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Phys 122-401
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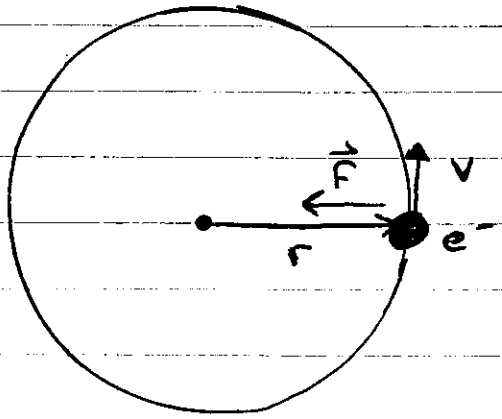
QUIZ 6: Magnetism

An electron ($m_e = 9.11 \times 10^{-31}$ Kg, $q = -1.6 \times 10^{-19}$ C) is subjected to a magnetic field $\vec{B}$ such that it remains in a circular trajectory with radius $r = 100\ \mu m$ and speed $v = 2$ Km/s. Find the magnitude and direction of $\vec{B}$.



(electron's trajectory is confined to plane of page)

- to stay in circular orbit $\vec{F}$ must be inward
- $\vec{F} = q\vec{v} \times \vec{B}$, and $q = -e$

$\Rightarrow$ $\vec{B}$ is out of the page

$\vec{v} \times \vec{B} \rightarrow$ outward

$\Rightarrow \vec{F} \rightarrow$ inward ✓

$$|\vec{F}| = |qvB| = \frac{mv^2}{r}$$

$$evB = \frac{m_e v^2}{r}$$

$$eB = \frac{m_e v}{r}$$

$$B = \frac{m_e v}{er}$$

$$= \frac{(9.11\times10^{-31}\ \text{Kg})(2\times10^{3}\ \text{m/s})}{(1.6\times10^{-19}\text{C})(100\times10^{-6}\ \text{m})}$$

$$\boxed{B = 1.1 \times 10^{-4}\ \text{T}}$$

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