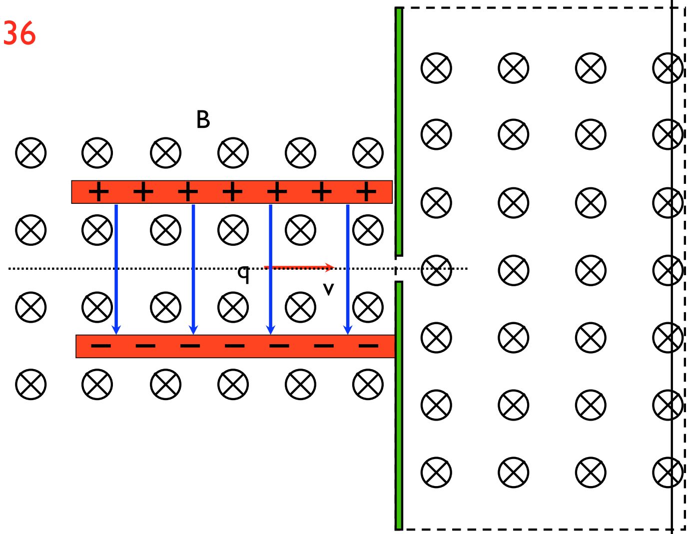
Problem 19.36

If the electric field is 950 V/m and the B-fld is .93 teslas, what will the radius of motion be for a singly ionized (i.e., charge of one *electron*) body of mass 2.18x10^-28 kgs be?

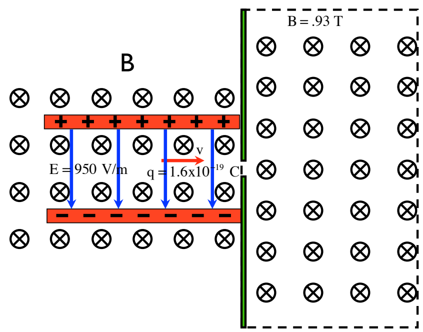


$m = 2.18\text{x}10^{-28}\ \text{kg}$ $E = 950\ \text{V/m}$

$q = 1.6\text{x}10^{-19}\ \text{C}$ $B = .93\ \text{T}$

The radius of the motion when the charge gets into the area where there is only a magnetic field?

Using N.S.L., we can write:



$$\sum F_{centripetal}$$

$$qvB = m\frac{v^2}{R}$$

$$\Rightarrow\ R = m\frac{v}{qB}$$

$$\Rightarrow\ R = \left(2.18\text{x}10^{-28}\ \text{kg}\right)\frac{v}{\left(1.6\text{x}10^{-19}\ \text{C}\right)\left(.93\ \text{T}\right)}$$

$m = 2.18\text{x}10^{-28}\ \text{kg}$

$E = 950\ \text{V/m}$

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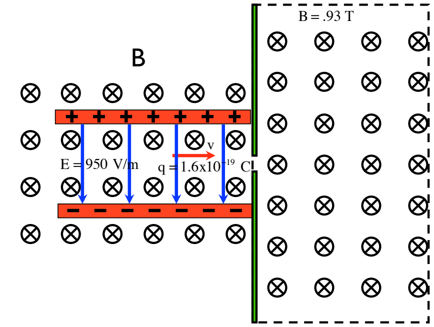


To do this, we need a relationship for "v" knowing the magnitudes of the E-fld and the B-fld. We can get that by noting that for the charge to pass through the left chamber following a straight-line path, the magnetic and electric forces must be balanced. In other words:

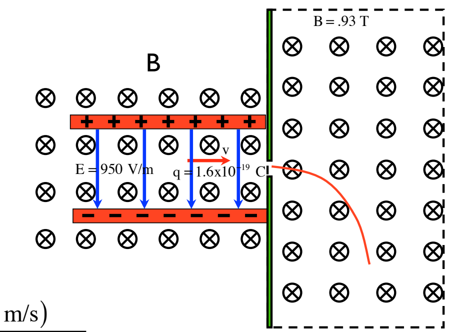
$$qE = qvB$$

$$\Rightarrow\ v = \frac{E}{B}$$

$$\Rightarrow\ v = \frac{(950\ \text{V/m})}{(.93\ \text{T})}$$

$$\Rightarrow\ v = 1021.5\ \text{m/s}$$

With the velocity, we end up with:



$$R = \left(2.18\text{x}10^{-28}\ \text{kg}\right)\frac{(1021.5\ \text{m/s})}{\left(1.6\text{x}10^{-19}\ \text{C}\right)\left(.93\ \text{T}\right)}$$

$$= 1.5\text{x}10^{-6}\ \text{m}$$