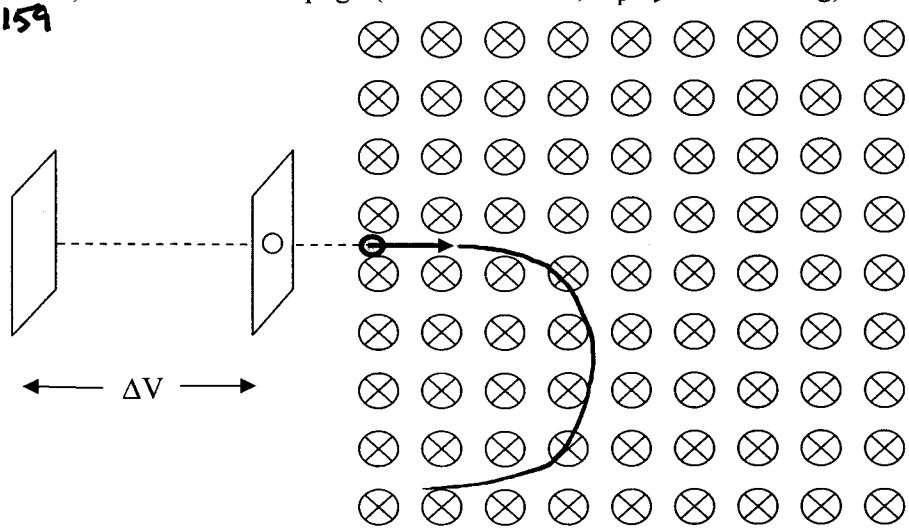
Name_____ SP222 Quiz

9.1×10^{-31}

A beam of electrons are traveling perpendicular to a uniform magnetic field with magnitude 0.00~~500~~ 159 T, directed into the page (e=1.6 x 10^{-19} C, m_p=~~1.67~~ x 10^{-27} kg).



a. Sketch the path of the electron.

b. If the potential difference between plates (ΔV) is 200 V, what is the kinetic energy of electrons in the beam entering the magnetic field?

$$U = q\,\Delta V = (1.6\times10^{-19}\,C)(200\,V)$$
$$= 3.2\times10^{-17}\,J$$

c. What is the speed of the electrons entering the magnetic field?

$$\tfrac{1}{2}mv^2 = 3.2\times10^{-17}\,J$$
$$v = \left[\frac{2(3.2\times10^{-17}\,J)}{9.1\times10^{-31}\,kg}\right]^{1/2} = 8.39\times10^{6}\,m/s$$

d. If the magnetic field has strength of 1.59 x 10^{-3} T, what is the radius of the electron's path?

$$\frac{mv^{\cancel{2}}}{r} = q\cancel{v}B \Rightarrow r = \frac{mv}{qB} = \frac{(9.1\times10^{-31}\,kg)(8.39\times10^{6}\,m/s)}{(1.6\times10^{-19}\,C)(1.59\times10^{-3}\,T)}$$
$$= 3\times10^{-2}\,m$$
$$\approx 3\,cm$$

$qvB = \frac{mv^2}{r}$ $\qquad$ $U = q\Delta V$