Homework: Ch. 22

1. For the bar magnet below, draw the magnetic field lines.

2. An electron moves in the negative *x* direction, through a magnetic field oriented in the positive *x* direction. What is the direction of the magnetic force on the electron?

3. A proton is placed in a uniform magnetic field **B** = 1.20 mT with an initial velocity of 3.20×10^7 m/s at an angle of 30.0° relative to the background magnetic field.
    a. What is the force on the charge due to the field?
    b. What is the acceleration produced by this force on the proton?

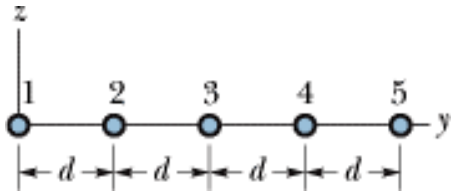
4. An electric field of 1.50 kV/m and a perpendicular magnetic field of 0.400 T act on a moving electron to produce no net force. What is the electron's speed?

5. What uniform magnetic field, applied perpendicular to a beam of electrons moving at 1.30×10^6 m/s, is required to make the electrons travel in a circular arc of radius 0.350 m?

6. A wire 1.80 m long carries a current of 13.0 A and makes an angle of 35.0° with a uniform magnetic field of magnitude B = 1.50 T. Calculate the magnetic force on the wire.

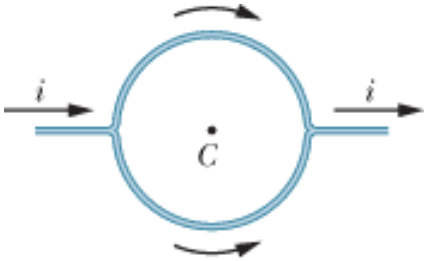
7. A 5.00 cm wide toroid, with an inner radius of 15.0 cm, has 500 turns and carries a current of 0.800 A. What is the magnetic field inside the toroid at (a) the inner radius and (b) the outer radius?

8. In the figure below, five long parallel wires in an *xy* plane are separated by distance d = 8.00 cm, have lengths of 10.0 m, and carry identical currents of 3.00 A out of the page. Each wire experiences a magnetic force due to the other wires. What is the magnitude of the net magnetic force on wire 1?



9. A long solenoid has 100 turns/cm and carries current i. An electron moves within the solenoid in a circle of radius 2.30 cm perpendicular to the solenoid axis. The speed of the electron is 0.0460c (c = speed of light). Find the current i in the solenoid.

10. A straight conductor carrying current i = 5.0 A splits into identical semicircular arcs as shown in the figure on the right. What is the magnetic field at the center C of the resulting circular loop?



11. A student makes a short electromagnet by winding 300 turns of wire around a wooden cylinder of diameter d = 5.0 cm. The coil is connected to a battery producing a current of 4.0 A in the wire. What is the magnitude of the magnetic dipole moment of this device?

12. A wire of length 25.0 cm carrying a current of 4.51 mA is to be formed into a circular loop and placed in a uniform magnetic field **B** of magnitude 5.71 mT. If the torque on the coil from the field is maximized,
    a. What is the angle between **B** and the coil's magnetic dipole moment?
    b. What is the magnitude of that maximum torque?