2. Tritium (^{3}H, a radioactive isotope of hydrogen) decays to ^{3}He with the emission of an electron (and an antineutrino). Assume that this decay and electron emission is rapid enough so that as far as the other electron is concerned all that happens is that the atom's nucleus instantaneously changes its charge from $+e$ to $+2e$.

a) Write the normalized ground state wave function for the one-electron atom or ion with nuclear charge Ze, neglecting spin and other fine-structure or relativistic effects. You may take it as given that the wave function is of the form $\psi(r, \theta, \phi) = A\, e^{-\kappa r}$ with A and κ dependent on the relevant parameters.

b) Assuming the tritium atom was originally in its ground state, what is the probability of finding, immediately after the decay, the resulting He^+ ion in its ground state?

c) In the event that the resulting He^+ ion is not in its ground state, compute its average excitation energy relative to the ion's ground state.