3. **Tritium Beta Decay**

The tritium nucleus is radioactive and decays to He^3 with the emission of an electron and an antineutrino $(T \rightarrow He^3 + e^- + \bar{\nu})$.

(a) Assuming that the electron in the tritium atom is originally in its ground state, what is the probability of finding the electron in the resulting He^3 ion also in its $1s$ ground state immediately after the decay? You can assume that, as far as the electron is concerned, all that happens is that the nucleus suddenly changes its charge from $+1$ to $+2$. The other newly-produced electron is emitted with such high energy that it effectively leaves the atom immediately.

(b) What are the probabilities of finding the electron in the He^3 ion in each of its three $2p$ excited states immediately after the decay?

(c) What is the expectation value of the energy of the atomic electron immediately after the decay (old wave function, new Hamiltonian)?