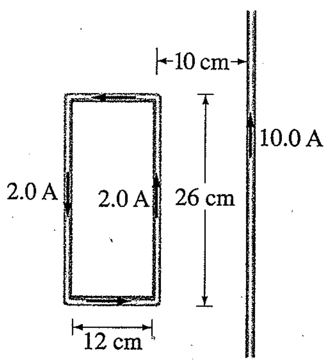
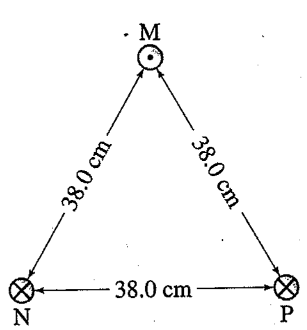
You have 1.0 kg of copper and want to make a practical solenoid that produces the greatest possible magnetic field. Consider variables such as solenoid diameter, length, and so on, to determine if you should make your copper wire long and thin, short and fat, or something else.

Near the Earth's poles the magnetic field is about 1 G (1×10^{-4} T). Imagine a simple model in which the Earth's field is produced by a single current loop around the equator. What current would this loop carry?

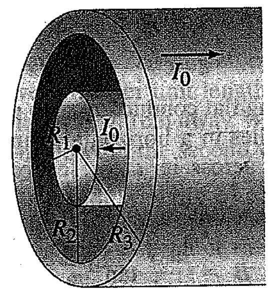
A rectangular loop of wire carries a 2.0-A current and lies in a plane which also contains a very long straight wire carrying a 10.0-A current as shown in Fig. 28–49. Determine (*a*) the net force and (*b*) the net torque on the loop due to the straight wire.



Three long parallel wires are 38.0 cm from one another. (Looking along them, they are at three corners of an equilateral triangle.) The current in each wire is 8.00 A, but that in wire M is opposite to that in wires N and P (Fig. 28–48). Determine the magnetic force per unit length on each wire due to the other two.

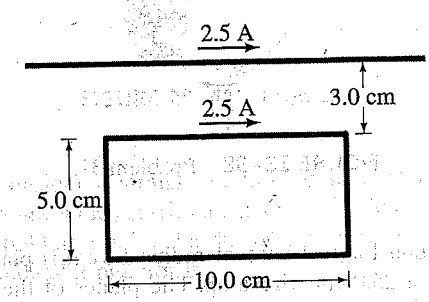


A coaxial cable consists of a solid inner conductor of radius R_1, surrounded by a concentric cylindrical tube or inner radius R_2 and outer radius R_3 (Fig. 28–36). The conductors carry equal and opposite currents I_0 distributed uniformly across their cross-sections. Determine the magnetic field at a distance R from the axis for: (*a*) $R < R_1$; (*b*) $R_1 < R < R_2$; (*c*) $R_2 < R < R_3$; (*d*) $R > R_3$.



A vertical straight wire carrying an upward 22-A current exerts an attractive force per unit length of 8.8×10^{-4} N/m on a second parallel wire 7.0 cm away. What current (magnitude and direction) flows in the second wire?

A rectangular loop of wire is placed next to a straight wire, as shown in Fig. 28–32. There is a current of 2.5 A in both wires. What is the magnitude and direction of the net force on the loop?



A very long flat conducting strip of width L and negligible thickness lies in a horizontal plane and carries a uniform current I across its cross section. (*a*) Show that at points a distance y directly above its center, the field is given by

$$B = \frac{\mu_0 I}{\pi L} \tan^{-1} \frac{L}{2y},$$

assuming the strip is infinitely long. [*Hint*: Divide the strip into many thin "wires," and sum (integrate) over these.] (*b*) What value does B approach for $y \gg L$? Does this make sense? Explain.

4. (FAE P4.54) An electron with charge $Q_e = -1.6 \times 10^{-19}$ C and mass $m_e = 9.1 \times 10^{-31}$ kg is injected at a point adjacent to the negatively charged plate in the region between the plates of an air-filled parallel-plate capacitor with separation of 1 cm and rectangular plates each 10 cm^2 in area (Fig. 3). If the voltage across the capacitor is 10 V, find the following:

(a) The force acting on the electron.

(b) The acceleration of the electron.

(c) The time it takes the electron to reach the positively charged plate, assuming that it starts from rest.

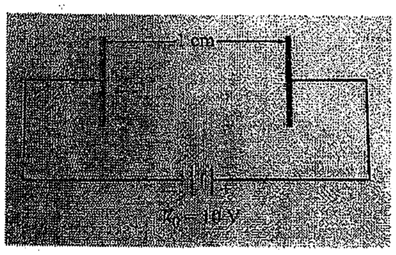


Figure 3: (FAE Fig. P4.54) Electron between charged plates of Problem 3.