Solutions to Chapter 24 Exercises

- 3. How the charge moves dictates the direction of its magnetic field. (A magnetic field is a vector quantity.) Magnetic fields cancel, more in some materials than others.
- 8. An electric field surrounds a stationary electric charge. An electric field and a magnetic field surround a moving electric charge. (And a gravitational field also surrounds both).
- 9. An electron always experiences a force in an electric field because that force depends on nothing more than the field strength and the charge. But the force an electron experiences in a magnetic field depends on an added factor: velocity. If there is no motion of the electron through the magnetic field in which it is located, no magnetic force acts. Furthermore, if motion is along the magnetic field direction, and not at some angle to it, then no magnetic force acts also. Magnetic force, unlike electric force, depends on the velocity of the charge relative to the magnetic field.
- 15. The needle is not pulled toward the north side of the bowl because the south pole of the magnet is equally attracted southward. The net force on the needle is zero. (The net torque, on the other hand, will be zero only when the needle is aligned with the Earth's magnetic field.)
- 24. Back to Newton's 3rd law! Both A and B are equally pulling on each other. If A pulls on B with 50 newtons, then B also pulls on A with 50 newtons. Period!
- 32. The beam must be traveling along or parallel to the magnetic field.
- 40. The Van Allen radiation belts are filled with swarms of high-energy charged particles that can damage living tissue. Astronauts, therefore, make an effort to keep below these belts.