Unit Exam III: Problem #1 (Spring '12)

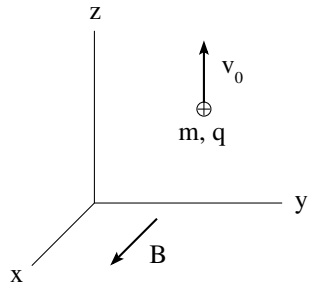
In a region of uniform magnetic field $\mathbf{B} = 5\text{mT}\hat{\mathbf{i}}$, a proton ($m = 1.67 \times 10^{-27}\text{kg}$, $q = 1.60 \times 10^{-19}\text{C}$) is launched with velocity $\mathbf{v}_0 = 4000\text{m/s}\hat{\mathbf{k}}$.

(a) Calculate the magnitude F of the magnetic force that keeps the proton on a circular path.

(b) Calculate the radius r of the circular path.

(c) Calculate the time T it takes the proton to go around that circle once.

(d) Sketch the circular path of the proton in the graph.



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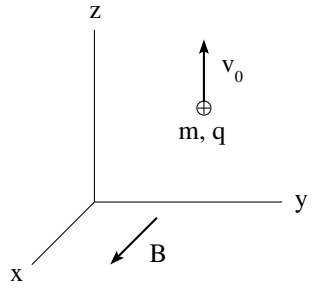

Solution:

(a) $F = qv_0B = 3.2 \times 10^{-18}\text{N}$.

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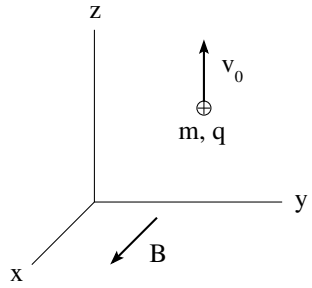

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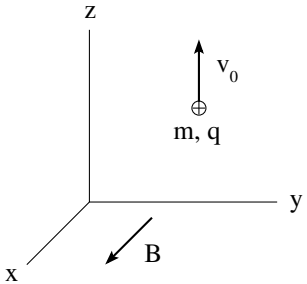

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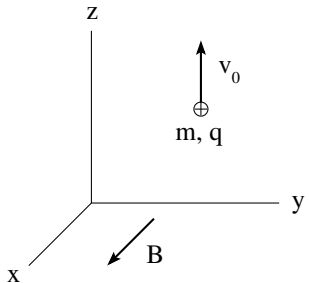

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(d) Center of circle to the right of proton's initial position (cw motion).