An electron is accelerated from rest by a potential difference of 525 volts. The electron is moving horizontally in a vacuum and enters a region where there is a magnetic field of $1.32 \times 10^{-4}$ T at right angles to its velocity. After it travels 12.5 cm (measured along its actual path) in the magnetic field the electron strikes a screen. Calculate the deflection of the electron from the path it would have followed in the absence of the magnetic field.

**STEP 1**

- **AB = Undelected path (without B-field)**
- **AC = Actual path = Arc of a circle**
  
  $AC = 12.5 \text{ cm}$

**STEP 2**

- **$d = OA - y$**
- **$d = R - y$**

**STEP 3**

- **charged particle in uniform B-field experience circular motion**
  
  $\vec{q} \vec{v} \cdot \vec{B} = \frac{m \vec{v}^2}{R}$

  $R = \frac{m \vec{v}}{q B}$

  $\vec{v} = \text{speed of electron in B-field}$

  Now, $T = \frac{1}{2} m \vec{v}^2 = q \vec{v}$

  Here $V = 525 \text{ volt}$

  $\frac{\vec{v}}{q} = \frac{\vec{e} V}{q} = 525 \text{ eV}$

  $\vec{v} = 8.40 \times 10^{-17} \text{ m/s}$

  $R = \frac{mv}{qB} = 9.1 \times 10^{-31} \text{ kg} \times 13.6 \times 10^6 \text{ m/s}$

  $1.6 \times 10^{-19} \text{ e} \times 1.32 \times 10^4 \text{ T} = 0.586 \text{ m}$

**STEP 4**

- $R \theta = 0.125 \text{ m}$

  $\therefore \theta = 0.2133 \text{ rad} = 12.22^\circ = \theta$

  $58.6 \text{ cm} \cdot 12.22^\circ = 57.28 \text{ cm}$

  $(2 \text{ pt)} : d = \text{ deflection} = R - y = (58.6 - 57.28) \text{ cm} = 1.33 \text{ cm}$