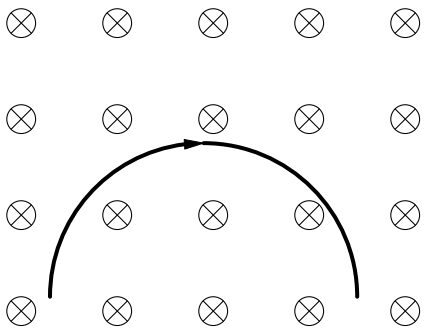
Physics 112-01: General Physics II
Test 2
March 28, 2014

Name: _____

All problems *must* begin with either a fundamental principle or with an equation from the equation sheet. If any question is unclear, please ask immediately. Be sure to show your work **clearly**. Partial credit may be given for work *if* it can be understood.

Problem 1: (20 pts.) A singly-charged ion (a charged particle) with speed $3 \times 10^4\,\mathrm{m/s}$ enters into a region with a uniform magnetic field of $0.5\,\mathrm{T}$ pointing into the page. The particle curves in an clockwise arc of radius $0.0218\,\mathrm{m}$.

a. (5 pts.) What is the sign of the charge on the particle: (+ or −)? Explain your reasoning *briefly.*



b. (15 pts.) What is the mass of the ion?

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Name: SOLUTIONS

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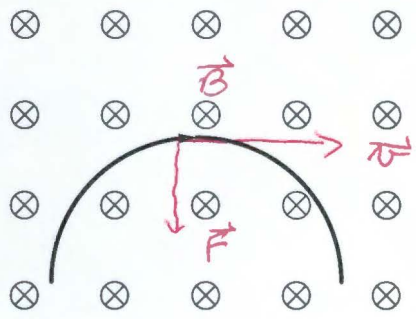
Problem 1: (20 pts.) A singly-charged ion (a charged particle) with speed 3×10^4 m/s enters into a region with a uniform magnetic field of 0.5 T pointing into the page. The particle curves in an clockwise arc of radius 0.0218 m.

a. (5 pts.) What is the sign of the charge on the particle: (+ or −)? Explain your reasoning *briefly*.

⊖ charge. $\vec{F}$ points towards the center of the circle, but $\vec{v} \times \vec{B}$ points outwards ∴ $\vec{F} = q\vec{v} \times \vec{B}$ must have a $-q$.



b. (15 pts.) What is the mass of the ion?

$$F = ma$$
$$qvB = mv^2/r$$
$$qB = mv/r$$
$$m = \frac{qBr}{v} = \frac{(1.602 \times 10^{-19}\,C)(0.5\,T)(0.0218\,m)}{3 \times 10^4\,m/s}$$

$$\boxed{m = 5.82 \times 10^{-26}\,kg}$$

(recall 1u = atomic mass unit = 1.66×10^{-27} kg, so this is ≈ 35u; a Cl ion.)