

Interactive Problem Set 21, SP212 Spring 2013

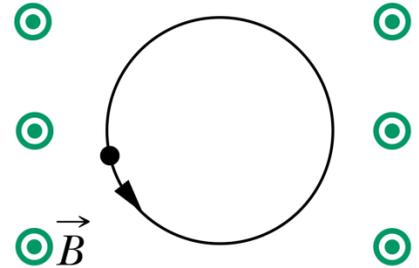
Topic: The Magnetic Field

1. An electron has velocity $\vec{v} = 2.00 \times 10^6 \frac{m}{s} \hat{i} + 3.00 \times 10^6 \frac{m}{s} \hat{j}$ moves through the uniform magnetic field $\vec{B} = 0.030 \text{ T } \hat{i} - .15 \text{ T } \hat{j}$.
 - a. Find the force on the electron due to the magnetic field.
 - b. Repeat your calculation for a proton having the same velocity.

2. An electric field of 1.50 kV/m and a perpendicular magnetic field of 0.400 T act on a moving electron to produce no net force. What is the electron's speed?

3. A circulating Charge Particle

- a. In the figure, a particle moves along a circle in a region of uniform magnetic field of magnitude $B = 4.00 \text{ mT}$. The particle is either a proton or an electron (you must decide which). It experiences a magnetic force of magnitude $3.20 \times 10^{-15} \text{ N}$. What are
 - (i) the particle's speed,
 - (ii) the radius of the circle, and
 - (iii) the period of the motion?



- b. An electron of kinetic energy 1.20 keV circles in a plane perpendicular to a uniform magnetic field. The orbit radius is 25.0 cm. Find
 - (i) the electron's speed,
 - (ii) the magnetic field magnitude,
 - (iii) the circling frequency, and
 - (iv) the period of the motion.