Name:_____

Student ID #:_____

Signature:_____

April 9, 2021

Physics 1C Midterm #1

- **Do not open this exam until instructed to begin.** You have 60 minutes to complete this exam, and it is recommended to finish your work in 50 minutes so that you have 10 minutes to upload it to GradeScope. NO LATE EXAMS WILL BE ACCEPTED.

- You MUST sign and date the 2nd page entitled "Academic Integrity – A Bruin's Code of Conduct" in order to receive credit for your work.

- The exam is open notes, open book, but you must not communicate with classmates or other people during the exam.

- Remember to write down each step of your calculation, and explain your answers fully.

Score :

I. _____/10 points

II. _____/10 points

III. _____/10 points

Total _____/30 points

Academic Integrity - A Bruin's Code of Conduct:

UCLA is a community of scholars committed to the values of integrity. In this community, all members including faculty, staff, and students alike are responsible for maintaining the highest standards of academic honesty and quality of academic work. As a student and member of the UCLA community, you are expected to demonstrate integrity in all of your academic endeavors. When accusations of academic dishonesty occur, the Office of the Dean of Students investigates and adjudicates suspected violations of this student code. Unacceptable behavior include cheating, fabrication or falsification, plagiarism, multiple submissions without instructor permission, using unauthorized study aids, facilitating academic misconduct, coercion regarding grading or evaluation of coursework, or collaboration not authorized by the instructor. Please review our campus' policy on academic integrity in the UCLA Student Conduct Code: https://deanofstudents.ucla.edu/individual-student-code

If you engage in these types of unacceptable behaviors in our course, then you will receive a zero as your score for that assignment. If you are caught cheating on an exam, then you will receive a score of zero for the entire exam. These allegations will be referred to the Office of the Dean of Students and can lead to formal disciplinary proceedings. Being found responsible for violations of academic integrity can result in disciplinary actions such as the loss of course credit for an entire term, suspension for several terms, or dismissal from the University. Such negative marks on your academic record may become a major obstacle to admission to graduate, medical, or professional school.

We cannot make exceptions to our campus' policy on academic integrity, and as we hopefully have communicated effectively here, penalties for violations of this policy are harsh. Please do not believe it if you hear that "everyone does it". The truth is, you usually don't hear about imposed disciplinary actions because they are kept confidential. So our advice, just don't do it! Let's embrace what it means to be a true Bruin and together be committed to the values of integrity.

By submitting my assignments and exams for grading in this course, I acknowledge the above-mentioned terms of the UCLA Student Code of Conduct, declare that my work will be solely my own, and that I will not communicate with anyone other than the instructor and proctors in any way during the exams.

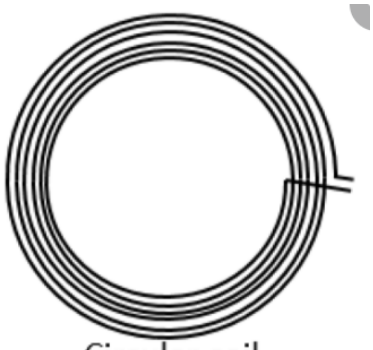
_____ _____

Signature Date

_____ _____

Print Name UID

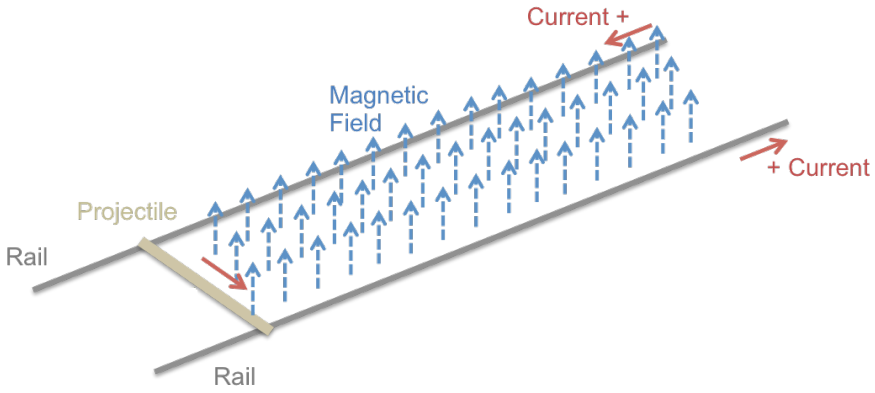
I (10 points) If you are asked to make a flat circular coil having large magnetic moment, and are given a certain length L of wire and a power supply having a certain maximum current output I_0, do you get a coil with larger magnetic moment using a single loop of wire, or using multiple loops? If multiple loops is better, is there a number of loops N that is optimal? Explain your reasoning.



Circular coil

II (10 points): Electromagnetic rail guns use Lorentz force to launch high velocity projectiles.

Model such a device by assuming that a metal wire slides without friction on two rails spaced by 0.15 m apart, as in the figure below. The wire carries a projectile, and the combined mass of wire plus projectile is 0.5 kg. Assume a constant current of 4×10^4 amps flows from the generator G along one rail, across the wire, and back down the other rail.



a) (1 pts) Indicate the direction of force $\vec{F}$ on the sliding wire on the diagram.

b) (1 pts) Determine your individual seed value C for subsequent problems in the following way: the first digit is 1, and add 0.1*the first non-zero digit of your student ID number. [For example, if your student ID is 00376031, your seed value will be C =1.3]

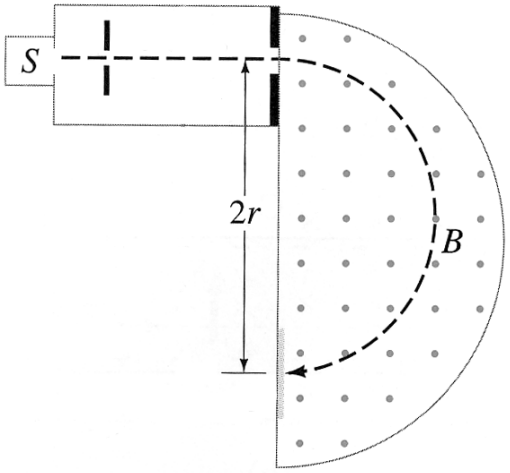
$C =$ _____ for me

c) (4 pts) Assume there is a constant magnetic field of C Tesla everywhere between the rails, find the magnitude of the force on the wire.

d) (4 pts) Find the speed of the wire v after 0.250 sec, assuming it was at rest at $t = 0$.

Additional paper for answer to problem II

III (10 points): See the diagram below: a particle of unknown mass m and charge q that is at rest at the source S is accelerated in a straight line from rest by an electrical potential difference V. The particle then enters a region of space containing a uniform magnetic field B that is perpendicular to the plane of the particle's motion as shown below. As a result of the magnetic field, the particle is observed to bend in a semi-circular path of radius r.



In terms of only these variables:

a) (2 points) What is the kinetic energy K of the particle as it enters the region of magnetic field?
b) (2 points) What is the speed v of the particle as it enters the region of magnetic field?
c) (4 points) What is the particle's charge-to-mass ratio q/m?
d) (2 points) Find the mass m of the particle, if $q = e = 1.60 \times 10^{-19}$ Coulombs (the fundamental unit of charge), $B = 1.1$ Tesla, $V = 5000 \times C$ volts, and $r = 10$ cm. [My value of C=_____ as calculated in problem II part b)]

Additional paper for answer to problem III