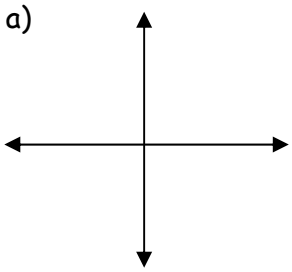
Physics 104 Exam 2 Name_____

1. An electron moves with a velocity of 7.0×10^6 m/s due west in a uniform magnetic field of magnitude 4.0 T at an angle of 30° East of North. At the same point an electric field of magnitude 9.0×10^6 N/C points due South.

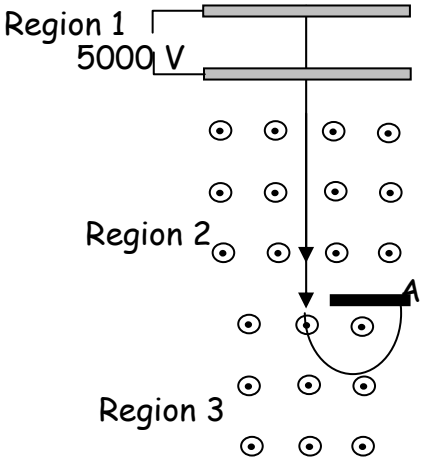
a. Draw the velocity **and** magnetic field vectors on a coordinate system so that they lie in the plane of the page. A set of axes is provided for you below.
b. Find the magnitude of the magnetic force on the electron.
c. Find the direction of the magnetic force on the electron.
d. Find the magnitude of the electric force on the electron.
e. Find the direction of the electric force on the electron.
f. Sketch the direction of the electric field **and** the electric force on the axes provided below. Be sure to include labels

a)



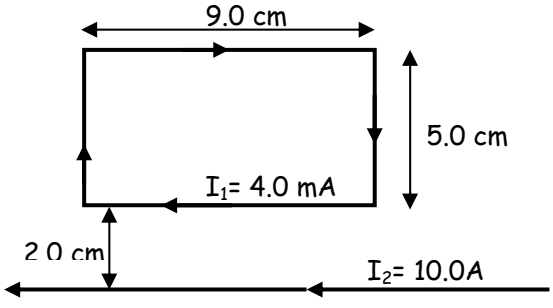
2. You captured a space Alien, named Zork. To determine what sort of fluid is inside him, you put a sample of the fluid through a mass spectrometer as seen below where the ions are moving downwards and the magnetic field is 3.0 T pointing out of the page. You discover that the ions reaching the detector at point A have a mass of 5.0×10^{-25} kg and are singly ionized (charge |e|).

a) Are the ions positive or negative?
b) What is the velocity of these ions as they leave 5000 V accelerating voltage due to the parallel plates in region 1?
c) Indicate the magnitude and direction of the Electric Field in region 2 that allows the region to act as a velocity selector for the velocity you determined in part (b).
d) What is the radius of the circular path in region 3.
e) Sketch a path an ion would take in the velocity selector of region 2 if it were moving too slow. (label it)

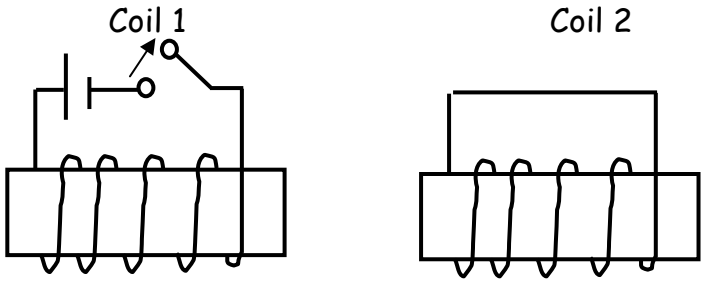


3. A rectangular loop of wire (wire 1) carrying a current $I_1 = 4.0$ mA in the clockwise direction is next to a very long wire (wire 2) carrying a current $I_2 = 10.0$ A to the left.

a) Find the magnitude **and** direction of the magnetic field due to wire 2 at a distance 2.0 cm above the wire.
b) Find the magnitude **and** direction of the magnetic field due to wire 2 at a distance 7.0 cm above the wire.
c) Indicate the direction of the magnetic force on each of the four sides of the rectangle due to the long wire's magnetic field? Sketch them on the diagram below.
d) Calculate the NET magnetic force on the rectangular loop due to the long wire's magnetic field.



4. Below are two coils. Coil 1 is on the left and Coil 2 is on the right. At the moment the switch is opened on Coil 1
   a. Sketch an arrow representing the flow of current in Coil 1
   b. Indicate the direction of the magnetic field in Coil 1 that occurs when the switched is opened by drawing an arrow AND indicating the pole on each side of the coil.
   c. Indicate the direction of the induced magnetic field in Coil 2 that occurs when the switched is opened in coil 1 by drawing an arrow AND indicating the pole on each side of the coil.
   d. Sketch an arrow indicate the direction of the current in Coil 2.



5. Below a long current carrying wire with a current of 5.0A is 8.0cm from a square conducting loop that is 0.40 cm on each side. The current travels to the left in the long wire.

a) Sketch vectors representing the direction of the magnetic field due to the long wire. Clearly lable them B_L. Find the magnitude of B_L
b) Find the magnetic flux in the loop.
c) If the current in the long wire is decreasing, what is the direction of the magnetic field induced in the loop? Clearly indicate the direction in the sketch below and lable it B_I.
d) Is the induced current in the loop clockwise or counterclockwise?
e) If the current in the long wire changes direction in 0.20s, find the average EMF in the loop.
f) Will the loop experience a force due to the long wire? If so, in what direction?