Physics 4B

PLC Activity #10: Magnetic Fields

To get credit for this activity, you must show your answers to a PLC tutor and have them initial the sign-out sheet ***before 4:00 pm on Wednesday.***

Show all of your work for each question.

Part 1: Magnetic Field Physlets

Go to **Chapter 27: Magnetic Fields and Forces**. Do the following Physlet Physics exercises and answer the questions listed.

1) Physlet Problem 27.8

The animation shows a particle passing through a mass spectrometer (position is given in meters and time is given in seconds). There is a constant magnetic field throughout the region directed into the screen. There is a constant electric field in the first region only.

a) Is the particle charged? How do you know? If it is charged, does it have a positive or negative charge? *Justify your answer.*

b) If the electric field produced by the charged plates in the first region is 80 N/C, what is the value of the magnetic field in that region?

c) What is the charge to mass ratio (q/m) of the particle?

2) Physlet Problem 27.6

An electron is shot through four regions of constant magnetic field (position is given in centimeters and time is given in seconds).

a) In which direction is the magnetic field in each region?

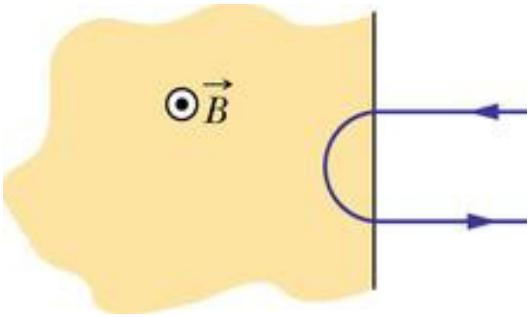
b) Rank the magnitude of the magnetic fields of the four regions, from smallest to greatest.

c) How would the path change if we inverted the direction of the magnetic field in every region? Draw the new path of the electron.

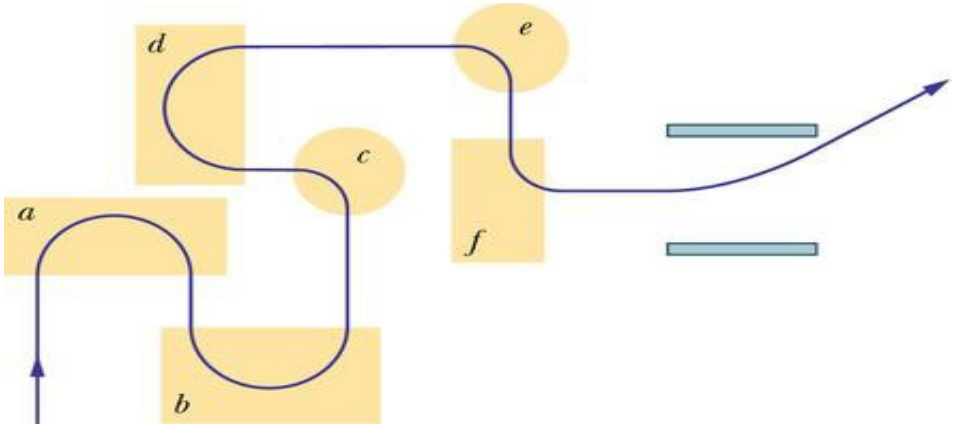
d) If you wanted to ensure that the particle did not enter Region II, would you increase or decrease the speed of the electron entering Region I? Give a mathematical proof of your answer.

Part 2: Conceptual Questions

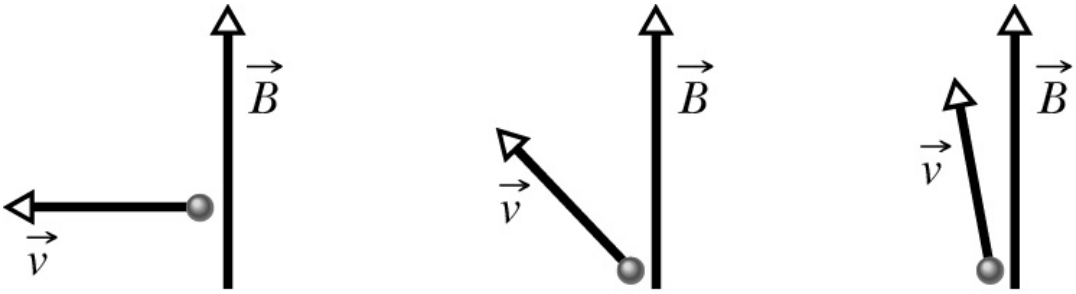
3) In the figure below, a charged particle enters a uniform magnetic field with speed v_0, moves through a half-circle in time T_0, and then leaves the field. (a) Is the charge positive or negative? (b) Is the final speed of the particle greater than, less than, or equal to v_0? (c) If the initial speed had been $0.5v_0$, would the time spent in field have been greater than, less than, or equal to T_0? (d) Would the path have been a half-circle, more than a half-circle, or less than a half-circle?



4) The figure shows the path of a particle through six regions of uniform magnetic field, where the path is either a half-circle or a quarter-circle. Upon leaving the last region, the particle travels between two charged, parallel plates and is deflected toward the plate of higher potential. What are the directions of the magnetic fields in the six regions?



5) The figure below gives snapshots for three situations in which a positively charged particle passes through a uniform magnetic field $\vec{B}$. The velocities $\vec{v}$ of the particles have the same magnitude but different directions (as indicated in the figure). Rank the situations according to (a) the period, (b) the frequency, and (c) the pitch of the particle's motion, greatest first.



(1) (2) (3)