A beam of electrons are traveling perpendicular to a uniform magnetic field with magnitude 0.005 T, directed into the page ($e=1.6 \times 10^{-19}$ C, $m_e=9.1 \times 10^{-31}$ kg).

a. Sketch the path of the electron.

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

$$U = q \Delta V = (1.6 \times 10^{-19} \text{C})(200 \text{V})$$

$$= 3.2 \times 10^{-17} \text{J}$$

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

$$\frac{1}{2}mv^2 = 3.2 \times 10^{-17} \text{J}$$

$$v = \sqrt{\frac{2(3.2 \times 10^{-17} \text{J})}{9.1 \times 10^{-31} \text{kg}}} = 8.39 \times 10^6 \text{ m/s}$$

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

$$\frac{mv^2}{r} = qvB \implies r = \frac{mv}{qB} = \frac{(9.1 \times 10^{-31} \text{kg})(8.39 \times 10^6 \text{ m/s})}{(1.6 \times 10^{-19} \text{C})(1.59 \times 10^{-3} \text{T})}$$

$$= 3 \times 10^{-2} \text{ m}$$

$$\approx 3 \text{ cm}$$