$$H_{approx.} = \sum_{i=1}^{N} h(i)$$

$$\Psi = \psi_a(1)\psi_b(2)\psi_c(3)\psi_d(4)......$$

$$\Psi = \frac{1}{\sqrt{N!}} Det\{\psi_a(1)\psi_b(2)\psi_c(3)\psi_d(4).....\psi_x(N)\}$$

$$H = \sum_{i=1}^{N} \left(\frac{\mathbf{p_i^2}}{2m} - \frac{Ze^2}{r} \right) + \sum_{i<j}^{N} \frac{e^2}{r_{ij}}.$$

$$\begin{aligned} & \left(\frac{\mathbf{p_i^2}}{2m} - \frac{Ze^2}{r} \right) \psi_a(i) \\ + & \left[\sum_b^{occ} \int \psi_b(j) \ \frac{e^2}{r_{ij}} \ \psi_b(j) \ dV_j \right] \psi_a(i) \\ - & \left[\sum_b^{occ} \int \psi_b(j) \ \frac{e^2}{r_{ij}} \ \psi_a(j) \ dV_j \right] \psi_b(i) \\ & = \ \varepsilon_a \psi_a(i). \end{aligned}$$

$$h(i)\psi_a(i) = \varepsilon_a \psi_a(i).$$

$$h(i) = \frac{\mathbf{p_i^2}}{2m} - \frac{Ze^2}{r} + u_{HF}(i).$$

$$
\begin{aligned}
& u_{HF}(i) \qquad \psi_a(i) \\
= & \left[\sum_b^{occ} \int \psi_b(j) \frac{e^2}{r_{ij}} \psi_b(j) dV_j \right] \quad \psi_a(i) \\
- & \left[\sum_b^{occ} \int \psi_b(j) \frac{e^2}{r_{ij}} \psi_a(j) dV_j \right] \quad \psi_b(i).
\end{aligned}
$$

$$
\begin{aligned}
& \left[\frac{\hbar^2}{2m} \left(-\frac{d^2}{dr_i^2} + \frac{\ell_a(\ell_a+1)}{r_i^2} \right) - \frac{Ze^2}{r_i} \right] \quad P_a(r_i) \\
& + \left[\sum_b^{occ} \int P_b(r_j) \ \frac{e^2}{r_{ij}} \ P_b(r_j) dr_j \right] \quad P_a(r_i) \\
& - \left[\sum_b^{occ} \int P_b(r_j) \ \frac{e^2}{r_{ij}} \ P_a(r_j) dr_j \right] \quad P_b(r_i) \\
& = \varepsilon_a \quad P_a(r_i)
\end{aligned}
$$

$$\psi(r,\theta,\phi,\sigma) = \frac{1}{r} P_{n\ell}(r) Y_{\ell m_\ell}(\theta,\phi) \chi_{m_s}(\sigma).$$