Problem Solving Class: Van Quark tot Biomaterie

Problem Set 5: The hydrogen atom in Quantum Mechanics Hand-in on paper Thursday 25 September (before lecture 9:00 h) Hand-in digitally, email to: <u>m.t.talluri@vu.nl</u>; All documents in a single file [file: YourName-WC-Q5] All answers in English

1) Probability of finding electron: "electron clouds"

Study section 39-3 of the Book

- a) By what factor is it more likely to find the electron in the ground state of hydrogen at the Bohr radius (r_0 or a_0) than at twice the Bohr radius ($2r_0$ or $2a_0$).
- b) What is the probability to find an electron (again in the 1s state) at less than one Bohr radius from the nucleus ? So at $r < r_0$. Hint: you may use some of the integrals in the book in section B-4.
- c) What is the probability of finding an electron (1s) between r_0 and $2r_0$?
- d) What is the probability of finding an 1s electron in hydrogen in the nucleus, if the nucleus is a sphere of size 1.1 fm (fm = 10^{-15} m)? Hint: you may write an approximation for the exponent in Equation (39-7), which makes it easier to calculate.