Problems Due Week Beginning Oct 25, 1999.

Prob3017: Current flows up the inner cylinder of a coaxial cable and returns on the outside cylinder. The radius of the inner cylinder is 0.1 cm, and the radius of the thin outer cylindrical shell is 0.5 cm. Calculate the magnetic field on the cylindrical surface midway between the inner and outer surfaces, given that the current is 10 A. Ignore end effects.

Hint:

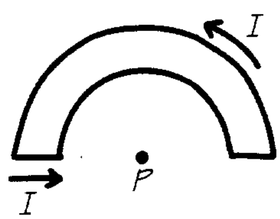
Prob3031: Consider a toroidal solenoid with a square cross section, each side of which has length L. The inner wall of the torus forms a cylinder of radius R. The torus is wound evenly with N loops of wire, and a current I flows through the wire. What is the total magnetic flux through the torus?

Hint:

Prob3038: Consider a thin dielectric ring 3 cm in diameter that rotates around a stem perpendicular to the plane of the ring and through its center at the rate of 200 revs/s. Assume that the ring is charged uniformly and carries a total charge of 2×10^{-5} C. What is the magnetic field produced at the center of the ring by the rotating charge?

Hint:

Prob3043. Consider the wire shown in the figure below with the inner and outer radii of the semicircle given as 5 cm and 8 cm, respectively. Given that the current in the wire is 12 A, what is the magnetic field at point P, the center of the semicircles?



Hint:

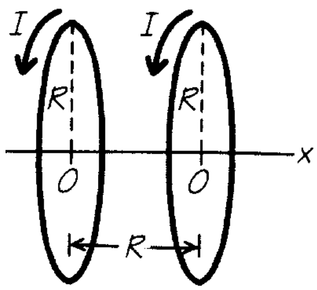
Prob3063. Consider two parallel wires spaced a distance d = 1 cm apart, which each carry a current I = 1 A. (a) Compare the magnetic force between these wires to the electric force they would exert on each other if the current carriers (electrons) were not neutralized by a background of positive charges. Use 10^{21} per cm as the linear density of charge carriers in the wire. (b) What excess of electrons per unit length over the positive background would make the electric force equal the magnetic force between the wires? (c) What fraction of the total number of charge carriers is the excess calculated in part (b)?

Hint:

Prob3065. The magnetic field due to a circular wire of radius R, carrying a current I, at a point a distance d away center of the ring but along the axis is:

$$B = \frac{m_0 I}{2} \frac{R^2}{(R^2 + d^2)^{3/2}}$$

A pair of such coils placed coaxially a distance R apart makes up a Helmholtz coil (see figure), for which the magnetic field everywhere inside is fairly constant . (a) Determine the magnetic field on the axis as a function of r, with x = 0 marking the location of the left-hand coil. Evaluate the field at x = 0, x = R/4, and x= R/2. (b) Show that dB,/dx- = 0 and d2B/dx2 =0 at x = R/2.



Hint: