$i\hbar\frac{\partial\psi}{\partial t} = \hat{H}\psi$ (Equations)

$$\hat{E} = i\hbar\frac{\partial}{\partial t} \qquad \hat{H} = \frac{\hat{p}^2}{2m} + V(\vec{r}) \qquad \hat{p} = -i\hbar\nabla \qquad \langle\phi_m|\phi_n\rangle = \int_0^a \phi_m^*\phi_n dx = \delta_{m,n}$$

$$\langle\phi_{k'}|\phi_k\rangle = \frac{1}{2\pi}\int_{-\infty}^{\infty} e^{i(k-k')x}dx = \delta(k-k') \qquad \psi(x,t) = \exp(\frac{-i\hat{H}t}{\hbar})\psi(x,0) \qquad \hat{x} = -i\frac{\partial}{\partial k}$$

$$\hat{V}(x) = \frac{1}{2}m\omega_o^2\hat{x}^2 \qquad \hat{T}_{rot} = \frac{\hat{L}^2}{2I} \qquad \frac{d\langle A\rangle}{dt} = \left\langle \frac{i}{\hbar}[\hat{H},\hat{A}] + \frac{\partial\hat{A}}{\partial t}\right\rangle \qquad \hat{D}(\xi) = \exp(\frac{i\xi`\hat{p}}{\hbar})$$

$$\hat{R}_{\Delta\phi} = \exp(\frac{i\Delta\phi\hat{L}_z}{\hbar}) \qquad \hat{P}f(x) = f(-x) \qquad \hat{a} = \frac{\beta}{\sqrt{2}}(\hat{x} + \frac{i\hat{p}}{m\omega_o}) \qquad \hat{a}^t = \frac{\beta}{\sqrt{2}}(\hat{x} - \frac{i\hat{p}}{m\omega_o})$$

$$[\hat{x},\hat{p}] = i\hbar \qquad [\hat{a},\hat{a}^t] = 1 \qquad \hat{x} = \frac{\hat{a}+\hat{a}^t}{\sqrt{2}\beta} \qquad \hat{p} = \frac{m\omega_o}{i}\frac{\hat{a}-\hat{a}^t}{\sqrt{2}\beta} \qquad \beta^2 = \frac{m\omega_o}{\hbar} \qquad \xi = \beta x$$

$$\hat{N} = \hat{a}^t\hat{a} \qquad \hat{a}\phi_n = \sqrt{n}\phi_{n-1} \qquad \hat{a}^t\phi_n = \sqrt{n+1}\phi_{n+1} \qquad v_p = \frac{\omega(k)}{k} \qquad v_g = \frac{\partial\omega(k)}{\partial k}$$

$$\phi_n = A_n H_n(\xi)e^{-\xi^2/2} = A_n(\xi - \frac{\partial}{\partial\xi})^n e^{-\xi^2/2} \qquad \langle n|l\rangle = \int_{-\infty}^{\infty}\varphi_n^*\varphi_l d\xi = \delta_{nl} \qquad \frac{\partial\rho}{\partial t} + \nabla\circ\vec{J} = 0$$

$$\vec{J} = \frac{\hbar}{2mi}(\psi^*\nabla\psi - \psi\nabla\psi^*) \qquad \hat{\vec{J}} = \hat{\vec{L}} + \hat{\vec{S}} \qquad [\hat{J}_x,\hat{J}_y] = i\hbar\hat{J}_z \qquad [\hat{J}_y,\hat{J}_z] = i\hbar\hat{J}_x$$

$$[\hat{J}_z,\hat{J}_x] = i\hbar\hat{J}_y \qquad \Delta A\Delta B \geq \frac{1}{2}\left|\langle[\hat{A},\hat{B}]\rangle\right| \qquad \hat{J}^2 = \hat{J}_-\hat{J}_+ + \hat{J}_z^2 + \hbar\hat{J}_z \qquad \hat{J}^2 = \hat{J}_+\hat{J}_- + \hat{J}_z^2 - \hbar\hat{J}_z$$

$$\hat{J}_+ = \hat{J}_x + i\hat{J}_y \qquad \hat{J}_- = \hat{J}_x - i\hat{J}_y \qquad \int_0^{\infty}\rho^n e^{-\rho}d\rho = n! \qquad \int_0^{\infty}e^{-\alpha x^2}dx = \sqrt{\frac{\pi}{\alpha}}$$

$$\hat{J}^2|jm\rangle = \hbar^2 j(j+1)|jm\rangle \qquad \hat{J}_z|jm\rangle = \hbar m|jm\rangle \qquad Y_l^m(\theta,\phi) = \sqrt{\frac{2l+1}{4\pi}\frac{(l-m)!}{(l+m)!}}P_l^m(\cos\theta)e^{im\phi}$$

$$P_l^m(\mu) = (-1)^m(1-\mu^2)^{m/2}\frac{d^m P_l(\mu)}{d\mu^m} \qquad \langle l'm'|lm\rangle = \int Y^{*m'}_{l'}(\theta,\phi)Y_l^m(\theta,\phi)d\Omega = \delta_{l'l}\delta_{m'm}$$

$$V(r) = -\frac{Ze^2}{r} \qquad \vec{r} = \vec{r}_2 - \vec{r}_1 \qquad \vec{p} = \mu(\dot{\vec{r}}_2 - \dot{\vec{r}}_1) \qquad \mu = \frac{m_1m_2}{m_1+m_2} \qquad \hat{p}_r = -i\hbar\frac{1}{r}\frac{\partial}{\partial r}r$$

$$\nabla^2 = \frac{1}{r}\frac{\partial^2}{\partial r^2}r + \frac{1}{r^2}(\frac{1}{\sin\theta}\frac{\partial}{\partial\theta}\sin\theta\frac{\partial}{\partial\theta} + \frac{1}{\sin^2\theta}\frac{\partial^2}{\partial\phi^2}) \qquad \rho = 2\kappa r \qquad \lambda = \frac{Z}{\kappa a_0}$$

$$|E| = \frac{\hbar^2\kappa^2}{2\mu} \qquad u(\rho) = e^{-\rho/2}\rho^{l+1}F(\rho) \qquad F(\rho) = \sum_i^{i_{max}}C_i\rho^i \qquad \varphi_{nlm}(r,\theta,\phi) = R_{nl}(r)Y_l^m(\theta,\phi)$$

$$R_{nl}(r) = \frac{A_{nl}u_{nl}(r)}{r} \qquad C_{i+1} = \frac{(i+l+1)-\lambda}{(i+1)(i+2l+2)}$$