44. A singly charged positive ion that has a mass of 6.68×10^{-27} kg moves clockwise with a speed of 1.00×10^4 m/s. The positively charged ion moves in a circular path that has a radius of 3.00 cm. Find the direction and strength of the uniform magnetic field through which the charge is moving. (Hint: The magnetic force exerted on the positive ion is the centripetal force, and the speed given for the positive ion is its tangential speed.)

45. What speed would a proton need to achieve in order to circle Earth 1000.0 km above the magnetic equator? Assume that Earth's magnetic field is everywhere perpendicular to the path of the proton and that Earth's magnetic field has an intensity of 4.00×10^{-8} T. (Hint: The magnetic force exerted on the proton is equal to the centripetal force, and the speed needed by the proton is its tangential speed. Remember that the radius of the circular orbit should also include the radius of Earth. Ignore relativistic effects.)

46. Calculate the force on an electron in each of the following situations:

a. moving at 2.0 percent the speed of light and perpendicular to a 3.0 T magnetic field

b. 3.0×10^{-6} m from a proton

c. in Earth's gravitational field at the surface of Earth

Use the following: $q_e = -1.6 \times 10^{-19}$ C; $m_e = 9.1 \times 10^{-31}$ kg; $q_p = 1.6 \times 10^{-19}$ C; $c = 3.0 \times 10^8$ m/s; $k_C = 9.0 \times 10^9$ N•m^2/C^2

Graphing Calculator Practice

Solenoids

A solenoid consists of a long, helically wound coil of insulated wire. When it carries a current, a solenoid acts as a magnet. The magnetic field strength (B) increases linearly with the current (I) and with the number of coils per unit length. Because there is a direct relation between B and I, the following equation applies to any solenoid:

$$B = aI + b$$

In this equation, the parameters a and b are different for different solenoids. The a and b parameters can be determined if the magnetic field strength of the solenoid is known at two different currents.

Once you determine a and b, you can predict the magnetic field strength of a solenoid for various currents.

The graphing calculator program that accompanies this activity uses this procedure. You will be given the magnetic field and current data for various solenoids. You will then use this information and the program to predict the magnetic field strength of each solenoid.

Visit go.hrw.com and type in the keyword **HF6MAGX** to find this graphing calculator activity. Refer to **Appendix B** for instructions on downloading the program for this activity.