

L//////////CCCCC//////////K/ $\frac{1}{2}$ //TE//TE//T
E//TE/ $\frac{1}{2}$ YO/ $\frac{1}{2}$ LO/:PO/ $\frac{1}{2}$ WOA/T:/RYB@RPB/R/C: $\frac{1}{2}$ /N:RTA@R/C: $\frac{1}{2}$ /NIRTAIR/CIR/N:
R/C:R/NRR/U/D/JQ/QOFS/PRR/SORHOE:H $\frac{1}{2}$ //ODST/NRTAI $\frac{1}{2}$ /Q////////K/D/:R/C@
D/J@EQOFS/PNRTA/RHOE:H $\frac{1}{2}$ //ODST/CRTA"E/PRRT/IR/C@D/JCEQOFS/PCRTA:DT
/@/ZARRTFHEQOKS/P $\frac{1}{2}$ RTAI $\frac{1}{2}$ HO $\frac{1}{2}$ R/C $\frac{1}{2}$ R/N $\frac{1}{2}$ R/ETET:A:/C $\frac{1}{2}$ R/N $\frac{1}{2}$ RTAE:H $\frac{1}{2}$ ////////
K/R/VA/TRR/CRR/NTR/E//T:RR/C $\frac{1}{2}$ $\frac{1}{2}$ /NVD/UTRTNLRTAR $\frac{1}{2}$ /JN $\frac{1}{2}$ /CRR/ $\frac{1}{2}$ TR/JTR/JHR
/E//T:C $\frac{1}{2}$ /CHR/FPR/E//T: $\frac{1}{2}$ R/CPR/FPR/E//T:T $\frac{1}{2}$ /CLR/FOR/E//T: $\frac{1}{2}$ R/COR/FOR/E
////////K/J///T:CR/COR/FOR/E//T:L $\frac{1}{2}$ /CTR/NGR/E//T: $\frac{1}{2}$ R/CGR/NGR/E//T:CR/
CCR/NMR/UISTCMRTAMR/KGR/FGR/EPRT $\frac{1}{2}$ ORTCGRTCVRTAID/J//EAMA/PTS////////Q
E////////M@IR $\frac{1}{2}$ ////////K/ $\frac{1}{2}$ /VRT $\frac{1}{2}$ E:/MVRTFMETNLE/H//T:H $\frac{1}{2}$ /CVR/FG//
MMRTAMRTFISTIGETIMRTAE:HOP $\frac{1}{2}$ /CMR/NMR/UVRTAV:/CVR/NVRTAVR/JY//:E:HGX
//TA/T:O $\frac{1}{2}$ /JY//:C/T:DSPGE:WGK/D/JE/OE:YGE:LGE:/O//L@ $\frac{1}{2}$ /JY//:V:/JY//
:DS/JY//:C/T: $\frac{1}{2}$ D/J//EAOE/PRD/J//EAOE/PZET:O $\frac{1}{2}$ /JY//:Y//:QE/P"////TS//
/"ASMGAS/RZAUC////////MEID $\frac{1}{2}$ ////////K/ $\frac{1}{2}$ /H////////
L:UCMOZA/S////////E/////O////////A/EAXHBW:////////TXKIWUERJ/
/:E///R////////Z//////////K/DTSE//P/E
@EE//Y/E@E@//O/E@EC//EIF/S///@I@/U///@I@////////////////MAI $\frac{1}{2}$
 $\frac{1}{2}$ ////H////////EC@EC@EC@EC@////////////////////////
/MAI/ $\frac{1}{2}$ KHS@EE//@I@/TTS//
////////////////M@I@ $\frac{1}{2}$ KI $\frac{1}{2}$ E/ $\frac{1}{2}$ POKPJEORTNM@IR $\frac{1}{2}$ MEIE $\frac{1}{2}$ KV $\frac{1}{2}$ EE:PGMEID $\frac{1}{2}$ MAI/ $\frac{1}{2}$ KHS@
EE//@I@/TTS////////////////////////////////M@I@ $\frac{1}{2}$ K: $\frac{1}{2}$ E/:YOKPJEORTNM@IR $\frac{1}{2}$ MEIE $\frac{1}{2}$ KEDED
SYGMEID $\frac{1}{2}$ MAI/ $\frac{1}{2}$ KHS@EE//@I@/TTS////////////////////////////////M@I@ $\frac{1}{2}$ KI $\frac{1}{2}$ E/:POKPJEOR
TCM@IR $\frac{1}{2}$ MEIE $\frac{1}{2}$ KV $\frac{1}{2}$ EDSPGMEID $\frac{1}{2}$ MAI/ $\frac{1}{2}$ KHS@EE//@I@/TTS////////////////////////////////C
CCCC////////////////////////////////CCCCCCC////////////////////////////////M@I@ $\frac{1}{2}$ KSR"//TE//TE//TE//TE//T
E//TE//TE//TE//TE//TE//TE/ $\frac{1}{2}$ CTR/NPR/E//T: $\frac{1}{2}$ R/CPR/NPR/E//T:T $\frac{1}{2}$ /CT
R/NOR/E//T: $\frac{1}{2}$ R/COR/NOR/EK@JEOR/NM@IR $\frac{1}{2}$ ////MAI/ $\frac{1}{2}$ KC $\frac{1}{2}$:FHZCDKX@QX@Q:E:UM
AI $\frac{1}{2}$ ////H////////////////////////////////EEEEEEEEEEEEEEEEEE//00

H-atom wave functions

$$\sigma = \frac{n}{2} \rho \left(= \frac{r}{a_0} \right)$$

$$\rho = \frac{2\sigma}{n}$$

$$3s : \left(\frac{Z}{a_0} \right)^{3/2} \cdot \frac{1}{9\sqrt{3}} (6 - 6\rho + \rho^2) e^{-\rho/2} \cdot \frac{\sqrt{2}}{2} \cdot \frac{1}{\sqrt{2\pi}}$$

$$= \left(\frac{Z}{a_0} \right)^{3/2} \cdot \frac{1}{18\sqrt{3\pi}} \cdot \left(6 - 6 \cdot \frac{2\sigma}{3} + \frac{4}{9} \sigma^2 \right) e^{-\sigma/3}$$

$$\frac{24 - 36\sigma + 4\sigma^2}{9}$$

$$27 - 18\sigma + 2\sigma^2$$

$$= \left(\frac{Z}{a_0} \right)^{3/2} \cdot \frac{1}{81\sqrt{3\pi}} (27 - 18\sigma + 2\sigma^2) e^{-\sigma/3}$$

$$3p_x : \left(\frac{Z}{a_0} \right)^{3/2} \cdot \frac{1}{9\sqrt{6}} (4 - \rho) \rho e^{-\rho/2} \cdot \frac{\sqrt{3}}{2} \sin \theta \cdot \frac{1}{\sqrt{\pi}} \cos \phi$$

$$= \left(\frac{Z}{a_0} \right)^{3/2} \cdot \frac{1}{18\sqrt{2\pi}} \cdot \sin \theta \cdot \cos \phi \cdot \rho (4 - \rho) e^{-\rho/2}$$

$$4 - \frac{2\sigma}{3}$$

$$\frac{2\sigma}{3} \cdot \frac{12 - 2\sigma}{3}$$

$$= \left(\frac{Z}{a_0} \right)^{3/2} \cdot \frac{\sqrt{2}}{81\sqrt{\pi}} \cdot \sin \theta \cos \phi \cdot (6\sigma - \sigma^2) e^{-\sigma/3}$$

$$\frac{24\sigma - 4\sigma^2}{9}$$

$$3p_y = \dots \sin \phi \dots$$

$$\frac{1}{9} \cdot \frac{12\sigma - 2\sigma^2}{3}$$

$$3d_{xy} : \left(\frac{Z}{a_0} \right)^{3/2} \cdot \frac{1}{81\sqrt{2\pi}} \cdot \sin^2 \theta \sin 2\phi \cdot \sigma^2 e^{-\sigma/3}$$

$$= \left(\frac{Z}{a_0} \right)^{3/2} \cdot \frac{\sqrt{2}}{81\sqrt{\pi}} \cdot \sin^2 \theta \cdot \sin \phi \cos \phi \cdot \sigma^2 e^{-\sigma/3}$$

$\therefore$ constants are:

3s.	$\frac{1}{81\sqrt{\pi}} \cdot \frac{1}{\sqrt{3}}$	$\rightarrow$	$\frac{1}{\sqrt{3}}$
3p	$\frac{1}{81\sqrt{\pi}} \cdot \sqrt{2}$	$\rightarrow$	$\sqrt{2}$
3d	$\frac{1}{81\sqrt{\pi}} \cdot \sqrt{2}$	$\rightarrow$	$\frac{1}{\sqrt{2}}$

$$3d_{xy} = \frac{1}{81\sqrt{2}\pi} \left(\frac{2}{a_0}\right)^{3/2} r^2 e^{-r/3} \sin^2\theta \cos 2\phi$$

$$= \left(\frac{2}{a_0}\right)^{3/2} \frac{1}{81\sqrt{2}\pi} \cdot \frac{2}{\sqrt{2}} \sin^2\theta r^2 e^{-r/3} (\cos^2\phi - \frac{1}{2})$$

$$\cos\theta = 1 \quad \sin^2\theta = 1 \quad \cos^2\phi = \frac{1}{2}$$

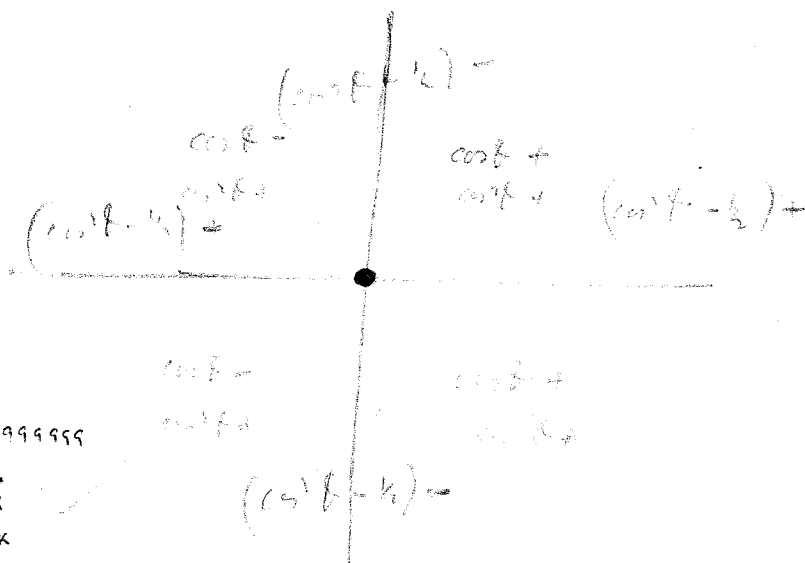
$$\begin{aligned} \cos 2x &= \cos^2 x - \sin^2 x \\ &= 2\cos^2 x - 1 \\ &= \underline{\sin^2 x} - 2\sin^2 x \end{aligned}$$

$$\begin{aligned} 2(\cos^2 x - \frac{1}{2}) \\ 2(\frac{1}{2} - \sin^2 x) \end{aligned}$$

$$+ \frac{1}{2} = \text{+++++} \star$$

$$\cos\theta \geq 0$$

$$\cos^2\phi - \frac{1}{2} \rightarrow -\frac{1}{2}$$



$$\text{then } \cos\theta = 1$$

$$\cos\theta = \text{+++++}$$

$$1/\sqrt{2} = 0.707106781$$

$$1^2 = \text{+++++}$$

Slate functions

$$3s = \left(\frac{2}{5.31\pi} \right)^{1/4} \rho^2 e^{-\rho/3} = \frac{1}{81\sqrt{\pi}} \sqrt{\frac{2}{15}}$$

$$3p = \left(\frac{2}{5.38\pi} \right)^{1/4} \rho^2 \cos \phi e^{-\rho/3} = \frac{1}{81\sqrt{\pi}} \sqrt{\frac{2}{5}}$$

$$3d = \left(\frac{2}{38\pi} \right)^{1/4} \rho^2 \cos \phi \sin \phi e^{-\rho/3} = \frac{1}{81\sqrt{\pi}} \sqrt{\frac{2}{1}}$$

H-like.	Slate	Program	Weights.
$\frac{1}{\sqrt{2}} \cdot \frac{1}{\sqrt{3}} \cdot .58$	$\sqrt{\frac{2}{15}} \cdot .36$	$\frac{1}{\sqrt{12}} \cdot .29$	$\frac{1}{2}$
$\frac{1}{\sqrt{2}} \cdot \sqrt{2} \cdot 1.4$	$\sqrt{\frac{2}{5}} \cdot .63$	$\frac{1}{\sqrt{6}} \cdot .41$	$\frac{1}{\sqrt{2}}$
$\frac{1}{\sqrt{2}} \cdot \sqrt{2} \cdot 1.4$	$\sqrt{2} \cdot 1.4$	$\frac{1}{\sqrt{30}} \cdot .18$	$\frac{1}{2}$

$y = 20 \quad x = 0$
 corresponds to
 $r = \frac{20 \cdot \frac{2}{3} \cdot a_0}{2}$

Try dividing by 4

$s : \frac{1}{4\sqrt{3}} = \frac{1}{6.928203} = .14433756 = \text{EDZMHBW} : \text{more exact } \boxed{\text{EAXHBW}}$

$p : \frac{\sqrt{2}}{4} = \quad \times \sqrt{2} = \frac{1}{2} = \boxed{\text{TTTTTTT}}$

$d : \frac{\sqrt{2}}{4} = .3535533906 = \text{TIWUERT} : \text{more exact } \boxed{\text{XKIWUERT}}$

$s : \frac{1}{4\sqrt{\frac{2}{15}}} = \frac{1}{4\sqrt{0.133}} = 0.0912870929 = \boxed{\text{FHZCDKXQ}}$

$p : \frac{1}{4\sqrt{\frac{2}{5}}} = \quad \times \sqrt{2} = \frac{1}{2\sqrt{5}} = 0.2236067978 = \boxed{\text{XQXQQ:f:u}}$

$d : \frac{\sqrt{2}}{4} = \quad \boxed{\text{XKIWUERT}}$