Formulas, PHYSICS 244

$$\Delta t = \frac{\Delta t(\text{proper})}{\sqrt{1-v^2/c^2}} \ , \quad \ell = \sqrt{1-v^2/c^2}\ \ell_0(\text{proper length}) \ , \ \Delta t = \frac{Lv/c^2}{\sqrt{1-v^2/c^2}} \ .$$

$$\mathbf{p} = \frac{m\mathbf{v}}{\sqrt{1-v^2/c^2}} \ , \quad E = \frac{mc^2}{\sqrt{1-v^2/c^2}} \ , \quad \frac{v}{c} = \frac{pc}{E} \ , \ K = E - mc^2 \ , \ E^2 = (pc)^2 + (mc^2)^2 \ .$$

$$\mathbf{F} = \frac{m\mathbf{a}}{\sqrt{1-u^2/c^2}} \ , \quad a_{\text{circular}} = v^2/r \ , \qquad \text{Work done} = \int_i^f \mathbf{F}\cdot d\mathbf{r} = E_f - E_i \ .$$

$$\mathbf{F} = q(\mathbf{E} + \mathbf{v}\times\mathbf{B}) \ , \qquad U = kqq'/r \ , \qquad K \approx \tfrac{1}{2}mv^2 = p^2/(2m)$$

$$c = 3\times 10^8 \text{ m/s} \ , \ e = 1.6\times 10^{-19} \text{ C} \ , \ 1 \text{ eV} = 1.6\times 10^{-19} \text{ J} \ ,$$

$$N_A = 6.022\times 10^{23} \text{ objects/mole} \ , \ ke^2 = 1.44 \text{ eV}\cdot\text{nm} = 1.44 \text{ MeV}\cdot\text{fm} \ .$$

$$m_e c^2 = 511000 \text{ eV} \ , \ 1\text{u} = 931.5 \text{ MeV}/c^2 \ , \ h = 6.63\times 10^{-34} \text{ J}\cdot\text{s} \ , \ E_R = 13.6 \text{ eV} \ .$$

$$E = hf \ , \quad hc = 1240\text{eV}\cdot\text{nm} \ , \qquad \text{De Broglie's matter wave:} \quad \lambda = h/p \ .$$

$$\hbar\omega = hf \ , \quad \hbar k = h/\lambda \ , \quad v_{\text{phase/wave}} = \omega/k = E/p \ , \quad v_{\text{group/packet}} = d\omega/dk = dE/dp \ .$$

$$|\psi(x)|^2 \text{ probabilty density} \ , \quad d\sin\theta = \text{ path diff.} \ ,$$

$$(\Delta x)(\Delta p) \geq \tfrac{1}{2}\hbar \ , \quad (\Delta E)(\Delta t) \geq \tfrac{1}{2}\hbar \ .$$

$$\text{1-d rigid box: } a = n\lambda/2 \ , \qquad E_n = \frac{\hbar^2\pi^2 n^2}{2ma^2}$$

$$\hbar \equiv \frac{h}{2\pi} \ , \ mvr = n\hbar \ , \ \frac{mv^2}{r} = \frac{ke^2}{r^2} \ , \ E_R = \frac{1}{2}\left(\frac{ke^2}{\hbar c}\right)^2 m_e c^2 \ , \ E_n = -Z^2 E_R/n^2 \ .$$

$$|L| = \sqrt{\ell(\ell+1)}\hbar \ , \quad L_z = -\ell\hbar, \cdots, +\ell\hbar \ , \quad n > \ell \geq |m| \ , \quad s_z = \pm\tfrac{1}{2}\hbar \ , \quad \mathbf{J} = \mathbf{L} + \mathbf{S} \ .$$

$$\boldsymbol{\mu} = -\frac{e}{2m_e}\mathbf{L} \ , \quad \Delta E = -\boldsymbol{\mu}\cdot\mathbf{B} = \frac{e\hbar}{2m_e} mB \ , \quad \mu_B = \frac{e\hbar}{2m_e} = 5.79\times 10^{-5} \text{ eV/T}$$

$$m_{\text{nuc}} = Zm_p + Nm_n - B/c^2 \ , \ m_p c^2 = 938.3 \text{ MeV} \ , m_n c^2 = 939.6 \text{ MeV} \ ,$$

$$\frac{dN}{dt} = -rN \ , \ N = N_0 e^{-rt} \ , \ \tau = \frac{1}{r} \ , \ t_{\frac{1}{2}} = \frac{\ln 2}{r} \ , \quad R = (1.07 \text{ fm })A^{\frac{1}{3}} \ , \ N = \sigma N_{\text{inc}} N_{\text{tar}}/A$$