Relativity: $\beta = \dfrac{v}{c}$ $\gamma = \dfrac{1}{\sqrt{1-\beta^2}}$ $t' = \gamma t_0$ $L = L_0/\gamma$ $x' = \gamma(x - vt)$

$y' = y$ $z' = y$ $t' = \gamma(t - \beta x/c)$ $\Delta s^2 = \Delta x^2 - c^2\Delta t^2$

$u_x = \dfrac{u'_x + v}{1 + vu'_x/c^2}$ $u_y = \dfrac{u'_y}{\gamma(1 + vu'_x/c^2)}$ $u_z = \dfrac{u'_z}{\gamma(1 + vu'_x/c^2)}$ $f = \dfrac{\sqrt{1+\beta}}{\sqrt{1-\beta}} f_0$

$\vec{p} = \gamma m \vec{u}$ $K = (\gamma - 1)mc^2$ $E^2 = (pc)^2 + (mc^2)^2$

Early Quantum Theory: $\dfrac{1}{\lambda} = R_H\left(\dfrac{1}{n^2} - \dfrac{1}{k^2}\right)$ $\lambda_{max}T = 2.989 \times 10^{-3}\ \text{m}\cdot\text{K}$

$R(T) = \epsilon\sigma_{SB}T^4$ $I(\lambda, T) = \dfrac{2\pi c^2 h}{\lambda^5}\dfrac{1}{e^{hc/\lambda k_B T} - 1}$ $E = hf = \dfrac{hc}{\lambda}$

$hf = \phi + \dfrac{1}{2}mv_{max}^2$ $\lambda_{min} = \dfrac{hc}{eV_0}$ $\Delta\lambda = \dfrac{hc}{mc^2}(1 - \cos\theta)$

Atomic Structure: $\alpha = \dfrac{k_e e^2}{\hbar c} \approx \dfrac{1}{137}$ $a_0 = \dfrac{\hbar^2}{mk_e e^2} = \dfrac{1}{\alpha}\dfrac{\hbar c}{mc^2}$ $\mu = \dfrac{mM}{m+M}$

$R_H = \dfrac{\mu}{m_e}R_\infty$ $E_0 = \dfrac{mk_e^2 e^4}{2\hbar^2} = \dfrac{k_e e^2}{2a_0} \approx 13.6\text{eV}$ $E_n = -\dfrac{Z^2 E_0}{n^2}$

Waves: $\lambda = \dfrac{h}{p}$ $k = \dfrac{2\pi}{\lambda}$ $v_p = \dfrac{\omega}{k}$ $v_g = \dfrac{d\omega}{dk}$ $\Delta p \Delta x \geq \dfrac{\hbar}{2}$ $\Delta E \Delta t \geq \dfrac{\hbar}{2}$

$P(x)dx = \psi(x)^*\psi(x)dx$ $E_n = n^2\dfrac{(hc)^2}{8mc^2L^2}$

Quantum Theory: $-\dfrac{\hbar^2}{2m}\dfrac{\partial^2\Psi(x,t)}{\partial x^2} + V(x)\Psi(x,t) = E\Psi(x,t)$ $\Psi(x,t) = \psi(x)e^{-i\omega t}$

$-\dfrac{\hbar^2}{2m}\dfrac{d^2\psi(x)}{dx^2} + V(x)\psi(x) = E\psi(x)$ $1 = \displaystyle\int_{-\infty}^{\infty}\psi^\star(x)\psi(x)dx$ $\hat{p} = \dfrac{h}{i}\dfrac{\partial}{\partial x}$

$< A >= \displaystyle\int_{-\infty}^{\infty}\psi^\star(x)\hat{A}\psi(x)dx$ $E_n = n^2\dfrac{h^2}{8mL^2}$ $E_n = (n + \dfrac{1}{2})\hbar\omega$

$\kappa = \dfrac{\sqrt{2m(V_0 - E)}}{\hbar}$ $T = 16\dfrac{E}{V_0}\left(1 - \dfrac{E}{V_0}\right)e^{-2\kappa L}$

Hydrogen Atom: $V = -\dfrac{k_e e^2}{r}$ $\psi(r,\theta,\phi) = R_{nl}(r)Y_{lm_l}(\theta,\phi)$ $E_n = -\dfrac{E_0}{n^2}$

$E_0 = 13.6\ \text{eV}$ $P(r) = |R(r)|^2r^2dr$ $L = \sqrt{l(l+1)}\hbar$ $L_z = m_l\hbar$ $\vec{\mu} = -\dfrac{e}{2m}\vec{L}$

$\mu_B = \dfrac{e\hbar}{2m}$ $V_B = -\mu_z B = +\mu_B m_l B$

Constants: $e = 1.602 \times 10^{-19}\ \text{C}$ $m_e = 9.11 \times 10^{-31}\ \text{kg}$ $c = 2.998 \times 10^8\ \text{m/s}$

$m_ec^2 = 0.511\ \text{MeV}$ $m_pc^2 = 938.27\ \text{MeV}$ $m_nc^2 = 939.57\ \text{MeV}$

$k_e = 8.9876 \times 10^9\ \text{Nm}^2/\text{C}^2$ $h = 6.626 \times 10^{-34}\ \text{Js}$ $\hbar = 1.055 \times 10^{-34}\ \text{Js}$

$hc = 1239.8\ \text{eV}\cdot\text{nm}$ $k_B = 1.3807 \times 10^{-23}\ \text{J/K}$ $R_\infty = \dfrac{\alpha^2 m_e c^2}{2hc} = 0.0109737\ \text{nm}^{-1}$

$R_H = 0.0109678\ \text{nm}^{-1}$ $1\text{u} = 931.5\ \text{MeV}/c^2 = 1.66 \times 10^{-27}\ \text{kg}$ $1\text{eV} = 1.602 \times 10^{-19}\ \text{J}$

$a_0 = 0.0529\ \text{nm}$ $\mu_B = 5.7884 \times 10^{-5}\ \text{eV/T}$ $\sigma_{SB} = 5.6704 \times 10^{-8}\ \text{Wm}^{-2}\text{K}^{-4}$