Magnetic Fields Worksheet

1. An electron moving along the positive *x*-axis perpendicular to a magnetic field experiences a magnetic deflection in the negative *y*-direction. What is the direction of the magnetic field over this region? [Negative *z*-direction]
2. A proton moves with a speed of 8.0 x 106 m/s along the *x*-axis. It enters a region where there is a field of magnitude 2.5 T directed along the *y*-axis. Calculate the magnetic force and acceleration of the proton. [3.2 x 10-12 N in the positive *z* direction (use RHR); 1.9 x 1015 m/s2]
3. An alpha particle (which is the nucleus of a helium atom) is moving northward with a velocity of 3.8 x 105 m/s in a region where the magnetic field is 1.9 T and points horizontally to the east. What are the magnitude and direction of the magnetic force on this alpha particle? [2.3 x 10-13 N into the page]
4. A proton moving with a speed of 4.0 x 106 m/s through a magnetic field of 1.7 T experience a magnetic force of magnitude 8.2 x 10-13 N. What is the angle between the proton’s velocity and the field? [48.8° or 131°]
5. A proton is moving in a circular orbit of radius 0.14 m in a uniform magnetic field of magnitude 0.35 T directed perpendicular to the velocity of the proton. Find the orbital speed of the proton. [4.7 x 106 m/s].
6. If the proton in question 2 were replaced with an electron moving at the same orbital velocity, what is the radius of the electron’s circular orbit? [7.6 x 10-5 m]
7. A wire carries a steady current of 2.4 A. A straight section of the wire, with a length of 0.75 m along the *x*-axis, lies within a uniform magnetic field B = 1.6 T along the *z*-axis. If the real current flows in the positive *x*-direction, what is the magnetic force on the wire? [2.88 N in the *y*-direction]
8. In an experiment designed to measure the strength of a uniform magnetic field produced by a set of coils, the electrons are accelerated from rest through a potential difference of 350 V, and the beam associated with the electrons is measured to have a radius of 7.5 cm. Assuming the magnetic field is perpendicular to the beam, what is the magnitude of the magnetic beam? [8.4 x 10-4 T]
9. Calculate the maximum kinetic energy of electrons in a cyclotron of radius 5.0 m in a magnetic field of 0.35 T. [4.3 x 10-8 J]
10. A singly charged negative ion has a mass of 3.2 x 10-26 kg. After being accelerated through a potential difference of 833 V, the ion enters a magnetic field of 0.92 T along a direction perpendicular to the direction of the field. Calculate the radius of the path of the ion in the field. [1.98 cm]

Textbook:

P.396 2-6

P.402 1 (do for negative charge)

P.402 2-6

P.405 1-4

P.407 1-6

P.419 1-4

P.428 Review (do a couple)