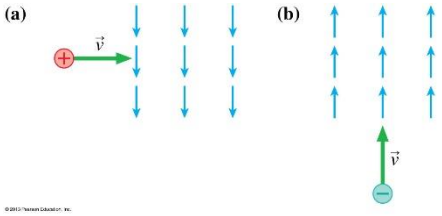
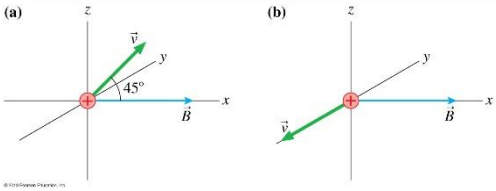
Name: _____ **Per.** _____

Magnetism: Worksheet 3

It doesn't matter how beautiful your theory is, it doesn't matter how smart you are. If it doesn't agree with experiment, it's wrong. — Richard P. Feynman

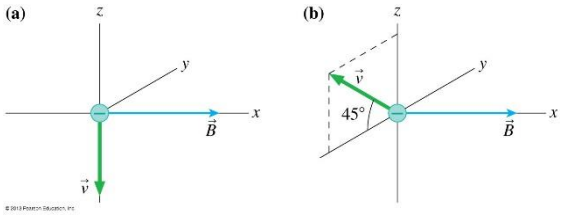
1. What are the initial directions of deflection for the charged particles entering the magnetic fields shown in the figure





2. A proton moves in the magnetic field $\vec{B}$ = 0.50$\hat{\imath}$ T with a speed of 1.0 X 10^7 m/s in the directions shown in the figure. For each, what is the magnitude and direction of the magnetic force $\vec{F}$ on the proton?

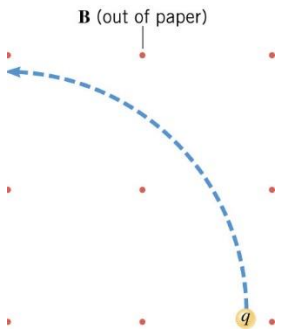
3. An electron moves in the magnetic field $\vec{B}$ = 0.50$\hat{\imath}$ T with a speed of 1.0 X 10^7 m/s in the directions shown in the figure. For each, what is the magnitude and direction of the magnetic force $\vec{F}$ on the electron?



4. An electron is moving through a magnetic field whose magnitude is 8.70 x 10^{-4} T. The electron experiences only a magnetic force and has an acceleration of magnitude 3.50 x 10^{14} m/s^2. At a certain instant, it has a speed of 6.80 x 10^6 m/s. Determine the angle θ (less than 90°) between the electron's velocity and the magnetic field.

5. An electron moves at a speed of 6.0 x 10^6 m/s perpendicular to a constant magnetic field into the page. The path is a circle of radius 1.3 x 10^{-3} m. (a) Draw a sketch showing the magnetic field and the electron's path. (b) What is the magnitude of the field? (c) Find the magnitude of the electron's acceleration.

6. A charged particle enters a uniform magnetic field and follows the circular path shown in the drawing. (a) Is the particle positively or negatively charged? Why? (b) The particle's speed is 140 m/s, the magnitude of the magnetic field is 0.48 T, and the radius of the path is 960 m. Determine the mass of the particle, given that its charge has a magnitude of 8.2×10^{-4} C.



7. The solar wind is a thin, hot gas given off by the sun. Charged particles in this gas enter the magnetic field of the earth and can experience a magnetic force. Suppose a charged particle traveling with a speed of 9.0×10^{6} m/s encounters the earth's magnetic field at an altitude where the field has a magnitude of 1.2×10^{-7} T. Assuming that the particle's velocity is perpendicular to the magnetic field, find the radius of the circular path on which the particle would move if it were (a) an electron and (b) a proton.

8. A beam of protons moves in a circle of radius 0.25 m. The protons move perpendicular to a 0.30-T magnetic field. (a) What is the speed of each proton? (b) Determine the magnitude of the centripetal force that acts on each proton.

9. A 45-m length of wire is stretched horizontally between two vertical posts. The wire carries a current of 75 A and experiences a magnetic force of 0.15 N. Find the magnitude of the earth's magnetic field at the location of the wire, assuming the field makes an angle of 60.0° with respect to the wire.

10. An electric power line carries a current of 1400 A in a location where the earth's magnetic field is 5.0×10^{-5} T. The line makes an angle of 75° with respect to the field. Determine the magnitude of the magnetic force on a 120-m length of line.