11.21. Assuming an electron is confined to a 1nm wide region, find the uncertainty in momentum using the Heisenberg Uncertainty principle. You can assume the uncertainty in position Δx as 1nm. Assuming $p = \Delta p$, find the energy of the electron in electron volts.

Answer:

As the electrons rotate in a circular path, $\Delta r = 1 \text{ nm} = 10^{-9} \text{ m}$

$\Delta p = h/\Delta x$

$\Delta p = (331/314) \times 10^{-25}$

$E = 1/2 \, mv^2 = \Delta p^2/2m$

$E = 3.8 \times 10^{-2} \text{ eV}$