(7) Find the probability of finding the electron farther away than the Bohr radius for the ground state of the hydrogen atom

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$$R(r) = R_{1s}(r) = 2e^{-r}$$

The ~~required~~ probability ~~is~~ beyond t a.u

$$4\int_t^{\infty} e^{-2r} r^2\, dr$$

$$\int e^{-2r} r^2 dr = e^{-2r}\left(\frac{r^2}{-2} - \frac{2r}{4} + \frac{2}{-8}\right) \qquad \left[\int x^2 e^{ax} dx = e^{ax}\left(\frac{x^2}{a} - \frac{2x}{a^2} + \frac{2}{a^3}\right)\right]$$

$$\therefore 4\int_t^{\infty} e^{-2r} r^2 dr = (2t^2 + 2t + 1)e^{-2t}$$

The required probability is for $t = 1$

$$= 5e^{-2} = 0.68$$

What is the electron density at the nucleus for the ground state?