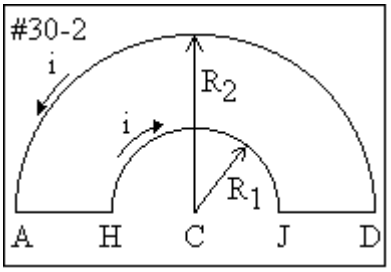
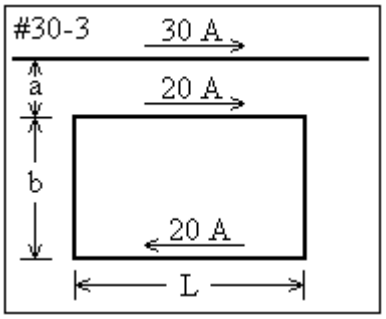
Phsx 2220 - Homework #7

30-1. The electron gun in a TV tube fires electrons of kinetic energy 25 keV in a beam 0.22 mm in diameter at the screen; 5.6×10^{14} electrons arrive each second. Calculate the magnetic field produced by the beam at a point 1.5 mm from the beam axis.

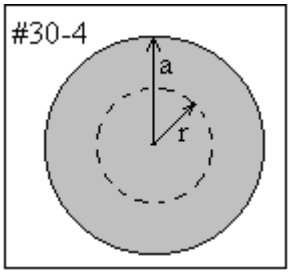
30-2. Use the Biot-Savart law to calculate the magnetic field **B** at C, the common center of the semicircular arcs AD and HJ in the figure at right. The two arcs, of radii R_2 and R_1, respectively, form part of a circuit ADJHA carrying current i.



30-3. In the figure at right, the long straight wire carries a current of 30 A and the rectangular loop carries a current of 20 A. Calculate the resultant force acting on the loop. Assume that a = 1.0 cm, b = 8.0 cm, and L = 30 cm.

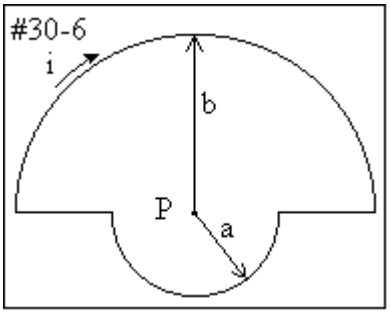


30-4. The figure at right shows a cross section of a long cylindrical conductor of radius a, carrying a uniformly distributed current i. Assume that a = 2.0 cm and i = 100 A, and plot B(r) over the range 0 < r < 6.0 cm.

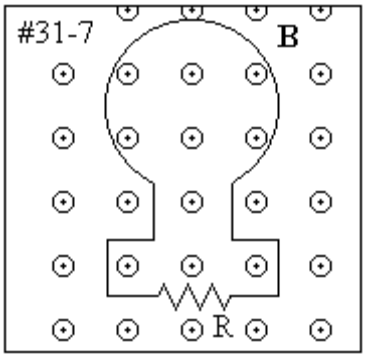


30-5. A long solenoid has 100 turns/cm and carries current i. An electron moves within the solenoid in a circle of radius 2.30 cm perpendicular to the solenoid axis. The speed of the electron is 0.046 c (c = speed of light). Find the current i in the solenoid.

30-6. A length of wire is formed into a closed circuit with radii a and b, as shown at right, and carries a current i. (a) What are the magnitude and direction of B at point P? (b) Find the magnetic dipole moment of the circuit.

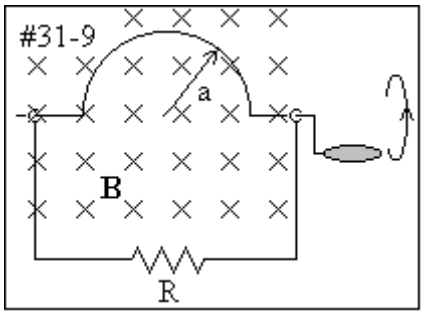


31-7. The magnetic flux through the loop shown at right increases according to the relation $\Phi_B = 6.0\ t^2 + 7.0\ t$, where Φ_B is in milliwebers and t is in seconds. (a) What is the magnitude of the emf induced in the loop when t = 2.0 s? (b) What is the direction of the current through R?



31-8. A long solenoid with a radius of 25 mm has 100 turns/cm. A single loop of wire of radius 5.0 cm is placed around the solenoid, the central axes of the loop and the solenoid coinciding. In 10 ms the current in the solenoid is reduced from 1.0 A to 0.50 A at a uniform rate. What emf appears in the loop?

31-9. A stiff wire bent into a semicircle of radius a is rotated with frequency f in a uniform magnetic field, as shown at right. What are (a) the frequency and (b) the amplitude of the varying emf induced in the loop?



31-10. The current in an RL circuit drops from 1.0 A to 10 mA in the first second following removal of the battery from the circuit. If L is 10 H, find the resistance R in the circuit.

31-11. The magnetic energy stored in a certain inductor is 25.0 mJ when the current is 60.0 mA. (a) Calculate the inductance. (b) What current is required for the stored magnetic energy to be four times as much?

31-12. A solenoid 85.0 cm long has a cross-sectional area of 17.0 cm^2. There are 950 turns of wire carrying a current of 6.00 A. (a) Calculate the energy density of the magnetic field inside the solenoid. (b) Find the total energy stored in the magnetic field there (neglect end effects).