

4. The electron in the 1s configuration of a hydrogen atom is described by the wave function $\psi_{1s}^{(Z=1)}(r)$, where

$$\langle \psi_{1s}^{(Z=1)} | \psi_{1s}^{(Z=1)} \rangle \equiv \int_0^\infty |\psi_{1s}^{(Z=1)}(r)|^2 4\pi r^2 dr = 1.$$

The nuclear charge is suddenly changed to $Z = 2$ and the stationary states of this one-electron system are $|\psi_{nl}^{(Z=2)}\rangle$. Does the orbital angular momentum change? Give an expression for the probability that the electron's energy does not change, explaining your reasoning.