Additional Exercises

A-1: In the giant CERN particle accelerator in Switzerland, protons are accelerated to speeds of 2.0×10^8 m/s through a magnetic field of 3.5 T and then collided with a fixed target. What is the magnitude of the magnetic force experienced by the protons as they are accelerated around the giant ring?

A-2: In Fred's color TV, electrons are shot toward the screen through a 1.0×10^{-3}-T magnetic field set up in the picture tube. a) If each electron experiences a magnetic force of 2.9×10^{-15} N, at what speed is it propelled through the picture tube? b) How does this speed compare to the speed of light?

A-3: A proton shot out of the sun at a speed of 6.0×10^6 m/s during a "sunspot maximum" travels through the strong magnetic field of the sun. What is the maximum magnetic force experienced by the proton at a point where the sun's magnetic field is 0.090 T?

A-4: A 0.90-m-long straight wire on board the *Voyager* spacecraft carries a current of 0.10 A perpendicular to Jupiter's strong magnetic field of 5.0×10^{-4} T. What is the magnitude of the magnetic force experienced by the wire?

A-5: While vacuuming the living room rug, Buster pulls the 4.0-m vacuum cleaner cord so that it is lying perpendicular to Earth's magnetic field of 5.3×10^{-5} T. a) If the cord is carrying a current of 6.0 A, how large a magnetic force is created on the cord by Earth's magnetic field? b) If Buster then pulls the cord so that it lies parallel to Earth's magnetic field, how large is the magnetic force now experienced by the cord?

A-6: At the equator, where Earth's 3.0×10^{-5}-T magnetic field is parallel to the surface of Earth, Donna is spinning her wedding ring (which has a diameter of 2.0 cm) on top of the table. Find the change in flux through the ring if Donna a) slides it horizontally across the table, b) rolls it across the table, c) spins it on its edge.

A-7: Amanda's little brother spins a bar magnet whose magnetic field is 3.0×10^{-2} T over the face of Amanda's electric watch, perpendicular to a circular loop of wire of radius 0.60 cm inside the watch. a) What is the induced voltage in the wire if the magnet is spun over the watch in 0.30 s? b) Why is it a bad idea to put an electric watch too close to a strong magnetic field?

A-8: While Hiroshi sits in his living room, the newspaper carrier rings his doorbell. If a voltage of 120 V passes through the 200-turn primary coil of the transformer, how many turns are needed in the secondary coil to reduce the voltage to the 6.0 V needed to run the doorbell?

A-9: A bug zapper in the Snyders' back yard runs off a 120-V household line through a transformer whose primary coil contains 50. turns while the secondary coil contains 2000. turns. a) What is the output voltage of the transformer? b) Is this a step-up or a step-down transformer?

A1. 1.1×10^{-10} N

A3. 8.6×10^{-14} N

A5. a) 1.3×10^{-3} N

b) zero

A7. a) 1.1×10^{-5} V

A9. a) 4800 V