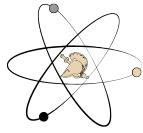




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Number Density

$$\mathcal{A}_x = \sum \gamma_i \mathcal{A}_i \quad (1) \quad w_x = \frac{n\mathcal{A}_x}{n\mathcal{A}_x + m\mathcal{A}_y} \quad (2) \quad \mathcal{A}_x = \left[\sum \frac{w_i}{\mathcal{A}_i} \right]^{-1} \quad (3)$$

$$N_i = \frac{\gamma_i \rho_x N_a}{\mathcal{A}_x} \quad (4) \quad \rho_i = w_i \rho_x \quad (5) \quad N_i = \frac{w_i \rho_x N_a}{\mathcal{A}_i} \quad (6)$$

Modern Physics

$$T = mc^2 - m_0 c^2 \quad (7) \quad E_0 = m_0 c^2 \quad (8) \quad m = \frac{m_0}{\sqrt{1 - \left(\frac{v}{c}\right)^2}} \quad (9)$$

$$\lambda = \frac{h}{p} \quad (10) \quad E = h\nu \quad (11) \quad p = \frac{E}{c} \quad (12)$$

Nuclear Energetics

$$E_B = a_v A - a_s A^{2/3} - a_c \frac{Z^2}{A^{1/3}} - a_a \frac{(A - 2Z)^2}{A} - \frac{\pm a_p}{\sqrt{A}} \quad (13)$$

where $a_v = 15.835 \text{ MeV}$, $a_s = 18.33 \text{ MeV}$, $a_c = 0.714 \text{ MeV}$, $a_a = 23.20 \text{ MeV}$, and $a_p = \begin{cases} +11.2 \text{ MeV, if o/o} \\ 0 \text{ MeV, if e/o or o/e} \\ -11.2 \text{ MeV, if e/e} \end{cases}$

$$BE({}_Z^A X) = [ZM({}_1^1 H) + (A - Z)m_n - M({}_Z^A X)] c^2 \quad (14)$$

$$S_n({}_Z^A X) = [M({}_{Z-1}^{A-1} X) + m_n - M({}_Z^A X)] c^2 \quad (15) \quad S_p({}_Z^A Y) = [M({}_{Z-1}^{A-1} X) + M({}_1^1 H) - M({}_Z^A Y)] c^2 \quad (16)$$

$$Q = [\sum m_{0,i} - \sum m_{0,f}] c^2 \quad (17)$$

$$Q = T_f - T_i \quad (18)$$

$$Q = T_1 \left(\frac{m_1}{m_4} - 1 \right) - \frac{2}{m_4} \sqrt{m_1 m_3 T_1 T_3} \cos \theta + T_3 \left(\frac{m_3}{m_4} + 1 \right) \quad (19)$$

Radioactivity

$$N = \frac{mN_a}{\mathcal{A}} \quad (20)$$

$$A = \lambda N \quad (21)$$

$$T_{1/2} = \frac{\ln 2}{\lambda} \quad (22)$$

$$\bar{T} = \frac{1}{\lambda} \quad (23)$$

$$N(t) = N_0 e^{(-\lambda t)} \quad (24)$$

$$A(t) = A_0 e^{(-\lambda t)} \quad (25)$$

Radiation Interactions

$$I(x) = I_0 e^{-\mu_t x} \quad (30)$$

$$\phi(x) = \phi_0 e^{-\Sigma_t x} \quad (31)$$

$$\bar{x} = \frac{1}{\mu_t} \quad (32)$$

$$\bar{x} = \frac{1}{\Sigma_t} \quad (33)$$

$$\mu_t = \left(\frac{\mu_t}{\rho} \right) \rho \quad (34)$$

$$\Sigma_t = \Sigma_s + \Sigma_a \quad (35)$$

Binary Reactions

$$E_1^K \approx - \left(1 + \frac{m_1}{m_2} \right) Q \quad (26) \quad E_1^C \approx 1.2 \frac{Z_1 Z_2}{A_1^{1/3} + A_2^{1/3}} \quad (27)$$

$$E^* = S_n + T_n \quad (28)$$

$$(E_1^{th}) = \max (E_1^K, E_1^C) \quad (29)$$

$$\left(\frac{\mu_t}{\rho} \right) = \sum_i \left(\frac{\mu_i}{\rho} \right) \quad (36)$$

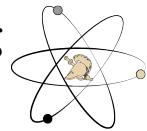
$$\Sigma_i = N \sigma_i(E) g_i(T) \quad (37)$$

$$\left(\frac{\mu_i}{\rho} \right) = \sum_j w^j \left(\frac{\mu_i}{\rho} \right)^j \quad (38) \quad \phi(r) = \frac{S_p}{4\pi r^2} e^{-\Sigma_t x} \quad (39)$$



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Reactor Physics

$$E' = \frac{1}{(A+1)^2} \left\{ \sqrt{E} \cos \theta_s + \sqrt{E(A^2 - 1 + \cos^2 \theta_s)} \right\}^2 \quad (40)$$

$$E'_{av} = \frac{1}{2}(E + \alpha E) \quad (41)$$

$$E'_{min} = \alpha E \quad (42)$$

$$\alpha = \left(\frac{A-1}{A+1} \right)^2 \quad (43)$$

$$\xi = 1 + \frac{\alpha}{1-\alpha} \ln \alpha \quad (44)$$

$$n = \frac{1}{\xi} \ln \frac{E_1}{E_2} \quad (45)$$

$$R_i = \Sigma_i \phi(E) \quad (46)$$

$$k_{eff} = \epsilon P_{NL}^f p P_{NL}^{th} f \eta \quad (47) \quad k_\infty = \epsilon p f \eta \quad (48)$$

$$P_{NL}^f = e^{-B_C^2 \tau_T} \quad (49)$$

$$P_{NL}^{th} = \frac{1}{1 + L_T^2 B_C^2} \quad (50)$$

$$f = \frac{\bar{\Sigma}_a^F}{\bar{\Sigma}_a^F + \bar{\Sigma}_a^{NF}} \quad (51)$$

$$\eta = \nu \frac{\bar{\Sigma}_f^F}{\bar{\Sigma}_a^F} \quad (52)$$

Thermal Reactor Neutron Lifecycle

