Answer on Question #43091-Physics-Atomic Physics

Estimate the orbital velocity in m/s of an electron orbiting the nucleus of a hydrogen atom at a radius of 0.05 nm.

SOLUTION:

The centripetal force which keeps the electron in orbit is provided by the electric force.

$$\frac{mv^2}{r} = \frac{ke^2}{r^2}$$

So,

$$v = \sqrt{\frac{k}{mr}}e = \sqrt{\frac{9 \cdot 10^9 \frac{Nm^2}{C^2}}{9.11 \cdot 10^{-31} kg \cdot 0.05 \cdot 10^{-9}\text{m}}} \cdot 1.6 \cdot 10^{-19} C = 1.4 \cdot 10^6 \frac{m}{s}.$$

Answer: $\mathbf{1.4 \cdot 10^6 \frac{m}{s}}$.