Bohr radius

$\rho = kr$

$$K = \frac{me^2}{2\pi\varepsilon_0\hbar^2\rho_0} \qquad \rho_0 = 2n$$

wave number $= \frac{1}{\text{length}} = \frac{1}{a_n}$ $\leftarrow$ $K = \frac{me^2}{2\pi\varepsilon_0\hbar^2 2n}$ $\boxed{= \frac{me^2}{4\pi\varepsilon_0\hbar^2 n}}$

$$\frac{me^2}{4\pi\varepsilon_0\hbar^2 n} = \frac{1}{a_n} \qquad a_n = \frac{4\pi\varepsilon_0\hbar^2 n}{me^2} = 0.529\ \text{Å} = \text{when} = 1$$

$\rho = kr \qquad k = \frac{1}{a_n}$

$$\rho = \frac{1}{a_n} r = \boxed{\frac{r}{a_n}} \quad (*)$$

$$\boxed{\therefore \psi_{nlm} = R_{nl} Y_l^m} \quad (*)$$

when $= 1$

replace n with 1 to get ground state wave function

$n = 1 \qquad l = (1-1) \qquad m = 0$
$\qquad = 0$

$$\psi_{(1)(0)(0)} = R_{(1)(0)} Y_{(0)}^{(0)} = \frac{1}{\sqrt{4\pi}}$$

Ex :- calculate R_{10} : & normalise it

$$\boxed{R_{nl} = \frac{1}{r} u} \quad (*)$$

$$u = e^{-\rho} \rho^{l+1} v(\rho)$$

$$\boxed{R_{nl} = \frac{1}{r}\left[e^{-\rho} \rho_0^{l+1} v(\rho)\right]} \quad (*) \quad u = Rr$$

$$\boxed{R_{(10)} = \frac{1}{r}\left[e^{-\rho} \rho_0 \, v(\rho)\right]} \quad (*)$$

$\left\{ \begin{array}{l} n=1 \\ l=0 \\ j=0 \end{array} \right\}$

$$\therefore C_{j+1} = \frac{2(j+l+1-n)}{(j+1)(j+2l+2)} C_j \quad (*) \text{ recursion relation}$$

wewe

$$C_{j+1} = \boxed{\frac{2(j+l+1-n)}{(j+1)(j+2l+2)}} c_j$$

$n=1$ $l=0$
$j=0$

$$\boxed{v(\rho) = = \sum_{j=0}^{\infty} C_j \rho^j}$$ ⊛function equation

$$v(\rho) = \sum_{j=0}^{\infty} C_0 \rho^0 + \cancel{C_1 \rho^1}^{0} + C_2 \rho^2 + C_3 \rho^3 + C\ldots$$

$C_0 \neq 0$

$v(\rho) = C_0$

$C_1 = 0$
$C_2 = (~~same~~ \text{ wewe}) \times 0$
$C_2 = 0$

$C_3 = (\text{wewe}) \times C_2$
$= (\text{wewe}) \times 0$
$= 0$

$R_{n1} = \frac{1}{r}[e^{-\rho}\rho^{l+1}] v(\rho)]$ entire thing is 0

$R_{nl} = \frac{1}{r}[e^{-\rho}\rho^{l+1}] C_0$

$R_{10} = \frac{1}{r}[e^{-\rho}\rho] C_0 = \frac{C_0}{a} e^{-r/a}$

$\int_{-\infty}^{+\infty} |\psi|^2 dx = 1$

$\int_{-\infty}^{+\infty} |u|^2 dr =$

derivation

$\frac{C_0}{\cancel{r}} \frac{\cancel{r}}{a_n} e^{-\frac{r}{a_n}}$

$R_{10} = C_0 e^{-r/a}$

$\int_{-\infty}^{+\infty} |R|^2 r^2 dr = 1$

$= \frac{C_0^2}{a^2} \int_0^{\infty} e^{-2r/a} r^2 dr = 1$

$= \frac{C_0^2}{a^2}\left[\frac{a^3}{4}\right] = 1$

$C_0^2 \left[\frac{a}{4}\right] = 1$

$C_0^2 = \frac{4}{a}$

$\boxed{C_0 = \frac{2}{\sqrt{a}}}$

$$R_{10} = \frac{C_0}{a} e^{-r/a}$$

$$R_{10} = \frac{2}{a\sqrt{a}} e^{-r/a}$$

$$\Psi_{(100)} = R_{10} Y_0^0$$

$$\Rightarrow \Psi_{(100)} = \left[\frac{2}{a\sqrt{a}} e^{-r/a}\right]\left[\frac{1}{\sqrt{4\pi}}\right]$$

$$\Psi_{100} = \frac{1}{\sqrt{\pi a^3}} e^{-r/a}$$