

Challenge Exercises for Further Study

- B-1:** When Helen turns on the TV set, electrons are accelerated through a 20 000.-V potential difference and deflected by a 1.0×10^{-2} -T magnetic field. What is the average magnetic force experienced by an electron? ($m_e = 9.11 \times 10^{-31}$ kg)
- B-2:** Captain Kittredge is sailing due north, as indicated by his compass needle, in a location where Earth's magnetic field is 2.0×10^{-5} T. The captain inadvertently places his radio near the compass, allowing the wire from his radio to align in a north-south direction. The 0.80-m-long wire carries a current of 5.0 A and produces a magnetic force on the compass needle of 2.8×10^{-4} N. To what angle will the compass needle turn while the wire is over it?
- B-3:** A velocity selector is a device that measures the speed of a charged particle by shooting the particle through oppositely charged plates enclosed in a tube. Inside the tube is a constant magnetic field, B . If a particle is to travel, undeflected, down the center of the tube, the magnetic force must equal the electric force. If the magnetic field of 0.630 T is perpendicular to the electric field of 5.00×10^4 N/C, find the speed of an electron sent through the velocity selector.
- B-4:** An alpha particle (He nucleus) is shot at 5.0×10^6 m/s into a magnetic field of 0.20 T in a device known as a mass spectrometer. What is the radius of the path followed by the alpha particle? (Hint: He nuclei contain 2 protons and 2 neutrons, each with a mass of 1.67×10^{-27} kg.)

