(1) You know that for a (charged) particle moving in any spherically symmetric potential, the wave function will be proportional to \( Y_{lm}(\theta, \phi) \) where \( l \) and \( m \) are the usual orbital angular momentum quantum numbers. Use the form of the \( Y_{lm} \) to show that electric dipole transitions imply the selection rule \( \Delta m = 0, \pm 1 \).

(2) Using, from the textbook, figures 9-6 and 9-15 (below) estimate the energy required to remove the remaining electron from the ground state of a singly ionized helium atom. Compare this to the exact value, which you already know how to calculate.

(3) The \( 2p \rightarrow 1s \) transition in atomic hydrogen has a lifetime of about \( 10^{-8} \) sec. Use this to estimate the lifetime of the \( K_\alpha \) X-ray transition in lead. Can you find a reference that confirms your answer?