Constants: $c = 2.998\times 10^8\,\mathrm{m/s}$ $e = 1.602\times 10^{-19}\,\mathrm{C}$ $N_\mathrm{A} = 6.02\times 10^{23}$

$k_\mathrm{B} = 1.38\times 10^{-23}\,\mathrm{J/K}$ $m_\mathrm{e} = 511\,\mathrm{keV/c^2}$ $\dfrac{1}{4\pi\epsilon_0} = 8.99\times 10^9\,\mathrm{N\cdot m^2/C^2}$

$h = 6.626\times 10^{-34}\,\mathrm{J\cdot s}$ $\hbar = h/2\pi$ $1\,\mathrm{eV} = 1.602\times 10^{-19}\,\mathrm{J}$ $R = 1.09737\times 10^7/\mathrm{m}$

$hc = 1240\,\mathrm{eV\cdot nm}$ $\dfrac{e^2}{4\pi\epsilon_0} = 1.44\,\mathrm{eV\cdot nm}$ $1\mathrm{u} = 931.5\,\mathrm{MeV/c^2}$ $a_0 = 0.0529\,\mathrm{nm}$

Classical Physics:

$$\vec{F} = m\vec{a} \qquad K = \frac{1}{2}mv^2 \qquad a = \frac{v^2}{r} \qquad F_{12} = \frac{1}{4\pi\epsilon_0}\frac{q_1q_2}{r^2} \qquad V_{12} = \frac{1}{4\pi\epsilon_0}\frac{q_1q_2}{r}$$

Modern Physics:

$$p = \frac{h}{\lambda} = \hbar k \qquad E = hf = \hbar\omega \qquad v_\mathrm{phase} = \frac{\omega}{k} \qquad v_\mathrm{group} = \frac{d\omega}{dk} \qquad a_0 = \frac{4\pi\epsilon_0\,\hbar^2}{e^2\;m}$$

$$\Delta p\ \Delta x \ge \frac{\hbar}{2} \qquad \Delta E\ \Delta t \ge \frac{\hbar}{2} \qquad \Delta x = \left[\langle x^2\rangle - \langle x\rangle^2\right]^{1/2}$$

$$-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}\Psi(x,t) + V(x)\Psi(x,t) = i\hbar\frac{\partial}{\partial t}\Psi(x,t) \qquad P(x) = |\Psi(x,t)|^2 = \Psi^*(x,t)\,\Psi(x,t)$$

$$-\frac{\hbar^2}{2m}\frac{d^2}{dx^2}\psi(x,t) + V(x)\psi(x,t) = E\psi(x,t) \qquad \Psi(x,t) = \psi(x)e^{-iEt/\hbar} \qquad \int_{-\infty}^{\infty} P(x)\,dx = 1$$

$$\langle x\rangle = \int_{-\infty}^{\infty}\psi^*(x)\,x\,\psi(x)\,dx \qquad \langle f(x)\rangle = \int_{-\infty}^{\infty}\psi^*(x)\,f(x)\,\psi(x)\,dx \qquad \langle p\rangle = \int_{-\infty}^{\infty}\psi^*(x)\,\frac{\hbar}{i}\frac{d}{dx}\psi(x)\,dx$$

$$\text{Square Well}:\ \psi_n = \sqrt{\frac{2}{L}}\sin\frac{n\pi}{L}x\ ;\quad E_n = \frac{n^2\pi^2\hbar^2}{2mL^2} \qquad \text{Oscillator}:\ E_n = (n+\tfrac{1}{2})\hbar\omega$$

$$T = \left[1 + \frac{V_0^2}{16E(V_0-E)}(e^{\alpha L} - e^{-\alpha L})^2\right]^{-1} \qquad T \simeq e^{-2G} \qquad G = \sqrt{\frac{2m}{\hbar^2}}\int [V(x)-E]^{\frac{1}{2}}\,dx$$

$$\psi_{n,\ell,m} = R_{n,\ell}(r)\,Y_\ell^m(\theta,\phi) \qquad E_n = -\frac{1}{2}\left(\frac{e^2}{4\pi\epsilon_0}\right)^2\frac{m}{\hbar^2}\frac{1}{n^2} = -\frac{13.6\,\mathrm{eV}}{n^2} \qquad P(r) = r^2R_{n,\ell}^2$$

$$\ell = 0,1,2,\ \ldots, n-1 \qquad m = -\ell, -\ell+1,\ \ldots, \ell \qquad L = \sqrt{\ell(\ell+1)}\hbar \qquad L_z = m\hbar$$