

Physics 380-001

Short Exam B

Practice

Your name: _____

Do not turn the page until you are told to begin. You will be given 55+ minutes to complete this exam. Show all your work on the exam itself; no credit will be given for anything written on other paper.

You may not use a calculator. You may speak with your peers but may not examine their work.

Do not write in the following table; it will be used for grading.

Problem 1	___ / 10
Problem 2	___ / 30
Problem 3	___ / 30
Total	___ / 70

Problem 1: Fundamental Concept [10 pts] You can only use Ampere's law in a number of situations. Please list those. Discuss what is similar in all of those solutions.

Problem 2: Biot-Savart Law [30 pts] Use the Biot-Savart law to find the magnetic field off axis of a current loop.

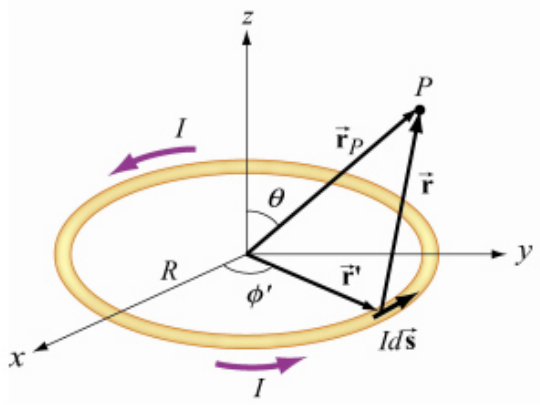


Figure 1 - Image taken from MIT

Hint: For simplicity, assume that Point P is at $(0, y, z)$. It is enough to show that if $\vec{B} = B_x \hat{i} + B_y \hat{j} + B_z \hat{k}$

$$B_x = 0$$

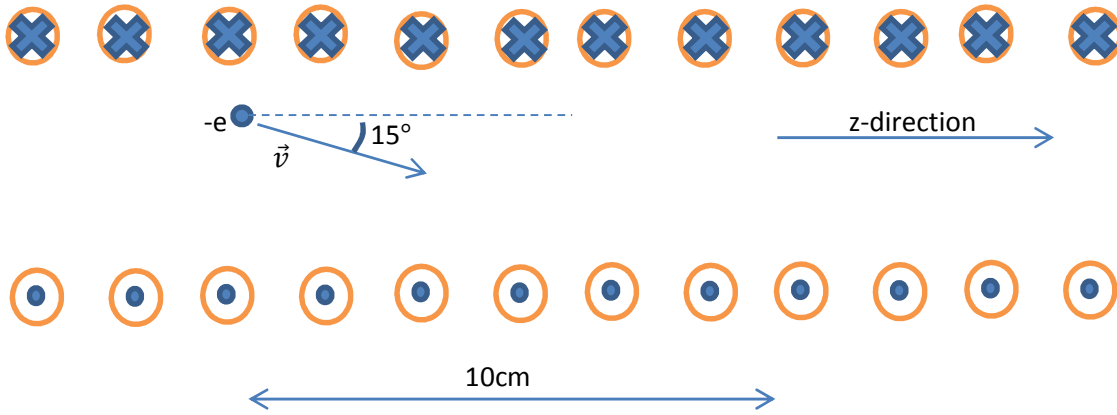
$$B_y = \frac{\mu_0 I R z}{4\pi} \int_0^{2\pi} \frac{\sin \varphi}{(R^2 + y^2 + z^2 - 2yR \sin \varphi)^{3/2}} d\varphi$$

$$B_z = \frac{\mu_0 I R}{4\pi} \int_0^{2\pi} \frac{R - y \sin \varphi}{(R^2 + y^2 + z^2 - 2yR \sin \varphi)^{3/2}} d\varphi$$

Problem 2: Con't

Problem 2: Con't

Problem 3: e - Motional day [30 pts]: An electron is dropped into the middle of the solenoid that is 1 m long and has a diameter of 50cm with a velocity as shown in the figure below. The solenoid has 300 turns. The current in the wire is 10 A. If the electron has a velocity of $3.0 \times 10^7 \text{ m/s}$ in the direction shown below, how long does it take for the electron to travel 10 cm in the z-direction?



Problem 3: Con't

Problem 3: Con't

Problem 3: Con't