Funciones de onda del átomo de hidrógeno

$$\Psi_{n,l,m}(r,\theta,\phi) = R_{n,l}(r)\Theta_{l,m}(\theta)\Phi_m(\phi)$$
$$\Psi_{n,l,m}(r,\theta,\phi) = R_{n,l}(r)Y_{l,m}(\theta,\phi)$$

Tabla 1: Funciones radiales del átomo de hidrógeno

n	l	$R_{n,l}(r)$
1	0	$2\left(\frac{Z}{a_0}\right)^{3/2} e^{-Zr/a_0}$
2	0	$\frac{1}{2\sqrt{2}}\left(\frac{Z}{a_0}\right)^{3/2}\left(2-\frac{Zr}{a_0}\right)e^{-Zr/2a_0}$
2	1	$\frac{1}{2\sqrt{6}}\left(\frac{Z}{a_0}\right)^{3/2}\left(\frac{Zr}{a_0}\right)e^{-Zr/2a_0}$
3	0	$\frac{2}{81\sqrt{3}}\left(\frac{Z}{a_0}\right)^{3/2}\left[2\left(\frac{Zr}{a_0}\right)^2-18\left(\frac{Zr}{a_0}\right)+27\right]e^{-Zr/3a_0}$
3	1	$\frac{2\sqrt{2}}{81\sqrt{3}}\left(\frac{Z}{a_0}\right)^{3/2}\left[6-\left(\frac{Zr}{a_0}\right)\right]\left(\frac{Zr}{a_0}\right)e^{-Zr/3a_0}$
3	2	$\frac{2\sqrt{2}}{81\sqrt{15}}\left(\frac{Z}{a_0}\right)^{3/2}\left(\frac{Zr}{a_0}\right)^2 e^{-Zr/3a_0}$

Tabla 2: Funciones angulares del átomo de hidrógeno

l	m	$Y_{l,m}(\theta,\phi) = \Theta_{l,m}(\theta)\ \Phi_{l,m}(\phi)$
0	0	$(1/4\pi)^{1/2}$
1	0	$(3/4\pi)^{1/2}\, cos\ \theta$
1	1	$(3/8\pi)^{1/2}\, sen\ \theta\ e^{i\phi}$
1	−1	$(3/8\pi)^{1/2}\, sen\ \theta\ e^{-i\phi}$
2	0	$(5/16\pi)^{1/2}\left(3\ cos^2\ \theta - 1\right)$
2	1	$(15/8\pi)^{1/2}\, sen\ \theta\ cos\ \theta\ e^{i\phi}$
2	−1	$(15/8\pi)^{1/2}\, sen\ \theta\ cos\ \theta\ e^{-i\phi}$
2	2	$(15/32\pi)^{1/2}\, sen^2\ \theta\ e^{2i\phi}$
2	−2	$(15/32\pi)^{1/2}\, sen^2\ \theta\ e^{-2i\phi}$

Tabla 3: Funciones de onda hidrogenoides reales

$\Psi_{n,l,m}(r,\theta,\phi) = R_{n,l}(r)Y_{l,m}(\theta,\phi)$
$1s = \frac{1}{\pi^{1/2}}\left(\frac{Z}{a_0}\right)^{3/2} e^{-Zr/a_0}$
$2s = \frac{1}{4(2\pi)^{1/2}}\left(\frac{Z}{a_0}\right)^{3/2}\left(2-\frac{Zr}{a_0}\right) e^{-Zr/2a_0}$
$2p_z = \frac{1}{4(2\pi)^{1/2}}\left(\frac{Z}{a_0}\right)^{5/2} re^{-Zr/2a_0}\ cos\ \theta$
$2p_x = \frac{1}{4(2\pi)^{1/2}}\left(\frac{Z}{a_0}\right)^{5/2} re^{-Zr/2a_0}\ sen\ \theta\ cos\ \phi$
$2p_y = \frac{1}{4(2\pi)^{1/2}}\left(\frac{Z}{a_0}\right)^{5/2} re^{-Zr/2a_0}\ sen\ \theta\ sen\ \phi$
$3s = \frac{1}{81(3\pi)^{1/2}}\left(\frac{Z}{a_0}\right)^{3/2}\left(27-18\frac{Zr}{a_0}+2\frac{Z^2r^2}{a_0^2}\right) e^{-Zr/a_0}$
$3p_z = \frac{2^{1/2}}{81\pi^{1/2}}\left(\frac{Z}{a_0}\right)^{5/2}\left(6-\frac{Zr}{a_0}\right) re^{-Zr/3a_0}\ cos\ \theta$
$3p_x = \frac{2^{1/2}}{81\pi^{1/2}}\left(\frac{Z}{a_0}\right)^{5/2}\left(6-\frac{Zr}{a_0}\right) re^{-Zr/3a_0}\ sen\ \theta\ cos\ \phi$
$3p_y = \frac{2^{1/2}}{81\pi^{1/2}}\left(\frac{Z}{a_0}\right)^{5/2}\left(6-\frac{Zr}{a_0}\right) re^{-Zr/3a_0}\ sen\ \theta\ sen\ \phi$
$3d_{z^2} = \frac{1}{81(6\pi)^{1/2}}\left(\frac{Z}{a_0}\right)^{7/2} r^2e^{-Zr/3a_0}\left(3\ cos^2\ \theta-1\right)$
$3d_{xz} = \frac{2^{1/2}}{81\pi^{1/2}}\left(\frac{Z}{a_0}\right)^{7/2} r^2e^{-Zr/3a_0}\ sen\ \theta\ cos\ \theta\ cos\phi$
$3d_{yz} = \frac{2^{1/2}}{81\pi^{1/2}}\left(\frac{Z}{a_0}\right)^{7/2} r^2e^{-Zr/3a_0}\ sen\ \theta\ cos\ \theta\ sen\phi$
$3d_{x^2-y^2} = \frac{1}{81(2\pi)^{1/2}}\left(\frac{Z}{a_0}\right)^{7/2} r^2e^{-Zr/3a_0}\ sen^2\ \theta\ cos\ 2\phi$
$3d_{xy} = \frac{1}{81(2\pi)^{1/2}}\left(\frac{Z}{a_0}\right)^{7/2} r^2e^{-Zr/3a_0}\ sen^2\ \theta\ sen\ 2\phi$