St John Baptist De La Salle Catholic School, Addis Ababa Grade 10 Physics Second Take-Home Examination

3rd Quarter

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Notes, and use of other aids is allowed. Read all directions carefully and write your answers in the space provided. To receive full credit, you must show all of your work. Cheating or indications of cheating and similar answers will be punished accordingly.

Information

- The Take-Home Exam is due on Wednesday, April 27.
- You should Work on it **individually** and consult me if you have any questions. As I have reiterated multiple times, cheating will have a serious consequence.
- For purposes of neatness and simplicity of grading, you should do the assignment on an **A-4 paper**.

Name:_____

Roll Number: Section:

- 1. (2 points) A physicist performing a sensitive measurement wants to limit the magnetic force on a moving charge in her equipment to less than 4.00×10^{-12} N.
 - (i) What is the greatest the charge can be if it moves at a maximum speed of 120.0 m/s in the Earth's field?
 - (ii) Discuss whether it would be difficult to limit the charge to less than the value found in (ii) by comparing it with typical static electricity and noting that static is often absent.

Earth's magnetic field ranges from 25 to 65 μ T at its surface.

2. (1 point) A cosmic ray electron moves at $7.50 \times 10^6 \text{ m/s}$ perpendicular to the Earth's magnetic field at an altitude where field strength is $1.00 \times 10^{-5} \text{ T}$. What is the radius of the circular path the electron follows?

- 3. (2 points) Find the magnetic force(both the magnitude and direction) acting on a proton if its velocity is V=3.6 × 10⁶ \hat{j} m/s and it is in a magnetic field of B=2 \hat{i} + 2 \hat{j} + 7 \hat{k} T
- 4. (1 point) When a loop of wire is placed into a magnetic field, a voltage is generated. This voltage is called the Hall voltage, the idea is that the voltage is a result of an equilibrium between the electric force and magnetic force. Give an expression of the Hall voltage in terms of current, magnetic field, electron density, charge and area of the conductor.
- 5. (2 points) What is the force and torque on a square-shaped 6A current carrying loop of conducting wire that has an area of $0.0025m^2$ and surrounded by a permanent magnet with a field strength of $B = 2 \times 10^{-2}T$ that is tilted at 37^0 to the loop?
- 6. (2 points) Find the charge to mass ratio of a charge moving if it is moving at a speed of $V = 2.0 \times 10^3$ m/s in a magnetic field of 0.08G and it has the same trajectory as an electron in the same magnetic field.
 - (i) Does the sign of the charge affect its trajectory?