Table 6.1 Normalized Wave Functions of the Hydrogen Atom for \( n = 1, 2, \) and 3*

<table>
<thead>
<tr>
<th>( n )</th>
<th>( l )</th>
<th>( m )</th>
<th>( \Phi(\phi) )</th>
<th>( \Theta(\theta) )</th>
<th>( R(\rho) )</th>
<th>( \psi(r, \theta, \phi) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>( \frac{1}{\sqrt{2\pi}} )</td>
<td>( \frac{1}{\sqrt{2}} )</td>
<td>( \frac{2}{a_0^{3/2}} e^{-r/a_0} )</td>
<td>( \frac{1}{\sqrt{\pi}} a_0^{3/2} e^{-r/a_0} )</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0</td>
<td>( \frac{1}{\sqrt{2\pi}} )</td>
<td>( \frac{1}{\sqrt{2}} )</td>
<td>( \frac{1}{2\sqrt{2} a_0^{3/2}} \left( 2 - \frac{r}{a_0} \right) e^{-r/2a_0} )</td>
<td>( \frac{1}{4\sqrt{2\pi} a_0^{3/2}} \left( 2 - \frac{r}{a_0} \right) e^{-r/2a_0} )</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>0</td>
<td>( \frac{1}{\sqrt{2\pi}} )</td>
<td>( \frac{\sqrt{6} \cos \theta}{2} )</td>
<td>( \frac{1}{2\sqrt{6} a_0^{3/2}} \frac{r}{a_0} e^{-r/2a_0} )</td>
<td>( \frac{1}{4\sqrt{2\pi} a_0^{3/2}} \frac{r}{a_0} e^{-r/2a_0} \cos \theta )</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>±1</td>
<td>( \frac{1}{\sqrt{2\pi}} e^{\pm i\phi} )</td>
<td>( \frac{\sqrt{3}}{2} \frac{\sin \theta}{2} )</td>
<td>( \frac{1}{2\sqrt{6} a_0^{3/2}} \frac{r}{a_0} e^{-r/2a_0} )</td>
<td>( \frac{1}{8\sqrt{\pi} a_0^{3/2}} \frac{r}{a_0} e^{-r/2a_0} \sin \theta e^{\pm i\phi} )</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>( \frac{1}{\sqrt{2\pi}} )</td>
<td>( \frac{1}{\sqrt{2}} )</td>
<td>( \frac{2}{81\sqrt{3} a_0^{3/2}} \left( 27 - 18 \frac{r}{a_0} + 2 \frac{r^2}{a_0^2} \right) e^{-r/3a_0} )</td>
<td>( \frac{1}{81\sqrt{3\pi} a_0^{3/2}} \left( 27 - 18 \frac{r}{a_0} + 2 \frac{r^2}{a_0^2} \right) e^{-r/3a_0} )</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>0</td>
<td>( \frac{1}{\sqrt{2\pi}} )</td>
<td>( \frac{\sqrt{6} \cos \theta}{2} )</td>
<td>( \frac{4}{81\sqrt{6} a_0^{3/2}} \left( 6 - \frac{r}{a_0} \right) \frac{r}{a_0} e^{-r/3a_0} )</td>
<td>( \frac{\sqrt{2}}{81\sqrt{\pi} a_0^{3/2}} \left( 6 - \frac{r}{a_0} \right) \frac{r}{a_0} e^{-r/3a_0} \cos \theta )</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>±1</td>
<td>( \frac{1}{\sqrt{2\pi}} e^{\pm i\phi} )</td>
<td>( \frac{\sqrt{3}}{2} \frac{\sin \theta}{2} )</td>
<td>( \frac{4}{81\sqrt{6} a_0^{3/2}} \left( 6 - \frac{r}{a_0} \right) \frac{r}{a_0} e^{-r/3a_0} )</td>
<td>( \frac{1}{81\sqrt{\pi} a_0^{3/2}} \left( 6 - \frac{r}{a_0} \right) \frac{r}{a_0} e^{-r/3a_0} \sin \theta e^{\pm i\phi} )</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>0</td>
<td>( \frac{1}{\sqrt{2\pi}} )</td>
<td>( \frac{\sqrt{10}}{4} (3 \cos^2 \theta - 1) )</td>
<td>( \frac{4}{81\sqrt{30} a_0^{3/2}} \frac{r^2}{a_0^2} e^{-r/3a_0} )</td>
<td>( \frac{1}{81\sqrt{30\pi} a_0^{3/2}} \frac{r^2}{a_0^2} e^{-r/3a_0} (3 \cos^2 \theta - 1) )</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>±1</td>
<td>( \frac{1}{\sqrt{2\pi}} e^{\pm i\phi} )</td>
<td>( \frac{\sqrt{15}}{2} \sin \theta \cos \theta )</td>
<td>( \frac{4}{81\sqrt{30} a_0^{3/2}} \frac{r^2}{a_0^2} e^{-r/3a_0} )</td>
<td>( \frac{1}{81\sqrt{30\pi} a_0^{3/2}} \frac{r^2}{a_0^2} e^{-r/3a_0} \sin \theta \cos \theta e^{\pm i\phi} )</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>±2</td>
<td>( \frac{1}{\sqrt{2\pi}} e^{\pm i\phi} )</td>
<td>( \frac{\sqrt{15}}{4} \sin^2 \theta )</td>
<td>( \frac{4}{81\sqrt{30} a_0^{3/2}} \frac{r^2}{a_0^2} e^{-r/3a_0} )</td>
<td>( \frac{1}{162\sqrt{30\pi} a_0^{3/2}} \frac{r^2}{a_0^2} e^{-r/3a_0} \sin^2 \theta e^{\pm i\phi} )</td>
</tr>
</tbody>
</table>

*The quantity \( a_0 = 4\pi\varepsilon_0\hbar^2/m_e^2 = 5.292 \times 10^{-11} \) cm is equal to the radius of the innermost Bohr orbit.