad E_b = \Delta m\, c^2$$

$$1 \text{ u} = 931.5 \text{ MeV}/c^2$$

Radioactivity and decay laws

$$N = N_0 e^{-\lambda t}, \qquad A = \lambda N$$

HALF-LIFE AND MEAN LIFE

$$T_{1/2} = \frac{\ln 2}{\lambda} = \frac{0.693}{\lambda}, \qquad \tau = \frac{1}{\lambda}$$

AFTER N HALF-LIVES

$$N = N_0 \left(\frac{1}{2}\right)^n$$

DECAYS

$$\alpha:\ A-4,\ Z-2; \qquad \beta^-:\ Z+1; \qquad \beta^+:\ Z-1; \qquad \gamma: \text{no change}$$

Fission and fusion

Q-VALUE

$$Q = (m_{\text{reactants}} - m_{\text{products}})c^2$$

fission splits heavy nuclei; fusion joins light ones; both raise binding energy per nucleon

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