PHYS 2326 - Dr. Honan - Test 3 - B   Name _____

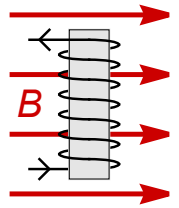**Possibly Useful Information:** $\mu_0 = 4\pi \times 10^{-7} N/A^2$, $\varepsilon_0 = 8.85 \times 10^{-12} C^2/(N \cdot m^2)$, $e = 1.60 \times 10^{-19} C$, $c = 3.00 \times 10^8 m/s$

Problem 1 Multiple Choice   (3 points each)

_____ [i] How will the coil move due to the magnetic field directed toward the right on the page?. (a) to left (b) to right (c) to top of page (d) to bottom of page (e) rotate clockwise (f) rotate counterclockwise (g) cannot be determined

_____ [ii] What is the direction of the force on an electron moving to the north toward a vertical wire with a downward current? (a) north (b) south (c) east (d) west (e) up (f) down (g) cannot be determined

_____ [iii] What is the direction of the magnetic field due north of a vertical wire with an upward current? (a) north (b) south (c) east (d) west (e) up (f) down (g) cannot be determined

_____ [iv] A car drives to the east in the earth's magnetic field, which points to the north. Where on the car is the electric potential the highest? (a) top   (b) bottom   (c) front   (d) back   (e) left (g) right

_____ [v] What is the direction of the current through the resistor when the switch is closed and then opened? (a) left then left (b) left then right (c) right then left (d) right then right (e) cannot be determined
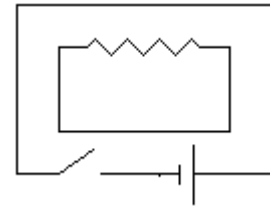
_____ [vi] Suppose an isolated magnetic north pole is discovered and then dropped through a horizontal conducting loop. What is the direction of the induced current in the current in the loop as the pole enters and then exits the loop? (a) clockwise then counterclockwise (b) clockwise then clockwise (c) counterclockwise then counterclockwise (d) counterclockwise then clockwise (e) cannot be determined

Problem 2 A long hollow wire has an inside radius a, outside radius b and carries a uniform current I. What is the magnetic field a distance r from the center? (Include $r<a$, $a<r<b$ and $r>b$.) (8 points)

Problem 3 A solenoid has a 3cm radius, a length of 80cm, 500 turns and carries a 4A current. (5 points each)
(a) What is the magnetic field inside the solenoid?

(b) What is the magnitude of the maximum torque on this solenoid if it is sitting in a 5mT magnetic field?

Problem 4 A solenoid has a radius of 2cm, 300 turns and a length of a 90cm . If this solenoid sits with its central axis aligned vertically in an upward magnetic field that *decreases* at a rate of 7T/s, then what is the induced emf in the solenoid? Also give the direction of the induced EMF as clockwise or counterclockwise as viewed from above.

Problem 5 Consider the arrangement shown to the right with a long wire with a current I_2 and a rectangular loop with a current I_1. (7 points each)
(a) What is the magnitude and direction of the magnetic field at the center of the loop, at (0,0)?
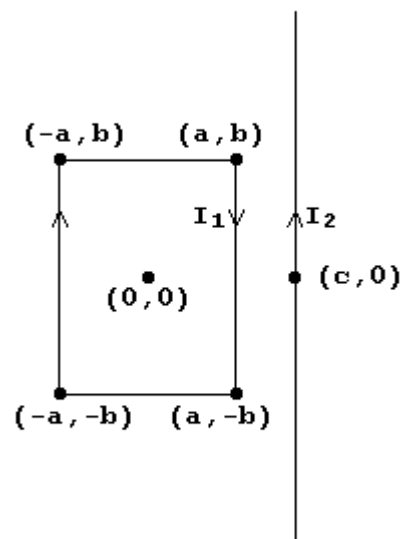
(b) What is the magnitude and direction of the magnetic force on the loop due to the long wire?