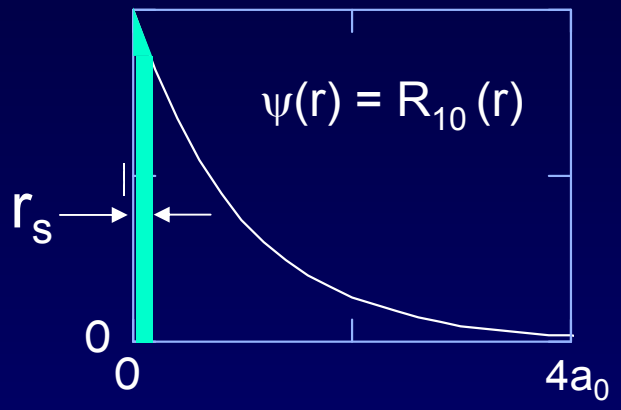
Solution

Estimate the probability of finding the electron within a small sphere of radius $r_s = 0.2\ a_o$ at the origin.



If it says "estimate", don't integrate.

The wave function is nearly constant near r = 0:

$$\psi(0) = \sqrt{\frac{1}{\pi a_o^3}}\ e^{-0/a_o} = \sqrt{\frac{1}{\pi a_o^3}}$$

$$\psi(r) = Ne^{-r/a_o}$$

Simply multiply $|\psi|^2$ by the volume $\Delta V = (4/3)\pi r_s^3$:

$$\text{Probability} = |\psi(0)|^2 \Delta V = \frac{4}{3}\left(\frac{r_s}{a_o}\right)^3 \approx 0.01$$